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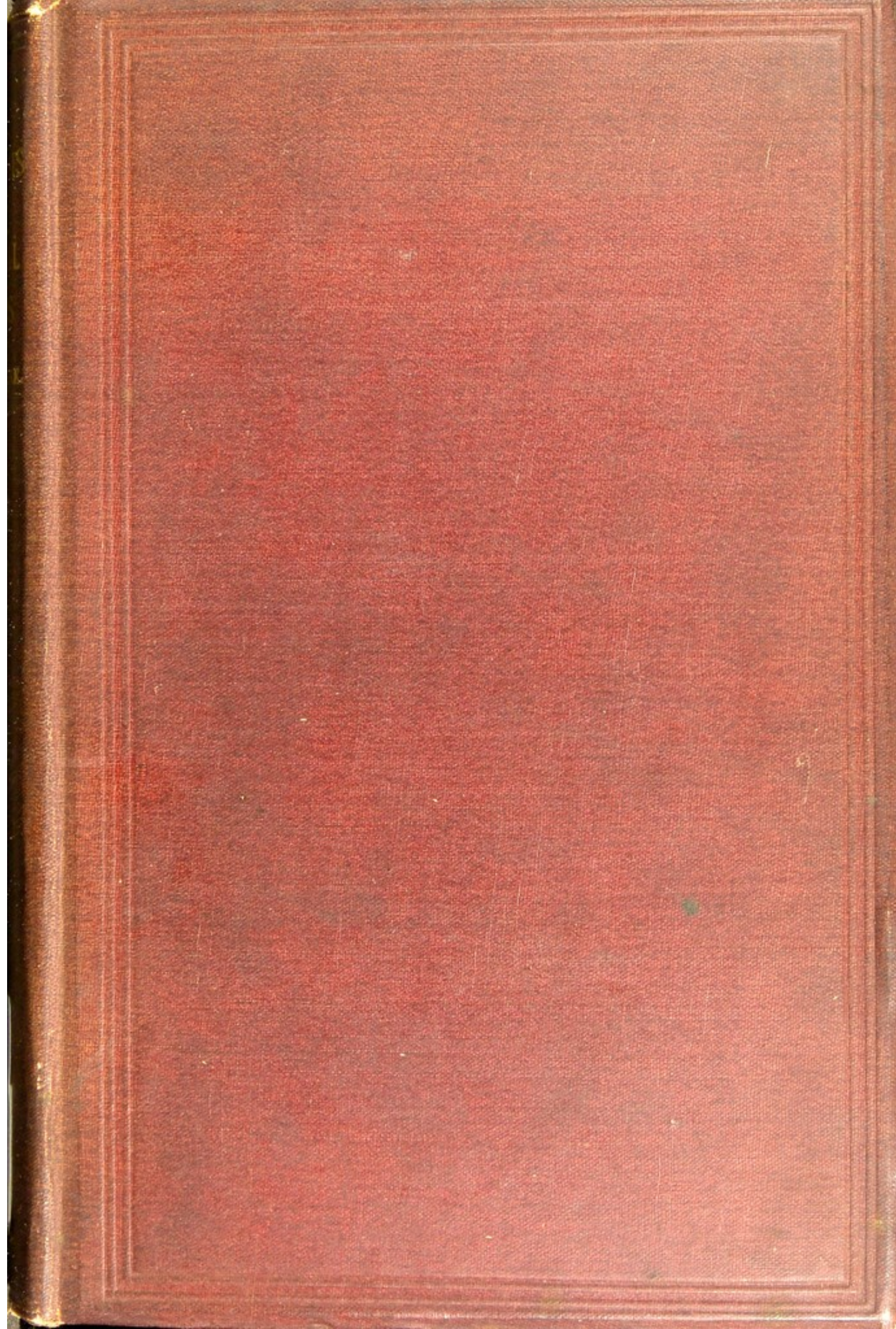
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with the kind regards of the
Author

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LECTURES

ON THE

PRINCIPLES OF SURGICAL DIAGNOSIS.



LECTURES
ON THE
PRINCIPLES OF SURGICAL DIAGNOSIS:
ESPECIALLY IN RELATION TO
SHOCK AND VISCERAL LESIONS.

DELIVERED BEFORE
THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.

BY
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AND EXAMINER IN SURGERY IN THE UNIVERSITY OF LONDON.



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TO
JOHN HILTON, F.R.S.,
AND TO
RICHARD QUAIN, F.R.S.,

SUCCESSIVELY PRESIDENTS OF THE COLLEGE OF SURGEONS

WHEN THE LECTURES WERE DELIVERED,

THIS VOLUME IS INSCRIBED,

AS AN EXPRESSION OF PERSONAL ESTEEM,

AND OF

RESPECT FOR THEIR HIGH PROFESSIONAL CHARACTER,

BY THE AUTHOR.



P R E F A C E.

THE following Lectures are printed as they were delivered, during the Sessions of 1868 and 1869, in the Theatre of the College of Surgeons, with the addition of some passages towards the close of the second Course, which it was found impossible to include within the allotted time. Woodcuts of a few of the preparations and diagrams, employed to illustrate the subjects under consideration, were introduced into the text printed in the 'British Medical Journal,' and have been transferred, by permission, to these pages. They might have been multiplied; but such illustrations are of questionable utility, where description suffices to place before the reader a true picture of the writer's meaning.

These Lectures would not have been published in this collected form, but for the encouragement of friends, on whose impartial judgment the Author

could rely. No doubt curtailment or omission of some parts in each Course, and expansion of others, might have been adopted with advantage in some respects; but, on consideration, a preference has been given to the publication of the Lectures in their original form.

DECEMBER, 1869.

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LECTURES

ON THE

PRINCIPLES OF SURGICAL DIAGNOSIS.

LECTURE I.

INTRODUCTORY.

MR. PRESIDENT AND GENTLEMEN,—When honoured by being elected to the Professorship of Human Anatomy and Surgery in this College, the duties of which I am now about to fulfil, I became sensible of the difficulty of selecting a suitable subject on which to address so learned an audience. My attention has not been directed to any branch of anatomy or surgery the special cultivation of which could constitute a justification or apology for authoritative teaching, or could hold out a hope of my enunciating any startling or attractive novelty. Under these circumstances, and in these days of aspiring talent, it may probably be thought by many that I should have exercised a wiser discretion if I had acted on my first impulse to abstain from tempting adverse criticism by declining the proffered honour; and I fear that, having accepted it, my temerity is rather aggravated by the selection of what may be deemed an ambitious subject. Having thus, Sir, placed myself in this dilemma, I have no alternative but to crave forgiveness for my temerity, and the indulgent consideration of my auditors, whilst I strive to fulfil an arduous and responsible duty, which I certainly should not have sought, but which, however I

might shrink from its performance, I did not feel myself at liberty to decline.

The natural alliance which exists between Anatomy and Surgery invests their combined pursuit with a peculiar interest to both student and teacher—a circumstance which is readily intelligible when we bear in mind that the lessons imparted and acquired are applied knowledge; and most learners have a greater aptitude in the acquisition of such information than in learning the rudiments of a science, the application of which they must defer until the details are mastered. And it is assuredly more agreeable to teach such practical application of facts, than to dwell on abstractions, which fail to fix the attention of the majority of students.

I do not mean by these observations to imply that anatomy is to be studied solely in subserviency to surgery, or that my remarks are not applicable, though in a minor degree, to other branches of professional study. In many of our pursuits, from the earliest period of education, it is requisite to instil the habit of patiently waiting until lapse of time shall unfold the *cui bono* of our work; but, in anatomy, I apprehend that the practical application of what is learned cannot be inculcated too soon.

The subject on which I have elected to address you is so comprehensive, and constitutes so important a section of medical science, that I think it excusable to devote my first lecture to the consideration of some circumstances which appear to me to have an influential bearing on its successful study and pursuit. The diagnosis of disease is the chief end and purpose of clinical instruction, and continues to be cultivated by the scientific practitioner with unrelaxing earnestness throughout his career.

The natural and fitting tendency of all scientific research is the development of principles or laws; and this result is promoted, though not actually attained, by the grouping and classification of the fruits of observation. The attractiveness

of discovery, which is the legitimate goal of persevering and intelligent industry, is apt to allure and beguile the impatient student; and I fear that, in medicine as in other pursuits, hasty generalisation is still a prevalent fault, and operates to the prejudice of its scientific progress. The explanation of this may be sought and found in the eagerness of the ardent student to distinguish himself by finding some short by-path to fame; and statistical records are not infrequently laid under contribution to prove the reality of an hypothesis or to support a crude suggestion. This abuse of an invaluable element in the advancement of medical knowledge is much to be regretted. Statistical records, to be available, must be extensive, and at the same time must be handled with discretion and entire impartiality; for, in the hands of the enthusiast or of the insincere inquirer, statistics not only lose their trustworthiness, but become a source of mischievous fallacy and of incalculable error.

The fact is, that the real discoveries in practical medicine are few, compared with the legion of *re*-discoveries which each successive generation makes;—so many old dishes, as my esteemed master, Mr. Travers, once remarked to me, served up under new covers. Yet these re-discoveries, which every attentive observer makes for himself, are by no means to be despised by their proprietor: they constitute, in fact and in the aggregate, the most valuable part of his experience—a possession, indeed, which in a measure is purely personal, which was not inherited, and which cannot be transmitted to another. Yet it is sad to contemplate how vast the stores of invaluable knowledge which are thus lost to the profession, as each practised hand and eye and matured judgment are withdrawn from amongst us by death; and it is much to be deplored that so many of our public men, surgeons of eminence, whose appointments afford them large means of observation, should leave no record of their experience. I am aware that something is being done by the publication of Hospital Reports;

but might not the evil I complain of be further remedied by more free intercourse between the Surgeons of our different Hospitals, whereby an interchange of thought and opinion might be facilitated, and the results recorded, from time to time, in some available and enduring form?

The accumulation of materials is essential to the progress of surgery, as of every other branch of practical medicine, and, indeed, of science generally; but their true and permanent usefulness is realised more in a reflected than in a direct sense: it consists in the establishment of Principles—that which I may venture to term inductive surgery, as distinguished from the study of those consequences of laws which is the occupation of the deductive mind. The inductive genius is rare, the master builders are few; yet we may all recognise the value of their discoveries, and endeavour to impress on those whom we teach the importance of leading principles. I venture to dwell on this point, as one of vital interest in our schools; for I believe that, as hasty generalisation is to be deprecated on the one hand, so our students should be taught, on the other, not to attach an undue value to details—to that which is visible and tangible. It is a serious, and I fear not uncommon, fallacy for them to adopt, that the chief purpose and end of their student life is to collect precedents for future use. Certainly these opportunities ought not to be neglected; but the learner should habitually realise that these facts, by which he lays so much store, are suggestive of higher and more general principles, and that they possess a significance which it is his business to unfold and master; as it is thus alone that he can employ them with safety and with advantage. The treatment of fracture affords a familiar illustration of my meaning; for, without some reference to the principles which guide the surgeon in his treatment, the student must often be much perplexed in what he witnesses. The valuable principle which Pott inculcated, of position to secure muscular rest, is, I believe, generally recognised; but its adoption is not, because it cannot

be, universal. Obstacles which cannot be thus controlled interpose, and necessitate the introduction of another and opposing principle, and the consequent employment of a different mode of treatment; yet Pott's principle is just and rational. How little, then, does the student carry with him which will avail him in future practice, if he merely watch the position of a limb, and the form of splint adopted in certain isolated cases of different fractures, and do not seek further the explanation of the principle, and of the numerous exceptions to it. The treatment of hæmorrhage, under various circumstances, affords another illustration in point; and so, indeed, does every branch of surgery in a more important or minor degree. But perhaps in no instance is the value of principles, in diagnosis as well as treatment, more aptly exemplified than in the various complications which are met with in the class of injuries which I propose to discuss in these lectures. And I would remark, that principles are not to be ignored or rejected because they do not admit of universal application. If we adopt them, they must become, so to speak, articles of faith on which we may rest, although we fail to discern always their precise bearing or relation in particular instances.

The subtle agencies which influence the living organism so materially modify existing conditions at different times, in diverse temperaments, and under varying circumstances, as to compel us also to modify and adapt our treatment in individual cases. Yet, I repeat, this is no reasonable ground for falling back on the empiricism of precedent: it may, indeed, stimulate us to further exertion and research, in the hope of attaining, by another step in generalisation, to some higher principle or law, which shall include the apparent exception to that which we now recognise as our guide.

The learned philologist, Max Müller, in speaking of the historical progress of the science of language, remarks that "each physical science begins with analysis, proceeds to classi-

fication, and ends with theory ;” but he goes on to observe, that “there are frequent exceptions to this rule ; and it is by no means uncommon to find that philosophical speculations, which properly belong to the last or theoretical stage, were attempted in physical sciences long before the necessary evidence had been collected or arranged.” Such, in truth, appears to me to be the history of the progress and development of all the natural sciences. The love of order and classification leads to premature generalisation, notwithstanding the consequent inconsistencies. Various are the expedients then resorted to, for the purpose of reconciling circumstances and opinions which are irreconcilable in the then existing state of our knowledge ; but, as we climb the hill and our sphere of vision becomes more extended, the perspective of the surrounding prospect is corrected ; each object assumes its proper place and due proportions, and harmony reigns where formerly all was discord and confusion.

The progress of generalisation in pathology and therapeutics is necessarily impeded by the obscurity which envelopes the operations of the living organism. We know so little, comparatively, of the influence of life, that we are continually foiled in our anticipations ; our calculations, based on antecedent experience, miscarry ; and we are compelled to forego conclusions, from the lack of coherence in our data. Observations, which we at one time felt justified in placing in the same category, cease to exhibit their former resemblance and relation when seen under different circumstances ; and the step we thought we had gained must be reluctantly retraced. Even that which we witness after death—the morbid anatomy of the changed textures, as displayed under the microscope, and subjected to chemical analysis—fails to inform us on points of deepest interest to us,—the *modus operandi* of the morbid agent, whatever it may be. We see the passive result, but miss the active agency by which this result was produced. Even therapeutic surgery is often coarse in its application, and

purely mechanical in its operation. Certainly, where there is not positive mutilation, the wider the divergence from Nature's indications, the more disastrous is the consequence of her resistance, and the greater, usually, the risk of failure.

"Naturam expellas furcâ, tamen usque recurret."

Yet some steps in advance have been made, especially in the accurate observation of chemical and mechanical changes in the living frame. The development of caloric generally in varying states of disease, and even topically in local affections, is a subject fraught with much interest, and promises to throw light on many obscure conditions which it is the province of the surgeon to treat. The electric condition of the body, considered dynamically, under various conditions of diseased action where the nervous system is involved, is another field for investigation to which I had looked hopefully in the illustration of these lectures. But I find this delicate subject so surrounded by difficulties arising from the many elements of disturbance, both intrinsic and extraneous, that I have been compelled to defer the experiments I had contemplated.

To the microscope we are much indebted for the display of morbid changes in the living mechanism. It has revealed to us that the first material step in inflammation is disordered, and then arrested, movement of the blood-corpuscles. But why does this occur as the consequence of some exciting cause acting locally? There is not, so far as I have been able to observe, any transudation, at this earliest stage, of the serous menstruum from the capillaries; the only reasonable explanation which offers itself, as it appears to me, is that a non-material agency is interfered with. There is a mutual living relation between the blood-vessels and their contents—its nature is still subject of conjecture—the interruption of which, for even a brief space, is fraught with risk, and its suspension for a longer time with certain mischief. The remaining steps in the development and consequences of inflammation are capable of demon-

stration. Yet, as this subject is treated and taught, I think much of the complexity which surrounds it is due to inattention in generalising ; and might be removed by the avoidance of expressions which are liable to misconstruction. Perhaps I should speak more correctly if I say that such expressions as I refer to should have their conventional meaning strictly defined and limited. Thus, acute and chronic inflammation simply denote degrees of intensity or duration ; and specific inflammation in all its varieties, means only this condition occurring as a consequence of, or allied with, some constitutional peculiarity. In all these instances, the actual state which we denominate inflammation is identical, though varying, as I have said, in degree ; and modified, in this respect and in the consequences it entails, by accidental circumstances. Again, as regards these consequences, it is too often the habit to view them as distinct from each other, and to describe them under the several heads of adhesive, suppurative, ulcerative, phagedænic, and gangrenous inflammation ; whereas the same remark applies here as to the pre-existing condition :—these results are only different phases of the same state, modified by accidental circumstances.

In slow ulceration, or progressive death of texture, the dead or effete matter is thrown off with the material supplied for repair. In phagedæna, the rapid destruction, without reparative effort, leaves the foul and sloughy surface. In gangrene, death falls suddenly on the part *en masse* ; and the dry or moist form is associated with the existing condition of the textures, whether natural or acquired.

Again, an ulcer is but an open abscess, and an abscess a closed ulcer. In one, the effete matter and accumulated but wasted material for reparation are retained ; in the other, they are continually draining away. The abscess must be converted into a hollow ulcer before it will heal. A sinus holds an intermediate position between the two ; it has no special characteristic, except that which is due to its form and the consequent

mechanical obstacle to its healing. So, in like manner, although there are distinguishing features in the consequences of inflammation affecting different tissues, there is identity in all essentials; the points of non-resemblance being dependent on the physical peculiarities of the affected textures. Bone-abscess, diffused suppuration, caries, necrosis, what are they but the consequences of the same proximate causes acting in bone, as in tissues differing in the physical characters of density and resistance and in their elementary constituents? But in all there is the same organisation,—the same, that is, in quality, though varying in degree; and there is thus, in all, the susceptibility to injury, the necessity for repair, and the liability to death: therefore we find, as we should anticipate from such data, that the same phenomena are witnessed, in these various lesions, attending the reparative inflammation or hyperæmia of the injured part, though stamped by the peculiarities of locality or of tissue, which thus impart apparently special characteristics that are, in reality, accidental and unimportant. So, likewise, in actual reparation. The agglutination of the broken ends of a severed bone, the healing of an abscess, the separation of a sequestrum, the closing of a carious cavity, are essentially identical with the healing of wounds in soft parts by adhesion, the separation of slough, and granulation.

I do not adduce those facts as novel; but simply as exemplifying the importance of generalising where we can, and of the value of general principles in reading the phenomena of disease and in interpreting its problems.

Inflammation is not now viewed as essentially mischievous in its tendency—a disease *per se*, to be combated by all available means in our power. Its friendly services are, indeed, under certain circumstances, hailed with satisfaction. I would even venture further, and regard inflammation as always friendly in design, though that intention is often frustrated, or aggravated into mischief. I think it doubtful whether inflammation is ever the *primum mobile* in the evil consequences

which are, in one sense justly, attributed to it. Even in such inflammations as those affecting joints or the lungs, some peculiarity of constitution, coupled with a hidden concatenation of accidental circumstances, predisposes to that general condition, in which some locally acting cause suffices to light up an inflammatory attack—a conjecture which is supported by the various results, in different individuals, consequent on the same exciting cause. Thus, local injuries, exposure to cold or malaria, may be followed by different degrees and diverse sequences of inflammation, or attacks of various organs, according to the idiosyncrasy, temperament, or hereditary tendency of the patient; periostitis, pneumonia, rheumatism, peritonitis, may result, in different individuals, from the same exciting cause, whilst others will escape unscathed; and even the same individuals may secure immunity at one time, whilst under other occult circumstances, they succumb to some acute inflammatory attack. To say that one organ is more susceptible than another, or that the same individual exhibits a varying degree of susceptibility at different times is no explanation. What we want to know is the reason of this susceptibility; and in this we should have revealed to us the real predisposing cause which, when stimulated into activity, suffices to excite the resentment of the vascular system.

In surgery, these relations, so momentous in diagnosis, are often less obscure, and therefore more demonstrable than in medicine; and yet they require comprehensive study to render them intelligible. Exclusive pursuits in our profession, embodied in the practice of specialities, have, for this reason, the effect of retarding the progress of scientific surgery. In defence of this innovation, it has been urged that a division of labour, as well as an exclusive devotion of time and ability to one particular class of diseases, must have the effect of extending our knowledge, by the enlarged opportunities which thus fall to the few, and the consequent accumulation of materials from which to draw accurate conclusions as to the pathology

and treatment of disease. I venture to suggest that there is much sophistry in this plausible reasoning. The effect of such division of labour is unquestionably often to concentrate the practice of some particular branch of surgery in the hands of those who have striven to acquire a special reputation; but, in proportion to such success, the very exclusiveness of the pursuit must leave the practitioner neither time nor opportunity to cultivate other branches of his profession. Nor is it in human nature to resist what I may term the warping influence of exclusive study under such circumstances. Conditions are liable to be viewed through a special medium; and defective experience, if not practical ignorance, in general surgery, compels the specialist to trust to precedent in his limited sphere. The *art* of surgery—its special manipulative details—may be acquired by the exclusive practitioner, and he may affect authoritative teaching in his particular subject; but I apprehend that scientific surgery cannot look for aid in this direction; and I regard with more than doubtful misgiving a principle of subdivision which offers so much temptation to members of our profession, because fostered and fed by public patronage and liberal remuneration.

I wish to be understood as making these remarks in reference to *exclusive* practice. That accident or taste should direct a surgeon's attention to some particular subject, is both natural and admissible. Most of our best monographs are, indeed, due to this circumstance; and their value is, I contend, greatly enhanced thereby. Such are the dissertations of Cooper on Dislocations, Lawrence on Hernia, and of Brodie on diseases of the Joints, not to refer to many older monographs, and others of more recent date.

May I not also exemplify my meaning by reference to that speciality, the operative department of which is, by common consent, and for an obvious reason, permitted to remain in the hands of few—I allude to Ophthalmic surgery. The most successful cultivators of this department of surgery have been

gentlemen whose position and reputation were also associated with general surgery; and the most valuable contributions in ophthalmology have been derived from such men as Travers, Lawrence, Tyrrell, Dalrymple; and such is likewise the case with their successors. It could not, in truth, be otherwise in the pathology of an organ the diseases of which have been, in a qualified sense justly, styled an epitome of those of the whole frame.

Other incidental, but not necessary, evils result from this splitting into fragments of our professional practice. The popular success which so often attends an exclusive pursuit is a temptation to the production of crude compilations, containing premature generalisations and authoritative expression of opinions, which the experience of the writers in no way justifies. And I would venture to add, that early success in practice is not the boon which many young men are disposed to regard it; and I am sure it is, in the aggregate, detrimental to the science of the profession which their natural endowments calculate them to illustrate and adorn. There is a risk that they will acquire merely empirical knowledge if their time is at once absorbed by the exacting requirements of active practice. In spring time the seed must be sown; and it is well that the early energy of youth should be devoted to those scientific pursuits which at once elevate the standard of the student's qualifications, and which have contributed largely to the development of surgery as a science. Sure I am that the fruit of many a promising worker's time has been lost to the profession in consequence of the premature engagements of a successful practice—a misfortune which rarely befalls him whose ambition it is to acquire a reputation as a general surgeon; whereas the history of our profession supplies many striking instances, among our distinguished surgeons, of the fruitful cultivation of science in their youth, as well as of the permanent influence such early devotion of their time and talents has had on their own future career.

It may be objected, Sir, that this subject, to which I have ventured to call attention, affects only the metropolitan cities, and, in a minor degree, our large provincial towns. This is, in one sense, true; yet the prejudicial influence on education must be felt throughout the breadth and length of the land, if special hospitals are to absorb the public practice, and exclusive practitioners are to monopolise the public confidence. But I will not pursue this question further. Perhaps I have already dwelt too long on an innovation which, I apprehend, contains within itself its own corrective.

As I have frequently employed the expressions "Science" and "Principles" in reference to the study of surgery, it may be convenient that I explain what meaning, in this relation, I attach to these words. I believe that the principles of surgery are too often regarded as derived directly from observation only, without inductive reasoning founded thereon. But there are greater truths beyond the immediate ken of our senses. Science deals with the mutual relations of objects observed or of facts recorded; it implies classification, arrangement, harmony, and the development of knowledge based on admitted truths. Thus, independent facts are not to be employed as precedents only; they must be subjected to the test of comparison, grouped into classes, and moulded so as to form the basis on which intelligible principles of practice may be founded.

The successful pursuit of the loftier walks of science implies a high order of intellect. To observe assiduously, and even to apply, judiciously, acquired knowledge, does not constitute even the ordinary man of science. To possess a just claim to this title, he must cultivate the habit of estimating correctly the evidence of his senses, and of judging between that which is simply matter of opinion and that which is true; and he must also further possess the qualifications to weigh, compare, and analyse, and the capacity to educe just conclusions from his premisses.

If the foregoing remarks are just, I think that the inference

which I desire to draw from them may be conceded ; viz., that long observation and practical experience are not the only measure of the surgeon's capacity to practise his profession successfully ; because, if he trust to precedent alone, he does not practise scientifically. And I am the more anxious to insist on this view, as the public estimate of professional capacity is, unfortunately, measured by a very different standard. It might be an interesting subject for speculative inquiry, were this the place and time, why charlatanism of the most papable and shameless character should so readily impose on the credulity of even the educated public. The responsibility of this anomaly does not rest with the profession, but is due to the partial education of those who are deluded, and to their consequent inability to distinguish between the claims of scientific cultivation and ignorant pretension. I remember a passage in the preface to Dr. Whateley's 'Elements of Logic,' in which the author defends the study of this science with his usual acumen and pointed felicity of illustration. "A sailor," he remarks, "will perhaps despise the pretensions of medical men, and prefer treating a disease by common sense ; but he would ridicule the proposal of navigating a ship by common sense, without regard to the maxims of nautical art." And so, he proceeds to point out, with respect to other special pursuits, educated persons would not recommend a reliance on common sense alone, to the neglect of those systems of rules which, in their respective arts, have been deduced from scientific reasoning aided by experience. Let us hope, as I am disposed to anticipate, that, when a larger infusion of the scientific element is mixed with the literature taught in our public schools and universities, the status and acquirements of the professional man will be more justly appreciated, because better understood, by the public.

On the other hand, the early instruction of our young men must ever have an influential bearing on their future career ; and the habit of looking beyond that which is presented to the

observation of the senses cannot be too soon instilled. In almost every walk of life we see the same truth exemplified, whether it be in the philosopher, the artist, the soldier, or the mechanic. It is not the man of precedent who rises above the level of mediocrity; but it is he whose capacity enables him to avail himself of combinations which elude the ordinary observer, and whose foresight appears to endow him with an intuition, which is, in reality, the offspring of deep study and careful thought. In a sound preliminary education we have the best guarantee that these mental requirements will be satisfactorily fulfilled. Our profession may be congratulated on the progress which has been made of late years in securing a higher standard of preparatory education in those who aspire to practise medicine and surgery; and I think, Sir, that this College has no reason to be ashamed of either a tardy recognition of this important step, or of indifference or laxity in the effort to realise it. Yet it is to be regretted that there must be a limit to the required qualifications both for the study and practice of medicine. Unfortunately, the inducements which now exist for young men to enter our profession are not of such an alluring character, in comparison with other engagements, as to admit of the introduction of further impediments by applying a too rigid test of scientific proficiency. The law of supply and demand might, no doubt, regulate admission to the profession, if a corresponding principle determined the remuneration of the practitioner. If such were the case, there could be no objection to an exclusive standard. But we know this is not so, either in public appointments or in private practice; and the necessary consequence of such a standard would be to starve the public service, and to deny to our teeming population a sufficient supply of qualified medical men.

To return from this digression. The influence of a recognition of the principles to which I was referring is apparent

equally in the diagnosis and treatment of disease : in diagnosis, by the enlarged view which is taken of all the particulars of the individual case, meting out a due value and proportion to each ; and by comparison with others, similar in all or some of their features : but most conspicuously so in instances where no precedent for comparison exists, and where an opinion must be formed by the observation of remote analogies, from the history of the case, the hereditary tendencies of the patient, and a variety of incidental circumstances which have only an indirect bearing on the questions at issue. In surgical *treatment*, still more will simple general principles be found efficient guides in practice. But, whether in diagnosis or treatment, the accomplished surgeon brings to the task an accurate acquaintance with the structure and functions of the human frame, and, as far as our knowledge extends, a clear perception of the various relations of sympathy and vicarious action in different organs ; so that he may read aright the pointing of the hands upon the dial, and know with confidence where and how to give assistance. But self-reliance is not the only attainment which familiarity in the treatment of disease brings with it. Trust in Nature's unaided efforts seems a simple lesson to learn ; yet, I apprehend, there are few of my elder hearers who will not echo the remark, that it is only as years pass by that this apparently rudimental knowledge is acquired. The readiness to interfere yields only to the conviction which is gradually forced upon us, that it is safer and wiser in this respect to follow than to lead ; more judicious to withhold interference until we see clearly the necessity for action, and then to act promptly and decidedly ;—taking, in short, for our guidance, those principles which were so ably enforced and exemplified by yourself, Sir, when you fulfilled the duties of the office I now occupy.

It would serve to abate our exaggerated reliance on our own resources, and to enhance our faith to those of Nature, if we could more familiarise our minds with the true character

of the phenomena which we are accustomed to regard and to treat as disease. These phenomena find their expression especially in the nervous and vascular systems; yet how rarely can they be interpreted as other than essentially curative in their nature. The excitement, both local and general, which attends the introduction of a poison into the system, and the train of symptoms which accompanies the eliminative effort, are so many steps in the direction of reparation; and such is likewise the case in severe mechanical injuries to the frame. The ulcer, slough, or abscess, are necessary preliminaries to, or accompaniments of, repair, though often destructive in their excess. And the surgeon who has been conversant with such cases will watch anxiously for the reaction which follows the shock of an injury or operation, and estimate thereby the reparative power of his patient. I shall have frequent opportunity, in the succeeding lectures, of illustrating this remark, and of showing that Nature's resentment of an injury is the measure of her ability and purpose to repair it; that the tranquil, unruffled state of the nervous and vascular systems is often a deceitful calm—the index of feeble power, the precursor of inaction, and the harbinger of death.

The intimate alliance which exists between the vascular and nervous systems, their interdependence and mutual reaction, are the sources of numberless complications, which, whilst they often perplex the scientific practitioner, are unintelligible to him who expects to find in the records of the past an exact rehearsal of the present. This remark applies with peculiar force to the class of injuries which I propose to consider. In many visceral lesions the nervous and vascular systems are immediately implicated; in all they are necessarily more or less involved; and the numberless sympathies which result demand both sagacity and patient research to unravel, and to refer them to their several sources. And it is often upon the just interpretation of the phenomena springing from these sympathies, that the correctness of the surgeon's opinions

and the fitness of his treatment much depend. But the subject of Diagnosis has a far wider basis than this. The etymology of the word implies breadth and penetration ; and these are qualities which are especially required in studying the signs and symptoms by which diseases are distinguished and identified. This single word includes a moiety, and a large moiety, of scientific medicine and surgery. Even with it, much of medical practice is empirical ; without it, medicine could have no claim to be classed as a science ; and surgery could scarcely be said to have existence, except, as was the case in barbarous ages, as a blind and cruel handicraft, rarely benefiting those whom it pretended to relieve, but mutilating and sacrificing many at the shrine of its ignorance. Happily, the qualifications for surgical diagnosis are within the reach of all who have the opportunity of study, and bring an earnestness to their work ; though it must be admitted that natural endowments are not without their influence in assisting their possessor to a rapid and precise judgment regarding the disease of which he may have to determine the character. Yet, as I just now remarked, I am disposed to regard the discernment, popularly attributed to sagacity or an intuitive perception of that which escapes common notice, as really the fruit of patient study and accurate observation, conducted by a well-balanced and educated intellect, of which the conscientious love of truth is a predominant characteristic. A bold and shrewd conjecture of the charlatan may be occasionally correct, and may dazzle the ignorant ; whilst the many failures are kept out of sight, or accounted for by explanations or excuses which impose too readily on the uninitiated, who are singularly incompetent to appreciate the long and tedious process by which the scientific practitioner attains that tact and aptitude in the diagnosis of disease, which expresses itself with the modesty and misgiving often appropriate even in the most experienced—appropriate, because he knows, as others cannot imagine, how many sources of error surround him ; how many accidental circumstances may in-

fluence a conclusion which, to the superficial inquirer, appears inevitable.

The special education of the senses—the agents in observing—has its import, in common with the calm and dispassionate consideration of the information they convey to the mind. Yet with all the acquired preliminary knowledge which physiology and pathology supply, with all the penetration in observing, and all the delicate tact and distinguishing refinement of eye and ear, which experience alone can impart, the diagnosis of disease and injury is often rendered obscure and perplexing by some novel circumstance, or by some accidental peculiarity which taxes the sagacity of the surgeon to the utmost. The concurrence of two forms of injury in the same locality, such as a fracture and a dislocation; the distortion or unsymmetrical development of limb consequent on occupation or habit; the modified expression of disease dependent upon temperament or excess,—these are conditions which illustrate my remark, and which meet the surgeon at every turn in his daily practice. Again, deformity, or other consequence resulting from pre-existent disease or injury, often masks a present malady. These cases are so frequently brought under the observation of the hospital surgeon, that scarcely a week passes without examples being offered to his notice. But they are not therefore the less perplexing, especially as patients are often unwilling to admit a relation between circumstances which they cannot themselves appreciate; and thus, sometimes in ignorance, sometimes wilfully, they mislead the surgeon.

In other instances, a misapprehension of the true nature of the case may lead to an incorrect history being given; or, again, the history may be true, but perverted by some preconceived opinion transmitted to the surgeon. In illustration of this source of complexity, I may refer to necrosis of bone; not so much because it may mislead, as to exemplify, in a striking class of cases, the difficulties which are sometimes thrown in the way of diagnosis.

The history of necrosis from acute ostitis is generally intelligible enough ; but the recognition of the original inflammation of the bone or periosteum would appear to be less simple, if we may judge by the frequency of its being overlooked, or rather masked, by the attendant symptoms. Exposure to cold and wet is a ripe source of ostitis and periostitis ; so it is of rheumatism. Both are attended with suffering, more or less localised, and likewise with febrile disturbance. Hence, these cases of recognised necrosis are transmitted to us, either as the sequel of rheumatism, or as consequent on fever. Whereas the acute suffering, not infrequently of the severest kind, and the corresponding constitutional or febrile disturbance, are both due to the inflammation of the bone or its investing membrane. Thus—to give one or two typical cases—a young sailor was hurt on the thigh, and this injury was followed by an attack of so-called rheumatic fever, and subsequently an abscess formed. When admitted into the hospital, the shaft of the femur was the subject of necrosis. A lad, after repeated exposure to cold and wet, was attacked with fever ; the right knee and shoulder being, at the same time, much swelled and very painful. His medical attendant appears to have at first regarded this attack as rheumatic fever ; but, the symptoms assuming a low type, he afterwards pronounced the fever to be typhus, and treated it accordingly. Ten days before I saw him, an abscess opened over the shoulder, and the upper extremity of the necrosed shaft of the humerus presented itself. I subsequently removed the entire shaft as a single sequestrum. These cases are typical of a large class which come to our hospitals for treatment. The apparent obscurity of their early history is not real to those who are conversant with this disease ; yet the examples may serve as illustrative of the difficulty in diagnosis to which I referred.

But there are phases of resemblance, in the early stage especially, of diseases and injuries, which may defy the most

discriminating diagnosis. Many such cases I shall have occasion to refer to in the ensuing lectures, such as early shock of the severer kind, without visceral lesion, and fatal injury to some important viscus.

In the later stage of some other complaints, where the history is obscure, it may prove impracticable to determine whether the preponderance of symptoms lean to the interpretation in favour of one or other of two diseases, essentially dissimilar in their nature as well as in their origin and development; such, for example, as tumours of various kinds, not excluding aneurism, and especially within the large visceral cavities. A striking illustration in point, and unique in my experience, occurred in a private case which I saw in company with a member of the Council of this College. The patient was the subject of a large tumour occupying the popliteal space, and bulging its lateral walls. This tumour was tense in some parts, soft in others, the skin being thin in many places, and the surface generally somewhat elastic. A distinct thrill was audible in the swelling, as of an artery pressed upon; but there was no variation in size when the femoral was compressed, no distinct pulsation nor expansive enlargement at each systole of the ventricle. The patient suffered considerably; he was emaciated, and his health was greatly deteriorated. The history of the case unfortunately threw but little light on the probable nature of the disease; and the question presented itself as to whether we had to deal with an aneurism or with the encephaloid form of cancer. The preponderance of evidence seemed to be in favour of the latter; and, with the doubt still resting on our minds, we thought the safest course was to recommend amputation. The patient returned to the country, where this operation was performed, and the limb was subsequently forwarded to me. On the morning of the amputation the operator remarked that there was no pulsation, although the tumour then fluctuated. The disease proved to be aneurism, extending from the upper part of the popliteal

artery down to its division; the sac was partially formed of arterial wall, which appeared to have given way in several places, causing extravasation among the muscles to a limited extent, the greater part of the sac, however, being bounded by a membrane, apparently adventitious, and in some places exceedingly thin. The sac was very large, and contained much soft, dark coagulum.

Negative evidence is often of the utmost importance in surgical diagnosis, where the positive symptoms, from their obscurity and the hidden or inaccessible locality of the disease or injury, evade the search of the surgeon. This is remarkably the case in visceral lesions, especially of the head and abdomen. In fact, the treatment of such cases is often determined by the absence of symptoms which, from many existing features, might have been expected to be present. I shall have the opportunity of exemplifying my meaning by reference to cases of injury of the skull, where the external mechanical lesion is unaccompanied by the usual cerebral symptoms; and, if the time permit, by instances of those obscure affections of the abdominal viscera, in which the cause of obstinate and protracted constipation is a subject of speculation, on which the life of the patient may hang.

Diagnosis is rarely a matter of simple curiosity, but is usually of vital importance to the patient; and especially so where the alternative of operative interference has to be entertained. Even when the question, in the abstract, of the propriety of operating admits of none but a positive solution, there are many subsidiary considerations which press themselves on the attention of the reflecting surgeon, apart from the details of the operation itself. He is bound to weigh these considerations carefully, without, however, allowing them to exercise an undue influence on the main question before him. The conditions which demand or forbid an operation must be determined by the general state of the patient, as well as by circumstances of a purely topical nature.

Among the general considerations are—the constitutional contamination or origin of the disease ; the temperament and habits of the patient ; the soundness of important organs ; the existing condition as regards the effects of shock and loss of blood, and the prospective risks attending these and profuse and protracted suppuration, as consequences of operating. The chief topical considerations are—the reasonable hope held out of removing the disease, or of affording compensating relief ; and the amount of mutilation which may be entailed. These appear to me the various circumstances associated with diagnosis, where an operation is contemplated ; and I need not add how much the success of any operation depends on the period selected for its performance, and the previous preparation and subsequent treatment of the patient. There are other adventitious and extraneous circumstances, which must not be overlooked where they present themselves. I refer to atmospheric variations and epidemic and endemic influences which may happen to prevail. On some of the more important of these points I shall offer some observations in my next lecture, when discussing the subject of Symptomatology.

But I cannot dismiss this allusion to operative surgery without remarking on the disparagement and commendation to which this branch of our art has been subjected—often unjustly so, as I venture to think—by both its detractors and eulogists, from a misapprehension of the true relation of manipulative skill to surgical science. The claims of surgery to be regarded as a science, and the privileges of its professors, have expanded, as the *chirurgie* has assumed its proper position, in subservience to those higher attainments which characterise the educated surgeon. I would not undervalue the clever performance of operations ; for such success implies the possession of acquirements which do not meet the eye ; and manual dexterity is an essential qualification in him whose business it is not only to decide what should be done, but also to do it. Yet, although the mere facility of execution is, after all, only a question of

mechanical dexterity, it is often regarded by the thoughtless with an admiration which is as exaggerated in degree as it is humiliating to the operator. No surgeon worthy of the name would, I apprehend, now covet to be described as "*audax in periculis, animo immisericors*;" yet such characteristics are implied by the language in which operative feats are sometimes described even in the present day. The merit of a well-conducted operation consists less in its rapid and skilful performance than in its fitness and the care with which it is planned; the arrangement of each step with anxious forethought, and the anticipation of obstacles and preparations to meet them, demand qualifications which test the resources of the surgeon; and the success of an operation depends at least as much on the possession of these qualifications as on the exercise of manipulative skill. There is this peculiarity in surgery, as compared with other professions in which science and art are combined, that the mind which plans and the hand which executes belong to the same individual. The soldier, the architect, the civil or military engineer, frame plans which others have to carry into effect; yet the credit of the execution is justly theirs, for often the actual agents are ignorant of all but the details in which they are engaged. I think there is sufficient similarity in my illustrations to justify the parallel; and, though I am aware that the mechanical skill exhibited in bricklaying is not very exalted, yet, in some of the higher branches of manual engineering, the ability to execute well is acquired only by long apprenticeship, patient toil, and a competent knowledge of mechanics.

In the few general remarks which I have made respecting the determination of the nature and the site of surgical disease, I must not omit to notice an attribute, without the possession of which the most accomplished pathologist may find himself at fault in the presence of his patient. Precision in diagnosis does not depend so much on the analysis of minute details and on the detection of every trifling symptom, as on sagacity in

eliminating all that is unimportant, and ability in selecting and giving due prominence to the salient points of a case. Success in practice probably depends as much on the development of this faculty as on any other single cause. In some individuals of great acquirements, their very store of learning becomes an incumbrance from want of tact in using it. Even pondering over the details of an anxious case long and wearily often unfits the surgeon for giving a lucid and independent opinion, where his diagnosis would be clear and explicit if he came fresh to the subject. He has approached, so to speak, too close to his patient, and the perspective of the picture, which the symptoms in the aggregate present, is defective. In such instances the value of a second opinion is obvious. Irregular practitioners—charlatans—are well aware of the value of selecting some conspicuous feature in a disease, and of professing to direct their treatment towards its removal. But, generally speaking, either in ignorance or from wilful concealment, the true nature of the disease is veiled, and the patient's attention is, in like manner, diverted from the really efficacious part of the treatment, and fixed upon some so-called specific, which is, at best, innocuous; and it is well for him if it be not mischievous; perhaps, fatally so. As in medicine, for example, diseased lungs are thus treated, so, in surgery, are diseased joints; beside numberless other ailments which flesh is heir to.

The peculiar qualifications to which I have alluded, as necessary for prompt and sound diagnosis, are exemplified in other engagements in life; and the failure to fulfil them satisfactorily is dependent on the same mental peculiarities, exaggerated by training. I remember being much struck with an instance of this, narrated in the biography of Laplace. The Emperor Napoleon, when First Consul, was anxious to show his high esteem for the philosopher, and his appreciation of science, in which he was himself no superficial student, and appointed Laplace to an important post among his ministers; but he soon discovered his mistake. The man of abstract science—the

profound mathematician—was found entirely incompetent, not from want of knowledge, but from an excess of accuracy which compelled him to investigate personally every subject which came under his notice, with such minuteness as to arrest the progress of business, and to blind him to the relative importance of various points submitted for his judgment,—defects which ill suited the practical and impatient temper of his imperious master. He was soon suspended; and the commentary of his patron was, that “Laplace, though a mathematician of the highest rank, looked at no question in its true point of view. He was always searching after subtleties; all his ideas were problems, and he carried the spirit of the infinitesimal calculus into the management of business.”

I fear it will be thought that I have been tedious and desultory in these introductory observations, and that I have dealt in trite platitudes which have but little direct relation to the immediate subject of these lectures. It may be so; yet I wished to say these things, and I trust that I have not misapprehended the purpose of the founders of this professorship, nor presumed upon the liberty which my position confers, in supposing that it is neither inconsistent nor irrelevant that I should avail myself of this public opportunity to give expression to my opinion on questions which I consider to be of vital interest, not only in the cultivation of surgical diagnosis, but in the influence they exercise on the progress of surgery as a science.

In medicine, empiricism has its justification in necessity; but, in surgery, it is without such apology, and degenerates from its original and worthy meaning to that popular and degraded interpretation which modern conventionalism has applied to it. Empirical surgery is a paradox, or, if it be not so, it is an imposture. I do not mean to affirm that experiment in surgical practice is never to be justified; but he who undertakes so serious an experiment as an operation, without a reasonable belief that benefit will result to his patient, and without a careful consideration and rational explanation of the grounds of

that belief, assumes a responsibility which ignorance and temerity may explain, but cannot excuse.

It is true that the successful cultivation of surgery demands not only careful and patient observation, but independence of thought tempered by cautious reflection. Without these qualifications self-reliance becomes rashness, and ceases to be that resource which it should be to the surgeon in diagnosis, as it is his unfailing stay in action. Such, at least, Sir, is the lesson I have been taught; or, to speak more correctly, the model which has been set before me by the great masters of our art, from whom it has been my privilege to learn; and by him in particular whose name I have already mentioned incidentally in this lecture as my own honoured master. Mr. Travers is above any eulogy to which I can give expression; but I may be excused for offering this passing tribute of respect to one for whose memory I retain an affectionate reverence, and whose philosophic mind must leave its lasting impress on our profession.

In an eminent degree did John Hunter strive, by his example, to give a scientific tone to surgery. *This* was the great object for which he lived; *this* the great result of his laborious life. He condescended to every detail; he accumulated his materials, shaped them, and put them together; and thus reared an edifice, which is not only an imperishable memorial of the genius of the builder, but an enduring protest against an impatient thirst for fame, and the use of illegitimate means in the effort to secure it.

LECTURE II.

Symptoms and Signs.—Antecedent Condition of Patient: his Habits, Temperament, and Occupation.—Exciting Causes of Injury or Disease.—Existing Subjective and Objective Indications.—Signs, Certain, Equivocal, Negative, and Accidental.—Sources of Obscurity and Fallacy.—Functions of Animal and Organic Life.—Intellect, Expression, Colour, Volition, Sensation, Excito-motor Phenomena.—Rigor, Specific Sensation.

MR. PRESIDENT AND GENTLEMEN,—An accomplished and eminent physician, when speaking in his lectures of the value of diagnosis in medicine, and of its forming “the indispensable basis of all *advances* in physic as a practical art,” goes on to observe that, “almost all we know concerning the proper treatment of the sick is *originally* derived from observation, *not* of the *nature of diseases*, but of the *effects of remedies*.” This apparent paradox embodies an important truth, as it is employed by its author in application to the practice of physic; because, as I took occasion to remark in my last lecture, the action of medicines can be learned only by experience, such knowledge being, for the most part, purely empirical, but, at the same time, essential in the medicinal treatment of disease. Yet it is equally certain that the most accurate acquaintance with therapeutics must be unavailing, unless the capability of identifying disease be also possessed; and it is thus alone that empiricism and science combine to make the accomplished physician. In surgery, apart from the medical treatment of our

cases, there is, as I remarked, but little scope or justification for empiricism ; diagnosis is all-important, and the association between the knowledge of what a disease is and its befitting treatment is, therefore, founded upon a more satisfactory basis. Physiology and pathology have taught us how to manage surgical disease ; where to interfere and where to withhold interference. All the great discoveries in practical surgery are due to the advance of our knowledge in these departments of science ; and our operations are performed with confidence and skill only by the practised anatomist.

I trust it may not be inferred that, in making these remarks, I desire to draw an invidious parallel between medicine and surgery. This is very far from my intention. I am not unaware of the vast strides which the practice of medicine has of late years made, both in acquaintance with disease and in the use of remedies ; and a new field has been opened up by the employment of spectrum-analysis in displaying the presence of elements in the animal body, which the most delicate chemical tests have failed to detect ; and also in demonstrating with what remarkable rapidity those elements pass into the circulation, and are found even in parts completely external to the circulating system. The discovery by Dr. Bence Jones of the existence, in every texture of man and of some animals, of a fluorescent substance, which has a very close optical and chemical resemblance to quinine, is a singular triumph of investigation in this direction. From this source, and from experimental organic chemistry, we may confidently anticipate that our knowledge in therapeutics will be advanced, and that our accepted empirical conclusions will receive a scientific explanation. But especially has the progress of which I speak been due to the more accurate diagnosis of disease, founded upon morbid anatomy and pathology ; and I cannot but recognise in this fact a bond of closer alliance between medicine and surgery ; a nearer approximation in our several pursuits, and an identity of interest in the investigations of the several co-

labourers in the cause of humanity—an association which should never have been disturbed by jealousy or rivalry, by pharisaical derision of empiricism on one side, and by contempt for handicraft on the other. Much has been accomplished in this welcome change even within my short memory ; and much, I may add, is due to the present high educational standard of that class which forms the bulk of our profession, and which, as embodying the scientific cultivators of both medicine and surgery, constitutes the great bond of union between the more exclusive branches of our common calling.

The evidence by which we judge of the nature of a surgical disease or injury, or, in other words, by which we form our diagnosis, is derived from various sources. Many antecedent circumstances in disease, and many concurrent circumstances in accidents, have to be carefully ascertained and considered, and this inquiry constitutes the *history* of the case. Any deviation from a normal condition, whether functional or organic, is called a symptom or a sign ; and it is either by the positive information supplied by the presence of such signs or symptoms, or, it may be, by the negative evidence afforded by their absence, that we judge of the nature of a disease or accident, and of the treatment which should be adopted for its relief.

In the foregoing paragraph I have employed two words, “symptom” and “sign,” as if they were convertible expressions, to which the same meaning is attached ; and yet this is not exactly the case. Even the etymology of the two words would seem to justify some distinction between them. The Latin word *signum* (itself of doubtful Greek origin) is more positive and emphatic ; it implies the evident manifestation of what it denotes ; whereas the Greek word *συμπτωμα* conveys to the mind the idea of concurrence and accident combined. By this I mean, not the concurrence of various elements by which a diagnosis is formed, but the coincidence of an *accidental* circumstance with, and denoting the presence of, that which is, as opposed to it, *essentially* the disease. And this definition is

in strict accordance with that pathology which regards disease as having an existence entirely independent of, though denoted by, symptoms. In other words, the symptoms, in the aggregate, do not constitute the disease, but their concurrent presence denotes its existence. But these distinctions in definition are determined much more by conventional usage than by grammatical rule; and I trust I shall not do violence to either by the interpretation I have been in the habit of attaching to these two words. Symptom seems to me more a medical, and sign more a surgical term; symptom conveys to my mind the idea of something, the communicated or obvious presence of which is indicative of some abnormal condition that is not otherwise or in itself manifest; sign appeals exclusively to the senses, and appears to imply the existence of a palpable token whereby we may recognise the presence or nature of some *material* change in the body. For example, it would, to my apprehension, be as inaccurate to speak of the functional disturbance of organs as signs of fever, as to enumerate deformity, crepitus, &c., as symptoms of fracture. I should prefer that diction in which the word "symptom" is employed in reciting the indications of the presence of cancer in the stomach, and the word "sign" in describing the same disease in the breast. Perhaps I should express myself more accurately if I speak of *symptoms* as denoting functional variations which are subjective, and *signs* sensible changes which are objective, the former being essentially dynamic, and the latter physical or chemical in their nature. Such, at least, is the sense in which I shall employ these expressions in the ensuing lectures; although I am aware that the restrictions I put on the words in question are open to criticism, and are not in accordance with the definition of them which is often given and received.

In the consideration of some of the cases of injury, and even of disease, which come under the care of the surgeon, he is able to dispense with any particular inquiry as to antecedent circumstances; but in the majority of instances the previous history

is an important element of information, as bearing upon the treatment, and requires careful investigation, while it tests the ability and discretion of the practitioner. Not infrequently the simple nature of the malady or injury, or the intelligence and good sense of the patient render the task an easy one, but very often the surgeon has to contend with a variety of adverse circumstances in this investigation. The antecedents may, in the patient's estimation, be overrated or underrated; he may attach an undue importance to some, whilst he conceals, either wilfully or ignorantly, others. In some instances patients are indisposed to answer any inquiry, and in others all suggestions are acquiesced in with a readiness which negatives the value of every reply. Leading questions may be requisite to elicit information, or they may be fatal by inducing assent, in compliant or fanciful clients, to every inquiry. Thus, both patience and sagacity are taxed in this investigation, and frequently it is only after both are well nigh exhausted, that a true history of the antecedent condition of the patient is acquired.

The circumstances into which it behoves the surgeon to inquire may be classed under two heads; viz., those which are associated with the general health, habits, occupation, temperament, and constitution of the patient, and those which more especially pertain to the existing disease or accident, and which constitute predisposing and exciting causes of the malady he has to deal with. There are few surgical cases in which the general antecedent condition of the patient has not an important bearing on the treatment and prognosis; and in many instances likewise a just diagnosis is dependent on an accurate acquaintance with the previous history of the patient. This is especially the case in large cities where life is more artificial, and the over-stimulation of the circulation, with insufficient exercise, is so common. Thus, it may be predicated with tolerable certainty of the gin-tipping mechanic or of the beer-drinking drayman, that they will bear injuries and

operations badly ; that their re-active power is feeble, or, if active, faulty and tending to destructive disorganisation rather than repair. The flagging and faltering steed requires both whip and spur, and the wonted stimulus must be supplied to rouse the sluggish organic energy, or to convert the morbid into a healthy action. I say the *wonted* stimulus, and I may remark that the caprice of the stomach often exacts the most scrupulous attention to its habits, so that even the substitution of one preparation of alcohol for another will not be tolerated—a circumstance which must, I think, be familiar to many of my hearers. In fracture, we frequently meet with cases exemplifying this fact ; a tardy union is stimulated by the welcome glass of gin, or the allowance, often not very moderate, of porter, as the case may be ; and in one instance, narrated to me by a provincial surgeon of eminence, non-union of a fractured leg was traced to the patient's privation of his evening indulgence in smoking, which was forbidden by the rules of the hospital ; but my friend procured a relaxation of this rule in favour of his patient, with the happiest result. The explanation of these circumstances is intelligible, if we trace the connecting links between the cause and effect. Assimilation of the food is essential to reparation, but digestion is dependent on the humour of the stomach, and the disposition of that organ depends on the ingesta and other agents, which influence it more or less directly. Thus, the diagnosis of the phase which disease resulting from lesion assumes, is often materially assisted by a proper appreciation of these circumstances.

The foregoing remarks apply with equal and even greater force where the history of pre-existent disease—*e. g.*, the presence of a poison in the system—affords to the surgeon an explanation of phenomena which would be otherwise perplexing. How long does the poison of malaria linger in the frame, and determine the intermittent type of many accidental disorders ? Gout modifies or aggravates the intensity of inflammation and influences its results ; but still more potentially does syphilis

often mar reparative effort, and predispose to local results which would not occur in a healthy constitution. Under these circumstances, the necessity of treating the constitutional condition in order to cure the local complaint, proves the importance of an accurate diagnosis in such cases.

The temperament of the patient, both physical and moral, has often a material influence in determining the course of action of the surgeon, where the responsibility of a serious operation is thrown upon him ; and undoubtedly peculiarities in these respects require due consideration where every element of information may assist in clearing away the obscurity of a doubtful diagnosis. The nervous excitability of one patient, the frigid impassiveness of a second, or the uncomplaining docility of a third, may so far modify the symptoms resulting from the same lesion, as materially to mislead the medical attendant, if unobservant of these peculiarities. No less does physical temperament produce similar qualifying results ; and injuries are differently resented by patients belonging to the sanguine, bilious, or nervous type.

The occupation of the mechanic or artisan, which demands the special use of certain muscles, or in which some constrained position is more or less constantly maintained, not infrequently entails unsymmetrical development, and even a certain amount of deformity which, if overlooked, may mislead the surgeon when treating an injury. In my last lecture, I took occasion to remark upon this fact, which should not be disregarded in cases where the diagnosis is not clear, and may owe its obscurity to this cause. And instances are not wanting, in which, even amongst the better class of our patients, a knowledge of their ordinary engagements may throw light of considerable value on the nature and consequences of injuries or diseases of which they are the subjects ; and such information may serve to guide the surgeon, not only in his diagnosis, but in his treatment.

The direct or exciting causes of surgical disease or injury

are many and various, but may, as regards the latter, be classed chiefly under extremes of temperature and mechanical violence, which produce results differing as widely in their degree as in their nature, according to the intensity of the agent, or the susceptibility of the recipient. A precise acquaintance with the character of the exciting cause and the manner of its infliction is always desirable, and often essential in forming a correct diagnosis; *e.g.*, in penetrating wounds, the form, size, sharpness, and other characteristics of the weapon, enable the surgeon to determine the probable depth of a wound, and to conjecture, if not to ascertain positively, the extent of the injury and the parts that are implicated. Again, the diagnosis of injuries at or near to the ball-and-socket joints is materially aided by a knowledge of the way in which the accident occurred; direct violence suggests fracture, and force indirectly applied points to dislocation. So uniformly almost is this the case, so rare are the exceptions, in the shoulder joint, that a clear and well-defined description of the manner in which the injury was inflicted is alone sufficient, in nearly all cases, to determine the nature of the lesion, whether it be dislocation or fracture.

Yet, whatever the value of the knowledge acquired by reference to antecedent circumstances, the existing condition of his patient is the chief source of information upon which the surgeon must rely, in forming a diagnosis of the disease or injury he has to treat. The changes which are thus offered to his inquiry may be classed under two heads, *viz.*, subjective and objective, or those which are simply functional, and those which are sensible. Each of these possesses a value in itself, though in general its importance is very much enhanced by association with other indications pointing in the same direction. Many subjective indications or symptoms are to be ascertained only by inquiry of the patient, and especially so those which have reference exclusively to his own feelings, such as the presence, character, and localisation of pain; but others, such as the state of the tongue and of the circulation, are tested by

the senses. Objective signs are exclusively sensible, and the aid of all the senses is called into requisition in determining their existence and their nature. Adventitious assistance is frequently of much value in helping the surgeon to a correct diagnosis ; as, for example, the microscope in suspected cancer, the stethoscope in aneurism, accurate measurement to test the symmetry of opposite sides of the body, and the exploratory needle in doubtful tumours. To these I may add the ophthalmoscope, the laryngoscope, and an instrument with the more comprehensive title of endoscope, for the use of those who are inquisitive respecting more remote regions in the interior of their patients. Even in subjective symptoms such artificial expedients are often adopted with advantage, and the condition of the secretions, the capacity for developing heat, or the character of the pulse, are ascertained by chemical analysis, the thermometer, or the sphygmograph.

It is not my intention to detain you with a detailed description of *all* the symptoms and signs with which it is the business of the surgeon to familiarise himself, although it is my wish and design to classify and comment briefly on the more important and significant ; but I shall venture first to occupy your attention for a few moments with some remarks on the *relative* value of these indications of disease or injury, individually or as noticed in association with each other ; and on some sources of obscurity and fallacy to which they are obnoxious.

The importance or worth of a diagnostic sign or symptom depends upon its more or less pronounced character ; or, in other words, upon its being certain or equivocal. In some instances, a solitary sign, such as abnormal mobility in fracture of a long bone, or transparency in a scrotal tumour, or the audible ring of a stone in the bladder, is characteristic or pathognomonic of the injury or disease with which each is allied. But in many more it is by the association of signs with each other, or with symptoms, that their value becomes apparent. Thus, pulsation alone is insufficient to characterise an

aneurism, because other tumours likewise pulsate; but if we find associated with this sign a diminution of the swelling when the supplying artery is obstructed, and an expansive return to its previous dimensions as soon as pressure is removed from the vessel, each sign imparts a significance to the other, which alone it does not possess. In this way an accumulation of evidence may be elicited, amounting to actual demonstration, leaving no room to doubt the nature of the case which is under investigation.

Not infrequently *negative* evidence has an important bearing on diagnosis. The presence of many symptoms and signs may point to a certain conclusion; but the absence of one particular indication may suffice to counterbalance all the positive evidence. This is occasionally exemplified in the diagnosis of tumours. Again, a tranquil pulse may be the only proof that suspected inflammation is not present,—the diagnostic distinction between cerebral excitement and inflammation.

But the value of diagnostic testimony to the existence of disease or injury varies with the capacity of the observer. The careless inquirer may overlook indications which are readily detected by the observant practitioner; or experience may teach various surgeons to place a different estimate on what they notice. Some have more tact in discriminating what is important, or in eliciting proof of what they are seeking for; in fact, it is in surgery as it is in medicine, that the senses must be well educated, the judgment well balanced, the fruits of experience well stored and readily accessible; and beyond all, there must be, as I have already insisted, such classification of acquired knowledge as shall constitute a sound code of principles on which to rest, where experience is at fault and precedent fails.

Among the many tests to which the tact and judgment of the surgeon are subjected, is that of the *accidental* presence of signs or symptoms, and the relation, if any, which these may have to the subject under consideration. The relative

value of concurrent signs I have already referred to ; but the present is a separate question, and often one of much delicacy. It is far from rare to meet with such peculiarities as I allude to. They may be due to circumstances quite independent of the existing malady ; or they may be allied with it, but without possessing any intrinsic value in determining the diagnosis in the case. They constitute for the most part the category of what I may term the "remarkable features" in the early cases, and especially the operations, of young surgeons,—features which cease to be remarkable, and which are estimated at their true value as experience ripens. Yet, on the other hand, some of these accidental or occasional concomitants are fraught with a deep and peculiar meaning to those who know how to read them aright ; they are as the floating feather, showing the course of the current of air or of the silent stream.

The coexistence of various signs or symptoms suggests the consideration whether they are consistent with each other, and how far they are diagnostic of the injury or disease which is suspected. In this investigation it becomes the duty of the surgeon to unravel the tangled web, and to ascertain the simplicity or complexity of the case before him. The concurrence of dislocation, with fracture near to a joint, may give rise to such a complication ; and the diagnosis of such injury is thereby rendered more obscure. Many opportunities will be afforded me of exemplifying this rife source of difficulty in the diagnosis of visceral lesions. These obscurities are sometimes intensified by the more urgent symptoms assuming such a predominance as, in part or entirely, to mask those of less prominence, though not of inferior importance in arriving at a correct conclusion. The sensations of the patient,—the pain he suffers, or the swelling of an injured part, are rife sources of obscurity in such circumstances, and necessitate delay in acting, on account of the difficulties they entail. Or, again, the surgeon may be misled by deception on the part

of the patient; and this source of embarrassment, as I have already observed, is not always wilful. His ignorance of the relative value of this or that indication may induce him to give prominence to one symptom, whilst he conceals another; or he may have some unrevealed motive for misguiding his medical attendant. Hysteria often perverts symptoms, by the substitution of those which are its peculiar attributes; or the acute or chronic effects of intoxicating drink may entirely alter the phase of indications, which would otherwise stand out in bold relief.

Another source of obscurity is the functional derangement consequent on the sympathy of different organs; such, for example, as arrested or excessive secretion, irritability of the stomach or bowels, obstinate constipation, dyspnœa, convulsion, paralysis of the bladder, and a host of other sympathies, some familiar in their interpretation, others unintelligible to us. The influence and effects of prior treatment also often call for the scrutinising attention of the careful practitioner; for in them we find an explanation of modified or qualified symptoms, which would be otherwise a prolific source of fallacy in diagnosis; and which sometimes suggest the wish that the case had been transmitted to us without this additional source of obscurity. The earlier treatment of strangulated hernia, of retention of urine, of misunderstood joint injuries, present us with many and painful proofs of the importance of investigating all that the patient has had done for him by those who have had the earlier management of the case.

These are the chief sources of fallacy or misdirection which occur to me to notice in connection with surgical diagnosis. It would not be difficult to extend this list, or to enlarge upon its details, by further illustrative commentaries on the different subjects to which I have alluded: but this would be inconsistent with the necessarily condensed style of these lectures; and the details of the outline I have sketched may be readily filled in. I shall next proceed to make a few remarks on

certain symptoms and signs which have a more special import and significance in surgical diagnosis.

The many functions of animal and organic life are variously influenced in maladies which it is the lot of the surgeon to treat; those which are under the influence of the cerebro-spinal nerve-centre more directly, and those over which the cyclo-ganglionic system presides more indirectly. Disturbance of the assimilative functions, in some of its varied forms, is commonly present in any local lesion which is of sufficient importance to produce a constitutional impression; and for the purpose of correctly interpreting these deviations from a healthy standard, it behoves the surgeon to have acquired familiarity with many details in diagnosis, which it was formerly too much the custom to regard as the special province, if not the exclusive privilege, of the physician to expound. The tongue, the pulse, the state of the excretions, all afford invaluable assistance to the surgeon in diagnosis, and, therefore, in treatment; and where it is needed no trouble should be spared, no means of investigation should be considered beneath his careful attention, in order to elicit the requisite information to guide him in forming an opinion. Chemical analysis, especially of the urine, will throw invaluable light on many symptoms which are otherwise inexplicable, and where there are no other more direct means of learning that the kidney or bladder is the seat of functional disturbance or even organic change. And where chemistry fails, the microscope, with its simple lenses, or its polarising arrangement, will supply the required information. The varying development of heat, as tested by the self-registering thermometer, has a significance which requires only the accumulation of facts, statistically arranged, to constitute a far more valuable guide in diagnosis, than is the case in the present limited state of our knowledge on this subject. It is not because the testimony we obtain from this source is, in some instances, apparently contradictory, that we are justified in disparaging its

value ; such, as I remarked in my last lecture, is often the case in the early steps of scientific investigation ; and it is not infrequently the most unpromising plant, that which requires most jealous watching and most careful tending, which ultimately bears the fairest and the richest fruit.

The state of the *Circulation*, as tested by the pulse and by listening to the beating of the heart, is too important to need a comment. Yet many precautions are needed, many influencing conditions are to be allowed for, and many accidental circumstances taken into consideration, in estimating the value of the pulse in diagnosis. In some individuals the normal standard is low in frequency, in others high ; or the power may be feeble, or the natural pulse strong and full ; and these conditions are by no means determined by the general physical development, or even by the ordinary health of the individual, whether weakly or robust. Again, the nervous excitability of one patient, or the stolid indifference of another, necessarily introduces a discordant element into a source of information which we would willingly have precise. Further, the surgeon will not forget the anatomical lesson he has learned in the dissecting-room, that deviations in arterial distribution may, if overlooked, lead to serious error in testing the pulse at the wrist. For these and other reasons I think the functional derangements of the circulation must be accepted, in many instances, with the allowance of a considerable discount for possible sources of fallacy, and consequent misdirection. The same remark applies with similar and even greater force to the act of *Respiration*, *i.e.*, apart from the stethoscopic examination of the lungs. It is from the persistence of an abnormal standard in these functions that we derive the most valuable information ; especially when the conclusions we draw from such conditions are fortified by collateral evidence of another kind.

Of the *Tongue*, as the index of functional changes which are otherwise hidden from our ken, I entertain a very different estimate. This little member rarely deceives the intelligent

inquirer ; I mean by its *silent* response to his queries. It tells its simple tale truly ; and on its face we may read with certainty not only the day to day variations of our patient, but full often his approaching end. I would trust the tongue, if it gave me encouragement, when almost all beside might seem to forbid hope ; and I should know that its glazed and brown surface tell more plainly than the parched member could articulate, that food is useless, the chemistry of organic life is at fault, nourishment has ceased, and that dissolution is near at hand.

Turning from these organic functions, which are under the guidance of the cyclo-ganglionic system, we will now contemplate briefly other functions which are controlled by the cerebro-spinal centre of nerve-power. Under this head we have to consider the intellectual faculties, voluntary movement, common and specific sensation, and likewise the excito-motor movements which are associated with the spinal cord as their source or centre.

In the deviations of these organs from a healthy condition the surgeon is deeply interested ; and especially so in the direct appeals which are made to them in accidental lesions from violence. In a future lecture I shall have occasion to illustrate this subject somewhat fully ; at present I shall confine myself to noticing the indirect influence exercised on the nervous centres, as exemplified in the aberration of their functions from a normal standard.

Wandering of the *Intellect* occurs under a variety of circumstances ; and, as a casual occurrence or taken *per se*, it is not to be trusted with any confidence as a diagnostic symptom. Not infrequently I have known temporary delirium to occur after an operation, without being accompanied or followed by any circumstance to create anxiety. This may be the result of mental reaction after much tension or subdued feeling ; it may be the consequence of wakeful watching, or the effect of the anodyne administered to relieve it. It is rarely produced by pain, unless long continued and severe ; but it often supervenes

in extreme feebleness and exhaustion, whether from hæmorrhage, profuse suppuration, or any other source of depression of the vital powers.

Yet, though often deceptive by itself, when viewed in connection with other circumstances, it is frequently a very alarming symptom. When accompanied by a calm and even pulse and a clean tongue, we know that the wildest delirium is the offspring of nervous irritation, and not of inflammation. But when associated with other indications of febrile excitement, anxiety is naturally aroused; and if, further, such disturbance is consequent on some injury to the head or spine, we have little room left to doubt that the nervous centres or their membranes are the seat of inflammation.

The delirium of nervous excitement—nervous delirium—and that of drunkards, delirium tremens, or, as a critical scholar and physician under whom I studied medicine used to term it, *delirium cum tremore*,—have much in common. Indeed, it has been denied by many surgeons, amongst whom is Dupuytren, that they are distinguishable. Probably this is altogether so in many cases; the quiet pulse, the clean tongue, the excited talk, the restlessness, the profuse sweating, are characteristic of both; but the tremor is more uniformly present in one than in the other; there is not sufficient difference, perhaps, to constitute this a diagnostic distinction between them; but still tremor is rarely absent in the drunkard's delirium, and not unfrequently so in the subject of nervous delirium. Perhaps I should express myself more accurately by terming the latter *agitation*, the former *tremor*. Each is attended by a remarkable insensibility to pain.

There is a close analogy, if not identity, between the delirium and other symptoms which attend the later stages of an exhaustive disease, such as gangrene, and that which is the sequel of typhus or typhoid fever. Is this wandering of the intellect the consequence of a specific poison circulating in the brain, or simply indicative of the declining powers of life, and of the

presence in the blood of the uneliminated products of organic conversion? Probably the latter, when unattended by excitement, and of that low muttering form which babbles incoherently of things long forgotten, and unintelligible to, or unheeded by, the bedside watcher. Misguided by the failing senses, the hands wander forth in quest of imaginary objects; and the poor wrecked intellect is busied with its own suggestions, as life ebbs away and leaves it stranded on the confines of eternity.

Here, as the fittest opportunity, I will introduce a few remarks on *Expression*, in attitude and feature, as an adjunct in surgical diagnosis. I say in attitude as well as feature; because in the former there is often much which is expressive of pain or ease, and also of the character of the suffering. The mode in which the arm is carried in axillary dislocation, the position of the outstretched leg in luxation into the thyroid foramen; the drawn-up knees in peritonitis; the uplifted arms in dyspnœa; the curving spasm of tetanus; the retracted limb in knee and hip disease, are all more or less characteristic of the maladies with which they are allied. Again, how much expression is there in the restless tossing to and fro of the nervously-excited patient, and in the languid, extended and flaccid limbs, and outspread hands of the worn-out sufferer. The hypocrite is sensible of the influence of posture in imposing upon the credulous and uninitiated; and the imitative faculty of hysteria in this respect is often such as to deceive even those who are alive to its Protean characteristics. Freedom from pain is expressed by an easy and unconstrained attitude, which may be detected even in the recumbent posture. I remember, among the many anecdotes which he used to gratify me by telling of his uncle, that Mr. Bransby Cooper said Sir Astley always augured favourably of a patient, who received his visit to his bedroom, with his hands clasped behind his head. I have often verified the correctness of this diagnostic sign of ease of body, as well, generally, as of mental quietude. It is scarcely

necessary to add that the surgeon's knowledge and sagacity should supply him with a ready tact in convicting an impostor of assuming an attitude which is inconsistent with the malady he wishes to affect; the detection of fraud may often be accomplished in this way.

In the *Face*, as the index of the mind and feelings, we have a guide on which, when allowed to tell its own tale, we may place much reliance. We are all, naturally, physiognomists; and our ability in reading expression is sharpened by contact with the world; but more truly so by familiarity with disease and suffering. In the intercourse of society, good breeding requires that the facial expression should be under control; though I fear that, from selfish motives, the features are too often made to subserve the purpose attributed by Talleyrand to words, viz., that of concealing ideas. But, in the sick room, human nature is stripped of this mask, and physiognomy may be studied usually without such fear of deception. Each feature has its own peculiar language, but the meaning is generally more intelligible in their combined expression than when they are studied separately.

The tint or colour of the skin is, especially in our climate, often though not invariably a measure of the state of health; more so, however, in youth than in the middle period of life or in old age. But the normal diversity of tint is so manifold, that it behoves the practitioner to be cautious as to the inferences he may draw therefrom. To the surgeon the information drawn from this source is of far less value than to the physician, in special diagnosis. To the latter, the yellow tint of jaundice, the blue colour of cyanosis, the copper dye in supra-renal disease, and the ashy hue in ague, are characteristic signs, severally, of these various maladies. It is said, indeed, that there is a peculiar tint of skin allied with malignant disease; but its frequent absence deprives it of its worth. Not infrequently disease of unequivocally malignant type is associated with a healthy complexion and well-nourished frame.

On the aspect and the expression of the features in disease much might be written ; it is a prolific subject, and yet one which, in its bearing on diagnosis, it is difficult to reduce to system and rule. The expression which betrays various degrees of pain is familiar to all observers ; indeed, it is intuitively known and understood. But it may be, and is, easily simulated, for the purpose of eliciting sympathy, or of extorting admiration for fortitude shown. Yet there is a silent utterance in the compressed mouth, dilated nostril, and upturned eye of genuine suffering, which makes a more forcible appeal than the violent distortion of feature which is indulged in or assumed.

The expression of the face may aid the surgeon in his diagnosis, when taken in conjunction with other signs or symptoms. Such are the crimson spot of hectic, the pinched features of peritonitis, and the peculiar but indescribable combination of anxiety and vacancy in shock. How anxiously does he look for any evidence of loss of symmetry in the face of a sufferer from head injury ; and often the first look of greeting cheers or depresses him in regard to the improvement or retrogression of his patient, whatever may be the disease of which he is a victim. I shall have occasion again to refer to this subject ; and will, therefore, leave it with this cursory notice, and proceed to comment upon some other functions allied with the cerebro-spinal nerve-centres.

The exercise of *Volition*, as evinced in muscular movements, is liable to be influenced by any cause which is operative upon the nerve centre from which it derives its power. Such influence may be transient or persistent, local or general, the consequence of functional sympathy or of organic lesion ; or, lastly, it may be due to some cause operating on the brain, or on some intermediate part of the nerve communication between that centre and the paralysed muscles. The state showing this disturbance varies in intensity from partial to entire loss of power ; or it may include the signs of irritation,—local or

general spasm. Further, there are accidental circumstances relating to lapse of time or to special seat of injury and treatment, which materially modify these conditions both in degree and character ; but of them I shall have to speak more especially in my next lecture, and, therefore, I will defer any further observations on this subject until then.

The phenomena witnessed in association with the true spinal centre and the excito-motor system of nerves are deeply interesting and of great significance in the diagnosis of surgical as well as medical disease. They are essentially distinct from, though often complicated and sometimes confused with, those referable to the encephalic centre ; and they are elicited by motive causes acting upon the cord itself, or upon the peripheral distribution of the nerves. The fact that the phenomena in question are, in some instances, more pronounced or more apparent when the cerebral functions are interfered with or in part suspended, enhances their interest and value in the diagnosis of brain or spinal injury ; and the recognition of the special functions of this system, and their alliance with the cord as their centre or source, in some part (not yet identified) of its complex structure, has led to an accuracy in diagnosis, which has already borne ample fruit in the treatment of disease, and still offers a field for further investigation, which has been and continues to be successfully cultivated by the physiologist, the anatomist, and the practical physician and surgeon. It would be invidious to attempt to enumerate the many labourers in this deeply interesting field of science : but I may be permitted to mention Sir Charles Bell, as the pioneer of this century ; of Marshall Hall, whose name is imperishably associated with these discoveries ; of Brown-Séquard ; and of Lockhart Clarke, who is still prosecuting his admirable and fruitful investigations in this delicate branch of histology.

Local or partial morbid manifestations of excito-motor phenomena are of frequent occurrence, and may be occasioned by trivial causes, acting directly upon distant organs, and mediately

or by sympathy upon the true spinal centre. The varying and doubtful character of the exciting cause in determining an uncertain result, deprives these pathological indications of much of their diagnostic value ; but where the characteristic spasm extends more generally throughout the frame, the source is, or becomes by transfer, more directly central ; as in tetanus, chorea, epilepsy, and hysteria. In some instances there seems to be reason for believing that persistent general symptoms are due to organic change in the cord itself, by transfer of irritation from the wounded periphera of a nerve. I have been favoured with a view of some preparations of Mr. Lockhart Clarke, which appear to demonstrate this fact, and to which I may again refer in a future lecture. In spinal lesions from violence there can be no doubt that such is the case. Partial and limited damage of the cord may produce involuntary spasm ; and organic change following injury may develop tonic spasm or rigidity of the limbs, after volition and sensation are suspended.

Rigor is an excito-motor expression, often of great value, in diagnosis, to the surgeon. But its full significance is elicited only by association with other symptoms ; by itself, the most severe rigor may denote nothing more than the response to a transient appeal which has been made to the sentient extremities of the excito-motor nerves ; as, for instance, by the introduction of a catheter into the bladder, or by the passage of a renal calculus along the ureter. Rigor may be due to cold applied to the surface of the body, to some depressing mental influence, or to miasmatic exhalation when it assumes an intermittent type. It is found to occur, indeed, in all forms of blood-poisoning, and in vital inflammations, which are allied in many of their phenomena, though unintelligibly so in their cause, with toxæmia. But, when associated with symptoms which are suggestive of suppuration, the critical rigor marks the period often with unerring accuracy ; or this indication of the formation of pus may, from the obscurity of the case, be

the first symptom to arouse suspicion as to its true nature. Probably in no case does the operating surgeon look with more alarm on this symptom, than when allied with an accelerated pulse, a hot skin, and profuse perspiration, under circumstances which induce him to apprehend the occurrence of pyæmia. Rigor is so usual—I may say so constant—an event as ushering in this fatal malady, that, although its presence may not be accepted as conclusively diagnostic, in combination with other indications, of the disease, yet the absence of this symptom may induce the surgeon to be hopeful, even when the otherwise condition of the patient might excite great anxiety.

Many circumstances indicate an affinity between rigor and other convulsive affections, such as epilepsy and the convulsive stage of shock. It is not unnatural there should be this relationship, as the spinal centre is appealed to in all, the points of difference being in degree of intensity or duration, and in the fact that the encephalic centre is involved in the severer forms of epileptic convulsion. An interesting phenomenon connected with these conditions is the variation of temperature in the different stages. Rigor is marked by a rise in temperature, and in the subsequent stage of sweating it falls, in some instances, below the normal standard. What may be the proximate cause of these changes, so entirely at variance with the feelings of the patient, is matter of conjecture. Dr. Johnson, in some interesting observations on this subject, remarks that probably the sympathetic plays an important part, by its influence on the muscular contractility of the capillaries; and that there seems reason for believing that in rigor there is an anæmic condition of the cord; and, in epilepsy, also an anæmic condition of the brain. Of epileptiform convulsion, in association with injury of the spine or head, I shall have to speak hereafter.

The information to be derived from the various states of *sensibility* or common sensation is very similar to that which is acquired from the allied function, as regards its cerebral source,

of motor power. As in the latter, so in the former, the cause of disturbance may be transient or local, or it may be such as to entail permanently suspended function over a considerable portion of the frame. The frequent coincidence of symptoms, indicating simultaneous derangement of the exercise of voluntary power and of sensibility, is accounted for by the anatomical relations of the centres of nervous influence, and of their prolongations in the spinal canal. I shall return to this subject in a future lecture; but there are certain conditions associated with common sensation, which it will be well to examine at the present time, as they have a more general interest than in their special relation to lesions of the nerve centres.

I have already remarked that intoxication has the effect of lowering the sensibility by its direct influence on the brain. I have observed a similar condition in severe shock, and apparently from the same cause. Loss of blood does not induce this effect, unless complicated with shock, or to such an extent as to cause faintness. Hysteria influences sensibility in various ways; in some instances suspending it for a time entirely, in others exalting it locally, and even generally. Depressed sensibility is, therefore, an equivocal diagnostic symptom, which may be interpreted in a variety of ways, and requires cautious consideration. But when the tactile insensibility of any part is complete and persistent, without evidence of nerve-lesion, the indication is much more definite, and denotes, as the case may be, pressure on, or disorganisation in, some portion of the encephalic centre, or of the spinal cord. Transient paraplegia may result from shock to the cord; but this symptom, under such circumstances, is limited in duration, and has no tendency to increase; extension upwards of the loss of sensibility is a fatal indication of organic or vascular lesion.

Localised tactile insensibility is indicative of pressure upon the supplying nerve, or of some interference, material or functional, with the nerve-centre from which it springs. But the motor nerve of the face is more obnoxious to such lesion than

any of the sensitive nerves passing out of the skull ; it is frequently paralysed by injury or disease of the petrous bone, or by the pressure of a tumour in the parotid gland. Under these circumstances this symptom is diagnostic ; but it should be remembered that the facial nerve is also liable to functional paralysis from cold.

Hyperæsthesia, or exalted sensibility to touch, is to be distinguished from pain. It has a certain analogy to spasm or rigidity in muscles, and is often due to the same cause, viz., some irritating agent applied to the nerve-centre. This is sometimes sympathetic, as in the tenderness, as well as pain, referred to the knee in hip-disease. The presence of simple tumours is sometimes accompanied by remarkable sensitiveness—as great as, or even in excess of, that which attends malignant growth ; and, therefore, this symptom cannot be regarded as diagnostic of the nature of a tumour, but rather, in many instances, of a preternaturally susceptible nervous system. There is a rare form of skin-tumour, of which I have met with some few examples ; it is usually very small, and remarkable sensitiveness is its chief characteristic. I remember removing one from a lady's thigh, which was the seat of such exquisite sensibility, that it was a source of almost constant suffering to her ; yet this tumour scarcely exceeded a barleycorn in size. In a similar tumour, but of larger size, which I removed from a lady's knee, the texture was purely fibro-cellular.

The feeling of heat or chill is a modification of common sensation, which has nothing to do with the actual temperature of the body ; indeed, as I just now remarked, a sense of chill is often accompanied by a rise in the thermometer, and the converse is also the case. The occurrence of these alternations in sensation is indicative of a disturbing cause, usually affecting both nervous and circulating systems, apparently simultaneously. This condition often precedes rigor, and introduces fever. The sense of chill is to rigor what the epileptic *aura* is to the convulsive fit—the premonitory symptom of the true convulsion,

or, it may be, its mild and transient representative. As a diagnostic symptom, this sensation is too inconstant to be of value, and it is often unimportant by itself, though deserving attention in concert with other symptoms, when we are seeking to clear up some obscurity in a perplexing case.

The nerves of *specific sensation* evince, in their various deviations from a normal standard and a healthy condition, different states of disease in the organs themselves, which it is not my intention, as it would be beside my purpose, now to discuss. Unquestionably these morbid changes are of infinite importance in the diagnosis of these special diseases, yet it would not subserve any good purpose that I should simply enumerate them; but they are also indicative or symptomatic of other diseases, and this circumstance imparts to them an interest and significance quite independent of the special affection of the organ implicated.

With a few remarks I have still to make on this subject, I shall close the present lecture, and resume the thread of these general observations in the next.

The insensibility or morbid sensitiveness of the eye to light are, when not due to any local cause, indicative of cerebral disturbance. This is the case likewise with the other senses; yet this disturbance is not necessarily an organic lesion, or, if it be, it may elude our scrutiny. This remark applies rather to increased sensitiveness than to dulness or loss of perception. Indeed, the former condition is closely allied with that hyperæsthetic state of which I have already spoken, as sometimes existing in the nerves of common sensation; and it is frequently met with, and diagnostic of, similar morbid changes. Yet, since writing the above, I have met with a singular instance of temporary suspension of sensitiveness existing in the retina, or, more probably, in the perceptive organ in the brain. A youth, who had fallen on his head, was admitted, with slight concussion, into the hospital. His most marked symptom was total loss of vision; he could not even perceive light. This condi-

tion was very transient ; in half an hour he could just detect the presence of my fingers when interposed between his eyes and the bright daylight, and in the course of another hour he had recovered natural vision. He made a speedy recovery.

The foregoing remarks are equally applicable to corresponding conditions of the organ of hearing, but with this reserve ; that, in diagnosis, the latter is less to be depended on, because the morbid changes to which it is liable are more occult, and therefore cannot be referred with the same certainty to a local or cerebral origin. In the details of these functional or organic derangements, there is a close analogy between the two organs. The flitting motes, the dancing sparks, or the flashing light of varied colour, and the low, humming murmur, the continuous rush, or the intermittent tinkle, as of the sheep-bell on the hill-side, and other similar conceits of sight and sound, mark these derangements, though generally with too much obscurity to be surely identified with their origin. It is not infrequent in certain cerebral conditions, and under the deceptive prompting of the distempered senses, for the imagination to frame, out of these fictions, definite sights and sounds. There can be little doubt that such is the case in delirium, especially that of drunkards ; and in the dying, these impressions assume a character in accordance with the habits, or, it may be, the hopes or fears of him who is about to sleep the sleep of death. The arms of lost and loved friends seem to be extended, in waiting attitude, to receive the spirit which is struggling for its release ; or the averted eye and horror-struck countenance may be in unison with the exclamations which betray the terror occasioned by the imaginary sight of the emissaries of torture. The recurring boom, as of a distant church-bell, will conjure up the vision of the impending funeral procession, or the ideal sound of soothing music may light up the dying countenance with placid hope. As with the eye, so with the ear, a morbid sensibility to sounds denotes increased sensitiveness in the perceptive organ, and usually indicates cerebral excitement ; dulness of hearing or

absolute deafness is valuable in diagnosis only in connection with other circumstances. It may indicate suppuration within the petrous bone or fracture at that part, when associated with paralysis of the facial nerve. When separately affected, the mischief may be cerebral, or it may exist in the auditory passage or drum. I have known deafness to precede suppuration of the mastoid cells, and, in another case, necrosis of the squamous portion of the temporal bone,—the duration of the affection being too long to ascribe it to obstruction in the external canal: in one case under my care, complete blindness of one eye, accompanied with deafness, supervened on paraplegia following injury to the lumbar spine.

The senses of *taste* and *smell* are still more closely allied than those of sight and hearing; because there is not only an analogy in their morbid derangements, but likewise a close association and interdependence in their functions. It is rarely that one organ is troubled without the other being involved; the loss of scent entails the loss of taste. But there is little to be gathered from these morbid conditions. A disagreeable sense of odour or taste implies perversion of the organs, which is often met with in fever and other maladies, involving derangement of the assimilative functions, yet without being specifically characteristic, except in confirming what is learned from other symptoms: but their successively suspended office sometimes indicates the progress of disease in the brain, when vegetative life alone survives; or, it may be, as I have witnessed, that the intellect is left to watch, unmoved, the onward march of that advancing disorganisation which marks the degradation of the earthly tabernacle, calmly anticipating the moment when the last prop shall be withdrawn from the tottering fabric, and seeing in “the damp vault’s dayless gloom” the welcome portal to unbounded liberty and unfailing light.

LECTURE III.

Pain—Sleep.—Objective Signs; viz., Deformity, Colour, Transparency, Temperature, Consistence, Œdema, Crepitation, Crepitus, Fluctuation.—Diagnostic value of Treatment.—Shock; —Definition. Causes; Physical, Mental, Toxæmic, Predisposing.—Effects at Different Ages.—Railway Collision.—Effects of Shock on Nerve-Centres; on Heart.—Temperature in Shock, and Reaction.—Shock in Relation to Operations.—Value of Stimulants in Diagnosis.—Causes of Fatality in Shock.

MR. PRESIDENT AND GENTLEMEN,—Of the many expressive monosyllables, whether of Saxon or Latin origin, with which our copious language abounds, probably there is not one which awakens more thrilling emotions when it is uttered than the word “pain.” In its etymology, the scholar discovers an association with the penalty and punishment of sin, whilst the physiologist, with a gentler and more tolerant construction, does not view it as an unmixed evil, but prefers to place it in the same category with labour, and to regard its conservative office as qualifying its penal character—a compensation whereby the curse is mitigated, and in one respect made a blessing. Pain is familiar to all; the wailing cry of infancy ushers in existence, and the moan of suffering is rarely absent from the bed of death. It is the lot of some to suffer much; of others to have comparative immunity from pain; some bear it with fortitude, others are restless under it; probably some frames are naturally more sensitive than others; and this circumstance of relative sen-

sitiveness merits consideration in estimating the value of pain as a diagnostic symptom.

The character of pain varies as remarkably as its degree of intensity. A whole vocabulary of epithets has been employed in denoting the sensations of suffering patients. Many of these expressions are very graphic; and the alliance between the special character of the suffering and disease is often a valuable element in identifying the nature of a malady. The throb of suppuration, the gnawing pain of articular caries, the plunging or lancinating pain of cancer, the tearing pain of rectal fissure, the scalding pain in urethral inflammation, are a few of the characteristics to which I allude. Then, again, intermittent pain often distinguishes so-called neuralgia from inflammation; pressure may relieve the former, but rarely fails to aggravate the latter; and the converse result is obtained when the temperature of the affected part is artificially lowered. In syphilitic ostitis, for some unexplained reason, the suffering abates during the day, and is augmented at night; and there are often similar exacerbations in arthritis. Pain which is evoked by pressure varies likewise much in its nature and degree.

The acute tenderness in peritonitis, the sensitiveness of inflamed periosteum or in joint-disease, can scarcely be mistaken, though they may be so simulated by hysteria as to deceive the unwary or inexperienced. The progress of an abscess is often marked by the character of the accompanying pain; and its abatement denotes the yielding of superjacent textures, and the approach of pus to the surface. In acute inflammation, the anguish of the patient is sometimes converted, and that speedily, into comparative ease; as, for example, in strangulated hernia: this symptom, perhaps a relief not only to the patient but to his friends, is differently interpreted by the surgeon; he knows it is the fatal indication of gangrene. Sympathetic pain is frequently a significant guide in diagnosis, and supplies valuable information to the surgeon. Such, for example, as pain at the orifice of the urethra in stone in the bladder; pain in the

testicle when a stone is traversing the ureter, or that which exists in the knee in hip-disease. In some structures, the presence of pain suggests or confirms the existence of inflammation, as in bone, and in serous and synovial membranes, which are but little sensitive in health. Pain, if long continued or severe, is exhausting ; but, *per se*, is very rarely fatal. I think the shock of pain is much over-estimated. It is difficult to separate from the suffering the effects which are due to concurrent causes in operations ; but it is certain that great and almost continued pain is compatible with protracted life. I have known some remarkable instances of this fact ; and, although I appreciate to the full the value of chloroform, I am not aware that operations are rendered less fatal by its agency in securing the patient from suffering. Of its influence in shock, I shall have something further to say by and bye.

Though not an easy transition in fact, yet it seems a natural one, in considering these subjects, to pass from Pain to its antidote, "Nature's soft nurse," as our poet designates it in his beautiful apostrophe to Sleep. Apparently partial and fickle in its visits, as he describes it, yet there is always a reason for its absence, its restless presence, or its protracted sojourn ; and, therefore, its peculiarities repay a careful study, and merit a passing notice as a valuable element in diagnosis. Sleep is rest of brain ; or, to use the language of advanced physiology, "in natural sleep the exhausted nervous system is storing its reserve ; when it is fully charged, there is resistance and awakening." Muscular rest alone is unrefreshing ; the nervous energy is unrecruited. It is vain to seek repose by shutting out the external world in silence and darkness ; this alone is insufficient to

"Steep the senses in forgetfulness."

The busy brain must relax its hold of the objects of its accustomed pursuits ; Nature's gentle pressure must weigh the eyelids down, and all the organic functions must sympathise by

their more tranquil rhythm. The sound, unruffled sleep of health must be distinguished from the deep sleep of exhaustion, as well as that resulting from the opposite condition of vascular repletion, whether temporary or more persistent, when it verges on coma ; as in threatening apoplexy or the advance of organic change in the brain. The drowsiness or stupor into which the wild mania of the earlier stage of a typhoid condition degenerates, would appear to be due, as already remarked, to the presence in the brain of uneliminated organic products, and indicates approaching dissolution.

But we often learn more from the absence than from the disturbed conditions of sleep. A restless night is frequently the first note of alarm to the surgeon in the after-treatment of an operation ; it ushers in febrile derangement, or precedes the fatal rigor of pyæmia. Wakefulness characterises all forms of nervous excitement, unrest then being the typical condition of the brain ; thus, in nervous and drunken delirium, in the constitutional irritation consequent on loss of blood and other depressing causes, the want of sleep reacts upon and aggravates the excitability of the brain. This state of wakeful delirium, combined with a quiet pulse and diminished sensibility to pain, is diagnostic of nervous excitement. The sleep from opium which visits the brain in this condition is deep, prolonged, and undisturbed ; but the sleep, in febrile or inflammatory diseases, whether natural or artificial, is usually troubled by distressing dreams, tumultuous, incoherent, perplexing, or alarming, and abruptly broken by startled wakings ; dreams such as De Quincey experienced in the depth of his wretchedness, and describes in his poetical 'Confessions of an Opium-Eater ;'—not of that cast which Queen Mab brings with her, but a bewildering medley of scenes and circumstances, of thoughts and feelings, which oppress the struggling slumberer, and prompt him to seek relief in wakefulness.

A low degree of nervous excitability is characterised by light, uneasy sleep, and frequent wakings, when the intellect seems

to stagger for a time before it recovers its equilibrium. As the loss of natural sleep is often the first harbinger of ill, so its return inaugurates a favorable crisis in disease. The reaction following the shock of a serious operation rarely permits sleep of any duration during the first succeeding night ; and the suffering entailed is often sufficient to interrupt rest for some time subsequently. Yet, in some instances, where the relief from exhaustion and pain is decided, as in the removal of an acutely inflamed and suppurating joint, the patient may at once recover the ability to sleep.

Setting aside the susceptibilities of individual patients, there is much to be learned, in diagnosis, by watching the effects of anodynes in procuring sleep. In nervous irritation, opium tranquillises, but in excitement from vascular repletion, it can rarely be borne ; yet, the exceptions resulting from idiosyncrasy or habit render it unsafe to trust to the influence of this drug, without other concurrent testimony, in distinguishing between these two conditions. The only assistance that I am aware of, which chloroform affords to the surgeon in diagnosis is, that by its agency he is enabled to make a more searching examination than he otherwise could, to verify the suspected presence of disease or injury.

The *Objective* signs which it behoves the surgeon to study, appeal directly to the senses. Thus, the altered form and colour of any part are recognised by the eye ; the consistence and temperature by the touch ; odour and sound, severally, by the appropriate organs. A few observations on each of these will suffice.

Altered form, or *deformity*, may result from various causes, both in disease and injury. It is one of the leading features by which we recognise fracture and dislocation, and distinguish various diseased conditions of the skeleton. Under the title of swelling, it is one of the characteristics of inflammation, and the nature of tumours is partly ascertained by their form. In some instances, deformity is *indirectly* indicative of existing

disease, as in the outgrowing shoulder in lateral curvature of the spine, and consequent distortion of the ribs ; or in the existence of œdema in the lower part of a limb, resulting from vascular obstruction higher up ; or, again, in the presence of psoas abscess in the groin in lumbar caries. The period at which any marked change of form was first observed, its sudden or gradual appearance, its variations under different circumstances, and the influence of remedial agents upon it, are all conditions which are available in diagnosis, and require the careful scrutiny of the surgeon, whose anatomical skill and accuracy are thereby not infrequently put to the test. I would remark that, in conducting these investigations, it is often requisite to ascertain by comparison whether there is any deviation from strict symmetry between corresponding parts on opposite sides of the body ; and I find that such inquiry is more satisfactorily conducted where one sense alone is employed at the time. Thus, in suspected injury at or near to the shoulder-joint, the eye should be allowed first to scan the upper part of the chest in front and at the back ; subsequently the surgeon should place himself behind the patient, and trace with both hands simultaneously the outline of the shoulders, from the sternal extremity of the clavicle outwards, until the examination is completed. I think much advantage accrues from these separate observations, and that the independent testimony of each sense is, in the aggregate, more valuable than when two or more are employed simultaneously.

Of *colour*, as generally diffused over the surface, I have already spoken ; it is more valuable to the physician than to the surgeon. But the latter is much indebted to its local manifestation as a diagnostic sign of considerable importance. In various types and stages of inflammation, the colour of the affected part is of material assistance in determining the nature and treatment of the disease. The diffused and rosy blush of erythema is distinguishable from the deeper hue of phlegmon or erysipelas ; the broad and often dusky red cord which marks

the course of an inflamed vein, does not resemble the more delicate and pink thread by which we trace an inflamed lymphatic. The approach of pus to the surface is indicated by the colour of the skin; and the dark dye of a stagnating circulation warns the surgeon of the incipient stage of a condition which will probably terminate in the ashy hue of gangrene. By its colour, ecchymosis is distinguishable from other effusions, and its different stages are indicated by its progression through the varying tints of the rainbow. *Transparency* reveals the fluid nature of a tumour, and its limpid character likewise, as in hydrocele. In ulcers and in healing wounds, the colour of the surface guides the surgeon in his treatment; and the copper hue of an eruption betrays the taint of syphilis. In hæmorrhage, the anxious inquiry of the surgeon is respecting the colour of the blood; or, again, the presence of bile in the alvine excretions, or a loaded condition of the urine, may be ascertained by their appearance.

It is principally by the sense of *touch* that we inform ourselves of temperature, consistence, fluctuation, and other allied sensations. Both locally and generally, *temperature* is useful as a diagnostic sign. It is raised in an inflamed part, and its permanent depression or loss indicate lowered vitality or mortification. Of the variations in temperature over the surface generally, and even locally, where there is no inflammation, I shall have to speak by and bye. I will not, therefore, enlarge on this subject now; but would add that this is a field of investigation which offers a rich harvest in its cultivation.

It is by their *consistence* principally that we distinguish tumours; but this is not frequently a deceptive sign when exclusively relied on. The information it conveys is often masked by superjacent textures, or disguised by the presence of some accidental concomitant circumstance. Thus, the hardness of a mammary tumour is suggestive of its scirrhus character; but this sign is possessed in common by cancer and

by chronic inflammation in this organ. Osseous growths may lose their characteristic hardness beneath a thick covering of muscle; and a soft tumour may have a firm resisting feel imparted to it when bound down by dense tissues. Thus, in a case under my care, the diagnosis of a large fat tumour beneath the pectoral muscle was obscure, until it made its way behind the clavicle into the neck, when its true character was revealed, and I removed it. A large inguinal hernia, which recently came under my notice, had taken the unusual course of extending itself beneath the aponeurosis of the external oblique muscle, instead of descending through the external ring; the diffused hard swelling in this case would not have suggested the existence of hernia, but for the symptoms of acute strangulation which were present. The brawny tension of phlegmon solicits the knife of the surgeon, equally with the soft yielding centre of an acute abscess. The impress which the finger leaves in *œdema* marks the existence of infiltration of the areolar tissue; and the *crepitation* of emphysema denotes the presence of air. This latter peculiar and unmistakable sensation is also occasionally met with in the neighbourhood of abscesses, and is the result of decomposition. *Crepitus*, as a diagnostic sign of fracture, is generally much valued by surgeons. I am not disposed to attach so much importance to it by itself, except in experienced hands and under peculiar circumstances. I think that it is subordinate in significance to many other signs, and is often obscure, and liable to be confused with a similar sensation encountered in synovial and other effusions.

Fluctuation, or the movement of a fluid within a more or less circumscribed space, is a sign, the value of which depends more on the tact of the surgeon in detecting it than on its own intrinsic worth. My meaning is that where it is palpable and unmistakable, there are usually other signs or symptoms present which point to the same conclusion; but where fluctuation is deeply seated, indistinct and, perhaps, the chief or

only guide on which the surgeon has to depend, its value is greatly enhanced in the hands of a skilful manipulator. In such investigations there are many points which require care and consideration. However limited the spot where you are seeking to ascertain the presence of fluctuation, a finger of each hand should be employed, if practicable, in preference to using two fingers of the same hand: the impression thus obtained is far more satisfactory. In examining a suspected cyst, it should be fixed by an assistant whilst the palpation is conducted; and much aid will also be afforded by making the object of examination as tense as possible, and bringing it near to the surface. If there be superjacent muscles they must be relaxed; if the accumulation of fluid be large, it should be allowed to gravitate towards one point. Yet, notwithstanding every precaution, there are many sources of fallacy associated with this diagnostic sign, which personal experience alone can teach the surgeon. Many parts of the body in a normal condition may be made to yield a sensation very like fluctuation. Subfascial serous infiltration, as in the muscles of the fore-arm, can scarcely be distinguished from the genuine sensation of a deep-seated and circumscribed cavity containing fluid.

In orchitis, a similar error, for the same reason, may occur. On the other hand, in subpectoral or perinæal abscess, the obscure fluctuation may readily be overlooked. Even the wave which is conveyed across the abdomen by a light tap with the finger is by no means a certain indication that we have fluid to deal with. Twice it has occurred to me to tap an ovarian cyst where the contents were gelatinous; and a few months since I removed such a cyst, of very large size, which was entirely filled with a very tenacious jelly. Yet, in each of these cases, the wave was as distinct as—I had almost said more so than—where nothing but fluid was present. Deep-seated fat tumours, in like manner, may be mistaken for cysts containing fluid. Thus, though the experienced surgeon may, with confidence, trust to, and act upon, his own impressions, he

will not infrequently pause, where a more limited practical knowledge might hurry another into an erroneous judgment and, consequently, injudicious action.

The use of the other senses, viz., of hearing, smelling, and tasting, is much more limited in surgical diagnosis. I do not mean, by this observation, that the surgeon is justified in neglecting, or being uninstructed in, the use of the stethoscope: his practice will afford him ample opportunity of using it, in testing the condition of the lungs and heart, as well as in abnormal states of the arterial system. The varying condition of the intestines in mechanical obstruction is capable of being verified by percussion. The ring of an urinary calculus, when the sound is introduced, leaves nothing to be desired in obtaining the requisite information for a correct diagnosis.

The sense of smell is brought into requisition in testing the character of the excretions; and still more importantly in ascertaining the presence of a foul atmosphere in the sick chamber, which is a rife source of many serious complications in the management of surgical operations.

Treatment is sometimes accidentally useful in the diagnosis of both injuries and surgical diseases; or it may be rendered available by carefully watching its effects. With this object in view, it should be the aim of the surgeon to remove as far as possible all adventitious circumstances which may influence the existing state of the patient; and I know of no condition more important in favouring this desideratum than *rest*. Especially is joint mischief, whether the result of injury or disease, thus most satisfactorily tested, where there exists doubt as to the true nature of the malady. More active measures may, of course, be resorted to, with the same object in view; but these must be used with discretion. Active treatment of any sort is rarely justifiable, where its proposed object is simply to unmask a disease: and exploratory operations should have attached to them the condition that the patient's chance of recovery will not be materially endangered by the proceeding.

I have thus, Sir, endeavoured to place before you in a condensed form—too compressed and imperfect to satisfy myself, and needing your indulgent criticism—the leading principles, which, I think, should guide the practitioner in the diagnosis of surgical diseases and injuries. I am conscious of having introduced much that is elementary in my observations; but I am not without hope that, in a collected form, these “first lines” may be suggestive, if they do not prove instructive.

In accordance with my proposal, I now proceed to exemplify these principles in their relation to Shock and Visceral Lesions; and I may at once remark that it does not form part of my arrangement or design to import speculative theories into these lectures, or to attempt an exhaustive treatment of any part of my subject. It is my intention to state simply the results of my own observation, in the diagnosis of the interesting and important class of maladies which are included in the category I have mentioned.

That condition which we denominate Shock is well known to the surgeon by its symptoms. But these symptoms are sometimes present under circumstances which would scarcely justify the use of the expression in its ordinary acceptation; for the word seems to imply that which is the immediate sequence of a sudden cause—a collapse of energy from a diversion of force. Yet this definition is not strictly accurate in all instances in which we meet with those symptoms that, in the aggregate, constitute the vital depression of shock. In the moribund we constantly notice, in many respects, a closely allied condition; and this is not surprising, inasmuch as the state of severe shock is in reality a critical one, which sometimes does terminate fatally without reaction. The peculiarity of shock, then, is this vital depression, generally sudden, which follows the exciting cause, whatever that may be, and which is marked by the influence thus exercised primarily on the nerve-centres and on the heart; and, secondarily, by implication or sympathy, and necessarily through the intervention of the

nerves, on the organs of respiration, of assimilation and secretion, and on the senses. I say primarily on the nerve-centres or heart, because the immediate consequences of sudden and copious loss of blood are, in effect, those of shock; the diminished quantity of the circulating fluid depressing the action of the heart, and thus influencing the nerve-centres. Where this hæmorrhage is not apparent, the early stage of simple shock is not distinguishable from that resulting from loss of blood. The sudden collapse consequent on the introduction of air into a vein may be placed in the same category. The differences exhibited in some of their details, in these causes of shock, are due to the appeal being made indirectly to the nerve-centres through the medium of the heart. As conventionally understood, the symptoms which collectively are named, or are characteristic of, shock, are essentially those which denote that the centres or sources of nerve-force or energy are under the potent spell of some powerfully depressing agent, whether physical or poisonous, whereby their influence in the animal economy is disturbed, partially suspended, or perverted.

When the causative injury is physical, as in a crushed limb, the effect upon the brain is seen in the mental and muscular prostration. The relaxed sphincters and general atony of the muscles indicate the share of the true spinal centre in the hurt inflicted. The feeble pulse and cold surface measure the impression made upon the heart; whilst the clammy sweat, the arrested or disturbed secretions, the nausea or vomiting, manifest the sympathy of the assimilative organs, consequent on the more direct implication of the cyclo-ganglionic nerve-centres. The expression of the face is in unison with the general condition of the patient, betraying alarm, anxiety and distress. But, when the shock of an injury is received directly upon the head, the symptoms are modified, but only in so far as the hurt has expended its force chiefly upon the brain. We thus have superadded to the other symptoms, in severe concussion of the brain, loss of consciousness, which may endure

for a considerable time, but which may be regarded as an accidental concomitant, and not as an essential feature, of shock.

Again, the rupture of some important viscus—say, of intestine or bladder—is often immediately succeeded by all the symptoms of shock; a condition which, in its early stage, is identical with that which is unattended by any visceral lesion.

Extremes of temperature, when sufficiently intense or long continued, are followed by severe and protracted shock, often terminating fatally.

In our surgical operations we inflict shock upon our patients, varying in duration and intensity, according to the severity and protraction of the operation and the susceptibility of the sufferer.

Mental emotion, apart from bodily hurt, may produce similar phenomena, varying likewise in their degree, in accordance with the exciting cause: and there is no doubt that alarm and anxious suspense, when a surgical operation is impending, tend very much to complicate and aggravate the shock of the operation itself; and herein is chloroform a friendly agent in modifying the depressing effect of our handiwork, in that the mind of the patient is tranquil in the anticipation of passing through the ordeal without pain. Some of the symptoms of blood-poisoning resemble those of shock; indeed, their identity can scarcely be doubted in the early stage of fatal contamination, although the different adventitious and associated circumstances subsequently impart a special type, which is manifested according to the nature and dose of the poison imbibed. The transient shudder consequent on the mechanical irritation of introducing a catheter into the urethra, and the terrible rigor which ushers in pyæmia, are alike due to an impression made on the nerve-centres. I am aware that, in extending such latitude to the interpretation of the word "shock," I am overstepping the limit of its conventional meaning. But, if I am not mistaken in this view, I think it

desirable to identify conditions which, though apparently dissimilar, are essentially the same in character, and exhibit phenomena, the analogy of which is not disproved by the variety of the exciting causes, and the consequently modified character of the resulting details. It seems to me that, wherever this can be safely accomplished, an advancing step in generalisation is thereby attained.

There can be no doubt that shock affects various individuals in a very different degree; and this, probably, in strict accordance with their natural or acquired susceptibilities. Certain mental peculiarities, allied with emotional sensitiveness and what is termed the nervous temperament, constitute the natural conditions which predispose to the severest consequences of shock; and disease, whether functional or organic,—especially the degeneration or textural change of some important viscus, operates by aggravating the immediate effects of an injury, but more particularly in protracting and complicating the effects of shock. Unsuspected degeneration of the liver or kidney, and, *à fortiori*, of the heart, are thus not infrequently revealed; and I believe that, in many instances, death after the shock of an injury or operation is due to this cause. For example, the organs of elimination, prior to such injury, were competent to the performance of their ordinary duties, by assisting one another; but, when taxed by the urgent demands of reparation, and impaired still further by the disturbed or perverted nerve-force, the assimilative process is left uncompleted; and death ensues sooner or later, in consequence of the blood being poisoned by the retention of the products of organic conversion. This appears to me the most probable explanation of death occurring, as a remote sequence of shock, where such visceral deterioration exists; and even under other circumstances, where there is no organic change, it is quite conceivable that the assimilative, and especially the excretory, organs, would be so far prejudicially influenced by the derangement in the supply of nervous energy, that they should be incapable of properly

performing their eliminative functions, and the blood should be thereby poisoned. Under these circumstances death may result, and that in some instances speedily, without the presence of pyæmic deposits, or other material effect being discovered after death. Of the direct agency of shock in altering the condition or constituents of the blood, I do not know anything.

As regards the effects of shock at different ages, my own observation has led me to the conclusion that, in the very young, the ordinary impressibility of childhood is manifested, as under most other circumstances in which it is evoked. But the shock is simple, uncomplicated by mental influence; and reaction is rapid in favourable cases. In fact, it would appear that deferred reaction in early life means no reaction. The most frequent opportunity we have of witnessing these phenomena in young children, is in cases of severe burn. Precisely the converse obtains in old age. The aged are less impressible than the vigorous adult; the effect of shock is less profound, but more often fatal, in consequence of the impaired resiliency of the organism,—the incapacity of the controlling centres to recover the equilibrium which has been abruptly disturbed; the enfeebled vessel has been so rudely jarred, that its contents have been spoiled by the commotion; and the lamp never burns brightly again, though the flame may flicker for a while in the socket. It is certainly in the prime of life, when the natural vigour is unabated, that the consequences of shock are most pronounced. And this is what we might anticipate, as the nerve-centres have then attained their full development, their mutual relations and sympathies are matured, and their functions, physical, psychical and organic, are most active. It is these same conditions, also, which determine a more energetic reaction,—proportioned to the vigour of the individual, and, within certain limits, to the gravity of the shock. Beyond such limits, *i. e.* where the shock is severe, the reaction is tardy and protracted in its full re-establishment; although indications of

an effort to restore the lost equilibrium may be observed at a comparatively early period.

In that form of shock which is consequent on *Railway collision*, usually the distant sequelæ are more noticeable than the immediate effects; and I may remark that these, as far as my experience enables me to judge, are more often observed in the adult than in the very young and aged. No doubt this relative proportion is in a measure due to the circumstance that there are comparatively few old persons and children who are travellers; yet, I think it may be accounted for, partly, by the relative susceptibility of different ages to which I have alluded. Unfortunately there is one seriously disturbing element in the data on which we may found any conclusions respecting this class of injuries, viz.: the temptation to the patient, from pecuniary considerations, to make the worst of his case; and it is almost impossible to arrive at the truth, where so many of the symptoms rest exclusively upon the sufferer's assertion. I speak especially of that class of cases—the most numerous—where there is no evidence of physical lesion, and in which the symptoms supervene at an interval, longer or shorter, after the occurrence of the shock. Some of these instances are, no doubt, genuine; and in them we have the opportunity of studying the remote effects of shock, in which the spinal cord is the nerve-centre which is often primarily, though not exclusively, involved. In some which are characterised by loss of muscular strength, shrunk limbs, defective power in co-ordination, feeble exercise of motive volition, and even paralysis and imbecility, there must be organic change, which is often progressive, and marked by corresponding development of the signs and symptoms above enumerated. But in others the morbid condition is evinced by deteriorated health and defective nerve energy; and in these probably the impaired health is due to the indirect influence exercised on the organs of assimilation, and a reactionary impression exerted on the nerve-centres themselves.

Certainly, one general feature which I have noticed in this class of injuries is, that the shock at the time is comparatively slight and usually transient; or, if enduring, is unmarked by any extreme symptoms or excessive reaction. Of course I refer to such cases as come within the category of so-called "railway injuries;" and not to those which present the usual characteristics of concussion of brain or spinal cord from other causes; and the shock of which I speak is that which I have already defined. The peculiarity of these accidents appears to be that the spine is roughly jarred, sometimes subjected to a succession of minor concussions or violent oscillations, and that the entire nervous system is simultaneously agitated. There is, consequently, no immediate persistent incapacity, as in ordinary concussions from a blow on the head or spine; but a prolonged series of symptoms ensue, directly traceable to the shock, and often assuming a more aggravated character as time elapses. But I am anticipating the next division of my subject, when I shall again refer to these injuries, and to the diagnostic features by which they are characterised. I may, however, be permitted to make a passing observation in reference to the remarkable, I fear I must say almost uniform, diversity of opinion which these cases elicit in medical witnesses, in Courts of justice. This subject, as is not unnatural, is regarded in its moral rather than its scientific aspect by the public, and in a way not very complimentary to the profession. No doubt much of this antagonism is due to a cause which I have already touched upon, viz.: the deception practised by patients, and the consequent suspicion aroused in the minds of those who are required to investigate critically the veracity or probability of their statements. Suspicion may, in some particular instance, ripen into an assurance of fraud; whereas, a confidence, which may be apparently well founded, in the honesty and truthfulness of the same individual, may induce another medical man to take an entirely opposite view of his case, which rests chiefly on assertion, or on symptoms which may be simulated. Never-

theless, after making every allowance for discrepancies arising from this cause, it must be admitted that there is left sufficient to constitute just ground for severe criticism on the part of jurists and of the public at large. I think this state of things is much to be regretted, and that an effort should be made to rid ourselves of the consequent scandal which attaches to the profession. The only remedy which suggests itself to me is, I fear, too utopian to hope for, and too simple to realise. It is that, when medical men are engaged in the prosecution or defence of such claims, they should make it conditional that they be permitted to confer together, and, at the least, attempt to arrive, by consultation, at a joint opinion as to the true nature of the case and validity of the claim; leaving, of course, the amount of compensation, if any, to be assessed by the jury. I trust, Sir, you will not think that I am deviating too far from the path of my duties, in thus glancing at an ethical question which involves the honour and credit of our profession.

To return from this digression, shock and impaired nerve-function are, in one sense, identical; that is, shock is impaired nerve-function, although the converse is not the case. Yet, certain symptoms are present which, in paraplegia, are fully established, and possess an intelligible meaning; such, for instance, is the apparent anomaly of retained urine and involuntary evacuation of the bowels. This, however, is no real anomaly, but a consistent consequence of the cause in operation; for we know that the contractility of the bladder, and the peristaltic action of the intestine, are under the control of distinct nervous centres. Volition is suspended by compression, or laceration of the spinal cord, but the cyclo-ganglionic influence is unimpaired. Peristaltic movement, therefore, proceeds; and the resistance,—probably enfeebled by the injury—due to the excito-motor contraction of the sphincter, is overcome by the *vis a tergo*; the action is entirely independent of the will. In some instances, in fact in most, of fracture of the spine, the general symptoms of shock give rise to difficulty in precisely

defining the extent of permanent lesion ; but as reaction succeeds, and the temporary disturbance in the circulation and respiration subside, the healthy restoration of the upper part of the body offers an interesting contrast to the suspended animal life of the lower half.

The influence of shock on the heart introduces the question of the dependence of this organ on nerve-energy for its contractility. Its essential independence has been assumed by physiologists, although nervous *control* has been admitted in its fullest sense. That the muscular tissue of the isolated heart is contractile there is no doubt : but so is that of any other isolated muscle ; such, for instance, as an amputated limb. But I apprehend the rhythmic action of the heart after death or removal, and the peristaltic action of the intestines under similar circumstances, may be explained in the same way, viz.: by the limited generation of nerve-force within the organs themselves, derived from the scattered ganglia which pervade their structure. Rhythmic or regulated action would seem to imply the existence of a co-ordinating influence.

Temperature is a sign of considerable importance, as diagnostic of the intensity of shock and of the energy of reaction, as well as of many allied conditions resulting from various causes ; and, as I have already remarked, a careful study of the subject will well repay the pathologist for the time and trouble he may bestow upon it. In an admirably arranged and philosophical Essay on Shock, by Mr. Jordan of Birmingham, the author introduces some interesting statistics respecting temperature ; his results are in great measure, though not wholly, in accordance with those which I have obtained, with the able assistance of my friend and former pupil, Mr. Wagstaffe, now the surgical registrar at St. Thomas's Hospital.

In simple *Shock* and *Reaction*, the fall in temperature appears to average about one or two degrees, as tested at the time of the patient's admission into the hospital—generally about half

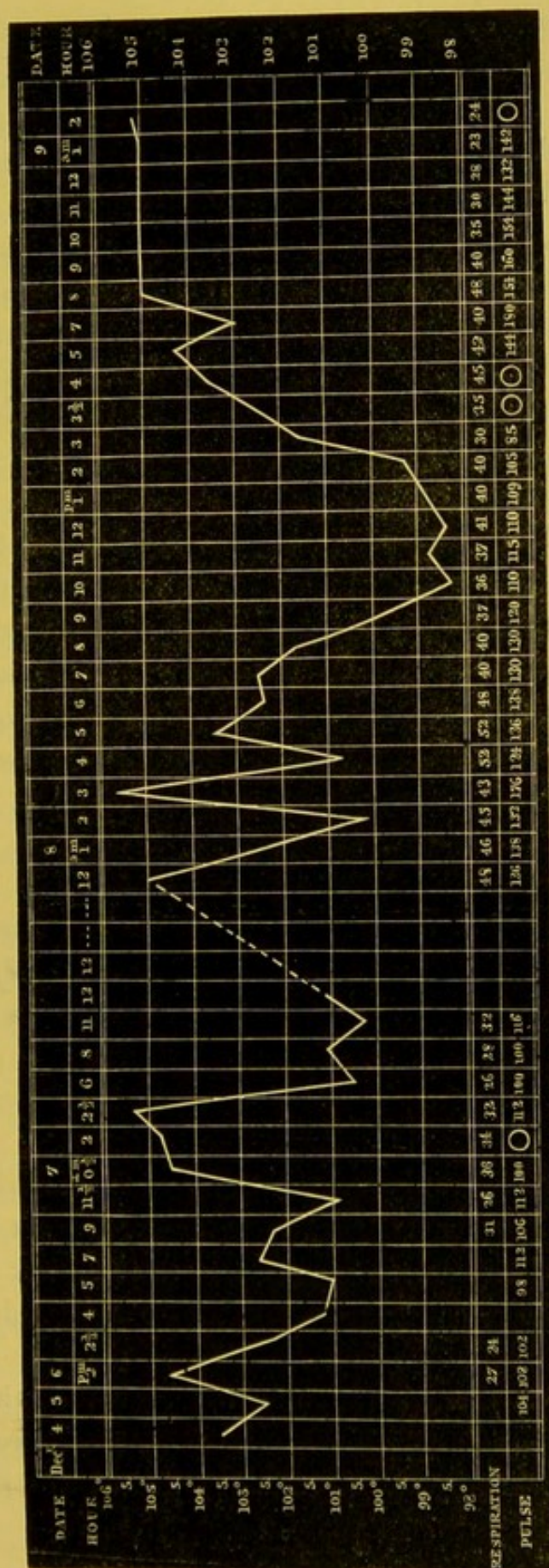
an hour or an hour after the accident; and the reaction is marked by a rise in temperature to over 100 deg., and usually below 103 deg., within the next thirty-six or forty-eight hours. When the shock is complicated by the occurrence of *Hæmorrhage*, even to a moderate extent, the fall in temperature has appeared, in some instances noticed, to be in excess of what might have been anticipated; in excess, that is, of the consequence of direct shock, *plus* the direct consequences of simple hæmorrhage. In one remarkable case of cut-throat, in a man of 63, the thermometer registered 91.2 deg. one hour after the injury, and remained at this standard, without varying, for another hour; and the highest point it reached, during reaction, was 100.1 deg. in twenty-four hours. The hæmorrhage was not excessive in this instance, and the patient recovered. His normal temperature was about 98.4 deg. Probably mental shock may have had some influence in producing this remarkably low temperature.

In *Rigor*, the temperature rises always shortly before the commencement of the attack, and remains high for a varying length of time,—generally about half an hour after the termination of the shivering. In the rigor of pyæmia, the height to which the temperature may rise appears to vary with the acuteness of the disease; ranging between 100 deg. and 106 deg.

In *Operations*, there was usually a fall of about half a degree, during or after the operation, in those cases which recovered. Chloroform seems to exercise little or no influence on the temperature, under these circumstances. In the fatal cases, no such fall took place. The temperature has been rarely observed to fall below 97 deg. during the shock consequent on an operation. In one case of amputation in which I had it tested, there was no change in the reading of the thermometer during the incision through the bone.

In the *Reaction* succeeding an operation, if the temperature exceed 104 deg., the prognosis is decidedly unfavourable; but

Scalp-wound: Concussion: Suppuration in Brain: Pyæmia: Death Twenty-two Days after Injury.



not necessarily so, if no rise occurs, provided the general condition of the patient be not otherwise unsatisfactory, as tested by the circulation, respiration and degree of prostration. Yet, it should be remarked, there is not the same definite relation between temperature and the heart's action and breathing, after the infliction of injury by violence as in medical fevers. The maximum temperature is reached in from twenty-four to forty-eight hours after operation, in cases which recover. In falling from the highest point, the descent is usually gradual and steady till the normal standard is reached; and there it is arrested.

Before *Death*, in acute sthenic diseases, the temperature rises till the time of death; and it is higher, just before death, in cases of inflammation following brain-injury, than in other cases recorded in the surgical wards. I shall exemplify this fact in a future lecture; and I may now remark that the highest death temperature of which we have a record was 106 deg., in a case of abscess of the brain complicated with pyæmia, to which the foregoing chart refers.

Where no reaction takes place after head injury, the temperature has been registered, before death, as low as 89.6 deg. The *lowest* temperature of which I have a record, where recovery took place, is that which I have already mentioned of cut-throat. Several cases of shock registered as low as from 96 deg. to 93 deg., and subsequently recovered. The *highest* temperature registered in cases discharged well, was 105 deg., in reaction after complicated fracture.

I have thought it desirable to throw these remarks together, though they are not all pertinent to the subject immediately under consideration. I shall reserve some further observations I have to make on temperature in shock associated with head-injury, until a future lecture.

Reaction implies pre-existent shock; it is the living organism—subdued, confused, narcotised by violence; bowed down but not broken—rising with a rebound, which exalts its functions

beyond their normal standard, and may thus prove, by its excess, destructive. This result, however, is practically limited to head-injuries, unless some mortal lesion have accompanied the shock, or reaction bring with it fatal hæmorrhage. The period at which reaction comes on or is fully established, varies considerably according to the nature of the injury, the degree of depression, and the age and condition of the patient. The shock inflicted by operations is that which most interests the surgeon, and that which he naturally watches with most anxiety and care. And yet, as experience ripens, we feel less anxious about excessive reaction, as we learn to view its symptoms as the necessary precursors of healthy repair. In capital operations, unless much blood has been lost, from eighteen to twenty-four hours generally suffices for such an amount of reaction as is indicated by the ordinary so-called febrile symptoms. The pulse is quickened, the skin hot, the tongue furred, and there is thirst. This condition is accompanied, simultaneously, by manifestation of increased local action at the seat of operation. Consequent on the culmination of these symptoms somewhat later, not infrequently the second and even the third night after an operation are passed more restlessly than the first. Yet, so far from being a source of alarm, we accept the very activity of these reactive signs as a measure of nature's resentment of the injury inflicted, and of her earnest intention to engage energetically in repairing the mischief. I do not usually regard it as a satisfactory announcement if, at my first visit after an operation, I am informed that my patient is so tranquil and unmoved in every respect, as scarcely to betray the fact that a severe ordeal had been so recently endured; and if the pulse and skin confirm this statement, the prospect of the case is far from encouraging. No doubt, owing to peculiarities in both physical and mental temperament, there are exceptions to this rule; but I am now speaking of the ordinary run of cases; and in such I do not hesitate to say that

excess is more promising than deficiency of reaction. But there is a second period through which this reactive stage has to pass, and one which may naturally excite more anxiety on the part of the surgeon; when, instead of subsiding, these feverish symptoms continue, with impaired general power, and nervous excitement becomes the predominant characteristic, with its attendant sleeplessness and a disturbed intellect. The tongue then becomes a valuable index of the condition we have to deal with; if moist and, though white, not coated, we may employ the necessary means to allay nervous irritation. But if a dry, glazed or furred tongue accompany an unhealthy, decomposing wound, with an extending blush of surrounding inflammation, just reason for alarm exists, as we thus have intimation of having lost our best auxiliary in the digestive organs; food is not assimilated, and medicines, even including opium, are generally worse than useless. Stimulants alone remain to us; and it is surprising how large a quantity, as in some instances also of protracted shock, may be taken with impunity. An improved appearance of the tongue is often, I had almost said usually, the first indication of an improving condition under these anxious circumstances.

It is essential that the condition I have just described should not be confused with that of nervous delirium. The latter state usually supervenes earlier after the infliction of injury; its development is sudden, or with premonitory symptoms which might be overlooked by an inattentive observer; and during the existence of the delirium, the pulse is comparatively tranquil, and the tongue clean. It is a condition in which the too keen edge of nervous sensibility requires to be blunted by opium.

The question of operating under shock has naturally engaged the attention of surgeons, and constitutes one, of the most momentous character, in which a prompt and discreet judgment must be formed. I do not hesitate to say that the diagnosis of each individual case must rest, more or less, on its

own merits ; but some general rules for guidance may be adopted, to supply the lack of special experience. Observation has taught me that operations of some severity may be undertaken, during shock, without seriously adding to the risk, if security against loss of blood can be ensured. The period at which nature most resents interference is when she is making the effort to establish reaction ; and the influence of this second blow on the nervous centres is much the same as that in reactionary hæmorrhage : the nerve-energy in the one instance and the blood in the other, have already been partially exhausted by the first demand ; and the resources of either system fails when called upon for a further effort ; serious reactionary hæmorrhage and recurrent shock are equally alarming ; the two combined are almost certainly fatal.

But a distinction must be made between cases in which profound shock succeeds a severe injury, and those in which a similar condition is the consequence of a slighter cause. We frequently meet with instances of both classes, in which the symptoms present no essential points of difference, and equal alarm might be excited by the one as by the other. Yet, experience teaches us that we may measure the probable duration and intractable quality of the shock by the extent and severity of the injury, especially if complicated with loss of blood ; and that a speedy reaction and normal re-establishment of the nerve-functions may be expected, where the lesion is not serious. Under such circumstances it is better to wait for reaction, before any fresh shock is inflicted ; for the exhaustion of nerve-force is more apparent than real ; just as the loss of a small quantity of blood may, in some individuals or under certain circumstances, produce complete but transient syncope, without exhaustion.

The *treatment* of shock does not come within the range of my subject : but it is not foreign to my purpose to notice the diagnostic value of stimulants, when the long continuance and intensity of the symptoms justify or demand their use.

their exhibition be unheeded, if the looked for response be not given by the heart to the whip and spur, we may judge the exhaustion to be great indeed;—a condition we meet with when the shock is the constitutional expression or warning of a fatal visceral lesion.

The exhibition of chloroform in profound shock I look upon as inadmissible. It subserves no good purpose, for the sensitiveness to suffering is numbed or deadened; and if a sufficient quantity be given to induce complete insensibility, the risk of paralysing the respiratory act is greatly aggravated, in a state in which all the organic functions are so feebly performed, and the animal force is at so low an ebb.

In my experience, shock, *per se*, is rarely, unless immediately, fatal. I have seen many cases of shock, without special brain-injury, so profound as to suggest the presence of fatal visceral lesion: yet recovery occurs after a longer or shorter interval; and may constitute the only test by which we conclude that no such injury has been inflicted. In suddenly fatal shock, whether the hurt be received on the head or neck, or in the epigastrium, or be a consequence of general concussion of the whole frame, the arrest of the heart's beat and of respiration are indirectly due to paralysis of the brain. The pneumogastric is probably almost exclusively a centripetal nerve, conveying impressions between the important organs to which it is distributed and the brain. Thus, it communicates the sensations of hunger, thirst, and repletion from the stomach; it gives warning of the presence of carbonic acid in the lungs: and that it possesses an analogous function, in relation to the heart, we conclude from negative rather than positive evidence. Division of the vagus nerve scarcely influences the heart's beat, whereas, its stimulation by galvanism retards it. The cardiac branches of the sympathetic are abundantly distributed to its muscular structure: irritation of the brain and spinal marrow modify the heart's action; and its rhythmic movements are arrested when the spinal cord is suddenly destroyed. Mental

influence, again, proves the sway which is exercised by the cerebrum over the heart. From these facts I conclude that the special function of the pneumogastric, in relation to the heart, is to communicate impressions made, simultaneously or independently, upon it and upon the lungs, to the brain. Cognisance may thus be taken of the presence of unoxygenated blood within its cavities; or its sympathetic action in unison with respiration may be thus secured. Certain it is that the regulated rhythm is seriously deranged by causes, such as shock, tending to disturb the healthy relations of nerve-force in these organs. To what, then, is the oft-cited death from a blow in the epigastrium to be ascribed? It is not due, I apprehend, to any inhibitory quality attributed to the pneumogastric in relation to the heart's contraction; but rather to the indirect impression upon that organ through the violence offered to the pulmonic and gastric plexus of the vagus, and thence conveyed to the brain: the ulterior consequence being suspension of both respiration and circulation simultaneously. Whether the pneumogastric nerve is the medium of a direct controlling influence over the action of the heart in these results, I do not know. Indeed, I must admit that I cannot understand how this negative influence—for as such the inhibitory property ascribed to this nerve must be regarded—is exercised, and what it may be. Probably further investigation may throw more light on the subject.

I have thus endeavoured to bring within the limited compass of the time allowed, some of the leading features of shock and its sequelæ. The many recent interesting experiments bearing upon nerve-function, held out to me the temptation to diverge into the pleasant paths of physiology; but I have felt compelled to restrict myself to very brief allusions to these subjects;—and I may now remark, in anticipation, that I must in like manner, in the subsequent lectures, avail myself, without entering into details, of such physiological facts as recent investigations have unfolded.

The ever-recurring tendency to generalisation is specially exemplified in the development of physiology in association with physical laws. New discoveries disturb our existing convictions ; but out of confusion comes, or, we may feel assured, there will come, harmony and light : for we know that Omnipotence and Truth cannot be disjoined. Yet, in dealing with an influence so complex and so subtle as Life, our most delicate instruments are coarse and subject to error. The relation of nerve-force to muscular contraction, and the inverse development of convulsive movement in relation to the supply of nervous influence ;—the apparent identity of muscular force and irritability, manifested in “the readiness with which muscle contracts, being in direct proportion to the amount of force accumulated in its structure ;”—the fact experimentally proved, that muscle more readily contracts in the absence of nerve influence ; and also that “in the absence of volitional or other excitement, both the nervous and muscular systems can accumulate their own special forces, and that to an extent which can never become apparent under normal life conditions ;”^{*} the assumed inhibitory influence of nerve-force over muscle ; the startling doubt which experiment seems to raise, as to the limitation of volition to the encephalic centre ; probably, however, explained by the exaltation, as we descend in the scale of creation, of co-ordinating nerve-power derived from several and independent sources ; the probable localisation of special attributes, as that of speech ; these are some amongst the many physiological phenomena and problems, allied with the subject I have been considering, on which further investigation will throw more light, and will bring into more harmony as that light is imparted. In physics, the universality of wave-motion, as the connecting link between mind and matter, recommends itself by its comprehensive grandeur : and the principle involved in the correlation or conservation of physical

^{*} Norris, “On Muscular Irritability,” in ‘Journal of Anatomy and Physiology,’ 2nd series, No. 2.

forces,—that force or energy, like matter, may be transferred or converted but not annihilated,—has opened a wide field for investigation in its relation to physiology. All seems to point in one direction,—to the inclusiveness of the laws and the simplicity of the instruments by which such varied, such complex results are obtained; and in this contemplation the mind is elevated by the conviction which is forced upon it, that the relative quality of magnitude is, like time, simply an accommodation to our finite intelligence: the myriads of worlds we gaze on in the infinity of space, individually of bulk too vast to be encircled by the earth's orbit around the sun, and the microcosm of our own bodies, yea, even the animalcule which is invisible to our unaided sense, are framed by the same Omnipotence, and governed by the same Omniscience;—and that each is perfect in its own degree, and equally cared for, in the adaptation of the laws which determine its existence, and secure the fulfilment of its destiny.

LECTURE IV.

Lesions of Encephalic Nerve-centre.—Introductory Remarks.—Objective and Subjective Indications.—Fracture of Skull ; its Detection and Import.—Use of Trephine.—Depression without Fracture.—Fracture of Base ; its Diagnostic Signs and Symptoms.—Inquiry respecting Fracture by Contre-coup.—Means of determining the nature of a Fracture of the Base :—Recovery after such Fracture.

MR. PRESIDENT AND GENTLEMEN,—Whilst natural science has been developed chiefly by accurate observation of facts, that development has, by a necessary and happy reaction, induced more caution in generalising from those facts, and more critical exactness in the definition and use of words. The vague mysticism of our past nomenclature has given place to intelligible precision of language ; and an affectation of learning is no longer tolerated as the substitute of that wisdom which can afford a confession of ignorance, and, in so doing, takes the first step towards renewed exertion.

It may seem a trite remark,—it is certainly one which needs little exemplification,—that our knowledge of many subjects associated with the laws of life is still very imperfect. Much light has been thrown upon the conditions on which life is maintained, but we are still in ignorance of what life is. Many changes which we formerly believed to be vital are now proved to be chemical ; and physical and vital energy have been shown to be more closely associated than was formerly supposed : but this scarcely brings us nearer to the demonstration of their identity. The capacity of the living germ for the conversion

of physical into vital force or energy, under favouring circumstances, implies the existence of a quality which distinguishes it from inorganic matter; and this property or endowment, whatever it may be, still eludes our research. Whether the assumed inseparable association between matter and force is a step towards the solution of this problem I do not venture to conjecture; and it would assuredly be an idle speculation to define any limit to the results of physical investigation.

Whatever life may be, we know that it exercises an all-pervading influence throughout the frame; that it endows organs with attributes which fail on its withdrawal; that the chemistry of inorganic matter is modified or suspended by its agency; that physical laws obey its behests; that it possesses its well-organised system of intercommunication, by which all parts of the frame are coerced into unity of action, and bound together by an invisible cord; that it resides nowhere, and yet is everywhere; that its presiding influence may be cut off, by violence, from a section of its dominions, without interference with the rest; that it will resist the rudest shock, or may succumb to one which could be scarcely supposed capable of disturbing its equilibrium;—exhibiting thus a sensitiveness which might be mistaken for inconstancy, if modesty did not prompt us rather to ascribe the apparent incongruity to our own ignorance.

Although the dominion of vitality is everywhere apparent in the animal organism, pervading or influencing every part, there are certain organs through the medium of which its phenomena find special expression; and the centres of nervous influence are the favoured agents in this mission. Theirs also is the still higher attribute of being the material medium by which the mind is brought into relation with the external world. Thus, in the diagnosis of the various lesions to which the nerve-centres are obnoxious, we are compelled to extend our survey over a large field, and to take cognisance of many associated circumstances, which are indirectly indicative of functional

disturbance or of organic mischief. These lesions constitute a branch of practical medicine which is shared between the physician and surgeon; but the line which separates the two sections is conventional rather than real. The results of violence cannot be profitably studied, apart from those conditions of the brain, for example, which are the concomitants or consequences of diseased action; and the converse may be affirmed with equal truth. Yet, I need scarcely observe that the scope of these lectures will compel me to limit my observations almost entirely to those conditions of disease or injury which fall within the special province of the surgeon; and to treat even them briefly and suggestively, as far as my experience has taught me to associate symptoms or signs with particular lesions.

And here I may at once remark that our knowledge is still very defective, perhaps necessarily so, from the difficulty which attends investigations of this nature, and the fact that there are, unfortunately, but few whose special education has endowed them with tact of hand and observation, to qualify them for the task of examining and reporting, in a trustworthy way, upon the delicate microscopic changes which disease produces in tissues, the actual healthy condition of which is not familiar to many. The intimate mutual relations of the various nerve-centres and of individual parts of each centre; our imperfect acquaintance with the localisation of special functions; our ignorance of what nerve-force is; the delicacy of the texture which is the subject of accidental injury or of experiment; the multitude of complicating circumstances which are often present, and the frequent incapacity of the patient to aid by replying to inquiries;—altogether constitute a serious obstacle to correct diagnosis in these injuries. But, on the other hand, physiology and morbid anatomy have promoted our acquaintance with pathological changes; and thus, by establishing principles of more accurate diagnosis, have conduced to the introduction of a more settled—we may hope a more successful—system of

treatment. Yet, I am bound to say, in reviewing my own experience and referring to the recorded observations of others, that, notwithstanding the obstacles to which I have alluded, I am disappointed to find that the advance made of late years in the special diagnosis of nerve lesions is so limited.

I should have been glad to introduce this subject by a review of the existing anatomy and physiology of the nervous system,—a course which, I apprehend, the conditions of this professorship would justify ; but I fear, for the reason already assigned, that I must content myself with such brief allusions as may assist me in the object I have more directly in view. It is my purpose to briefly exemplify, as far as opportunity has enabled me, the various lesions, to the diagnosis of which I shall refer.

The diagnostic indications of injury to the Encephalic centre are both objective and subjective. The skull may be fractured ; or functional derangement may denote that the brain has received a shock or hurt. Nevertheless, such injury to the bone by no means necessarily implies the coexistence of lesion of the contained nerve-centre ; and the latter may exist, even to a fatal extent, without actual breach of texture of the osseous case. It is scarcely necessary to remark that fracture or other injury to the skull is, as such, comparatively of little importance, except in so far as it is accompanied by, or entails as a sequence, mischief to the brain. It may be accepted, therefore, as a *general* principle, that the presence of fracture, which is unattended by cerebral symptoms, rarely requires or justifies surgical interference. I speak of the principle as *general*, and of interference being *rarely* demanded, because instances do occur in which extensive fracture with depression exists, without producing immediate cerebral symptoms of urgency or even of importance, but which, nevertheless, call for surgical assistance. This apparent anomaly, of serious textural lesion without immediate interference with any special function, seems to be due to the absence of compression of the brain, and to the duality of the cerebral hemispheres. I may mention one

striking example of this, among many of the same class which have come under my notice.

A workman in a factory, whose business it was to clear away the dust produced by the action of a revolving saw, had his skull cloven whilst he stooped at his work. The saw cut through the skull parallel to, and a short distance from, the longitudinal sinus, tearing it open, shattering the bone from the centre of the forehead to the occiput, and driving several fragments into the brain, which was ploughed up and extruded from the cranium in considerable quantity, passed out through his nostrils, and adhered to the temporary dressing which had been applied. Although the longitudinal sinus was freely laid open hæmorrhage from it was readily controlled by a compress. He recovered consciousness on the following morning, vomited constantly for three days, and then began to take food. Even subsequently, this injury was unaccompanied by any manifest evidence of its severity, except partial hemiplegia. The patient remained conscious till he died; replied to questions with perfect intelligence; described his accident; took food freely; and attempted to sit up in bed. He survived ten days, and then died suddenly from hæmorrhage into the brain.*

My late dresser, Mr. Frederick Ward, has communicated to me the following case, which, from the similarity of the accident and the recovery of the patient, I think worthy of record:—
“J. S., aged 14. Three years since, his head came in contact with a circular saw in motion; and the consequence was an extensive laceration of the scalp and fracture of the skull. The direction of the injury was from the right eye backwards; and several fragments of bone were removed, and some extruded brain subsequently sloughed. The extent of the injury is shown now by a cicatrix over the frontal and parietal bones, measuring six inches; the greater part firm, but presenting a space, both anteriorly and posteriorly, closed only by soft

* See ‘Medical Times and Gazette,’ Clinical Lectures, Nov. 10th, 1860.

tissues, which rise and fall considerably with each beat of the heart. Since his recovery, his mother states that he has become forgetful, passionate, and very mischievous and untruthful. The temperature of the left side (hands and arms) feels perceptibly lower than that of the right. The vision of the left eye and hearing of the left ear, as well as the discriminating power of taste, are very sensibly impaired; and extremes of temperature are not perceived. His sleep is unsound, and he frequently talks incoherently." This patient was under the care of Mr. Corner of Poplar, who kindly sent him to me for inspection.

It must have occurred to many of my hearers, as to myself, to raise large fragments of bone which have been driven into the brain; the patient meanwhile being conscious of all that was going on. But such lesions necessarily entail, sooner or later, consequences of imminent peril; and, therefore, steps must be taken to limit the risk in these cases, so far as practicable and safe, by raising depressed fragments of bone.

There is also another class of cases in which the question of primary interference with the trephine may be entertained; I mean those in which a limited and penetrating wound of the skull can leave but little doubt in the mind of the surgeon that the brittle internal table has been splintered. Of course, the presence of symptoms of compression, under such circumstances, demands interference; but, in my experience, the occurrence of such an injury without some symptoms of compression is rare; and, when such cases do occur, I cannot say I am disposed to subscribe to the doctrine that so serious, and in itself dangerous, an operation as trephining should, as a rule, be resorted to. I cannot recall a single instance in which I have felt myself justified in performing this operation where no symptoms have been present, or in which I have had occasion to regret such abstinence. I must, however, admit that fatal mischief does sometimes supervene from inflammation and suppuration between the dura mater and bone, or even in the substance of

the brain; and then the use of the trephine rarely affords more than temporary relief. This secondary form of mischief is occasionally exemplified where there is no depression of bone, and where, therefore, the alternative of primary operation could not be entertained.

I have thought it expedient to make the foregoing remarks, with a view of avoiding subsequent reference to the questions involved, which possess a general rather than a special interest in relation to diagnosis. But it is essential to bear in mind that there is no direct proportion between the extent of actual breach of texture in the brain and the accompanying or even consequent symptoms.

In the absence of cerebral disturbance, the existence of fracture can be determined only by objective signs, which are sensible to the touch or sight. These are generally at once apparent, or may be ascertained by careful examination; but, as the importance of diagnosing fracture is to be measured by its actual or contingent implication of the brain, caution must be exercised in seeking, by any operative interference, for confirmation of suspected injury to the skull. Thus, it may be difficult even for the experienced surgeon to distinguish between a puffy circumscribed tumour of the scalp with sharp and well-defined circumference, and actual depression of bone; but his acquired knowledge will probably have taught him that, in the absence of cerebral symptoms, he is not justified in gratifying his curiosity by an incision. Nay, I would say further, that such incision should not be practised even when early symptoms indicate functional disturbance of the brain, which may be due exclusively to shock or concussion. The same rule should, in my opinion, apply even where the scalp is wounded. Extended incisions, made with a view of discovering fracture, are, under the above circumstances, mischievous, by denuding the pericranium, and thus aggravating the risk to which the patient is exposed. It therefore behoves the surgeon to discriminate between symptoms which are due to depressed bone, and those

which may be explained by a blow upon the head, without such complication ; and it is preferable to await the development of the case, than to be precipitate in acting.

Fissure of the skull, without displacement, may be detected where the scalp is wounded. Thus, a patient was admitted into the hospital, under my care, who had been struck on the head by an iron girder. He was stunned, but soon recovered consciousness, and walked to the hospital. He was very sick on his admission. He had a scalp-wound over the right parietal bone, and a distinct fissure of the skull, without displacement. He had no subsequent head-symptoms, and the wound healed kindly. He was watched for a considerable time, and then allowed to go home. Or, again, inequality of the line of fracture may be detected, indicating some depression of bone, without any attendant symptoms of injury of the brain. In such a case, the depression may be of the outer table only. Thus, a middle-aged man was recently under my care, who had been struck down with a bludgeon, and robbed. A contused wound of the scalp enabled me to feel a fracture, with irregularity such as I have described ; yet, after recovering from the shock of the blow, he walked home, and was then brought to the hospital. There was entire absence of cerebral symptoms, beyond such as would be accounted for by reaction after shock. I was, of course, alive to the possible contingencies in this case, and kept the patient for a long time under my notice. He suffered at times severely from pain in the head ; and a small wound continued to discharge, until I satisfied myself that the proper time had arrived to enlarge this opening, when I removed a loosened fragment of the outer table of the skull, and the patient recovered speedily and permanently.

Such an injury may present an extent of depression which compels the conviction that both tables are fractured ; yet, as I just now remarked, symptoms of compression may not be present. I remember a well-marked exemplification of this condition, occurring in a young man under my care some five

or six years since. He was struck down by a blow on the forehead from a falling box of bricks. He rallied speedily from the stunning effects of the blow, and his only symptom, on admission into the hospital, was a little drowsiness. About two inches above the orbital ridge, and near the centre of the os frontis, the scalp was lacerated, and a fragment of bone, about half an inch in breadth and two and a half inches in length, was driven in and depressed, so as to place the outer table on a level with, or even a little beneath, the inner table of the surrounding bone; moreover, it was evident that the inner table of the fragment covered a larger area than the outer, being fractured with a squamous or bevelled edge. Pulsation, synchronous with the heart's action, was apparent in the wound as the blood welled up. Yet this patient never had any brain symptoms; but after five weeks a thin plate of bone exfoliated, evidently the outer table only. I anxiously weighed the risk of secondary mischief in this instance against that of trephining; and the extent of depression, together with the healthy youth of the patient, and entire absence of symptoms, determined me in abstaining from interference. I have the notes also of another case, which presented a remarkable feature, the explanation of which can only be conjectured. A boy, aged 14, was struck by a falling rocket-stick on the right temple. There was a double fissure in the frontal bone; one extending directly upwards from the superciliary ridge, the other outwards. He was insensible, with a short interval of consciousness, for some hours after the accident. The eye was closed, but uninjured; this was particularly noticed. He rallied without head symptoms, after recovering consciousness; but the eye was lost by sloughing of the cornea and suppuration. Was this due to the injury of the fifth nerve?

Although I regard the use of the trephine as an expedient fraught with danger, there can be no doubt about the propriety of using it to afford the chance of relief in intra-cranial suppuration. That its employment is so often unsuccessful, is probably

due to extension of mischief, consequent on violence to the brain-substance. Although the diagnostic signs of compression from the intra-cranial suppuration in disease are identical with those which arise secondarily from injury, I am disposed to be more hopeful as to the result, and for the reason assigned, in the former than in the latter condition. An interesting case of syphilitic necrosis of the os frontis was under my care about six years since; the patient, whilst under treatment, became dull, and complained of headache. In the course of two or three days coma seemed imminent; and, on applying the trephine, both tables of the skull were found to be necrosed, and pus was deposited between the bone and dura mater. The operation was succeeded by immediate relief from the symptoms; but sloughing of the dura mater ensued, followed by protrusion of the brain. This was cautiously controlled by pressure, but continued for many days. He struggled through; and I afterwards removed a large fragment of the entire thickness of the frontal bone. Ultimately he quite recovered, without any apparent deterioration of brain-function, but, of course, with a gap whence the necrosed bone had been removed.

Fracture, with depression, may occur over the frontal sinus, and then we should not expect brain symptoms. In a case of this kind, where a considerable portion of the front wall of the sinus was driven in, the only special memorandum I have is, that air was freely extravasated into the areolar tissue of the eyelids. It is not infrequent to find the frontal sinus involved in other fractures of the skull.

Fissure of the skull, accompanying scalp-wound, but unattended by brain disturbance after subsidence of shock, and followed by rapid recovery, is by no means an infrequent occurrence. These cases are suggestive of extreme caution in prognosis, and demanded long-continued abstinence from any and every source of excitement on the part of the patient. Of such fissures when associated with fracture of the *base* of the skull, I shall have to speak presently.

In diagnosing the presence of fissure, the error of mistaking for this condition a suture or Wormian bone must be guarded against. The sutures are rarely separated to any extent, except in severe and crushing injuries of the skull. Of fissures of the inner table alone I have no record.

In children, there seems to exist a mutual accommodating property between the skull and brain, admitting of considerable depression of bone, without the coexistence of any symptoms of compression. I remember witnessing a remarkable instance of this kind many years since in one of Mr. Green's patients ; and an equally striking illustration occurred in my own practice. I was requested, when in South Wales about ten years ago, to see, with Mr. Chater of Tenby, a child who had been injured on the head by a fall. Although I retain an accurate recollection of the chief features of the case, I have recently sought and obtained an interview with the boy and his parents, and am thus enabled to give the particulars of it more circumstantially.

C. F. is now a little over ten years of age. When about six months old, he sprang from his sister's arms and fell, striking the ground with the left side of the head. He had on a thick hood at the time, so that the skin was not broken, but a deep indentation was caused by a pebble with which the head came in contact. The indentation was oval, about three quarters of an inch deep in the centre, and looked as if half an egg had been pressed in ; the end of the thumb might easily have been buried in it ; this depression presented no sharp edge to the touch, and was situated a little posterior to the parietal eminence. How long it lasted the parents are unable to say ; but the depressed bone appears gradually to have risen to its former level ; neither indentation nor roughness can now be felt ; but the parietal eminence on that side is flat when compared with the other. The child was not unconscious at the time, smiled soon afterwards when spoken to by its mother, and recognised her ; it had no head-symptoms, and soon recovered. The boy is now at school, is sharp at his lessons,

and has a good memory, and is reported as being rather mischievous—not a very rare trait in a boy of ten. Of course, I recommended that nothing should be done in this case, and predicted an early recovery of the normal form of the skull.

In fracture of the *base* of the skull, the objective signs are indirect and equivocal; most of them are rare. Thus, ecchymosis in the mastoid region, or in the pharynx, or in the eye, may be due to other causes. Of these, probably, the pharyngeal extravasation is most to be relied on, but it is infrequent or but rarely observed. In one instance which came under my notice, hæmorrhage from the pharynx, accompanying cerebral mischief, was suggestive that the injury was in the base of the skull; this patient recovered. Ecchymosis, and even abscess, may occur over the mastoid region without necessarily indicating fracture. About a twelvemonth since, a boy was under my care with head-injury, who recovered in a few weeks so far as to be convalescent; and then he had a relapse. He became drowsy and irritable, and complained of severe pain over the mastoid process; after a few days an abscess declared itself, and was opened. I could not satisfy myself that this suppuration was associated with the original injury, though I thought it not improbable. He obtained immediate relief, and soon made a good recovery.

In a young woman, recently under my care, remarkable tenderness over the mastoid process suggested to me that fracture of the base existed, even before other symptoms had become sufficiently developed to excite alarm. A *post-mortem* examination after survival for a fortnight, revealed fracture of the petrous bone.

In another of my patients, who had fallen into the hold of a ship, and was brought to the hospital, where he died in a few hours, the only external indication of injury was ecchymosis in the occipital region. The base of the skull was found fractured across, the injury involving both petrous bones.

Although ordinary ecchymosis affecting the eyelids, or even

the surface of the eye, is not to be depended on as characterising fracture of the base in which the orbit is involved ; yet the occurrence of this condition, under certain circumstances, is pathognomonic of this special form of fracture. The circumstances to which I allude are, that an interval of some thirty-six hours after the injury should elapse before the ecchymosis makes its appearance ; and then that it should be first apparent on the ocular conjunctiva, and *subsequently* spread to the lids.

Bleeding from the nose is so frequent a concomitant of injury to the head, that its occurrence can scarcely be regarded as of diagnostic value in fracture of the base, unless persistent, and under circumstances to excite suspicion.

Of serous discharge from the nostril I have no record among my own cases ; but a child was recently under the care of my colleague, Mr. Solly, in whom this occurrence succeeded epistaxis, consequent on injury to the head. The child had been run over, was unconscious for some time, and subsequently had a succession of fits. Nearly a month after the injury, the little patient had recovered from the more urgent head-symptoms, but continued fretful in temper ; there was marked facial paralysis, with much serous discharge from both right ear and right nostril : the pupils were equally active.

I may remark that force directly applied to the face may involve the base of the skull. This occurred in the case of a gentleman, who was struck by the shaft of a cab in rapid motion, on London Bridge, and was immediately brought to the hospital. The nasal region of the face was driven in, whereby frightful mutilation was produced, but the patient's condition did not excite immediate apprehension. Cerebral symptoms, however, supervened shortly afterwards, and death ensued. These symptoms indicated the condition which was verified at the *post-mortem* examination ; viz., that injury to the cribriform plate of the ethmoid bone had involved, secondarily, the anterior lobes of the brain in the inflammation which followed this lesion.

I have already mentioned one case in which the escape of cerebral matter by the nostrils proved fracture of the cribriform plate of the ethmoid bone. In another patient, whose head was crushed between a falling weight and the axle-tree of a railway carriage, cerebral matter was found mixed with the blood which was vomited. The ethmoid bone was involved in an extensive fracture, and the inferior surface of the anterior lobe of each hemisphere was lacerated. Yet this patient survived till the fifth day, and was rational till the morning of the third. The vault was also extensively fractured.

Much importance has been attached to the oozing of fluid from one or both ears, as a diagnostic sign of fracture of the base of the skull, crossing the petrous bone. Such fluid may be blood, or serum, or a mixture of the two. Blood must, of course, be derived from lacerated vessels; pure serum, or a limpid liquid closely resembling it, has its source in the sub-arachnoid space; sero-sanguineous fluid may consist of a mixture of blood and cerebro-spinal fluid, or it may be blood combined with the labyrinthine secretion, if the quantity be limited; or, again, it may be, and I think usually is, such a dilution of blood with serum as is met with in subsiding hæmorrhage from an external wound: this last is probably always the explanation of such mingled oozing when it succeeds, as is so frequently the case, the escape of pure blood. My own experience has taught me to attach but little importance to bleeding from the ears, and succeeding sero-sanguineous oozing. Cases presenting this condition so frequently recover, and in so short a space of time, as to forbid the supposition that the base of the skull had been fractured; under such circumstances the blood is probably derived from the auditory canal, or from the tympanum. But, in combination with other associated signs, it may assist in supporting the supposition that the petrous bone has been fractured; although the recovery of the patient, in the absence of such allied indications, might reasonably suggest serious doubts on the subject. An interest-

ing case, exemplifying this remark, came under my notice about four years since. I was asked by Mr. Mitchell, of Clapham Road, to see with him a young lady, who had imprudently jumped from a carriage in rapid motion, and, her dress becoming entangled in the door, she was thrown with violence on her head; the only mark, indicating where the blow was received, being behind the left ear, just above the mastoid process: this part was contused, but the skin was not broken. The insensibility which ensued was very transient, but the patient remained in a state of collapse for some hours; reaction was moderate. There was bleeding from the ear, mouth, and pharynx, which persisted for several days; there was complete paralysis of the muscles supplied by the portio dura, and hearing on the same side was entirely suspended. Six weeks elapsed before these nerves recovered their functions. This young lady's recovery took place without the occurrence of any serious brain-symptoms. In such a case as this, there is no demonstrative proof that the petrous bone is broken; but the combination of circumstantial evidence is very much in favour of the supposition that it was so in this instance. Possibly the pharyngeal hæmorrhage was from the Eustachian tube.

Persistent arterial bleeding from the ear, especially where such hæmorrhage recurs after an interval of some days, is suggestive of fractured petrous bone as its source. I shall presently cite a case exemplifying this condition.

A limpid fluid, supplied in abundance, can have but one source, the sub-arachnoid space. Frequently, this lasts for several days, and saturates the pillow of the patient. I apprehend that this sign may be regarded as unequivocally diagnostic of fractured petrous bone. Under these circumstances, reaction may be accompanied by hæmorrhage; in which case the mixture of blood and serum is to be viewed in a different light from the same coincidence, when it occurs primarily; the latter condition may accompany fracture of the base; but as an element in diagnosis it is not to be depended on.

The absence, except in small quantity, of albumen, and the presence of an excess of chloride of sodium, in the cerebro-spinal fluid, has been repeatedly shown by analysis. I have on the table some fluid removed, by tapping, from the head of a hydrocephalic child; and it is characterised by the peculiarities above mentioned: there is just a trace of albumen, but chlorine is present in unusual abundance.

The occurrence of paralysis of the facial and auditory nerves, as exemplified in the case I have just narrated, is a consequence of fracture; but it may also depend on pressure resulting from hæmorrhage: it is, however, a suspicious symptom, especially in connection with others indicative of fracture. Yet this paralytic condition is not always an immediate sequence of the injury; it may supervene after the lapse of some days. In such case it seems more probable that this symptom may be due to inflammation; and it might be inferred, therefore, that it is not characteristic of fracture: but this would be an illogical conclusion, because the inflammation, if the cause of the paralysis, may have been induced by the proximity of a fracture. The following case illustrates this condition. A workman, in the employ of Mr. Penn, the engineer, was struck on the head by the revolving arm of a crane. He was quite insensible when admitted into the hospital, and in a state of collapse, bleeding profusely from the left ear. There were three scalp wounds: one on the forehead, where the crane struck him, and two on the occiput, caused by the fall. The hæmorrhage from the ear, which was abundant and arterial, continued for eight hours after his admission. On the fourth day he began to have transient gleams of consciousness, and then the bleeding from the ear recurred, and lasted for some hours. On the following day there were indications of facial paralysis on the injured side; this was limited to the muscles supplied by the portio dura. As the stupor diminished, the paralytic condition became more decided up to the tenth day. The subsequent history of the case is replete with interest, and

left but little doubt in my mind that there had been fractured base, accompanied by other serious lesion. The patient made a slow recovery; and when I saw him some months after he left the hospital, he continued feeble and incapable of exertion, with some hesitation of speech, though he had to a considerable extent, but not entirely, recovered from the facial paralysis. Serous oozing from the ear, which succeeded the bleeding, continued even at the expiration of the second month.

In singular contrast with the foregoing case, except in the special feature which induces me to cite it, is that of a young woman recently under my care. She was thrown from a cab, and it is presumed that she struck her head, though no indication of a contusion could be discovered. When brought to the hospital she was insensible, but not collapsed. On the following day, sero-sanguineous oozing from the right ear aroused suspicion, but there were no head symptoms, except drowsiness, to excite even anxiety. Facial paralysis gradually supervened, after the lapse of some days, but so imperceptibly at first, that it escaped notice unless specially looked for; there was also much tenderness over the mastoid process. Subsequently the right eye was inverted, and the intellectual faculties became torpid; and she died on the thirteenth day, in a state of muttering delirium; the temperature having risen to 106.2 Fahr., an hour before death. The *post-mortem* revealed the presence of pus in the right posterior fossa of the skull. There was slight laceration of the left middle cerebral lobe, with some extravasation into the arachnoid at that spot; there was also fracture of the right petrous bone, taking a somewhat unusual course.

As the specimen is a recent one, I have placed it on the table, as a good illustration of this form of injury. The line of fracture extends from the posterior inferior part of the right parietal bone to the front of the base of the mastoid process; thence forwards and inwards in the long axis of the petrous bone, crossing the auditory meatus and tympanic cavity, and

separating the ossicula. The membrane of the tympanum is torn, and the bony part of the Eustachian tube divided. I attribute the deafness and facial paralysis, in this instance, to the extension of inflammation, by contiguity, to the Fallopian tube.

From this class of cases, of which the preceding are typical examples, I conclude that facial and auditory paralysis is not necessarily indicative of fracture of the petrous bone, when unsupported by other confirmatory symptoms or signs; that, in combination with serous, or even sero-sanguineous discharge from the ear, the existence of fracture is very probable; and when both these signs co-exist with cerebral symptoms, either primary or secondary, there can be little, if any, doubt that there is fracture of the petrous bone. It is not, however, necessary that the signs of nerve lesion should correspond with the side on which the injury is received. I have the notes of one of my cases in which defective hearing and vision occurred on the left side, the blow having been inflicted behind and above the right ear. There was no paralysis in this case; but defective articulation and great hesitation in expression, which persisted for some months afterwards. This is a condition suggestive rather of extravasation of blood or of cerebral pressure, than of fracture of the base.

I have never seen actual laceration of the seventh nerve; and probably this is a rare occurrence, and by no means necessary to account for persistent loss of function, even when the immediate sequence of injury to the head. Displacement of bone or extravasation of blood, and consequent pressure on the nerve are, in such instances, the more probable explanation.

Under what circumstances does fracture of the skull occur, at a spot remote from the part which is struck? And how far are we justified in forming an opinion as to the position of fracture in the base, from the part of the head on which the blow is inflicted? It cannot be affirmed that, for therapeutic

purposes, such diagnosis is very important ; but it is an interesting inquiry ; and, as I believe it touches an error which has been generally accepted, I will venture to devote a short time to the consideration of the subject.

The doctrine of fracture by contre-coup has been generally taught, without, as it appears to me, satisfactory proof of its actual occurrence, or a sufficient consideration of the mechanical force by which it is supposed to be produced. Indeed, I think it may be questioned whether the term "contre-coup" is admissible in physics ; certainly the conventional meaning which is attached to this adopted word in surgery is very loose, and does not bear a careful examination. It is employed to define the force by which fracture of the base is produced by a fall on the head ; yet, in analysing the mode in which fracture occurs in this accident, we find that the application of the force is as direct as if the vault of the skull be driven in by a sledge-hammer. The plunge of the body is suddenly arrested by the vertex coming in contact with the ground ; and the entire superincumbent weight, with the superadded momentum acquired by the velocity of the fall, is concentrated around the condyles of the occipital bone, and the central compartment of the base of the skull is thus broken across. Or, this result may be varied by the blow being received on the forehead or occiput ; the anterior or posterior divisions being then, severally more obnoxious to fracture. But it is surely incorrect to say that these fractures are the result of a "contre-coup." I do not cavil about the employment of the word in this sense, although I think it incorrect, provided the conventional meaning is clearly understood ; and that an admitted lesion, albeit improperly designated, is not confused with an asserted form of injury, the reality of which I think it would be difficult to demonstrate in fact or experimentally.

It has been affirmed that a blow received on one side of the head may produce fracture on the other ; or that a blow on the frontal bone may result in fracture of the occipital

bone. The possibility of such an occurrence cannot be doubted, when the head is forced against an unyielding surface; under such condition, the side which is weaker or on which the force applied is more circumscribed or concentrated, would most readily yield. But, that fracture should result in the way described, without the existence of the condition mentioned, is opposed to sound reasoning, applied upon mechanical principles. The proposition that such might be the case would probably assume the following form. As a consequence of force sharply applied to the side of a suspended hollow sphere, the *vis inertiae* is overcome at the point struck, and some change of form is the consequence, converting momentarily the circle into an ellipse, or the sphere into a spheroid; the vibrations are, at the same time, propagated in all directions away from the point struck, and would proceed around the sphere, until they met in a kind of focus at the point exactly opposite, where they would neutralise each other. The result would be the conversion of a state of active vibration into one of rest; and, as a consequence of this sudden change, disruption of the vibrating body at a point diametrically opposite to that which received the impact of the force. Whether such a consequence would be likely to ensue, where the sphere or circle acted on is of highly elastic and homogeneous material, such as glass, I must leave to physicists to determine. But I would submit that it seems impossible that such an effect could be produced in the skin-clad skull, irregular as it is in form, made up of many segments, varying in density, and presenting anatomical characteristics specially designed to break up and neutralise such physical force as I have supposed to be in operation. Under these circumstances, it cannot be credited that vibrations could be propagated with sufficient regularity to permit of any focus of neutralisation being found; and I cannot suppose any other hypothesis upon which the occurrence of such fracture can be founded. But, it may be remarked, the sphere is filled. Yet, if it is difficult to conceive

that fracture could be produced in the way I have described, the supposition that fracture could occur as a consequence of the transmission of vibrations through the soft and inelastic brain-substance is still less tenable. If such fractures have ever been observed, they were probably produced under conditions unknown to the investigator.

It is true, as I have witnessed in several instances, that blood may be extravasated into, or on the surface of, the brain, at a distance from, or even precisely opposite to, that point on which a blow has been received. This is, no doubt, due to the vibration transmitted across and through the substance of the brain. When this vibration is suddenly arrested by the rigid skull, the adjacent portion of the brain and its membranes is subjected to a considerable instantaneous pressure, and the vessels give way. A similar effect is produced as the vibrations travel across from side to side: numerous small extravasations or blood-points are by no means infrequently met with in fatal concussion; and this condition was especially remarkable in a case, which I shall presently mention, of extravasation between the dura mater and skull, at a distance removed from the point of impact of the head against the ground. When the extravasation is distant from the point struck, in the course of the meningeal artery and between the dura mater and skull, probably the rupture of this vessel is influenced, if not determined, by the vibrations of the skull: but the texture of the meningeal arteries is very thin and delicate; and they would yield much more readily, even to pressure, than arteries in other parts.

Whenever I have noticed a fracture or fissure of the skull, not directly communicating with the seat of injury, I have always found a ready explanation in the relative strength of the different bones subjected to pressure.

Thus, the frontal bone as low as the superciliary ridges, the occipital as low as the transverse sinuses, and the entire parietal bones, are denser and stronger than the roof of the orbit, the

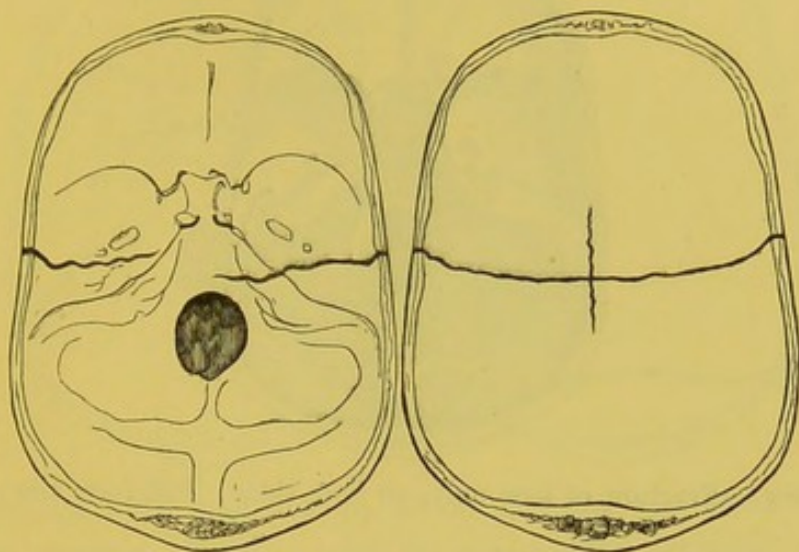
cerebellar portion of the occipital region, and the squamous plate of the temporal. Yet, all these parts of the skull are immovably fixed in their position; and pressure applied to the vault, therefore, more readily fractures the weaker part to which the force is transmitted. Indeed, in some instances of fracture of the skull, the extent of injury to the base is so great as compared with that of the vault, as to indicate that the fissures in the latter must have spread from the base upwards, and not from the vertex towards the base.

I think that the explanation I have suggested is sufficient to account for the phenomena which we meet with in complicated injuries of the skull, including laceration of the brain-substance; at least they are not inconsistent with the results of experiments on the dead body, nor with the consequences of physical force applied under other and analogous circumstances. If such be the case, we may discard as a fiction the assertion that fracture of one side of the skull may result from a blow received on the other; unless, indeed, the head be forced against some resisting body. I have never met with such an instance; and I have failed to learn that other surgeons of extended experience, with whom I have conversed on the subject, have ever seen a case of this kind.

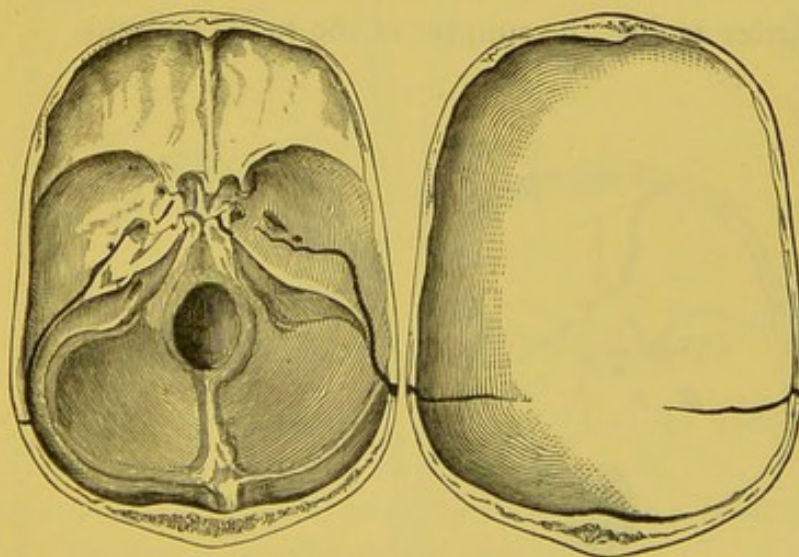
It is well known that a fall or blow on the vertex may be attended by fracture of the vertex, of the base, or of both. It may be interesting to examine how far the character of the injury may be inferred from the nature of the accident. I believe that the conclusions to which we should be led by a consideration of the mechanical conditions under which such fractures occur, are consistent with those which we realise in practice. Thus, if the injury be inflicted by the fall of a *hard* and heavy body on the vertex, this part would be fractured; and if the weight were not very great, the mischief might end there, as the resistance offered by the head may so far exhaust the momentum of the falling body, that the force would not be transmitted in sufficient amount to cause fracture of the base.

But if the weight and momentum of the falling body were in excess of the expenditure of force in causing fracture of the vertex, the impulse would drive the head down upon the summit of the spinal column; and fracture of the base would result: in that case, mechanically viewed, the lower fracture would be successive to the upper. But, if the falling weight which struck the vertex were of a *yielding* material, fracture, if any, would be in the base, and not of the vertex, because the *vis inertiae* of the skull would be overcome, and it would be driven down upon the spine, without the application of circumscribed force to the vault. The same reasoning applies when fracture of either the vault or base, or of both together, is the effect of a fall on the vertex. If the fall be on a hard and *resisting* surface, the fracture of the vault would precede that of the base; but if upon a *yielding* body, there would probably be fracture of the base, without fracture of the vertex.

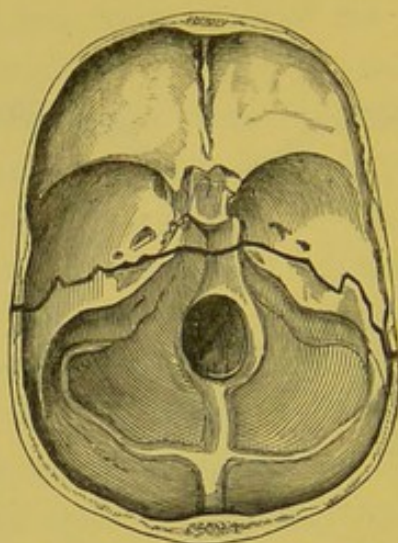
When fracture encircles the skull, vertically, it will generally be found to occur as the consequence of a perpendicular fall on the vertex, the head being jammed between the point of impact and the summit of the vertebral column. Sometimes, as in a case I am about to mention, the upper fracture is starred. Under these circumstances, the two lines of fracture usually, but not necessarily, intersect or run into each other. Whenever fracture of the base occurs, and fissures extend from it towards the vertex, but do not reach the point of impact which is indicated by bruising or laceration of the scalp, it may be assumed that the fracture has proceeded from below upwards. But when fracture extends entirely from the vertex to the base, the origin of the fracture may be determined, *post-mortem*, by its relative severity, and the amount of displacement at the vault and base. Thus, when the base is fractured, and the vertical extremity of the fracture exhibits a simple fissure, which is gradually lost as it extends upwards, it may be concluded that the fracture originated in the base. [See Figs. 1, 2, 3, 4, 5, 6, 7.]



1. LEA.—Starred fracture of vertex and fracture of base. A beam, weighing 20 lb., fell thirty feet on the vertex.

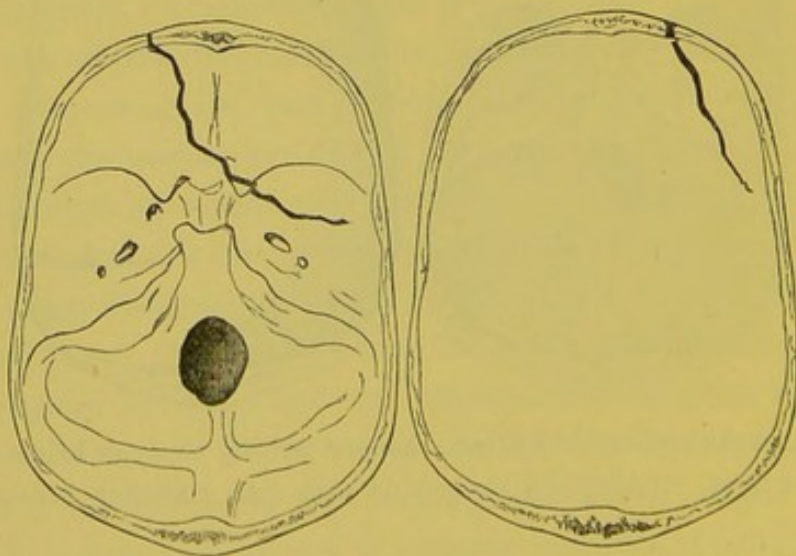


2. DORRELL.—Double fracture, but not uniting above or below. Fell against a gate, striking the occiput on each side, probably between the bars.

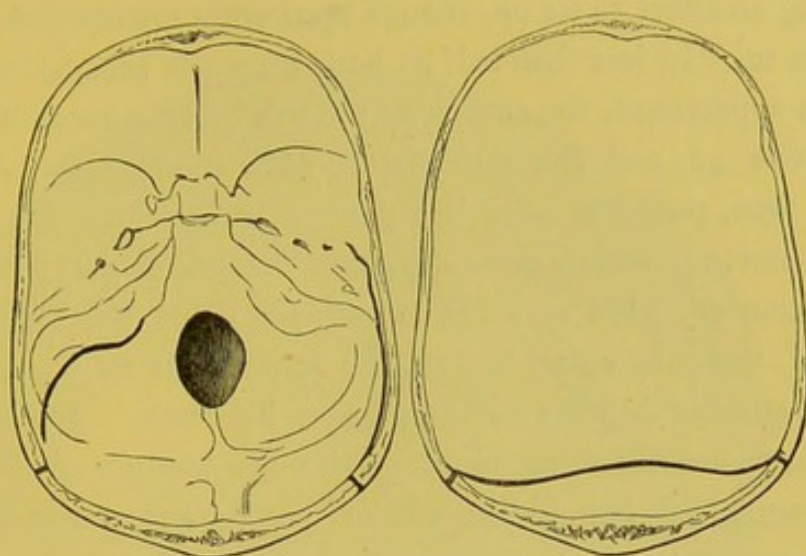


3. BIRD.—Fracture of base only, on both sides Fell forty feet on the vertex.

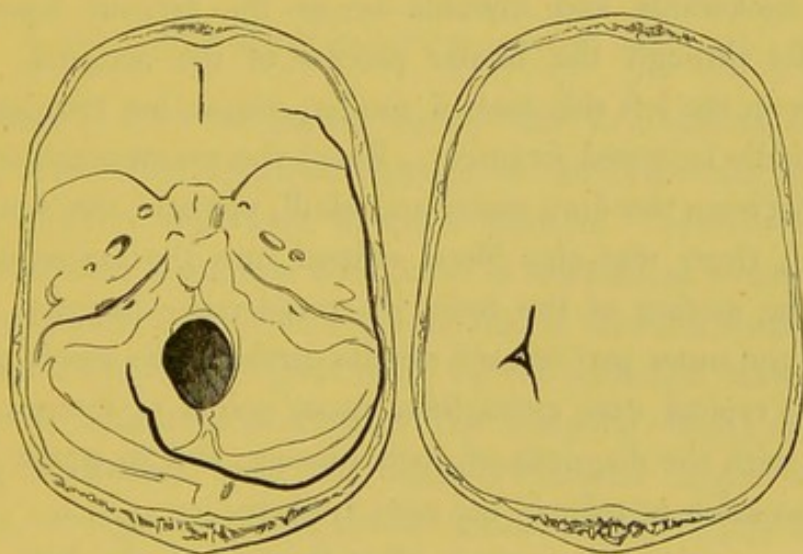
I have met with several instances which, like the following, seem to admit of but one explanation; viz. that fracture of the vertex and of the base, simultaneously, occurred as the result of a blow received on the former, and of irresistible compression of the latter against the summit of the spinal column.



4. DODD.—Fracture in anterior fossa. Was thrown from a cart, and struck the frontal eminence of the same side.



5. FEARN.—Fell from the top of an omnibus, and struck the left parietal eminence. Fracture across the posterior fossa, including the body of the sphenoid, and extending from left to right.



6. TAYLOR.—Circular fracture, extending from the posterior fossa round to the anterior. Nature of the accident unknown.

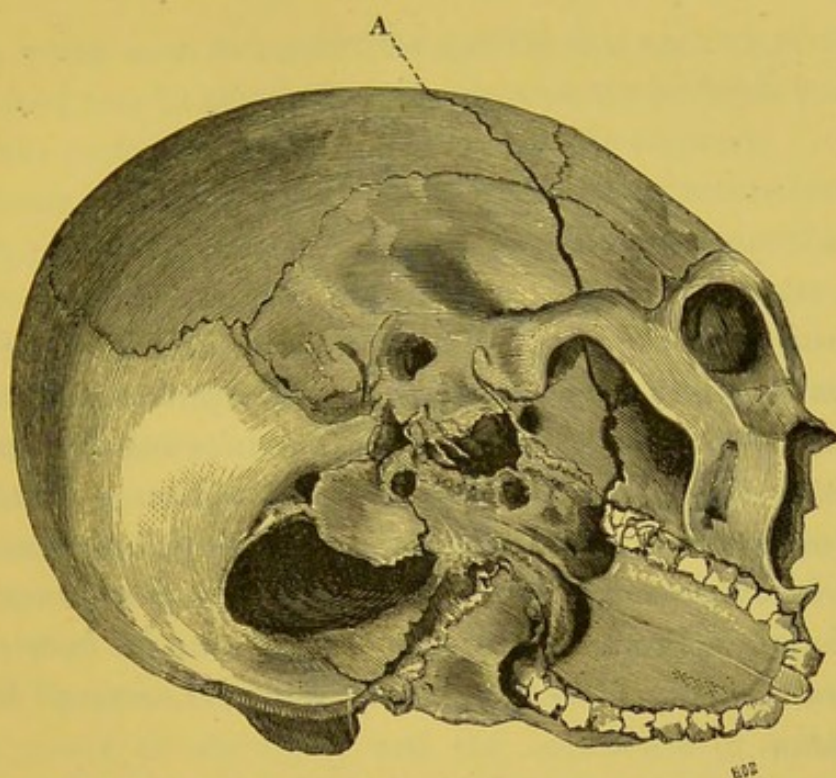
7. GARNHAM.—Fracture of vertex from a blow with a stone in a handkerchief. Recovery, after exfoliation of outer table.

A bargeman, aged 51, was admitted under my care at the close of last year. A heavy beam of wood had fallen perpendicularly, thirty feet, on his head. He was insensible and in a state of collapse, but without the usual symptoms of compression,

making an effort to sit up, though apparently unconscious when spoken to. In less than half an hour his pupils became inactive, stertor supervened, the surface of the eye became insensible, the pulse was 42, and the temperature sank to 95 deg. At the same time, puffiness over the parietal bone, which had before been observed, became more apparent. Reactionary hæmorrhage had occurred. He survived twenty-six hours, the face being flushed, the pulse rising to 128, the respirations to 40, and the temperature to 104·8, two hours before his death. Both vertex and base were found fractured. The upper fracture commenced as a fissure, just behind the coronal suture, and was crossed at its commencement, at right angles, by another fissure, constituting, in fact, a starred fracture. On the right side, this fissure extended downwards across the anterior half of the right parietal bone, and the squamous plate of the temporal bone; then backwards and inwards across the petrous bone, and partially through the basilar process of the occipital. The fissure on the left side took a similar course, but terminated at the middle lacerated foramen. Blood was extravasated on each side, between the dura mater and skull, opposite the squamous suture; there was also blood effused into the arachnoid and over the surface of the brain in considerable quantity. The under and outer part of each middle cerebral lobe was lacerated.

This typical case exemplifies many points of interest, associated with the diagnosis of such injuries, and to which I shall have occasion to refer in my next Lecture.

The question of recovery after fracture of the base of the skull is necessarily one which rarely admits of demonstrative solution. Yet, the circumstantial evidence, based upon diagnostic characteristics which we are enabled to identify with these injuries, and upon analogy, amounts to proof little short of demonstration, that recovery from fracture of the base of the skull is by no means an infrequent occurrence. A simple fissure extending across the central compartment of the base of the skull—the most frequently fractured—is not liable to



A, indicates the line of fracture, as described in the text.

disturbance ; and if the patient survive the first effects of the injury, there is no apparent obstacle to the cementing of the broken surfaces thus kept in close relation. Moreover, we know that such reparation does occur in fracture, as exemplified in the specimen I have here before me, in which a fissure had extended through the great wing of the sphenoid bone, and across the squamous portion of the temporal bone ; thence passing backwards from the anterior inferior angle of the parietal, through that bone, to the coronal suture. The line of fracture is very distinctly marked on the exterior of the bone, but is scarcely perceptible internally. As I obtained the skull accidentally, I cannot supply any history in connexion with the injury.

LECTURE V.

Diagnosis of Hæmorrhage within the Skull: its Different Positions.—Reactionary Hæmorrhage.—Consequences of Hæmorrhage.—Diagnostic Indications of Concussion and Compression Compared.—Temperature in these Conditions.—Contused, Punctured, and Incised Wounds: Laceration of Brain-texture: their Relation to External Injury.—Effects of these Lesions.—Abscess of Brain.—Accidental Complications in Injuries of Brain.—Pyæmia.—Diagnosis of Special Lesions of Encephalon.

MR. PRESIDENT AND GENTLEMEN,—There are certain effects of injury to the head, apart from lesions of the encephalic centre, to the diagnosis of which I will now briefly advert, before discussing the symptoms of direct injury to the brain itself.

Although I have verified, from repeated observation, the impunity with which fissure of the skull may be sustained, my own experience has likewise confirmed the observation of others, that blows, unattended by fracture of the skull, may be succeeded by very grave symptoms, and even a fatal result. Some of these sequences are remote, others are immediately associated with the accident as their exciting cause. Extravasation of blood is, probably, less infrequent than is generally supposed; of course, I mean in very limited quantity, and diffused over the surface of the brain. Certainly this organ has the property of accommodating itself to such pressure as would be hereby exercised upon it, where vascular lesion alone occurs; and the *post-mortem* appearances which present themselves in fatal cases that have been carefully watched during

life, would seem to support the opinion that such extravasation of blood may be absorbed, whilst its presence probably accounts for the protracted symptoms which precede recovery.

Some hæmorrhage must always accompany fracture involving both tables of the skull, and those which extend into the base. But we know that this consequence of injury may also occur without any fracture.

Viewed by itself, hæmorrhage between the dura mater and skull is manifested by unequivocal symptoms, which also indicate, in many cases, its position. The circumscribed nature of this extravasation, which is due to the close adherence of the dura mater to the skull, is at once suggestive of the nature of the lesion and constitutes its dangerous feature. In some instances, no doubt, a short interval may elapse between the receipt of the injury and the occurrence of symptoms indicating pressure. Where such is the case, the surgeon has a valuable aid in forming his diagnosis. He may reasonably conclude that, as the collapse of shock is succeeded by renewed vascular activity, blood has been poured out, so as to press upon the brain; and if fracture co-exist, even without depression, an effort should be made, with the trephine, to save his patient. But, if there be no fracture, he cannot be certain where the blood is to be found. Profound coma is diagnostic of this form of extravasation, and the presence of such extravasation is probable when this condition exists and where no fracture can be detected; or hemiplegia is indicative of the side affected. Certainly the same quantity of blood may be diffused over the surface of the brain, at its base, or be discharged into the ventricles, without producing the same symptoms of simple and deep coma. The same condition may co-exist with fracture; and, even under these circumstances, hemiplegia of the same side of the body will point to the opposite hemisphere as the seat of pressure. Unfortunately these diagnostic manifestations are not generally such as can be acted on; for, although there can be no doubt that the seat of extravasation,

when distant, is sometimes diagonally opposite to the spot where a blow has been inflicted, this is by no means invariably the case: blood may be poured out over any part of the opposite hemisphere, in the course of the meningeal artery or of its primary branches. Where the extravasation in the situation referred to is abundant, profound coma ushers in speedy death. The following is a typical example.

A middle-aged man was admitted under my care, immediately after he had fallen from a height of not more than ten feet on to his head. He was quite insensible. On examination, there was found a scalp-wound on the *right* side of the head, towards the vertex; it was about an inch long, and the periosteum was removed at one point, but no fracture could be detected. The breathing was stertorous, with groaning. The pupils were quite inactive, the left being much contracted, the right somewhat dilated. He died in forty-eight hours, without rallying in any respect. There was no fracture; but, on removing the skull-cap there was found to be a large mass of dark-coloured coagulum, weighing upwards of four ounces, beneath the left parietal bone, outside the dura mater, to which it was rather firmly adherent, and causing a marked lenticular depression on the surface of the middle lobe of the *left* hemisphere; (the contusion was on the right side). There was no hæmorrhage into the arachnoid cavity, but a small amount beneath the arachnoid, over the left hemisphere of the cerebellum; and at the base of the anterior extremity of the right cerebral hemisphere, the grey substance of the brain was bruised and ecchymosed. The white substance of the left cerebral hemisphere, beneath the depression caused by the clot, was studded with small blood-points looking like minute extravasations. (Illustrated by preparation.) I may remark, respecting this case, that it further exemplifies conditions of which I was speaking in my last Lecture, in relation to the effects of vibration communicated through the brain-substance. The extravasation was not limited to the membranes and

surface of the brain, but extended through its substance, involving the cerebellum and even the under surface of the cerebrum. But I shall presently return to this subject.

I have not on record any case in which extravasation of blood between the dura mater and *vault* of the skull was not primary, *i.e.*, indicated by the immediate or early presence of symptoms of pressure on the brain. No doubt these symptoms are, as I just now remarked, in some cases, less positive at first, and become confirmed by further effusion, as the heart recovers from the first shock of the injury; but the cases are, I think, exceptional and rare where the symptoms of compression are *entirely* absent in the early stage of shock, and supervene only when reaction takes place. I must, however, qualify the preceding remarks on these effusions, by observing that extravasation, having the same relations in the *base* of the skull, may exist without entailing necessarily the same consequences. I have met with several such instances, which admitted, *post-mortem*, of no other interpretation than that the blood was deposited between the fibrous membrane and bone some time prior to death, and yet there were no symptoms to indicate its presence during life. Probably the pressure in this direction is more readily diffused by displacement of the sub-arachnoid fluid, or the extravasation takes place more slowly if the lesion be not arterial. Usually in these cases of extravasation, external to the dura mater, this membrane is not ruptured nor torn; but, when there is fracture, and that fracture is accompanied by displacement, the dura mater may exhibit the lacerated appearance in proximity to the clot, which is presented by the accompanying preparation of fracture, with extravasation in the base of the skull. (Preparation shown.)

Extravasation of blood into the cavity of the arachnoid is commonly seen in fracture of the base of the skull; but, in my experience, it is less frequent than sub-arachnoid effusion, on the *upper* surface of the hemispheres, which sometimes extends

into the interstices of the convolutions. It is also seen in some instances diagonally opposite to the seat of injury. In these situations probably reactionary hæmorrhage often occurs, as there is less resistance to be overcome by the current of the blood. The following case exemplifies the condition which I regard as diagnostic of this form of limited reactionary hæmorrhage.

A labourer fell from a scaffold two stories high, and was brought to the hospital immediately. He was stupid, and answered questions confusedly, and complained of pain over the right eye-brow, which was contused and swollen, and in the back; he was pale and suffering from shock. Two hours afterwards he became rapidly comatose. I ordered cold lotion to the shaved head, a brisk purge, and leeches to the spine. On the following day he was sensible; his pulse was quiet, and all symptoms were improved. But on the third day the pulse had risen to 120, his breathing was laboured, and coma appeared again imminent. The scalp was freely leeches, and small doses of grey powder and ipecacuanha were given. From this time he rallied, and subsequently quite recovered.

The succeeding case is a fatal one of the same class; I quote it as characteristic, though, unfortunately, I was unable to verify the diagnosis by *post-mortem* examination. A livery-stable keeper was thrown from his gig, and fell on the right side of his head. When brought to the hospital he was in a state of collapse, with contracted pupils, slow and feeble pulse, and cold skin. The only injury detected was a trifling contusion on the right side of the head; he was in a state of semi-consciousness. The usual means were employed to restore warmth. On the following morning the pulse had risen in number and volume, the skin was warm, and he had vomited. He answered questions rationally, and complained of most pain at the back of the neck. A purgative was ordered, and acted in the course of the day. On the second day it was more difficult to rouse him; the pupils were

dilated, especially that on the side opposite to the injury, and there was some hemiplegia on that side also. The nape of the neck was blistered, and a dose of calomel was ordered. Profound stupor afterwards ensued, and he died on the morning of the third day. As a *post-mortem* examination was not permitted, it is impossible to say that the base was not fractured, and the suffering he complained of at the back of the neck suggested the possibility of this complication; but the symptoms under which he sank indicate extravasation of blood and consequent pressure. The memorandum I affixed to this case is to that effect; and that probably such extravasation was at the base of the skull, associated with fracture. I have no record of any ecchymosis being observed at the nape of the neck in this instance.

That extravasation of blood may exist in this diffused form without producing symptoms of a nature to excite alarm, I think there can be little doubt; but of secondary consequences under these circumstances we have not infrequent instances. The following case is interesting in many respects, in a diagnostic point of view, both negatively and positively; exemplifying the above remarks and other points to which I shall presently refer.

A cab-driver, of middle age, was thrown from his box, and taken up insensible. When admitted into the hospital, it was found that he had a severe scalp-wound over the left temple, and a bruised face. He gradually rallied from his state of unconsciousness, and on the following day was quite sensible, with moderate reaction, the pulse being 80. He continued free from suffering and any head symptoms; there was denuded bone, and a fetid discharge escaped from the scalp-wound. At the end of a month he was convalescent, the wound in the scalp healing, and the part entirely free from tenderness; he was permitted to walk about, and would soon have been discharged, when, on the twenty-ninth day after the accident, he complained of having caught cold, and remained in bed; he

had a flushed face, hot skin and quick pulse, and was inclined to sleep. In the evening of the same day he became insensible. There was no swelling nor inflammation of the scalp around the wound, but it adhered to the edge of the exposed bone, which was dry and white. The trephine was applied on the same night, and a small quantity of pus escaped where the bone was raised; the dura mater was sound. As no amelioration of the symptoms resulted, I punctured the dura mater on the following morning, permitting the escape of a considerable quantity of serum, but no pus. Towards the afternoon he became sensible, but was unable to speak, though he attempted to address his wife on several occasions. At night the circulation again became more excited, and he died comatose about fifty-six hours after the first indication of relapse. The following are the *post-mortem* appearances recorded.

There were the remains of a partly healed scalp wound over the left temple, with a circular opening in the skull about an inch in diameter; the dura mater thus exposed was blackening. There was no fracture of the skull, which was very thick, with but little *diplôë*. The dura mater was separated from the skull for a short distance in the neighbourhood of the trephine aperture, and the interval contained some recent clot. The dura mater was healthy over the part corresponding to the aperture; but a short space in front of this, in the frontal region, it was sloughy and presented a small perforation. Beneath the dura mater, and forming a thin layer over the left cerebral hemisphere, was a coagulum partially adherent to the dura mater by its outer surface, but softening within; the corresponding portion of the surface of the brain being also softened and covered with pus. The grey matter of the greater part of the hemisphere was softened and discoloured; and a portion of that of the middle lobe was in a similar condition, and, together with the adjacent portions of the white matter, much congested. The right cerebral hemisphere and the base of the brain appeared healthy.

The purulent deposit is often more circumscribed than in the preceding case, and the local pain more manifest; but the relief obtained by the application of the trephine is, as I formerly observed, rarely permanent in this class of cases.

When hæmorrhage takes place into the ventricles of the brain, it is usually in sufficient quantity to produce coma, but this is not invariable; and the record of such cases in my possession affords no diagnostic characteristic of this special form of extravasation, on which dependence can be placed.

The causes which operate in producing functional disturbance or material injury of the brain-structure are so frequently complicated with those lesions of which I have already spoken, that it is often, I may say generally, impracticable to draw anything approaching to a sharp line of definition between these several conditions. The diagnostic signs of concussion and of compression are, no doubt, distinct in a certain sense; yet compression rarely exists, as a consequence of violence, without concussion; and both are complicated by shock. Further, symptoms of simple concussion may become developed, at a later period, into those which indicate some more serious lesion; and it is in exceptional cases only that we can identify, with any degree of certainty, the efficient and sole cause of compression. The practical lesson to be learned from these facts is, caution in prognosis, and the importance of carefully investigating all the circumstances presented to our notice, in connexion with the causative accident; and of justly estimating their bearing and value in each individual case.

Some of the symptoms which characterise *Concussion* are positive, but the most valuable are relatively negative. In the stunning effects which succeed a blow on the head, we attach more importance to the absence of those consequences which manifest compression or other material injury to the brain, than to those which indicate what we are accustomed to call concussion. Thus, if we can rouse a patient from his state of

unconsciousness, even for a few moments, if the breathing is calm and noiseless, if the pulse is feeble, the pupils are contracted, and reflex action can be excited, we conclude the condition is that of concussion; because the above symptoms, collectively, are not consistent with a state of compression of the brain. But very often the diagnosis is by no means so simple; for, much that we witness in concussion is due to, and possessed in common by, shock: indeed, in some instances, the more alarming symptoms are those of general prostration; and these may survive the functional disturbance of the brain, which is, so to speak, an accidental concomitant of the shock. On the other hand, the disturbing effects of concussion or violent commotion of the brain, may be such as produce irreparable organic change in its structure, without palpable laceration or contusion of any particular part. The intensity of the effects of so-called concussion are marked by the character of the symptoms and by their duration. Yet, these two elements in the diagnosis of such an injury do not always bear a direct proportion to each other. I have already suggested that the probable explanation of protracted somnolence and other evidence of brain disturbance, is the presence of diffused extravasation of blood over the surface of the hemispheres, which is subsequently gradually absorbed.

The milder forms of concussion present the general indications of shock, with such cerebral derangement only as is frequently present in the latter state; and are manifested by giddiness, confusion of intellect, a tottering gait, functional disturbance of the senses, and sympathetic irritability of the stomach. In fatal concussion, if the existence of such a condition be admitted, death occurs from shock rather than from direct injury to the brain; unless, indeed, such injury imply organic lesion, which places it out of the pale of so-called concussion. The symptoms in such cases are those of fatal shock, with suspension of the functions of the brain. Whether, in a supposed instance of this kind, the brain would ever be found devoid of material

injury I am not prepared to say ; I should think not : certainly I have never made nor witnessed a *post-mortem* after speedy death from a blow on the head, where there was not some palpable lesion of the brain. Yet, I would not deny the possibility that concussion, without organic lesion of the brain, but accompanied by severe general shock, may prove speedily or even suddenly fatal ; especially if the heart be feeble, or the presence of some other accidental circumstance favour this result. This question, indeed, presents a very apt exemplification of the erroneous conclusions that may be reached by disuniting different conditions, which, conjointly, are competent to entail consequences that, separately, they would not produce. The diagnosis does not involve the dilemma of selecting concussion, or shock, or extravasation, as the cause of death ; it is rather concussion, *plus* shock, and it may be also *plus* other predisposing conditions or concomitant injuries which have been overlooked, or were beyond the reach of observation.

The symptoms of traumatic *Compression*, when well-marked and uncomplicated, are those of apoplexy. The pulse marches slowly, with a full beat ; the pupils are fixed and generally dilated ; voluntary movement and sensation are partially or entirely suspended ; and the intellectual functions are in abeyance. The soft palate partakes of this general paralysis ; and the stertor which marks the apoplectic condition is due to the vibration of the velum, when the recumbent position of the patient favours this result ; but change of posture may modify or remove this diagnostic sign. The unresisting cheeks flap loosely, and are inflated at each expiration ; the distended bladder retains the urine ; and the still-active intestine overcomes the feeble resistance of the sphincter, and discharges its contents. This condition is met with in cases where a circumscribed portion of bone or any foreign body is driven into the brain, or where a large clot of blood is suddenly extravasated between the dura mater and skull, or into the substance or ventricles of the brain.

The state just described is well-marked and readily distinguishable, by the symptoms presented, from cases of simple and uncomplicated concussion. Moreover, the more serious, indeed, almost invariably fatal lesion, is not infrequently unaccompanied by those indications of shock which always, in a greater or less degree, characterises the milder injury. The temperature is maintained and the pulse is well-filled for a time, often when the stertor and flaccid limbs, and profound insensibility betoken the fatal pressure to which the brain is subjected. The force applied has been expended on the shattered skull and in the lacerated brain; it has been less diffused through the system, or the special injury is too exclusive and certainly mortal, to arouse the sympathy of the organic nerves. Be this as it may, the temporary existence of this state in compression of the brain, as contrasted with the, often protracted, organic prostration in concussion, would seem to point to the conclusion that simple shock has more share in producing the symptoms of the latter condition than is generally assigned to it.

But these typical cases of cerebral injury so often merge in each other or are combined, or they are so often complicated with contusion or laceration of the brain-substance, whereby the symptoms are materially modified, that much disappointment necessarily awaits the inexperienced surgeon, who anticipates that he will realise in practice the sharp line of definition, in diagnosis, which he has learned theoretically.

Just now I remarked that, in compression, the temperature is maintained. I should express myself more correctly if I say, that the registered temperature in cases of severe head-injury seems to be no measure of the amount of lesion sustained by the brain, in those instances in which it has been tested in my hospital cases. Thus, in two instances of simple concussion in which the temperature was taken, half an hour and an hour respectively, after the accident, it was found to be 93.5 deg. and 96.2 deg.; yet both these patients recovered without any reaction, beyond the normal standard. In another case of

hæmorrhage into the brain, with total unconsciousness, the temperature was noted as being 95.2 deg., half an hour after the injury, and never sank below 94.9 deg. In another remarkable instance, however, of fractured base, with laceration of brain, the temperature fell as low as 87.4 deg. in one and a half hour after the accident. I am not aware of any lower recorded temperature. This patient survived about nine hours, but the temperature scarcely attained 90 deg. just before death.

I may take this opportunity of saying, in anticipation, that the records which have been kept at St. Thomas's Hospital, of spinal and of other visceral injuries, seem to point to a different conclusion as regards the diagnostic value of temperature in these lesions. It has been found more uniformly low in them than in head-injuries, the depression corresponding with the amount of injury received. Moreover, there seems to be, in this class of cases, a more steady fall in temperature after the injury, lasting for a greater length of time, than in head-cases, before reaction occurs. The observations on which these remarks are founded, are too limited to permit me to generalise from them; but I throw them out as suggestive of the value of further research in this subject.

The brain is obnoxious to the various forms of mechanical injury to which other more accessible textures are liable. It may be bruised on the surface, or have blood extravasated into its substance or interior; it may be punctured, cut, or lacerated. These lesions are not necessarily fatal, though most of them are usually so; sometimes death ensues without reaction; in other instances it is the indirect consequence of renewed vascular action; or it may be deferred until inflammation is developed. In exceptional cases recovery takes place, even after loss of texture. Punctured and incised wounds are of comparatively rare occurrence in civil practice. When a sharp fragment of bone penetrates the dura mater and enters the brain, we have an exemplification of the former kind of injury. It has never been my fortune to witness a case in which a foreign

body has been thrust through the nostril or orbit into the brain ; but several such cases are recorded. Incised wounds occur in military practice. There is a specimen in the Museum of St. Thomas's Hospital which shows that the original proprietor of the skull had been the subject of a sabre-wound, which probably penetrated the brain. The edges of the bone are rounded off.

The symptoms consequent on penetrating wounds of the cerebrum, when unaccompanied by pressure, are frequently not developed until inflammation ensues ; and therefore the diagnosis is necessarily obscure, or the nature of the lesion is overlooked, until alarm is excited by the indications of brain-disturbance, after an interval which may extend to three or four days or even longer. The same remark applies to the far more common injury of contusion or laceration of the hemispheres. That the brain may be bruised, without any symptoms to show that such is the case, there is no doubt. The history of the cab-driver, the details of whose accident I just now narrated, together with his death and the *post-mortem* more than a month afterwards, exemplifies this fact ; and I apprehend we may conclude, from the occurrence of such instances, where we have an opportunity of verifying the actual condition after death, that similar mischief may happen, without the development of any symptoms of importance at any time. But recovery in such instances is probably limited to cases in which the texture of the brain is not seriously damaged. I say seriously, because extravasation into the substance of this organ must, more or less, break up or disintegrate its tissue. Extravasation is sometimes diffused, in the form of a series of small blood-points, over various parts of the brain-structure ; or the bruising may be circumscribed. In either case the result must be occasioned by the vibration transmitted through and across the brain. When the contusion is at a distance from the spot on which the blow was received, the mode of its production must be the same ; it must be due to shock

directly transmitted, and not to vibrations travelling round the skull.

It is difficult to separate, for purposes of diagnosis, these cases of contusion manifested by extravasation, from laceration of the brain. They are, in fact, essentially the same; and, as far as my experience has enabled me to judge, they are characterised by similar symptoms, which vary only in accordance with the degree and locality of the lesion. Whatever may be the correct explanation of the circumstance, it is certain that the middle lobes of the cerebrum are most frequently contused, and the posterior lobes least frequently so; but I am unacquainted with any diagnostic indications by which we may know with certainty where the bruising has occurred. We may suspect that it is near to the seat of injury, or opposite to it; but whether far forward or toward the back of the hemisphere must, so far as we depend on symptoms, be matter of conjecture in most cases.

Of bruising of the brain on the opposite side to the part of the skull which was struck, I select from my notes the following case, which exemplifies the above remark. A lad of 18, having fallen from a height into some water, struck, in his descent, his head and right elbow. There was a compound fracture of the latter, and a scalp-wound, without fracture, on the right side of the occiput. He was stunned at the time, but rallied when he was admitted into the hospital. He had no stertor nor other symptom of compression, but was very restless, dozing at times, and then throwing his arms about, but not involuntarily. He lived for thirty-six hours, remaining conscious to the last. Blood was found extravasated on and in the brain, at a point diagonally opposite to where the blow was received, viz., in the left temporal region.

As regards the relative liability of the different lobes to contusion, of which I just now spoke, I apprehend this may be explained by their several relations. The consequence of transmitted vibration would be greater where it falls upon that

part of the brain which is beneath the vertex, and is resting on that portion of the base of the skull which is in nearer proximity to the spine; whereas, on the other hand, the transmitted shock would be broken and diffused by the tentorium on which the posterior lobes rest.

I have said that we possess conclusive evidence, that a certain amount of contusion of the brain may be unattended by other symptoms than those which are usually described as pertaining to concussion; but when the bruising is extensive, or there is actual laceration of texture from violence or extravasation of blood, not only are the symptoms and signs of concussion more intense and prolonged, but we have others superadded, which I have observed to be present usually, though not invariably; and when not present, I believe their absence is generally due to the co-existence of such an amount of pressure from effused blood as to produce coma. The indications I refer to are, more or less constant restlessness, accompanied by spasm, in which some particular member is affected, or amounting to general convulsion. If capable of giving expression to his feelings, the patient will point to some particular part of the head as the seat of pain. In some instances, noisy incoherency and obtuseness of intellect accompany this condition from the first. When these symptoms are well marked, they usually culminate after three or four days, provided the patient survive so long, in fever, wild delirium, and more violent convulsion, in which he may die; or he sinks into a state of coma, which is the precursor of speedy death. These are the symptoms of fatal inflammation supervening on the mechanical lesion.

In some instances of laceration or severe contusion, accompanied by extravasation of a large clot, hemiplegia indicates the hemisphere opposite to the paralysed side as the seat of injury. But such hemiplegia may be accompanied by convulsion of the opposite side of the body: the interpretation of this complication is, that both hemispheres are injured, but that

pressure exists on one side, viz., that opposite to the paralysis, and laceration or contusion on the other. It is scarcely necessary to add that the cross effect is equally uniform, whether the mechanical condition be that of pressure or of irritation.

I have remarked that the upper surface of the hemispheres may sustain considerable injury, without the immediate presence of symptoms to indicate it. Therefore, the absence of such symptoms must not be considered as conclusive evidence that the brain has escaped material lesion. The same remark applies, though with less force, to the substance of the hemispheres at their upper part; and it is especially remarkable what extensive lesions may occur in the anterior lobe of either hemisphere, without serious primary disturbance, either physical or mental.

The tendency of these mechanical injuries is similar to that of wounds in other tissues; but reparation requires increased vascularity, and the hyperæmic condition or inflammation is almost uniformly fatal. This result appears to be due to the delicacy of the organ involved, and to the absence of any vent for disorganised tissue and the superfluous products of the reparative effort; and probably, also, to the facilities afforded for fresh extravasation of blood. Thus, the period at which such indications may be looked for is after the lapse of three or four days, though they may supervene after a much longer interval. General increase of vascular action accompanies the indications of local hyperæmia. The patient complains of pain more or less severe, and a sense of fulness or distension at some particular part of the head; and there is general feverishness, with disturbance of rest: this is followed either by stupor, or by the signs which I have just mentioned as characterising, at an earlier period, contusion or laceration of the brain; local or general convulsion, hemiplegia, delirium; and, after a varying interval, coma succeeds. If abscess form, it is usually, but not invariably, indicated by a well-marked shivering fit; and

this is not necessarily accompanied nor followed by coma. I have witnessed many instances in which the intellect has been unaffected till within a very short period of death, but where, after death, a large abscess has been found in the substance of the brain. I should, however, observe that the cases to which I refer were not directly consequent on cerebral lesion. Indeed, I believe circumscribed traumatic abscess in the substance of the brain to be of rare occurrence as an *immediate* sequence of injury to the head.

In one case, of which I have the notes, the patient, a young man of 23, had previously been the subject of severe headache, terminating in abscess of the left ear, on which side he was deaf; but in the intervals between these periodical fits of suffering, he was tolerably well. Two weeks before his admittance into the hospital, he had one of his usual attacks, but this did not terminate as on previous occasions. When admitted, he complained of extreme pain over the left temporal region, and a small quantity of pus was liberated by incision of the temporal fascia. The febrile disturbance, however, continued, and he became delirious, frequently pointing to his head as the seat of suffering. In this condition he remained until his death, forty-six hours afterwards. Pus was found within the sloughing temporal fascia, and over the corresponding portion of the bone within, separating it from the dura mater; also in the tympanum; the auditory passage was blocked with fungoid granulations. Nearly the entire middle lobe of the left cerebral hemisphere was occupied by an abscess, containing dark and fetid pus, which had found its way into both ventricles, but seemed to have no communication with the surface of the brain.

The succeeding case exemplifies the occurrence of abscess after injury, and the latent nature of the mischief during a considerable period,—a circumstance which has been observed and commented on in other cases.

Not long since, I was consulted respecting the probable

cause of abscess in the brain, occurring in a schoolboy who had previously enjoyed robust health. I inquired whether he had been the subject of any injury, and was informed by his father that he had been struck violently by a cricket-ball on the back of the head; but that occurrence preceded the illness about five weeks. He had been stunned by the blow, but recovered apparently in less than a week, pursuing his studies as previously, until he was suddenly, and without any suspected assignable cause, attacked by his fatal illness. The first symptom was a sense of cold, attended by shivering. On the second day, he complained of pain in the back, but continued to be tolerably cheerful. On the third day, he complained for the first time of pain in the head, pointing to his forehead as the seat of suffering; he was feverish, and became rather sick. Later in the day the pain increased, and he became convulsed and delirious. The night was passed in sleepless delirium, frequent and incoherent talk, with occasional intervals of apparent consciousness. The fourth day was passed in the same state, and he seemed to suffer acutely in the head. On the fifth day, he was weaker; and he died, without coma or paralysis, on the sixth day. An abscess was found in the anterior part of the cerebrum, about large enough to contain a walnut, and at a point diagonally opposite to where the blow was received. There was no trace of tubercle found in the brain.

The following case appears to belong to the same category, and ran its course in a remarkably short time. An apparently robust youth of 17, a sailor, applied for admission into the hospital, stating that he had been attacked suddenly on the previous day with pain in his head. He did not account for this by referring to any injury which he had received. The pain was diffused, and he frequently shivered; he had an injected eye, a quick and small pulse, and a coated tongue. He passed a restless night, and on the following morning the headache was more intense, and located in the right temple; he lay

on this side with his head low—the position he preferred. Through the day he appeared very drowsy but quite rational, desiring to be left alone that he might sleep. In the afternoon he became convulsed, and speedily died; little more than forty-eight hours having elapsed, according to his account, from the commencement of the attack. On examination of the head, a small quantity of pus was found over the right orbital ridge; and at this point was an irregular indentation, presenting the appearance of an old fissure; there was pus on the corresponding part of the cerebrum. On the same side, above the frontal sinus internally, two small tubercles or blunt spicula of bone were found projecting inwards; they were cylindrical and rough, and about half an inch apart; and in the interval a small squamous edge of bone overlapped the neighbouring part of the inner table: this corresponded to the indentation or fissure externally, but there was no communication between the interior and the exterior of the skull. Within the anterior lobe of the right cerebral hemisphere, superficially situated and opposite to the osseous projections, was a small circumscribed abscess, containing dark-coloured, unhealthy pus. The dura mater was entire. The comment which I attached at the time to this case is, that the accident, of which the patient had evidently been the subject, had been forgotten; and that the mischief, which proved fatal, had probably been *excited* by intemperance and irregular habits when he came on shore.

I shall presently refer to another case of traumatic abscess occurring concurrently with other complications; and I may take this opportunity of remarking, that the absence of symptoms of compression in this condition is probably due to the fact that brain-abscess is, usually, devoid of any new element in the composition of its ingredients, which are found to consist of nerve-matter in a state of degeneration and decomposition: pus-globules and other reproductive or reparative elements are almost or entirely absent. The surrounding cerebral structure is generally in a state of inflammatory softening, similar to that

observed in traumatic lesion; and the extension of this mischief to some vital part explains the symptoms that accompany the sudden and fatal change which precedes death.

In a patient of whose case I have notes, though he was not under my own care, three weeks elapsed from the time that he received a blow on the forehead before *any* head-symptoms declared themselves. He had, in fact, left the hospital, when a succession of fits was followed by left hemiplegia; subsequently, agonising pain, convulsion, and delirium preceded death about forty-eight hours. At the *post-mortem* examination, the skull was found to be fractured, and an abscess occupied the right anterior lobe of the cerebrum.

Independently of the complications which are, so to speak, inherent in injuries of the head, there are others of an accidental nature which are occasionally a source of additional perplexity to the surgeon. Drunkenness is so often instrumental, indirectly, in causing accidents, that we are frequently called upon to discriminate between this predisposing condition and its more serious consequence. Under such circumstances, I am not acquainted with any conclusive evidence by which we may measure accurately what is due to intoxication, and what to brain-injury, assuming that they co-exist. The safest course is to wait until the effect of the drink has passed off spontaneously, and then the indications of brain mischief become apparent from standing alone.

Again, delirium tremens may be excited by injury of the head, as by any other traumatic cause, and thus give rise to perplexity in diagnosis as well as treatment. I have the notes of one case under my care which proved fatal. A middle-aged man had fallen on his head and sustained a scalp-wound. Three days afterwards, symptoms of delirium tremens supervened; and before the opium which was given had tranquillised him, an epileptic fit closed the scene. The *post-mortem* examination revealed neither injury to the skull nor abnormal condition of the brain. In another of my patients, of whose case

I have kept a record, the injury to the head was more severe. The man had fallen and struck his head against a lamp-post ; he was taken up, bleeding from a scalp-wound, and insensible. When admitted into the hospital, he rambled and answered questions incoherently and irrationally. In the course of three or four hours he became violent and noisy. He was sleepless, and had the other well-marked symptoms of drunken delirium. Opium was given cautiously ; and, after profound sleep, he awoke rational, and ultimately made a good recovery.

The diagnosis of drunken delirium, when the head is injured, is all the more important, as we meet occasionally with a class of head symptoms due to other causes, but in many respects resembling that condition. I have several cases recorded which exemplify the association to which I allude. In some, the incoherence, want of intelligence, and noisy, rambling talk, or violent resistance requiring restraint, date from the period of recovering from the first shock of the accident ; or these symptoms may appear synchronously with others indicative of inflammation, and be thus more readily identified.

Two patients were admitted under my care, into the hospital, within a few days of each other, whose cases exemplify all these several states. One, an omnibus-driver, was thrown from his box, and suffered severe fracture of the base of the skull, with laceration of both hemispheres. Though almost in a state of collapse when admitted, he was rambling about his horses, and repulsed the attempts made to examine his injuries. He survived four days, and continued to ramble and vociferate loudly from time to time, being always engaged ideally in his usual occupation ; this seemed to be his one mental impression. He did not appear to understand questions put to him, and gradually passed into a state of muttering delirium before he became comatose just prior to his death.

The other patient was an engine-driver, whose head was struck by a locomotive at Woking. The left parietal bone was comminuted and driven into the brain, the middle menin-

geal artery being wounded. After removing an overhanging angle of bone with Hey's saw, I raised the depressed portion, and removed several loose fragments imbedded in the hemisphere; a compress was then applied to the torn artery. The patient was perfectly conscious and collected during the operation, and afterwards recounted how it occurred. On the second day he became feverish, and complained much of pain in the head, and his articulation was impaired; but it was not until the third day that he began to vociferate, and soon afterwards he became violent and convulsed. Coma preceded death a short time. Inflammatory softening had extended from the upper surface through to the base of the brain, and there was considerable extravasation of blood.

I will mention the particulars of another case, as illustrative of the difficulties which sometimes attend the diagnosis in doubtful cases of head-injury. An excavator was buried beneath some fallen earth in a drain. He was soon disinterred and brought to the hospital. He was insensible; his pupils were contracted and sluggish; his breathing was stertorous, and he was convulsed. His respiration became intermittent, and at shorter intervals; and he died comatose after six hours, his heart continuing to beat for some time after respiration ceased. There was not any injury found in the brain or spinal cord; but a part of the contents of the stomach, indentified by comparison, had found its way into the trachea, and had blocked up many of the bronchial tubes. The case was one of apnœa, complicated probably, with concussion.

Occasionally it happens that an antecedent condition is mistaken for a consequence, just as patients so often ascribe fracture of the patella to a fall on the knee, whereas the fall is caused by the previous fracture of the bone from muscular action. The cases to which I refer are those in which apoplexy occasions a fall. An instance in point recently occurred in one of my hospital patients. A middle-aged woman was admitted, who said she had fallen downstairs, and

her symptoms were assigned to injury of the head. At first she was insensible, and all her limbs were paralysed and without feeling, as if she had been the subject of head-injury; and I was induced, when I first saw her, to take the same view as the house-surgeon, without making any special inquiry as to the particulars of her accident. But in a few days her condition induced me to question her more particularly, and I found that she could not account for her fall. She was standing still at the time, and suddenly found her limbs give way beneath her. Her symptoms at this time were also considerably modified. There was feebleness in the right limbs, but complete paralysis of the left; sensation in the right limbs was considerably impaired, but scarcely perceptibly so in the left. The expression of the face, the speech, and the eyes were unaffected. This patient made a slow progress towards recovery.

The history of another of my patients points more distinctly to a similar explanation of the circumstances of his case. He had fallen downstairs, and was insensible for some time after the accident; on recovering consciousness, he was unable to move either left arm or leg. A careful examination failed to detect any injury to the head or spine; but, on inquiring into his previous history, it appeared that he had been subject for some time to giddiness and headache, with a sense of fulness about the head, especially aggravated in stooping; and that he had suffered from slight sun-stroke, eight or nine years before, in India. The conclusion I arrived at was, that the fall was occasioned by the condition of the brain, whatever that might be. He speedily recovered the use of his paralysed limbs, and left the hospital, still suffering from frontal headache, ten days after his admission.

The occurrence of Pyæmia, in association with injuries of the head, has been noticed by writers on the subject. This form of blood-poisoning, with purulent deposits in distant organs, presents no peculiarities in the relation referred to; but

it may introduce an additional perplexing element in the diagnosis, where obscurity previously existed. In my experience this is not a common occurrence. I think I may say that not more than two cases have been observed during the last five or six years at St. Thomas's Hospital, and not one in the many cases of head-injury of which I have records, in my own patients. During last year a single case occurred in the practice of one of my colleagues; in this instance there was no fracture: the trephine was applied for secondary intra-cranial suppuration, and the patient died with brain abscess and purulent deposits in the lower lobe of the left lung. The pyæmic condition was masked by the more urgent cerebral symptoms. It is to this case that the chart, exhibiting the variations of temperature in rigor, refers.

The opportunities which the surgeon has of studying the effects of lesions of particular parts of the brain are unfortunately few; not because cases in which many such lesions occur are rare, but because the shock and concussion consequent on the violence inflicted, and the complicating sequences of the injury, deprive the lesion of those simple diagnostic characteristics, which enable the physician more frequently to identify and localise symptoms in disease. Such, at least, is the result of my own experience and observation; and although one-sided paralysis or convulsion point to the opposite hemisphere of the cerebrum as the seat of mischief, I am unacquainted with any diagnostic signs by which to determine whether it is the upper or under surface of the hemispheres which is the seat of laceration or of pressure from extravasated blood; unless we except affections of the special nerves of sense.

I have pointed out and exemplified the fact that even extensive lesions of the cerebral hemispheres do not give rise immediately to paralysis; but that this condition is a common sequence of such lesions, after an interval of three or four days, more or less, when inflammatory changes have extended to the corpus striatum or optic thalamus. When paralysis occurs as

an early symptom, these bodies are, one or both of them, the seat of lesion, or are pressed upon indirectly or by blood extravasated in their immediate neighbourhood. In the hemiplegic condition resulting from lesion of the optic thalamus or corpus striatum, the face is only slightly affected, especially about the ala nasi and angle of the mouth; the patient can voluntarily close his eye. But where the trunk of the facial nerve is diseased, the facial paralysis is universal and more strongly characterised. The former condition alluded to is exemplified in an interesting way, in a case the record of which I have in my dresser's report. The patient, a young man, was the subject of an injury to the head, by which the left parietal bone was extensively fractured, the coronal suture separated, the dura mater torn open, and the brain extruded. This patient survived till the fourth day, and was sensible for a considerable part of the time. The first symptom of paralysis was a slight loss of expression on the left side of the mouth, about twelve hours after the accident. This was more marked on the second day, when he began also to complain of some tingling and formication of the left hand, with loss of power; his articulation also became indistinct. The hemiplegic condition became rapidly developed in the leg and arm, and was complete before he lost consciousness; but the facial paralysis did not proceed beyond a marked loss of expression on the left side. The autopsy revealed, among other lesions, "softening of the cerebral substance, with effusion of blood extending to the *right* corpus striatum and optic thalamus which were both involved, the structure of these bodies being distinctly softened, and presenting a blood-stained colour."

Of aphasia as associated with right hemiplegia I have no particular record. In several instances, both of fatal and recovered injuries of the head, I have noticed both difficulty in articulation, and perplexity in the selection of words to express ideas; but this condition existed without hemiplegia, or with hemiplegia indifferently of either side. In one particular case,

in which the patient at first talked thickly, and was subsequently unable to speak, though evidently intelligent when roused, there was found considerable contusion, with extravasation of blood in the upper and anterior part, as well as on the posterior and inferior surface, of the left anterior lobe of the cerebrum. But there was no paralysis in this case; and the patient survived only eight hours. He had been struck on the occiput, and his condition and manner at first led to the impression that he was intoxicated.

Traumatic lesions of the cerebellum, pons, and crura cerebri are, comparatively, infrequent; and, when met with, they usually co-exist with other injuries, and thus the special characteristics associated with these lesions are masked; and even in disease they are not constant. In one case under my care, in which more than half of the right cerebellar hemisphere was occupied by an abscess, severe headache, flashes of light, singing in the ears, were the chief symptoms. In another case of severe laceration of the cerebellum, shock and other injuries hastened a fatal termination; but in neither of these cases was there convulsion; and in the former there was no evidence of want of co-ordinating power. When this last-named defect is present, together with dilated pupils and pain in the head, and involuntary periodic cries are uttered, without interference with the intellectual functions, we may predicate pretty certainly the existence of cerebellar disease. When hemiplegia exists, it is on the side opposite to the lesion.

The co-existence of hemiplegia of one side, with paralysis of the third nerve of the opposite side, is indicative of lesion of the crus cerebri on the side on which the third nerve is paralysed.

LECTURE VI.

Lesions of Spinal Cord.—Analogy with those of Brain.—Resistance of Spinal Column.—Fracture; Mode of Production.—Dislocation.—Diagnosis of Sprain.—Extravasation of Blood; its Varied Position.—Simple Concussion.—Railway Concussion.—Shock.—Morbid Appearances.—Punctured Wounds.—Double Fracture.—Dislocation in Upper Cervical Region.—Complication of Encephalic and Spinal Injury.—Conclusion.

MR. PRESIDENT AND GENTLEMEN,—Whilst the physiology of the *Spinal Cord* is, in some respects, more defined than that of the encephalon, the complexity of its functions, as a centre of nerve-force, and as a conductor of that derived from the brain, together with the concentration, so to speak, of those functions within a very limited space at any given point, enhances the difficulties of identifying its special injuries. As surgeons, we generally have to deal with the spinal cord as a whole; the lesions to which it is obnoxious from violence rarely affect it partially, but implicate more or less completely all its texture, and consequently all its functions. Some of these effects are sudden, absolute, and speedily fatal; others are deferred, insidious, prolonged in their endurance, and destructive of health, and ultimately, perhaps, of life. But the pathological condition is the same in each, modified only by the element of time; arrested function from grievous injury in one case, and deteriorated organisation, with its long train of disastrous sequelæ in the other, leading to the same issue.

In some respects there is, as might be expected, a close analogy between the consequences of injury to the spinal cord

and those of the brain ; whereas, in others, the contrast is remarkable. Both are liable to concussion, to compression, to irritation, to apoplexy, and to organic changes resulting from inflammation ; but the consequences of organic lesion, both immediate and remote, differ materially in the two, and are not similarly under the control of surgical treatment. We have seen that extensive lesions of the encephalon may occur without immediate material disturbance of function ; nay, that loss of texture is not necessarily a fatal injury ; and that, in compression, the removal of the offending cause, as in the uplifting of a depressed fragment of bone, may afford even permanent relief to the sufferer. Not so, however, in spinal injury. In the cord, every segment is, if I may be allowed the expression, a representative of the whole ; and violence attended by organic lesion thus produces a concentrated effect, which renders these injuries so little amenable to surgical interference, and so commonly fatal.

In the skull, as in the pelvis, strength, and resistance to the effects of violence are due to solidity and form ; in the spine, as in the chest, for obvious reasons, the important element of yielding elasticity is introduced, and constitutes the chief security against harm. It would be difficult to select, even in organic mechanism, a more beautiful exemplification of the adaptation of contrivance to a special and complicated purpose, than is presented by the spinal column ; combining as it does, free mobility with economy of muscular power, and security of the tender organ enclosed within its canal. The mechanism is perfect, and yet the security is not complete ; and we here observe, as is still more noticeable in the shoulder joint, that necessary defects are compensated for in the most admirable way ; but that no miracle is wrought to reconcile incompatibilities. In the scapulo-humeral articulation, security against dislocation is important ; yet freedom of movement is a still more urgent desideratum ; and, consequently, the former is sacrificed to the latter. The bony configuration of the joint,

and its lax capsule, afford every facility for free movement, and also for displacement: but this imperfection, as regards safety, is counterbalanced by the mobility of the scapula enabling it to follow the more extended movements of the humerus, and by the attachment, close to the fulcrum, of the rotator muscles. Nevertheless, dislocation of this joint is a common occurrence. And so likewise with the spine; if this long elastic lever is bent beyond its capacity of resistance, it yields and snaps. But, even in these injuries, it evinces the perfection of the arrangement existing for the preservation of its integrity: for it is the arch and body of the vertebra which, as a rule, give way; and rupture of the intervertebral substance, with dislocation, is the exception to that rule.

I fear that the brief time allotted to these lectures will not allow of my expatiating, at any length, on the various forms of injury to the spinal column: and I am not aware that it would subserve any good end in assisting me to classify the diagnostic indications of injury to the cord. I may, however, remark that the inferior half of the cervical region, and the lower extremity of the dorsal, are the parts of the column most obnoxious to fracture—a generally admitted fact, I believe, and certainly borne out by my own experience. This is due to several causes: the mobility and relatively small development of the cervical vertebræ, and the horizontal facing of their oblique processes, tend to facilitate fracture and displacement in this part of the column: the converse obtains in the lumbar region; and this arrangement compensates for the enhanced liability to fracture at that part, dependent upon extended length of leverage. But this latter source of weakness tells upon the lower dorsal and upper lumbar regions, where the additional security obtained from the lateral support of the ribs is suddenly withdrawn. As regards the comparative immunity of the cord from concussion, no doubt it is in part due to the layer of cerebro-spinal fluid which is interposed between the arach-

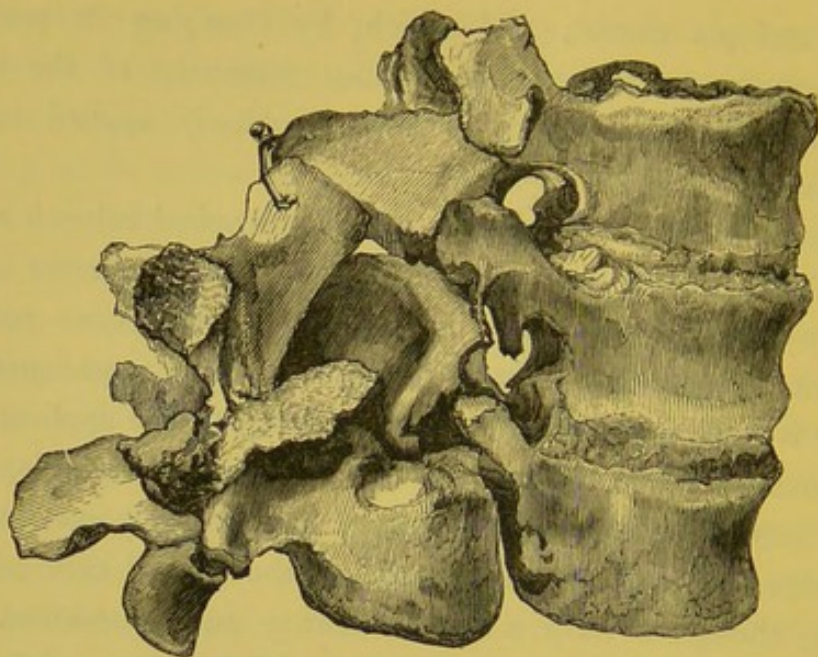
noid and pia mater; and which, by changing its position, accommodates itself to the various inflexions of the spine, and modifies the effects of force suddenly applied to the column.

The manner in which fracture of the spinal column is produced, has a more important bearing upon the character of the injury which is sustained by the cord. Direct or indirect violence may break the back-bone; but, in my experience, the latter is much more frequent than the former: the application of violence by which the column is bent forcibly forwards, is the most common cause of fracture. I have scarcely ever seen an instance of simple dislocation below the second cervical vertebra, though I have examined many such combined with fracture: indeed, such complication of dislocation and fracture in this region is the type of the majority of cases which have come under my observation.

I believe that my experience in this respect differs from that of some other observers, who have published statistical records of this class of injuries. It is true that the amount of fracture is, in many instances, limited to a thin segment of the body of one of the vertebræ involved, or, it may be, to the edge of the oblique process. But I repeat that, in the many cases I have examined and have records of, some fracture, be it little or great, has complicated the dislocation in this region, in almost every instance.

In the dorsal and lumbar regions of the spine, simple dislocation is almost a physical impossibility; and rupture of the intervertebral substance, without fracture of the body of one or both of the vertebræ implicated, is of rare occurrence.

The preparation I have on the table is a remarkable example of this form of injury; and its singularity is enhanced by the history which was forwarded with it from the country, when it was sent to the Museum of St. Thomas's Hospital.



Fracture of fourth lumbar vertebra, with dislocation backwards of fifth.

It exhibits a fracture of the fourth lumbar vertebra, with complete dislocation backwards of the fifth. The arch of the fourth is broken perpendicularly, and wedged between the spinous and right transverse processes of the third. The fifth is completely severed from its connection with the fourth, and lies directly behind it, the anterior part of the body of the former being in contact with the posterior part of the body of the latter; the lower border of the fifth does not extend more than a quarter of an inch below the lower border of the fourth.

The patient, a strong man, aged 20, received a blow on the back by the fall of a heavy weight. There was entire paralysis of the lower extremities. At the end of five weeks he had recovered sensation perfectly, and motion partially. He died, exhausted by sloughing of the nates, etc., seven weeks after the accident. His arm and leg had also suffered fracture, and the former had united. Such recovery of function could have occurred only where the lumbar region of the spine was the seat of injury.

Force which tends to produce fracture may, stopping short of that result, severely strain the ligaments of the spine.

These cases frequently present themselves in hospital practice, though unfortunately we rarely have the opportunity of watching them beyond the period of relief of the early symptoms. Most of them recover: but in some few, more enduring mischief results. Local tenderness, defective innervation of the lower extremities, sometimes morbid sensibility combined with loss of power, and general deterioration of health, are symptomatic of the cord itself, or its membranes, being secondarily involved. This condition may be the consequence of violent muscular action, or of sudden twisting of the spine. Thus, I knew it to occur in a patient, whom I attended with Mr. Pink, of Greenwich, an engineer whose spine was violently twisted in working the engine of a steam frigate: he was unable to walk, and complained of severe pain in the lumbar region, and of acute tenderness at one spot. The pain extended down the right lower extremity, which was partially paralysed. After local depletion and protracted rest, he recovered; but six months elapsed before he was well. Another instance I witnessed in an acrobat, one of whose feats was to bend himself backwards in a most unnatural way. The same result is met with in some cases of violent concussion in railway accidents. The symptoms I have enumerated are not, however, to be regarded as necessarily implying irrecoverable organic change, or any change at all in the cord; the mischief may be purely meningeal in its nature. I may refer to a very common early concomitant of these injuries, viz., hæmorrhage from the bladder, as suggesting that the kidney is the seat of inflammation and of consequent suffering. I am satisfied, from repeated observation, that such is not the case. No doubt the blood is derived from the kidney, which suffered from compression; but, of the many cases I have witnessed, I have never had reason to suspect that nephritis or organic disease followed.

Extravasation of blood within the theca vertebralis may occur without fracture; but such instances, affording an opportunity of verifying the actual condition, are rare. I have a memo-

randum of a remarkable case of this kind, which was narrated to me but which I did not see. A man was struck violently on the back with a chain-cable; there were no immediate symptoms of spinal injury, but a paraplegic condition soon supervened, and extended rapidly upwards, destroying life by asphyxia. The theca was found distended with fluid blood, derived from a ruptured spinal artery. Paraplegia, supervening after an injury to the spine, is suggestive of hæmorrhage; and probably, in many instances, the protracted character of the symptoms, indicating concussion of the cord, may be due, as in the brain, to the presence of extravasated blood, which is slowly absorbed. But I am not prepared to say that the symptoms of pressure, in *fracture* of the spine, are *usually* in any degree due to extravasation of blood, either external to or within the substance of the cord. I am inclined to think not; although the red appearance, occasionally seen on section of a recently injured cord, is suggestive of the presence of effused blood, rather than of the consequences of inflammation. Certainly I have seen instances of fracture unattended by primary, or indeed any, symptoms of the cord being implicated. I have a record of several cases in which depression, mobility and crepitus indicated that there was fracture of the spinous process or arch of one or more vertebræ; and yet the patients recovered without harm being done to the cord.

The following case may serve to exemplify this condition. A porter was knocked down by a cab, the wheel of which, he thinks, struck his back. He could walk, but with difficulty. His chest was contused, and he was suffering from general symptoms of shock; but there was no paraplegia, nor other symptom of injury to the spinal cord. The spinous processes of two of the upper dorsal vertebræ were freely moveable, and crepitus was distinct. This patient made a good recovery. Instances of this class are not very rare; and the injury is generally the consequence of violence directly applied to the spine.

In one case under my care, seven or eight years since, the injury was still more severe; in fact, the nature of the lesion with its associated consequences is, in my experience, unique. A painter had fallen from a ladder, thirty feet high, and was impaled on some spiked area railings. One spike entered the lumbar mass of muscles, just above the sacrum; another entered the gluteal region. There was no indication whatever of any visceral or spinal injury. He had a violent rigor on the fourteenth day, and died on the sixteenth. On examination there was found to be a transverse fracture through the lower part of the second dorsal vertebra; and pus burrowed from this spot beneath the pleura, forming a bulging swelling there; but there was no displacement of bone, the anterior and posterior ligaments being entire. The spinal cord was softened, and showed, under the microscope, exudation corpuscles and other inflammatory products. The softening extended in both directions, but more upwards, and was more apparent in the anterior than in the posterior columns.

I have notes of another case, which resembles the preceding in the mode in which the injury was inflicted, the patient being impaled by falling, with his abdomen downwards, on some spikes. He survived forty-eight hours; and, on examination after death, the extremity of one of the spikes, which had entered near the umbilicus, was found lying across the rectum. The centre of the body of the second lumbar vertebra bore an indentation, corresponding to the point of the spike which had been thus broken off; yet this patient had no spinal symptoms.

Simple *Concussion* of the spine occurs as the consequence, usually, of a fall on the nates or back. I say concussion, because the analogy in the symptoms which characterise this condition and so-called concussion of the brain, justifies the use of the expression.

The shock in spinal concussion is not, generally, severe, even when the paraplegic condition is well-marked. The existence of this injury is determined principally, as in con-

cussion of the brain, by negative evidence. The absence of local signs which indicate fracture, the mode in which the injury was produced, and the amount of violence applied, rendering it improbable that the spine is broken, constitute the negative evidence to which I refer. Yet, in some cases, where the symptoms are persistent, doubt must remain as to the true nature of the lesion, and a cautious prognosis is, therefore, required.

One of the earliest cases which I remember, as well as one of the best marked, occurred to a gentleman who was thrown from his gig, and was landed, in the sitting posture, on a heap of stones by the road-side. The general symptoms of shock were not severe, and the patient's health did not seriously suffer; but he was entirely paraplegic for a time, and did not quite recover until after the lapse of some months.

As the diagnostic indications of this injury are well exemplified in the following instance, I will give the details of the case, which occurred in my hospital practice, about two years since. The patient, a man thirty-six years of age, weighing $11\frac{1}{2}$ stones, gave the following account of himself. He was tripped up in the road, and fell heavily on his left hip, and then turned over on his back. On trying to rise he failed, not having any power of movement in either lower extremity. He was at once brought to the hospital. On admittance, he complained of pain in the lumbar region, and there was slight tenderness on pressing the spinous ridge of this part; but careful examination failed to detect any irregularity or other sign of mechanical injury of the vertebral column. There was entire loss of power in his lower limbs; he could not even move a toe; sensation was impaired; he said his legs were numbed. There was slight priapism, and he was unable to micturate. His pulse was 60, but there were no signs of well-marked collapse. On the third day he was able to move his toes a little. On the ninth day sensation was perfect, but he had made very little progress in regaining muscular power. Nearly three weeks elapsed before he was able to dispense with the catheter; and

at the expiration of five weeks he was still almost as helpless in moving any part of his lower extremities. He remained in the hospital for four months, his health being tolerably good throughout. He was then able to get about very fairly, but with a shuffling unsteady gait. I have not given any account of the treatment, as it is not necessary to my purpose. It consisted in rest, which indeed was compulsory, and attention to the bladder and the general health. I have no memorandum of the condition of the urine, which I believe was healthy.

The causative accident in this instance was slight, too trivial to produce fracture, and the symptoms were not those of sprain. There were no physical signs of displacement; yet, the paraplegia was marked; but not including corresponding loss of sensation, which would have been present if a displaced vertebra had pressed on the cord. The slow recovery was a gradual confirmation of the diagnosis, that fracture with displacement was not the injury to which the symptoms were due.

Yet, I must admit I cannot dismiss from my mind the impression that, in these and similar protracted cases, there is something more than simple concussion needed to account for the duration of the symptoms; probably extravasation of blood into the theca or canal, which is slowly absorbed. I do not think that the unequal effects produced on the several columns of motion and sensation forbid this supposition, for this effect is by no means uncommon, being usually in favour of sensation, where the inequality is noticed, and indicating that the anterior half of the cord, and part of the lateral columns, are the parts implicated. A child, $3\frac{1}{2}$ years old, was admitted under my care, who had been run over by a heavy sand-cart, sixteen days previously, the wheel passed over the loins. There was nothing particular noticed at the time, except her inability to walk as well as usual. This disability increased, and, when seen by me, she could scarcely manage, when held up, to shuffle her feet along. She complained of no pain, had no difficulty in passing her water, and the sensibility of the legs seemed to be

in no degree impaired. On careful examination there was nothing abnormal to be observed in any part of the spine. The treatment consisted in rest, and friction of the back with liniment of ammonia. She remained in the hospital five weeks, and then left quite well.

A remarkable case was mentioned to me by the late Dr. Dyer, who acted for the Brighton Railway Company. A man was injured in a collision in the tunnel, four or five miles from Brighton. He walked this distance with some difficulty into the town; and within twenty-four hours became entirely paraplegic. He recovered slowly; and after the lapse of two years was able to walk as well as before the accident. One spot on the back was always tender, and continued so still at times. The analogy between this case and a similar but fatal injury which I have already mentioned, seems to point to hæmorrhage as the probable cause of the protracted symptoms.

In the category which I am now considering a class must be included, which has assumed an adventitious importance, in consequence of the claims of the sufferers to pecuniary compensation for injury received in railway travelling. Although I have seen many such cases, especially when acting on behalf of one of the railway companies, I am free to admit that the multiplication of my notes, respecting the various complaints of the patients, has by no means simplified the classification of their ailments, nor facilitated the reduction of their symptoms into such a code as may claim to be justly regarded as diagnostic of this special form of concussion. I speak of it as special, because there certainly are distinctive characteristics attending railway concussion of the spine, which are exceptional, to say the least, in similar injuries otherwise produced. And this exceptional character consists in the curiously diversified results which are met with; sequences which seem to be more allied with general nervous shock, and consequent deteriorated innervation, than upon special shock or concussion of the spinal

cord. Indeed, it is difficult to explain many of the sequelæ of these injuries without supposing that the organic nerves, and therefore functions, are seriously implicated; that the excretory functions are imperfectly performed; that the organic chemistry is deranged; and that the source of life, the blood, is poisoned.

Again, as in hysteria, obstacles beset the surgeon in his honest effort to disentangle the confused web of symptoms, by the admixture of that which is real with that which is imaginary, exaggerated or assumed. The motive for exaggeration is sufficiently strong to induce self-deception, and therefore to raise sceptical surmises in the mind of the surgeon. I have no doubt that mental shock acts an important part in aggravating many, and even in inducing some, of these symptoms; and it is impossible to ignore the fact that the mischief, demonstrated by even physical signs, extends to the encephalon, as in loss of co-ordinating influence over the muscles; or, again, in deterioration of mental power, or of some particular faculty, such as memory or readiness of expression. In some instances the shock is received especially on the spine, as when the sufferer is sitting with his back so placed as to experience in this part the violence of the concussion. When this is the case, the symptoms are usually immediate and decisive, and assume very much the character of spinal shock from other causes. Yet, even in these instances, I have observed that, very often, the sequelæ are more varied and protracted than in ordinary concussion; a circumstance which is probably explained, in a measure, by the influence of emotion; as I think I have noticed it more frequently in women than in men. But in some of the most aggravated cases I have encountered, this direct injury has not been noticed, and could not have occurred, from the position of the sufferer at the time of the accident.

Concussion from a blow on the back is not always immediately followed by spinal symptoms, as is shown in a case which was under my care about four years since. A wheel-

wright had been knocked down by a severe blow with the fist on the upper dorsal region. There was considerable shock produced; and in some thirty-six hours afterwards he began to complain of pain extending downwards from the point where he was struck; and partial paralysis of both arms gradually supervened, attended by diminished sensibility; the lower extremities retained their natural state. This patient quitted the hospital, at his own request, whilst still very helpless.

In another case, reported in one of my clinical lectures, a young sailor was thrown violently down by catching hold of the revolving wheel of a carriage which struck him. When brought to the hospital, he made light of his injury, and complained only of a little tenderness on percussion over the upper dorsal region. His breathing was peculiar, a long inspiration followed by a rapid expiration. He soon after vomited; and, during the night, had a succession of epileptiform fits, attended by violent emprosthotonos and unconsciousness. He had never had a fit before. Yet, in the course of a few days he expressed himself as feeling quite recovered, and requested to be dismissed.

I have referred to these cases as presenting some features allied to the consequences of railway injury; and yet others in marked contrast with each other. The age of the former patient was sixty-four; that of the latter, twenty-two; an important element in its influence on the sequelæ of these injuries.

In order to exemplify what I have been saying respecting this class of railway injuries, I will enumerate the principal symptoms I have observed in the instances which have come under my notice, and make a few remarks on them. I think this will be preferable to occupying your time by the detail of particular cases. Spinal concussion may be immediate and well-marked; or the indications of spinal mischief may not supervene until after the lapse of some time. General shock is often, but not always, in excess of that which accompanies

simple concussion; in some instances the collapse is great, accompanied by insensibility, but without evidence of injury to the head. Reaction, under such circumstances, is tardy, and irregular. Numbness and tingling, sometimes local, sometimes universal, is complained of. Other symptoms are, rigor, continued sickness, intermittent fits of numbness, excito-motor spasm in the limbs, violent throbbing sensations, a sense of heat or cold in the head or other parts, want of sleep or continued drowsiness, confusion of intellect, enfeebled muscular power, deafness, defective sight accompanied by ocular spectra, hyperæsthesia in some parts, but especially in the spine; great emotional excitability. Besides these I could enumerate other more especial symptoms; but they have been peculiar to isolated cases. With rare exception, extreme sensitiveness of the spine is present in these cases, and more frequently located at some particular part, than distributed over the whole column. Again, this pain or pressure is sometimes referred to the lumbar muscles, at others to the spinous ridge. In some of these cases the patients entirely recover after a longer or shorter interval; in others, the health is permanently enfeebled, and a life of protracted discomfort is entailed; or the sufferer sinks, emaciated and exhausted, into a premature grave; or becomes the victim of some acute disease, the destructive tendency of which his defective organism is incapable of resisting.

It will be perceived that many of the foregoing symptoms and signs may be referred to what we are accustomed to regard as concussion of the spine, but many also are due to general rather than special nervous shock. In some instances there is probably meningeal mischief; but the indications in others clearly point to organic change in the cerebro-spinal centre.

I have already shown, in a preceding lecture, how powerful an influence emotional shock or physical concussion may exercise on organic vitality; and I think it not inconsistent with acknowledged facts, to affirm that protracted functional

disturbance, or even fatal disease, may be the consequence of a rude shock, simultaneously, to the nerve-centres of the emotions, of organic and of animal life. I am, therefore, disposed to regard these cases of so-called railway spinal concussion as, generally, instances of universal nervous shock, rather than of special injury to the spinal cord. At the same time, I admit that in this class of cases we meet with instances of simple concussion, but I see no reason for taking *them* out of the category of concussion of the spine from other causes.

I will close these remarks by narrating the history and *post-mortem* appearances of a fatal case of injury to the spine, where no fracture occurred; and also the microscopic appearance presented in a case which was examined by my friend, Dr. Lockhart Clarke, who has kindly supplied me with a drawing of the affected part, from which the succeeding diagram has been made.

A female child $2\frac{1}{2}$ years old, was admitted into the hospital, under my care, in October 1866, having been thrown down in the street by a passing cart, the wheel of which went over the abdomen. The child was unable to walk, but moved her legs and did not seem to be seriously hurt; sensation did not appear to be impaired. The bladder retained its contents, and catheterism was required. The feebleness of the lower limbs increased; and in the course of a few days, the paraplegic condition was complete, including entire loss of sensation in the lower extremities. The child survived rather more than three months, varying as regards her general health; and usually dull and indifferent to all around her, with occasional transient fits of animation. At the autopsy, the bladder was found thickened; there were inflammatory deposits in the lungs; and the veins in the lower half of the abdomen and spinal canal were much congested. There was no fracture nor displacement of vertebræ; the membranes were healthy, although there was a considerable quantity of fluid in the lower half of the arachnoid space. Opposite to the eighth dorsal vertebra, the normal size

and healthy appearance of the cord suddenly ceased ; and below this point, nothing was left but a string of soft atrophied nerve-matter. On cutting into it at different parts, there was no trace of hæmorrhage anywhere, and the investing membranes were in no way diseased. When examined microscopically, the cord was found to contain inflammation corpuscles for about three-quarters of an inch above the point of apparent distinction between the healthy and diseased cord ; and in the lower part they were extremely numerous and of large size, but there was no trace of blood.

What might have been the proximate cause of this injury to the cord it is difficult to say. The most probable surmise is, that blood was extravasated ; and yet I failed to discover any trace of it within or around the cord. The microscopic condition of the affected portion of the cord enables me to say with more certainty that inflammation, softening and disintegration preceded the atrophic state of its extremity ; a change very closely allied to that which is witnessed after mechanical lesion of the same part.

The case of Dr. Lockhart Clarke to which I alluded, is published in the Transactions of the Pathological Society for 1866. It is, I believe, the first instance in which the peculiar degeneration in these special injuries has been described and figured ; I venture, therefore, to give an abstract of the symptoms and microscopic appearances.

The gentleman from whom the spinal cord was taken, had been the subject of a railway injury $3\frac{1}{2}$ years before his death. His health and physical power gradually failed, leaving his intellect unaffected ; his gait became unsteady, as if he were somewhat intoxicated, but without jerking or twitching ; and his speech had latterly become thick and hesitating. The cortical substance of the brain was found generally pallid and soft, particularly on the under surface of both anterior lobes. The spinal cord was generally wasted and shrunken, this change chiefly depending upon a diminution of the antero-posterior

diameter, which, in many places, was not more than equal to half the transverse. This was especially the case in the upper portion of the cervical enlargement. On making sections, it was found that, of all the *white* columns, the posterior were exclusively the seat of disease, being darker and more opaque and dense than the antero-lateral. When examined, both transversely and longitudinally, under the microscope, this appearance was found to be due to the presence of a multitude of compound granular corpuscles and isolated granules, and to an exuberance of wavy fibrous tissue replacing the obliterated nerve-fibres. The posterior horns, at their extremities, contained an abundance of isolated granules, and the anterior cornua were smaller than natural. This patient had suffered no fracture, wound, nor material contusion, but simply from the shock consequent on the collision. (See Figs. 1 and 2.)

There is a close resemblance between this condition of the cord, and that which is described by a recent author* as obtaining in simple locomotor ataxy, not dependent on injury, where the morbid changes are limited, with rare exception, to the lumbo-sacral region. In this condition, the posterior columns of the cord and the posterior roots of the spinal nerves are found diseased, the morbid appearances consisting sometimes in grey degeneration, or in a gelatiniform or translucent condition, with a diminution of consistency, or induration (sclerosis). In some instances the posterior cornu of the grey matter is involved. The diseased structure presents oil-globules, and is made up of atrophied and degenerated nerve-tissue, connective tissue in excess, and amorphous granular matter.

Of bruising or crushing of the cord, in fracture or dislocation of the spine, it is necessary I should say but little; the experience of hospital surgeons scarcely varies, I apprehend, in regard to the diagnostic characters by which these injuries are identified. It is true that the consequences of pressure may be present without fracture, and obscurity may thus attend a case,

* Dr. Radcliffe, in Reynolds's 'System of Medicine.'

FIG. 1.

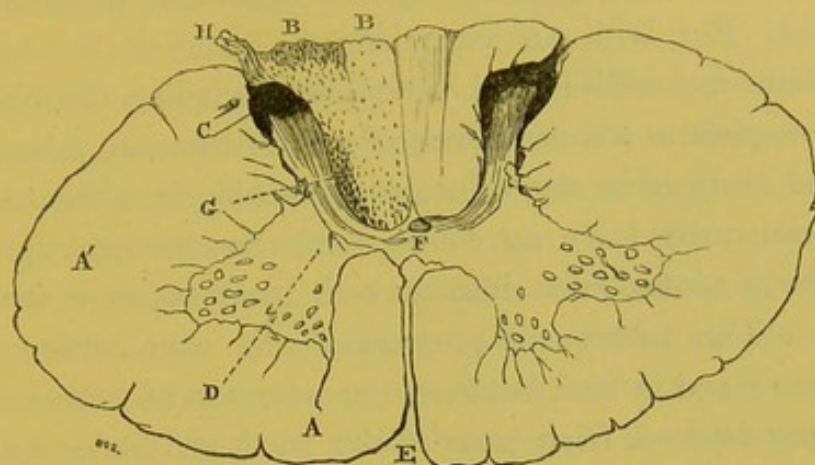


FIG. 2.

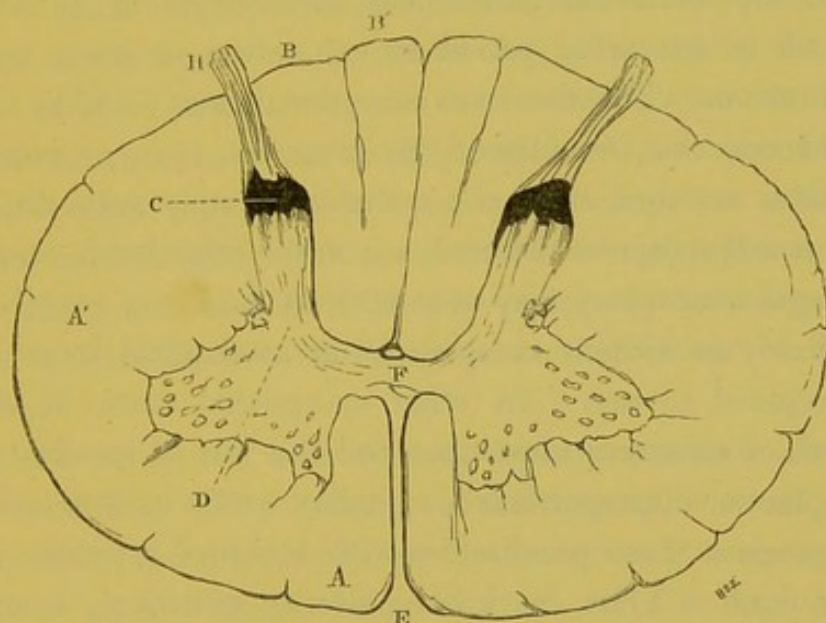


FIG. 1.—Transverse section of human spinal cord through upper third of cervical enlargement, from a case of injury in railway collision. Cord very much flattened from before backwards, as seen when compared with a corresponding section (FIG. 2) from a healthy cord.

AA'. Antero-lateral column of left side. BB'. Outer and inner portions of posterior column. c. Gelatinous substance of posterior grey horn. D. Anterior grey substance of horn. E. Anterior median fissure. F. Commissures between the lateral halves of the grey substance, containing the oval canal.

The antero-posterior flattening is due to atrophy of the posterior columns. The dark dots represent the cut ends of longitudinal nerve-fibres, which are scanty in the intervening space between B and C, and have nearly disappeared in the inner division, B', of the posterior column.

in which the local physical signs are doubtful or cannot be detected. But, with rare exceptions, the nature of the accident, immediate and well-defined paraplegia, including the bladder, early priapism as a consequence of spinal irritation, subsequent alkaline changes in the urine, due, probably in a measure, to the same cause, leave no doubt, even when the local signs are not clearly marked, that fracture with compression of the cord exists. The subsequent progress of the case confirms the diagnosis; and in fatal instances the extension of inflammatory softening deprives fresh parts of the trunk and limbs of power of motion and sensibility, until the chief centre of respiration is reached, when the patient dies asphyxiated, if he do not succumb at an earlier period to exhaustion or some organic complication. Yet, there are exceptional cases; and as I have pointed out that fracture of the processes, arch, or even the body of a vertebra, does not necessarily imply such displacement as will compress the cord, so, on the other hand, complete paraplegia after injury may exist without fracture; but whether persistently so without compression or mechanical lesion I am not prepared to say. In other exceptional cases, in which paralysis of voluntary movement and the loss of sensibility are incomplete or disproportioned, or reflex action is increased, we may associate these peculiarities with lesion of particular parts of the cord. Thus, as I have already remarked, complete suspension of voluntary motion and diminished sensibility indicate lesion of the anterior half of the cord, including the grey matter and part of the lateral columns; whereas, partial loss of voluntary movement, and complete or nearly complete loss of sensibility, accompanied by heightened reflex activity in parts receiving their supply of nerves from below the seat of injury, may be associated with lesions of the posterior columns and the grey matter, in any limited part of the cord. But when the same columns are deeply affected for at least two or three inches, the anæsthesia is accompanied by the loss of muscular co-ordination in the limbs; which, together with

acute shifting pains and other symptoms, constitute locomotor ataxy.

But, as I have remarked, it very rarely falls to the lot of the surgeon to witness these symptoms as the consequence of mechanical lesion, and still more rarely to verify them by *post-mortem* examination. The phenomena of reflex action are most commonly noticed, in association with paralysis, whether the lesion be in the anterior, posterior, or lateral column. No definite conclusion can, therefore, be drawn from this circumstance, beyond the fact that the cord is the seat of lesion. Relaxation of the sphincters is often enumerated among the signs of spinal compression, or of functional deterioration of the cord from other causes. I believe this is an error; the reflex action of these annular muscles is stimulated, when the source of their innervation is not directly implicated, in common with that of other muscles; but the voluntary power which, in health, may be and often is exercised over these muscles, is suspended; and, as I have already explained, the reflex action alone is insufficient to resist the expulsive power of the intestine.

A case which has been recently under my notice illustrates this condition. The patient, an elderly man, is weak in the lower limbs, and there is defective co-ordinating power, especially apparent on any fatigue being incurred. He is rarely able to evacuate the bladder spontaneously; but habitually uses a catheter for that purpose. Under ordinary circumstances the reflex power of the sphincter is sufficient for the retention of the contents of the bowel; but if there be any disposition to relaxed bowels, or if the peristaltic movement be stimulated by medicine, he is quite incapable, by any exercise of volition, of resisting the expulsive force, although he is conscious of the necessity of making the effort.

The period of survival in fatal traumatic lesions of the spine bears, *cæteris paribus*, a direct proportion to the interval between the chief respiratory centre and the seat of injury. The general

condition of the patient frequently, I may almost say usually, is not characterised by any corresponding depression or downward tendency ; and it would be an error to augur favourably of the issue because the intellect is clear and active, and the organic functions are healthily performed. Vivid dreaming, though not necessarily of a distressing character, I have noticed as a frequent symptom towards the close of life. The steady extension of paraplegia upwards is a sure measure of the progress of the mischief, and an indication of its impending fatal result.

Penetrating wounds of the cord, without compression, are rare in my experience, and I am tempted to quote the following interesting case, as exemplifying this form of injury and the attendant symptoms, together with some accidental concomitants which are met with in lesions of the cord.

A labourer, aged 24, was engaged in working in a tunnel near Sydenham, when a large mass of earth fell upon him, throwing him on his side, and doubling his legs up under his body, so that his toes were almost forced into his mouth. When lifted up, his lower extremities were paralysed and insensible, but he was conscious and collected. When admitted into the hospital he was in a state of collapse, and complained of pain in the back and crest of the ilium ; extravasation, extending from the latter spot along the lumbar spine, prevented me from ascertaining, by such manipulation as was justifiable, whether the signs of fracture were present. The bladder was paralysed. In the evening he had slight sensation when pinched in the thighs. On the following day there was moderate reaction, and slight sensibility in the lower limbs. On the fifth day the urine became ammoniacal ; on the sixth day there was blood mixed with the mucus in the urine ; and he complained of pain in the hypogastric and iliac regions. On the ninth day he could feel as low as the knees ; the urine continued bloody. On the eleventh day, sensation had extended still lower, and there was evidently an expulsive effort made when the catheter was partly introduced, as the urine escaped in considerable quantity, if it was then

withdrawn. On the thirteenth day he complained of a peculiar sensation of numbness all over him, and of fluttering at his chest and rising in his throat. When pinched in the upper extremities, he could only just feel it; but he could move and make use of his arms and hands. His pulse was very rapid. Some brandy revived him. On the following day, the fourteenth, he was seized with a similar paroxysm. The muscles of the upper extremities were, at intervals in a state of violent spasm; his face was expressive of extreme anxiety, and he rolled his head violently from side to side. He complained of an inward consciousness of loss of sensation, and earnestly asked those around him when this feeling of an impending fit would pass off. There were intervals of rest. His heart beat with excessive violence and rapidity; and on listening to it a peculiar ringing sound was audible at its base. The respiration was hurried, but unaccompanied by mucous râle. He expired quietly on the following morning, without dyspnœa supervening.

On examination, the brain was found healthy. In the spine, the left transverse processes of the first, second, and fourth lumbar vertebræ were fractured. The bodies of the last dorsal and first lumbar were broken through obliquely, from the right side downwards. There was scarcely any displacement visible from the front, but there were spicula of bone projecting backwards from the fracture into the spinal canal; and opposite to these was a small wound penetrating the dura mater, from which some nerve-pulp protruded. On laying open the theca, the substance of the cord appeared to be very much softened in this situation, and there was a less degree of softening for three or four inches upwards; the pia mater covering this portion was injected. A little blood was effused beneath the pia mater at the seat of injury. Microscopic examination of the softened portion of the cord exhibited numerous aggregations of compound granule cells, some of which were seen in the upper portion of the cord, above the seat of softening. The pelvis of either

kidney was inflamed, and there was a patch of lymph in the left.

Double fracture of the spine is occasionally met with ; but, in my experience, this is a rare occurrence, where there is a wide interval between the injuries. It is most likely to occur where the force producing the fracture begins to operate, or has not fully expended itself by breaking the spine at one point. The symptoms would be referred to the upper injury, supposing that the cord is compressed at each fracture. I have notes of a case of this kind, in which a young woman was crushed by a falling woolpack. She survived for some days, and the *post-mortem* examination showed a comminuted fracture, with compression of the cord at the first lumbar vertebra. The second fracture was also comminuted, and involved both the arch and body of the second dorsal vertebra, but without such displacement as to compress the cord ; yet the texture of the cord at this spot was discoloured on the surface, and presented a diffused clot in its interior. The young woman's symptoms were somewhat peculiar, and indicated that the primary and more severe mischief was at the upper lumbar fracture. She had no sensation, properly speaking, below the *mammæ*, for she was not conscious when she was touched or pinched ; yet she said that her feet felt swollen as if they would burst, and she had tingling sensations, as of the pricking of pins or needles, in the lower extremities. The muscles of the legs could be excited to action by tickling, and she was conscious when her bladder was distended, though she could not evacuate it.

Of simple dislocation in the upper cervical region, death is the immediate consequence. The following case of traumatic disease thus terminating is an interesting instance in point, and will serve to exemplify the condition of the patient as the disease progressed.

A warehouseman, aged 45, was admitted under my care in 1864. His history was that sixteen months previously he was knocked down by a horse, and fell on his head, which was cut,

and his back was bruised. He was stunned for a time, but soon returned to his work, though unable to rotate his head for two days. Five months afterwards his health began to fail, and prominence of the spine with pain in the dorsal region followed; he was unable then to rotate his head, except to a limited extent. This last symptom was intermittent—that is, he described the movement to be entirely suspended for a time, and then the bones suddenly slipped into their places, and free movement was restored; the apparent slipping out of position was as sudden. The intervals during which he enjoyed free movement extended usually to several weeks. When admitted, he could walk, and the sensibility of the lower part of the trunk and extremities, and command of the bladder, were natural. The head was fixed; the axis was very prominent, and the atlas seemed to have slipped forward; the lower dorsal spines were prominent and tender. A few days after his admission, he was seized with sudden dyspnœa and paralysis, and soon expired.

Autopsy.—There was caries in the dorsal region of the spine. The odontoid process of the axis was seen close to the posterior margin of the occipital foramen, its surface being carious and denuded of ligaments; the transverse ligament of the atlas had also disappeared. The upper extremity of the spinal cord appeared quite crushed and pulpy, and the lower portion of the medulla oblongata was also soft. The brain and its membranes were healthy; but much cheesy matter was found in the dorsal part of the vertebral canal, in front of the dura mater.

The condition of this patient, as described by himself, clearly indicated the state of the cervical vertebræ, as verified by dissection; yet his description could scarcely be credited, on account of its improbability. The explanation probably is, that the moderator ligaments remained to support the relations of the atlas and axis, after the transverse ligament had given way by ulceration; or the converse might have been the case. There was no effort at repair by ankylosis.

As an illustration of the obscurity sometimes attending the

diagnosis of injuries of the head and spine, and of the importance of giving a cautious prognosis, I will quote this final case which was recently under my care in the hospital, of the grave and complicated nature of which I was unsuspecting during the time that the patient survived.

A married woman, aged 58, was admitted in June 1865. She had been thrown from a cart and fell on her face; but her husband, who was with her, thinks that the wheel did not pass over her. When brought to the hospital she was much agitated, and complained most of pain and stiffness in her neck, and of her jaw. The lower jaw was fractured in two places; and there was a diffused swelling on the right side of the neck, extending below the clavicle. The slightest movement of the head occasioned pain in the neck. The left ear was much torn, and the face was lacerated in several places. The injury of the jaw was attended to, and an ice-bag was applied to the neck. She passed a restless night, and complained of a sense of suffocation when the jaw-bandages were tightened; otherwise she seemed as well as could be expected, considering the nature of her injury, as far as it was apparent. On the second morning the cervical swelling had much subsided, and she expressed herself as feeling better, and imprudently sat up, outside her bed, to wash herself. After returning to bed, and whilst sitting up, her face suddenly became livid, and she fell back dead. Besides the injuries enumerated, the *post-mortem* examination revealed the following lesions. The brain was very soft, and there was bruising of the inferior surface of the anterior lobes of the cerebrum, with slight extravasation of blood extending as far as the white substance. There was a fissure in the skull, passing through the left side of the cribriform plate of the ethmoid bone, and reaching back to the optic foramen. There was some blood effused between the dura mater and the left cerebellar fossa of the occiput; and there was a fracture in the same situation, extending into the jugular fossa. The spinous process of the sixth and seventh vertebræ were broken off, and there

was abnormal mobility between the axis and third cervical. On their removal, it was found that the connecting ligaments and intervertebral fibro-cartilage were ruptured, so as to allow of considerable movement of the second vertebra forwards on the third, but of very limited movement backwards. The upper part of the spinal cord was crushed; but the second and third vertebræ were not broken.

This case is remarkable for the entire absence of cerebral symptoms, such as might have been expected as a consequence of the injury to the skull and brain; and also for the fact that the spinal displacement did not occur earlier. That this complicated mischief was the result of the fall rests on the assertion of the patient's husband; but the external contusion seems to be suggestive that the wheel of the vehicle had passed over the neck. The interest of the case is enhanced by the fact that the rupture of the intervertebral substance was unaccompanied by fracture of either of the cervical vertebræ implicated—a circumstance which would have been scarcely possible in any other region of the spine, and is of very rare occurrence even in the cervical.

In the preceding remarks, I have kept in view the relation of shock to the various injuries which we have been considering. In other visceral lesions, especially those of the abdomen, the symptoms of shock are more sharply defined than where they are complicated with injury to the cerebro-spinal nerve-centre. In shock, the appeal is specially and directly made to the cyclo-ganglionic system of nerves, and organic life is primarily affected; the functions of animal life are involved secondarily and by sympathy. In lesions of the brain and spinal cord, this order of phenomena is inverted.

I have often been struck with the limited amount of shock which, as a rule, accompanies even severe lesions of the cerebro-spinal centre; whereas, in structural injury of other viscera, especially of the membranous organs of the abdomen, the shock is immediate and fully pronounced. The evident explanation

of the contrast is, that the abdominal membranous viscera are largely supplied by the cyclo-ganglionic nerves, and that the ganglia themselves are implicated, more or less, in the hurt, even where mechanical violence is unattended by textural lesion.

I had still much to say, had the time permitted, on some other lesions of the cord, including tetanus; and I feel that even this short sketch, imperfect as it is, is rendered still more incomplete by the omission of some comments on operative interference in fracture of the spine. I entertain an opinion decidedly adverse to any such proceeding; but I feel it would be impracticable for me to represent fully my reasons for this opinion, at the same time that I do justice to the arguments which have been urged in favour of operating, without extending this lecture beyond the prescribed limits; I am compelled, therefore, reluctantly to acquiesce in this omission, and also to relinquish my original design of including in the present course other visceral lesions, which abound with elements for illustration in their many and varied phases.

If the confidence of the Council should be extended to me during another season, and I am spared to realise my wish, I may hope to complete the present division of my subject; and also to place before you, in a collected form, the results of my experience in other visceral lesions in association with shock.

I feel that the value of the remarks I have thrown together in the preceding lectures, bears no proportion to the importance of the subject, or, I may add, to my own anxious desire to do justice to it in such limited space, and in the time which has been at my disposal to collect and arrange my materials. Respecting these materials I may say one parting word. My illustrations, in nearly every instance simply typical of the class to which they belong, have been drawn exclusively, or almost so, from my own cases. Yet, I trust it may not be inferred that, in so making my selection, I have been unobservant of the vast store of facts which have been within my reach, in the

practice of my colleagues, during the quarter of a century that I have been on the surgical staff of St. Thomas's Hospital, or unmindful of the labours of others in the same field of scientific surgery. Had I been so negligent, I should indeed have done violence to my own sense of duty, and have been heedless of becoming modesty in my endeavour to fulfil it; at the same time I should have negatived those principles which I sought to establish in commencing this course. I may venture to claim that the opinions enunciated have not been hastily formed; and the records of the cases, by which I have exemplified and supported these opinions, may possibly be regarded as possessing the merit, *quantum valeat*, of being an impartial chronicle of my professional experience.

To my colleagues on the Council, and to the visitors who have honoured me, I beg to offer my acknowledgments for the compliment embodied in their attendance at these lectures; and especially I thank you, Mr. President, for the encouragement your presence has afforded to me,—an attention which I the more appreciate, as I cannot but be aware that the claims upon your time are such as might reasonably have excused you for absenting yourself from the chair on these occasions. Amongst my auditors I have recognised some of my former pupils. This testimony of their regard is a gratifying assurance to me that the time we have spent together in the lecture and dissecting rooms, and in the hospital wards, is not without its agreeable reminiscences to them; whilst it has left to me the valued heritage of many an enduring friendship.

LECTURE VII.

Lesions of Spinal Cord.—Introductory Remarks.—Tetanus: its Varieties, Causes, Symptoms, and Signs.—Comparison with other Convulsive Affections; Hydrophobia, Epilepsy, Chorea, Hysteria.—Acute and Chronic.—Shock.—Tetanus in Lower Animals.—Morbid Anatomy.—Repair of Cerebral Substance after Breach of Texture.—Affinity between different Convulsive Affections of the Cord.—Effects of Spinal Caries on the Cord.—Surgical Operation in Fractures of the Spine Discussed.

MR. PRESIDENT AND GENTLEMEN,—It may be in the memory of some of my hearers, who did me the honour of attending my former course of lectures, that I proposed to supplement my observations on injuries of the spinal cord, by some further remarks, having for their object the consideration of certain lesions, which the limited time at my disposal did not then permit me to discuss.

The deviations from health of the nerve-centres, dependent on accidental causes, are so various, that many of the consequences of such casualties exemplify an observation I formerly made, that it is very difficult to draw a well-defined line of distinction between that which is medical and that which is surgical; and that it is, consequently, impracticable to study to advantage these several consequences in isolation. Even functional disturbances are often brought under the notice and treatment of the surgeon; and organic changes of a similar nature as regards their effects, though dependent perhaps on

widely different causes, are, in like manner, the common property of both branches of the profession.

I am prompted to make these observations to guard myself against the imputation of trespassing on the province of the physician in this and, I may add, the ensuing lectures, to which the foregoing observations are equally pertinent.

Tetanus is a disease which exemplifies the preceding remarks. Sometimes idiopathic in its origin, more often traumatic, it was long classed with functional lesions; and its treatment is assigned to the physician or to the surgeon, according to the latent or apparent source of the disease. Yet, this distinction is purely conventional, and has no foundation in science. It matters little whether an external wound be the cause of the disease, so far as the nature of the malady is concerned: when once established, the treatment of the original lesion appears to exercise no more influence on its consequences, except in rare and doubtful instances, than the excision of the bitten part after the, in many respects, allied disease of rabies is developed. It is true, as far as my experience has enabled me to judge, that the so-called idiopathic form of tetanus is more amenable to treatment than the traumatic. Probably the exciting cause is, though unseen, more accessible to remedies; and the disturbance, being unattended by breach of surface, is more often purely functional in its nature. Yet, in whatever sequence or under whatever circumstances the symptoms of this terrible malady present themselves, we may feel assured of the existence of some antecedent disturbing cause, usually, if not invariably, peripheral in its nature, and affecting some distant part of the nervous system. The expression "idiopathic" must not be accepted as convertible with spontaneous or causeless,—an interpretation which is, I think, too often carelessly applied to it. It can simply mean in this instance, as indeed in others where it is similarly employed, that the exciting cause of the disease cannot be demonstrated, is unseen, probably unknown, or only subject of conjecture. In this sense it is admissible,

as opposed to traumatic, where the *primum mobile* of the central nervous irritation is apparent, although we may be as much in the dark as regards the manner of its operation in producing the phenomena we witness.

Whether the class of symptoms, which respond strictly to the definition of tetanus, ever spring from a purely central origin, may, I think, admit of question. But we know that they may be accurately imitated; in fact, the disease itself may be excited, and in a fatal form, by the agency of a drug. Convulsion also characterises certain injuries of the brain, as I have formerly had occasion to remark. This question, however, opens up the wide and important inquiry, how far all these convulsive affections are allied; and whether they may not, in an extended sense, be regarded as different phases of a diseased action, the modifications of which are dependent on some constitutional bias, organic change, or accidental influence, which determines the character and degree of the resulting consequences. That these excito-motor diseases possess many characteristics, and present many phenomena, in common, there can be no doubt. The premonition of the convulsion in tetanus, epilepsy, and hysteria, often manifests a palpable resemblance. In tetanus, for example, I have known the fit, if I may so term it, arrested, or, at any rate, delayed, by forcibly grasping the wrists of the patient, in anticipation of the spasm which extended, periodically and at definite intervals, from the hands to the arms, and thence to the chest, until the whole trunk was involved in the terrible convulsion. But in these cases of deferred paroxysm, it would seem as if there were a cumulative force in operation; for a repetition of this compulsory delay entailed a renewal of the effort at shorter intervals, and ultimately terminated in a fit of painfully increased intensity. In tetanus alone, of these affections in their severer form, the intellect is not involved; and in this respect it is more allied to chorea. But in the more developed type of hysteria, entire and prolonged unconsciousness may accompany

the most protracted tonic spasm that I have witnessed in any of these affections. The respiratory muscles are *specially* involved in tetanus, though, no doubt, the diaphragm is sometimes affected, in company with other and voluntary muscles of inspiration and expiration.

In the tetanic convulsion the excitement of the spinal cord, as a centre and source of reflex motor power, overrides the controlling influence of the brain; and the inhibitory authority of volition is thus suspended, leaving the voluntary muscular system generally under the undisputed sway and dominion of excited reflex action. This definition is, however, more or less applicable to all these convulsive affections: the points of contrast are observed in the duration and intensity of the spasm and in the particular set of muscles which are more especially affected. Thus, in chorea, the muscles of the limbs and trunk, and those employed in articulation, are under this excited influence; and the contortions produced by their irregular and involuntary contraction are, in one sense, aggravated by the exercise of the partially effective effort to control them. The spasm is, however, limited in intensity, although usually without remission, except during sleep. In hysteria there would appear to be no spasm of the glottis, and therefore there is no lividity of face; but the repeated sobbing acts of inspiration are followed by the shrill cry or interrupted cachinnation of prolonged expiration. In marked contrast with these characteristics are those of epilepsy: in the latter, the closing muscles of the jaws and larynx are specially affected, simultaneously with the muscles of expiration; and the struggle seems to be between this determined obstruction and the effort to overcome it: but the convulsion is by no means limited to these muscles. Yet I have witnessed in hysteria convulsion as violent, cramp as rigid, as in tetanus, and unconsciousness as profound and prolonged as in epilepsy; but without the capillary congestion of the brain, characterising the partial asphyxia of the latter. In all, probably, the exciting cause of the disease may be either eccentric

or centric; and it may be assumed that the eccentric form is more amenable to treatment in all: *i. e.* if we admit that the conversion of the eccentric into the centric form by the secondary development of organic mischief in the spinal cord, places traumatic tetanus in the latter category.

Both animal and vegetable poisons are capable of producing convulsive affections, in many respects nearly allied to tetanus. The close resemblance between the effects of a dose of strychnine and this disease is so remarkable that, but for the direct dependence of the symptoms on the poison, and their presence as an immediate consequence of its exhibition, the two conditions could scarcely be distinguished. In rabies, the introduction of an animal poison is the exciting cause of that frightful train of consequences, of which the leading feature has given its popular name to this malady. But in hydrophobia the muscles of deglutition seem to be specially affected, whilst those of mastication are not so: the symptoms, in fact, indicate that the eighth pair of nerves is particularly implicated. The distressing thirst accompanied by the dread of making the effort to satisfy it; the wild and wandering expression of countenance, the suffused eye, and, beyond all, the helpless, purposeless, unremitting restlessness of this disease, suggestive of the undefined apprehension of something more terrible than death itself, under which the senses reel and the intellect staggers,—distinguish rabies from tetanus and all other convulsive affections, and mark it as the most dreadful of diseases to suffer or to witness. Yet the symptom which is considered as pathognomonic of this malady, and gives to it its name, is not limited to hydrophobia; in many convulsive affections, the spasm induced by the effort excites the same dread of attempting to swallow liquid: and in hysteria it has been occasionally observed as a prominent and most distressing symptom, enduring for many days. I have also the notes of two or three cases of acute tetanus, in which spasm was excited specially by the effort to drink: these, however, are exceptional instances.

In its traumatic form, the invasion of tetanus can scarcely be mistaken. The general premonitory symptoms may be so unimportant and undefined as to escape notice, but not so the uneasiness about the neck, the sense of constriction about the throat, and the stiffness of the jaws. The period at which these first symptoms present themselves varies considerably; and this variation does not appear to influence the subsequent progress or probable issue of the case. Neither does the nature of the wound nor its condition bear any relation to the intensity of the symptoms: the tetanic spasm may not be developed till the causative lesion is healed, and may then prove rapidly fatal. Pain in the epigastrium or behind the sternum is an early symptom; and cramp in the spinal and abdominal muscles usually precedes that of the limbs. The respiration is often laboured and painfully performed, irregular or hurried, and deglutition is difficult. Even slight physical or emotional causes excite a paroxysm; and the dread of its approach stamps on the countenance an expression of anxiety and alarm. Whilst the fit is on, the muscles contort the trunk and limbs in various ways, the extensors of both, however, appearing to have the predominance. The expression of the appealing, anxious face is, at the same time, rendered painfully hideous by the spasm of its muscles. The circulation and respiration are excited; and perspiration is abundant, as a consequence, apparently, of the muscular perturbation. The feebleness of the articulation seems due to the same cause. The temperature is often raised, and usually in a marked degree towards the close of life; but there does not appear to be any febrile action—any sympathetic fever excited by the disease. Constipation of the bowels, more or less obstinate, characterises this malady, and is accompanied by a fetid state of the dejections.

The explanation of these phenomena is not very clear. Probably the sympathetic system is so far involved in the mischief, as to give rise to spasm or irregular contraction of the muscular coat of the intestines; and this may also account for

the mal-assimilation or decomposition of their contents. There is no doubt that the excited action of the sphincter ani is an obstacle to the relief of the bowel; but cannot alone explain its obstinate resistance to the action of aperients. Retention of urine, when it occurs, is due to spasm of the retaining muscle of the bladder, as its occasional involuntary ejection is consequent on that of the abdominal muscles. Unrelaxing cramp, with exacerbations which recur with increasing frequency and violence—the broken rest—the imperfect nourishment of the frame—the exhausting effect on the nerve-centre resulting from the continuous demand on it by the unremitting spasm—all aid in bringing to a speedy close the acute form of the disease; and the unhappy victim sinks into a state of prostration, both physical and mental, which brings with it some relief to his suffering before he dies. But, more often, death is sudden, and caused by spasm of the larynx, induced by some accidental exciting agency, or occurring during a paroxysm of general convulsion: a livid hue overspreads the face and chest, the eyes become fixed, and the patient dies asphyxiated.

Deviations from this, which may be called the normal course of the disease in its acute form, are occasionally met with, such as a remission of symptoms for an extended period, and the simultaneous, perhaps indirectly consequential, occurrence of other affections in which the cerebral functions are more or less implicated. But these latter rare exceptions are not likely to mislead the practitioner, because they are not sufficiently pronounced to mask the original disease, unless as the precursors of death. Indeed, the diagnosis of tetanus is rarely obscure, unless in its subacute form, or when occurring as a phase of hysteria; and the history of the attack is scarcely needed to throw light upon its nature. In the acute form, mechanical lesion of some sort, but not necessarily a breach of surface, is usually the exciting cause; and, in my experience, contused or lacerated wounds, especially of the hands and feet, are the most rife. Of tetanus following severe burns I have

seen many instances; and also, though rarely, I have known the healing of a wound precede the first symptoms of the disease. There is no doubt that its most acute form may result from the agency of exposure to sudden transitions of temperature, or even from mental impressions; but such examples are usually classed with the idiopathic, as distinguished from the traumatic, type of the malady.

It has been asserted that the acute form of tetanus is invariably fatal. In one sense this may be true, if the term "acute" be restricted to those cases which never assume, by virtue of the lapse of time, the chronic form. But the instances of recovery are not limited to such as may be denominated subacute in the early stage; though I admit that the acute traumatic type of tetanus is almost always mortal.

Symmetrical spasm is the usual type of tetanus; but occasionally the spinal affection of one side is determined by the position of the injury. A remarkable illustration of this rare form of the disease occurred about two years since in St. Thomas's Hospital. The patient, a lad of eleven years of age, injured his ulnar nerve by falling on a rusty nail. Some days after the wound had healed he was attacked with spasm in the arm, and pleurosthotonos succeeded. Although the spasm subsequently became more general, the unilateral feature characterised the case until its fatal termination after three days; the intensity of the spasm continuing more marked, and at times exclusively present on the injured side. I may remark that, in this instance, as in a few others, I noticed the exceptional circumstance of delirium supervening towards the close of life.

As surgeons, we meet with many illustrations, in a modified form, of the characteristics of this large category of spinal affections; to some of these I have already alluded: *e.g.* the penetration of the cord by a spiculum of bone, and tetanic spasm as the consequence of the irritation; also the same result occurring, but with more of an epileptic type, as a

sequence of concussion of the spine. Likewise, sources of local irritation in distant organs not unfrequently excite tetanic symptoms; and the general convulsion, induced by apparently trivial causes, indicates a condition really independent of, though commonly referred to, exalted sensibility. The attendant symptoms may be described as those of spinal irritation, and often resemble hysteria: the disturbance is purely functional. I remember witnessing in a young lady, of robust frame, but under the influence of moral depression, a very severe attack of what could scarcely be designated by any other name than that of tetanic spasm, but especially affecting the legs. Her suffering was intense; and the spasm had lasted, without intermission, for several hours. I referred these symptoms to spinal irritation; and a counter-irritant to the spine, with an anodyne draught, afforded relief. Derangement in the urinary organs not unfrequently provokes this condition; and the reactionary consequences which are commonly observed affect the same organs, giving rise to spasmodic stricture, incontinence, and other affections simulating organic changes, and requiring care and sagacity in their diagnosis. Spasm in the urethral bulb and in the sphincter ani, severally in vesical calculus and in fissure of the rectum, are familiar illustrations of a similar form of excited local reaction.

I have, in an earlier lecture, pointed out that concussion of the spine is, in some instances, followed by convulsive movements simulating, if they may not be strictly regarded as, epilepsy. True tetanic spasm will also sometimes be a sequence of such injury, assuming perhaps an intermittent type, and persisting for some time, without there being any ground for supposing the presence of organic lesion.

Again, progressive organic change in the cord, accompanied by corresponding deterioration of cerebral influence and true spinal power, is occasionally attended, under favouring circumstances—of which exhaustion is the most common—by genuine tetanic symptoms. This is a transient phase of excited motor

action which yields speedily to treatment tending to re-establish or equalise the circulation. True shock can scarcely be said to be an attendant or sequence of these convulsive affections of the cord. Nervous exhaustion is common, and proportioned to the violence or protracted nature of the attack; and this very result seems, as I just now remarked, to constitute one exciting cause of renewed muscular spasm. The appeal to the nerve-centre, whatever may be the morbid stimulus, is not of a character to prostrate, but rather to exalt, for a time, its energy; and thus the train of consequent symptoms is of a character diametrically opposed to those of shock.

Tetanus in the lower animals is marked by the same class of symptoms as in man; and the acute traumatic type would appear to be excited by the same causes, and to be as resistant to treatment, as in the human subject. I am informed by an intelligent veterinary surgeon, that he finds medicine of little or no avail in this disease; but that absolute quietude, and exclusion of light in a large loose box, is the management he adopts in the treatment of tetanus in the horse. The necessary intrusion is rare, and conducted with the utmost caution, to avoid startling the animal; and food of a semifluid consistence is left in a convenient position, so that it may be imbibed by suction. He added, that some of the most acute cases he has witnessed have been produced by chill. Exposure to a cold draught of air, or washing with cold water, when the animal is heated and exhausted, is a not uncommon cause of this disease. A pupil of the late Professor Sewell informed me that, when lecturing at the Veterinary College on tetanus, that teacher was in the habit of taking from his pocket a stable-key, and saying emphatically, "This, gentlemen, is my treatment of tetanus:" so great was the value he attached to seclusion and repose, and so anxious was he to impress on his class the imperative necessity of attending to this feature in the treatment of the disease. I think we might take a lesson, in our own practice, from this rational advice, which recognises

and strictly enforces the treatment which is best adapted to a malady that may be said to depend, for its sustenance, so much upon extraneous excitement.

In traumatic tetanus, the *condition* of the wound seems to have as little influence as its nature in determining the central nerve-lesion. Punctured, contused, lacerated, very rarely incised, wounds; bruises, and burns, are followed by tetanus: and the intensity of the attack is in no degree proportioned to the severity of the injury. Sometimes the disease seems to be more prevalent than at others; and I have, on more than one occasion, observed that, at one particular period, cases of severe burn seemed to be peculiarly liable to an attack. Although tetanus is usually developed whilst the causative wound is open, this is not uniformly the case; and a healthy granulating surface is quite consistent with the presence of the disease in its most acute form, though not so commonly so as an angry or sloughy wound. In the lad whose case I just now related, the wound in the wrist had healed. In another instance, the period at which the contraction of a cicatrising wound, after removal of a recurrent fibroid tumour, was most active, was that in which tetanus was developed. Whenever I have seen the disease follow a burn, it has been at an early period, before cicatrisation had commenced.

One of the few cases of acute tetanus which I have known to recover was in a patient whom I watched with much interest whilst under the care of my colleague Dr. Barker. The symptoms appeared shortly after he had received a severe blow on the back, and lasted for about a fortnight, varying in their intensity; but at times the paroxysms were remarkably severe. The treatment consisted in administering large doses of the tincture of Indian hemp, and afterwards of morphia. In this instance there was no breach of surface.

I am not aware that any good purpose could be answered by discussing the medicinal treatment of tetanus. Unhappily it is an unsatisfactory topic, and throws very little light upon the

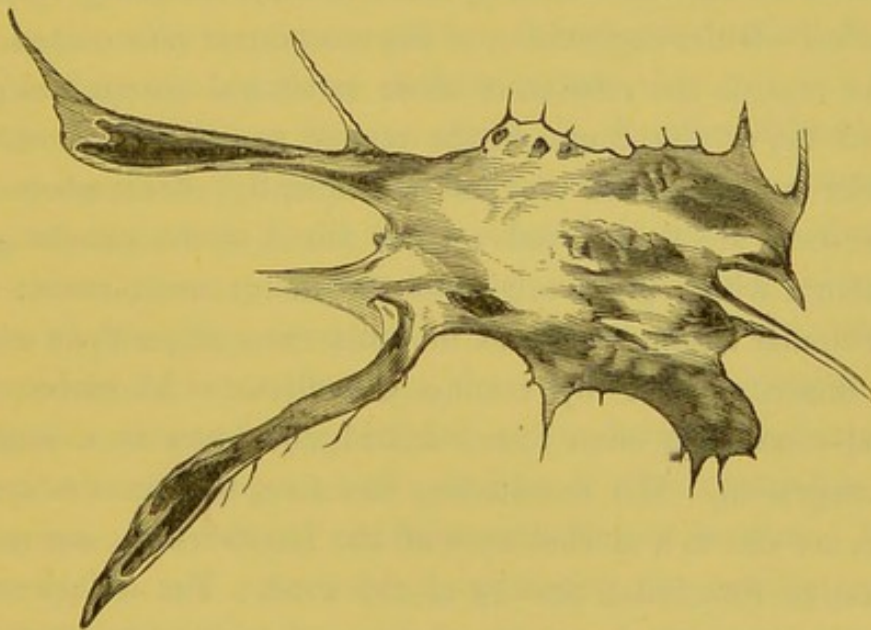
pathology or diagnosis of the disease. I would, however, venture to remark, in connexion with the question of the differential characteristics between convulsion and shock to which I have referred, that the artificial substitution of the latter would seem to operate in paralysing the former. Thus the influence of tobacco is manifested in this way. An instance which I witnessed at an early period of my professional life made a great impression on me. It was that of a young girl, who was under the care of Mr. Travers whilst I was his articled pupil and dresser. Her hand had been severely lacerated on the palmar surface by a carding-machine, and acute tetanus followed. An infusion of tobacco was injected into the rectum, and the consequence was an amount of prostration which threatened speedy extinction of life. She, however, rallied, and ultimately recovered. I have never seen so acute a case saved; but whether this result was simply *post hoc* or *propter hoc*, I do not pretend to decide.

Before quitting this interesting subject I will briefly advert to the morbid anatomy of tetanus, on which considerable light has been recently thrown. The rare occurrence of this malady, as compared with the frequency of such wounds and contusions as are known to be the most rife exciting cause of its existence, would seem to indicate that a variety of concurrent circumstances must be present to determine the development of the disease. No doubt many of these are extraneous and purely accidental; such as season, locality, and temperature; or the presence of any depressing external agency. But there must be, also, other and intrinsic predisposing conditions which influence the production of this convulsive affection; and it would appear probable that these reside especially in the nerve-centre itself. I cannot say I have ever attached much importance to the *post-mortem* appearances which were supposed, formerly, to be associated with fatal tetanus. As far as I have been able to judge, they are so

ill-defined and irregular as to be both unreliable and insufficient—accidental changes which might or might not be associated with the fatal disease. When a nerve of sufficient magnitude has been wounded, and this injury has been succeeded by tetanus, the injured nerve generally betrays signs of inflammation. Flesh wounds are often angry-looking, especially when the symptoms of convulsion are developed early. But these conditions are by no means necessary or uniform. On the contrary, I have known such a wound, involving the ulnar nerve, entirely healed, before the first indication of tetanus was observed; and flesh wounds will heal kindly during the progress of the disease. We must, therefore, seek for some other explanation of its pathology than can be afforded by the unhealthy or unhealed condition of the wound. The peripheral source of irritation is not necessarily perpetuated as such, but is transferred to the nerve-centre; and these cases are, perhaps, among the most hopeless, and run their course rapidly. The natural inference under such circumstances is, that some organic change has been established in the nerve-centre, which no longer needs the primary irritation in the circumference to maintain it. On the other hand, such peripheral irritation alone would appear to suffice, in some cases, to excite tetanic convulsion, by reflexion through the cord; and the removal of the offending part will then arrest the disease. Under these circumstances it becomes a matter of vital importance to distinguish such cases as are of a purely eccentric character; for, in such only should an operation be contemplated. Certainly these instances of successful interference are rare, especially where the disease presents itself in the acute form—where there is no remission of symptoms; this, indeed, appears to be the class of cases in which the disease is centric, and, probably, as such always fatal. But in subacute and intermittent tetanus, the removal of the injured member, say a finger or thumb, has been immediately followed by relief. Perhaps a careful analysis of these circumstances, founded on more accurate and

extended pathological observation, may lead to more satisfactory results.

To Dr. Lockhart Clarke we are indebted for our acquaintance with those pathological changes in the organic structure of the cord, which are found in fatal cases of tetanus. In several specimens examined by this careful observer, there were noticed extensive areas of disintegration in the grey substance of the cord, especially round the central canal, with softening and exudation of a finely granular fluid, and the *débris* of blood-vessels and nerves in the same locality. Swelling or falling in of the cord at the parts affected was also noticed, and extravasation of blood into its texture. And these changes, though varying in degree in different parts, were not limited to one segment of the cord, but involved the greater part of its extent, from the upper cervical region downwards.



Section of spinal cord in tetanus, showing its distortion and falling-in from the fluid disintegration of the grey matter; a condition which prevailed, in this instance, more or less throughout the whole length of the cord. After a drawing by Dr. Lockhart Clarke.

Several inquiries, and of an eminently practical character, in relation to diagnosis as well as treatment, are suggested by

these facts, and are referred to by Dr. Lockhart Clarke, at the conclusion of his paper on the subject. The first which naturally presents itself is, whether the structural changes observed are present in cases which recover. The reply to this inquiry must necessarily be purely conjectural; but the probability is in favour of the negative. If the positive be assumed, the alternative is implied of entire restoration to a normal condition, or the persistence of some indication of permanent functional nervous derangement. The former is scarcely consistent with our present knowledge of these organic changes in the structure of the *cord*; and, as regards the latter, I cannot recall any instance in which evidence of such enduring derangement has existed, after recovery from tetanus. It seems more probable that, in such cases, irritation without organic change—an expression which is admissible in the absence of one to which a more definite meaning may be attached—is the explanation of the consequent phenomena.

As regards the relation of these structural changes, as produced by, or the cause of, the tetanic spasms, Dr. Lockhart Clarke remarks that they most frequently occur where the nerve-cells are scanty, and are not found in the anterior grey substance which gives origin to the motor nerve-roots; and that similar lesions are found in those cases of paralysis which are unaccompanied by tetanic convulsion. Moreover, the blood-vessels are often found dilated, and even in a state of disintegration. His conclusion, therefore, is, that the symptoms are due to a morbid state of the blood-vessels, and not to excessive functional activity of the cord. Yet it appears to me that this exalted activity of the cord must exist, albeit as a consequence of such morbid condition of its blood-vessels; and this supposition is consistent with the conjecture that the vascular disturbance, whether functional or organic, does not necessarily imply any structural lesion of the nerve-tissue itself. May it not be that the *rapid* evolution of these organic lesions produces tetanic convulsion, and that their *slow* development

causes paralysis, with the accompanying phenomenon so frequently observed, of spasm or twitching of individual muscles? Just as chronic affections of the grey matter of the hemispheres produce dementia, and acute affections produce delirium. Muscular atrophy has also been shown, by the author to whom I was just now referring, to be due to softening and disintegration, chiefly of the grey substance of the cord, and to atrophy of its nerve-cells; accompanied by morbid exudations, and frequently by great dilatation of blood-vessels, the result of inflammatory action; and where paralysis is the consequence of lesions of the grey substance, in any limited part of the cord, reflex action is increased in parts receiving nerves from portions of the cord below the seat of alteration.

Examination of the brain and spinal cord, after death from hydrophobia, has failed hitherto in demonstrating any organic change in their structure. The great vascularity and pink hue noticed in their texture may be a consequence rather than a cause of the excited action of these organs.

In epilepsy, Schræder van der Kolk describes dilatation of blood-vessels;* and Dr. Lockhart Clarke has found disintegration of the surface of the fourth ventricle in the same disease.† In chorea, the same author has remarked extensive disintegration of the grey substance, and softening of the white.‡ According to other observers, the sensori-motor ganglia (the corpora striata and optic thalami) at the base of the brain, are the seat of this disease; and embolism of their vessels has been assigned as the actual condition to which it is due. These observations are remarkable, considering the usually curable nature of this affection.

On the other hand, my friend and colleague, Dr. Clapton, suggests that epilepsy is generally a blood disorder, and that it

* 'Spinal Cord.' Sydenham Society.

† Beale's 'Archives,' No. xiv, 1864.

‡ 'British and Foreign Medico-Chirurgical Review,' January and April, 1868.

is dependent on some chemical change, probably the slow abstraction of animal quinoidine from the system, and its substitution by some morbid matter which exerts its own specific influence on the nervous centres, and gives its peculiar character to the convulsive affection, whether tetanus, hydrophobia, or epilepsy. And he bases this conjecture on the peculiar effect of quinine in large doses—from five to twenty grains—if given in solution during the premonitory symptoms of an epileptic seizure, when they are of sufficiently long duration to administer the draught. In about fifty cases, in which this treatment was tried, it failed in four only; two of these were instances in which the fits followed injury to the head; one was a case of syphilis, and one of tuberculosis.

In connexion with this subject I may allude, incidentally, to an interesting circumstance mentioned to me by Mr. Erasmus Wilson, which seems to suggest the presence of a condition affecting the sensory nerves, analogous to those convulsive affections of the motor nerves which have been under consideration; and identical as regards its causative agency, if we may draw that inference from the efficacy of the remedy. Mr. Wilson has found some most aggravated cases of prurigo and pruritus yield to large doses of quinine, after every other form of treatment which suggested itself had been tried in vain; moreover, the relief proved to be permanent as well as speedy.

The facts which I have mentioned, both pathological and therapeutic, would seem to raise the question whether the morbid changes observed in the spinal neurine, in these convulsive affections, stand in the relation of cause or effect to the phenomena, presented by and characterising this class of diseases. We know that either epileptic or tetanic convulsion may be due entirely to central irritation, as where it is traumatic from the presence of a depressed fragment of bone; and also in some diseases of the brain and spinal cord; and the pathological appearances to which I have referred, as noticed in the tetanic cord, are similar in their nature to those which are observed in the slower disin-

tegration of the cord, in ordinary paralysis and in muscular atrophy: but, in locomotor ataxy, as Dr. L. Clarke has shown, the nature of the lesion is somewhat different, and is always limited to the posterior columns of the cord, and to the posterior grey substance.

If we assume that these convulsive affections are usually dependent on blood-poisoning—as they certainly are often influenced by endemic causes operating in conjunction with peripheral irritation—we may the more readily understand how, in certain instances, the malady may continue to be purely functional in all its attendant phenomena; but that organic change in the cord, dependent probably on the intensity and persistent operation of a diseased circulating medium, will react by producing an aggravation of the functional disturbance; and, further, that the disintegration of texture in the spinal cord, noticed in fatal cases of this class, is irrecoverable. On the other hand, in tetanus caused by peripheral lesion, the reflected agency seems to be so clearly established, that it is difficult to evade the conclusion that the central change in the texture of the cord is directly dependent on the peripheral irritation, and is itself the cause of that convulsion. Yet, this does not, in my apprehension, exclude the operation of some morbid condition of the circulation in the production of the disease. In the allied malady hydrophobia, the agency of a blood-poison seems scarcely to admit of a doubt. In this affection, as I have remarked, the cord does not exhibit any discoverable changes, similar to those which are noticed in tetanus; and it is an interesting fact that strychnine produces no morbid change in the cord: this I am assured by Dr. Lockhart Clarke is the result of experiments performed by him; and M. Vulpian also has shown that the spinal cord of frogs, kept in repeated convulsions by strychnine for a month, presented no change.* The phenomena of tetanus and those produced by strychnine are undistinguishable; but the causative influence is different. It seems, therefore, justifiable to infer

* 'Archiv. de Physiologie,' 1868.

that the mere occurrence of muscular spasm is insufficient, in the former case, to account for the morbid change in the texture of the cord.

I am disposed, from the foregoing considerations, to draw the following conclusions.

1. That these convulsive affections may all be dependent on blood-poisoning.

2. That the phenomena of rabies are distinctly due to this cause.

3. That even in traumatic tetanus the pathological changes in the cord are probably influenced by a morbid condition of the blood; but this progressive disintegration would appear to be the cause, and not the consequence, of the muscular spasm.

The condition of muscular fibre, which had been the subject of tetanic spasm, was first noticed, I believe, by Mr. Busk, and has been commented on by Mr. Bowman in the *Philosophical Transactions*.* These accurate observers found the fibres ecchymosed and ruptured, and presenting appearances of disintegration, "to such an extent that, in many parts, neither transverse nor longitudinal striæ could be discerned, but only a confused mass of primitive component particles, held together by the sarcolemma." This condition I have verified in an acute and rapidly fatal case of traumatic tetanus recently under my care, and it is shown in the accompanying woodcut,



from a drawing by Mr. Stewart, Curator of the Museum at St. Thomas's Hospital. The specimen is represented as magnified 300 diameters. I may further remark that, in this instance, the extensor muscles of the spine were deeply congested,

* Vol. for 1840, p. 490; and Vol. for 1841, p. 69.

and presented, in their cellular interstices, numerous broad patches of extravasation of semi-fluid blood and coagulum. The case ran its course in about seventy hours.

We have no very definite information as to the extent to which breach of texture of the cerebral substance may be repaired, and the mode in which such repair is effected. Yet there seems to be no reason why brain texture should be absolutely exceptional in this respect; indeed, instances of restoration of disturbed or interrupted function, after the lapse of time, would seem to indicate that repair is sometimes accomplished. But loss of texture, as in abscess, is not restored by reproduction of nerve-substance, as, in all probability, elementary degeneration, constituting organic change, is not supplanted by new and healthy neurine. In the rare instances in which abscess of the brain does not destroy life and heals, its walls become thickened and contracted; and with this and inflamed surrounding nerve-substance, a sort of cicatrix is formed; or the space is occupied by a portion of the contents of the abscess becoming mixed with chalky deposit.

In studying the phenomena which accompany and characterise the various diseases of the spinal cord to which I have briefly alluded, and the distinctions on which their diagnosis depends, it is difficult to resist the conviction, as I remarked at an earlier part of this Lecture, that a nearer affinity between them is manifested, as the physiology and morbid anatomy of the nerve-centre become better understood. There can be little doubt, I apprehend, that many of these affections, evincing even aggravated symptoms and having an eccentric or peripheral origin, are purely functional and therefore remediable; whilst others of the same class, as regards their source, are accompanied by organic change, and therefore resist treatment. But wherever these convulsive affections, whether tetanus or chorea, epilepsy or hysteria, are centric in their origin, and consequent exclusively on central irritation, the cause must be organic change; and recovery, as a rule if not invariably, is hopeless.

Gradual disorganisation of any portion of the spinal column, from slowly progressive disease, such as caries, is, in exceptional cases only, accompanied or succeeded by functional disturbance of the cord, and still more rarely by organic disintegration. Permanent loss of texture in the bone and the connecting fibro-cartilage between the vertebræ may entail great distortion, and yet the cord may preserve its functions intact. This destructive process attacks the bodies of the vertebræ and the intervening elastic texture which binds them together; and the superincumbent weight or position acts mechanically in inducing approximation of the adjoining bones, thereby excluding from the canal the disorganised tissues and pus, which find their way to the surface, either in the loins, or, guided by the sheath of the psoas muscle, at the groin. But, in more rapid cases paraplegia may ensue, and then becomes a diagnostic sign, in company with others, of the disease. The contiguity of morbid action, in such cases, to the anterior columns, explains the secondary affection of the nerve-centre; and the paraplegia is due chiefly to softening or fatty degeneration, similar to the changes which I noticed in a former lecture as occurring in the brain. When the destructive process extends more deeply, anæsthesia also supervenes.

Apart from these decisive proofs that the cord is involved, a distressing sense of tightness and pain, extending round the umbilical or epigastric region, is often complained of in caries, and is very characteristic of the condition of which I am speaking. It is almost constant in some cases, and is the principal source of suffering and complaint of the patient. This pain would appear to be due to pressure or irritation of the posterior roots of the nerves distributed to these parts, and of course manifested in their sentient extremities. But I have noticed the same condition in some instances of fracture of the spine, where the paraplegic condition has not been complete. Thus, it was present in a patient of mine whose cervical spine was fractured, and whose chief complaint was pain and tightness

across the epigastric region and round the abdomen, and also in the arms and between the shoulders.

I propose closing this lecture, and the present division of my subject, by some remarks on the propriety of interference by surgical operation in cases of fracture of the spine.

The analogy and close alliance between the functions of the brain and spinal cord, has led to the inquiry whether there are any diagnostic indications on which dependence can be placed, as a guide to the surgeon in entertaining the proposal to operate, for the purpose of relieving the spinal cord from irritation or pressure; whether there is any condition which can justify an interference so grave in its nature, that it may be regarded as more momentous, in all its risks and bearings, than the corresponding operation of trephining the skull.

This question must be viewed in different aspects, such as the following inquiries embody. What extent and character of lesion demand an operation: how can the surgeon satisfy himself of the nature of the injury and of its position: is it possible to relieve the condition for which the operation is undertaken: what are the risks of the operation: and what consequences beyond those intended may be entailed by interference?

I take it for granted that no surgeon would advocate the performance of an operation, which is to lay open the spinal canal, unless the symptoms are so pronounced as to leave no doubt that the cord is so far compressed or irritated, that there is no reasonable probability of its unaided recovery. The diagnosis in this respect may, no doubt, be affirmative in many instances; but whenever such is the case, I am unacquainted with any sign or symptom by which we can judge that the nature and extent of the injury is not such as to render an operation altogether abortive. This dilemma may result from the aggravated nature of the injury, amounting, perhaps, to complete disintegration or severing asunder of the cord; or it may be the consequence of the position of the injury, which is

inaccessible to the operator, as exemplified in a case I related in my former course of lectures, in which a spiculum of bone projected into the cord from the *front* of the canal ; and it must be borne in mind that, although fracture of the *arch* of a vertebra is by no means infrequent ; the injury sustained by the cord is rarely due to this cause, but to concurrent fracture with displacement of the body of the vertebra implicated. On the other hand, complete paraplegia is not necessarily an irrecoverable condition, even when accompanied by fracture ; the prospect of amendment depending on the nature of the lesion, and the extent to which the cord is disintegrated : and these are circumstances of which it is impossible to predicate positively, at such early time as an operation would be proposed. But, it may be urged, does not the doubt justify the interference ? This question must be answered by ascertaining what additional risk the operation entails ; and, in a proper appreciation of the attendant peril, we have, in my opinion, a practical answer to the inquiry.

The *end* proposed in an operation of this kind is, to remove displaced bone which is supposed to press upon or irritate the cord. But, as I have already remarked, however plausible, on theoretical grounds, such a proceeding may be, it is most likely to prove abortive from the inaccessibility of the displaced bone. Of the many cases of fractured spine which I have on record, and which I have examined *post-mortem*, I cannot recall an instance in which the depression of the arch *alone* sufficed to account for the symptoms. I am aware that such cases are recorded, but I speak only of my own experience, and therefore I conclude that they are rare. Yet, in such recorded fractures, which have been usually in the upper region of the spine, death has almost always supervened speedily ; thereby proving the serious and probably irreparable nature of the injury inflicted. The expanded form of the vertebral arch is not favorable to its simple fracture ; for such injury, with depression, could scarcely occur except as the result of direct violence.

That force directly applied to the back of a vertebra is likely to produce fracture of the spinous process I have already shown ; and fracture of the arch, as a sequence of fracture of the body, of a vertebra, and the result of overbending of the spine, is a typical form of injury—I should say the most common. But the direct violence which would suffice to fracture the arch and drive the spinous process into the cord, the body of the vertebra remaining unbroken, must almost inevitably prove hopelessly destructive to the nerve-tissue ; as is illustrated in a rare and interesting case recently recorded by Dr. Maccormac of Belfast ; in this instance, the cord, “had been compressed, almost to complete division.”

Again, the question of time is one which must necessarily press upon the surgeon, in contemplating such an operation. He must ask himself, is it justifiable to operate without waiting to ascertain the amount of permanent injury, which, in some instances, time alone can develop ? Yet, if an operation is to be performed, certainly delay diminishes any chance of success that may exist ; and thus the surgeon is compelled to risk the consequences of an operation which, if unnecessary, very seriously prejudices the prospects of a patient's recovery.

The mode of proceeding adopted by the advocates of this operation is, to expose and remove a part of the spinal column, and to open the canal containing the cord, perhaps to lay bare the cord itself. A simple fracture is thus converted into a compound fracture, and a communication is established with a canal having the most delicate and susceptible relations, and which must be liable to the intrusion of the products of inflammation during such period as the patient may survive the effort to repair the lesion. If the cord have been crushed, and the operation have been consequently useless, probably life may, thereby, be only curtailed ; but if (as must be presupposed for the operation to have a chance of success) the cord be not crushed, it appears to me that the best chance of the patient's recovery is thereby extinguished. Indeed, my conviction is

that the operation has been advocated on the erroneous hypothesis that the spinal cord can be compressed, without serious disintegration of its texture. I believe this is scarcely ever the case, unless such pressure result from extravasation of blood—a condition which, if it could be ascertained, certainly would not justify the risk of an operation. In the majority of instances, probably, the amount of compression witnessed in a *post-mortem* examination, is but an inadequate measure of the disintegrating force which was applied, at the time the column snapped under the violence to which it was subjected;—violence sufficient not only to fracture the arch, but to break through the bodies of the vertebræ, or to wrench asunder the tough intervertebral substance which connects them together.

It is true that cases are recorded in which amelioration of symptoms is attributed to an operation. But are such indications to be depended upon? Unfortunately this is a class of cases in which it is almost impossible to affirm what is due to operative interference, as we cannot estimate or limit the amount of improvement which might have followed if no operation had been practised.

Certainly instances occur from time to time, as I have witnessed, in which injury of a very unequivocal character, especially in the lower region of the spine, has not been followed by the result which the decisive symptoms seemed to foreshadow. Life has been protracted, and even great amelioration in the general condition of the patient has occurred, though without any marked change in the paraplegic condition. The management of a patient, under these circumstances, is all-important, and is very influential in protracting life. Rest in a suitable position and on an appropriate couch; attention to the bladder and bowels, as well as to the diet and cleanliness of the patient, should be the constant care of the surgeon; and will accomplish much which might be attributed to an operation where the same advantages had not been so scrupulously secured previous to such interference.

As regards the diagnosis of the nature and extent of the lesion, my own experience affords me no certain or reliable diagnostic guide, except the completeness of the paraplegic condition. I cannot say I place dependence on the activity of the excito-motor phenomena, as developed in an inverse proportion to the amount of damage to the compressed cord: frequently in the most serious and irreparable lesions, the excited muscular movements are by no means strikingly marked; indeed they are often almost in abeyance.

A parallel has been drawn between the consequences of pressure from the presence of purulent deposit external to the theca vertebralis, and that resulting from traumatic lesion; and also between the effects of curvature from caries and the sudden distortion of the spine from violence. I think such parallel in either case is unreal. I do not deny that traumatic pressure on the cord without contusion of its structure or intrusion within its theca, may be relieved, and suspended function be restored, by removing such pressure. But there is a vast difference between the slow and gradual encroachment on the cord by an abscess, or by the yielding curvature of progressive caries, and the sudden and violent consequences of fracture with depression of bone, or of distortion from the same cause. Indeed, recovery from the consequent paraplegia in the former class, when the cause ceases to be operative, and the generally speedy death which ensues in the latter, prove this contrast. There is not necessarily organic change in the one instance; but in traumatic pressure, even where there is no change apparent to the naked eye, the microscope reveals organic lesion as the consequence of violence, and hence the fatal result. But if the pressure be due to extravasation of blood, this may be absorbed; and in such cases an operation would greatly diminish the patient's chance of recovery.

The only supposable form of spinal injury which, in my opinion, might be benefited by operation, is a fracture of the vertebral arch alone, with limited depression, or the recent

intrusion of a spiculum of bone within the theca, whereby the cord is pricked and irritated. But where are these cases to be met with, and how are they to be recognised?

I fear we must abandon this operation. I have seen it performed on three or four occasions many years since, but certainly not with such results as to induce me to repeat the experiment: and the recorded advantages of more recent cases do not impress me more favourably. Even admitting, as I have admitted, that certain special features might justify surgical interference, I believe that they are rare, and very difficult of diagnosis, if not absolutely impossible to identify. I am satisfied that the risks attending an unnecessary operation are great: and, in balancing these risks against the possible good which may be accomplished in isolated instances, my conviction is that the preponderance is decidedly in favour of non-interference. I am aware it may be urged that any risk is justifiable where a patient's condition is hopeless. But, I rejoin, how are we to identify the absolutely hopeless cases? Some linger on a long time, and even partial recovery is occasionally witnessed under favouring circumstances; and it is precisely these cases in which interference is likely to prove mischievous, by extinguishing the prospect of spontaneous repair, and the chances in favour of the patient's recovery or protracted survival: for, it can scarcely be alleged by the advocates of this operation that, if unproductive of good, it is harmless. To weaken still further the remaining connexions of a broken spine; to convert a simple into a compound fracture; to expose the sheath of the cord and possibly the cord itself; and to entail the risks attending the period of repair,—cannot be regarded as circumstances of indifference. Accidentally, here and there, an instance may occur in which benefit does, or seems to, result from surgical interference; and the time may arrive when, perchance, the means of diagnosis at our command may enable us to judge with more precision of the nature and extent of the injury inflicted: but at present,

with every disposition to regard this subject impartially, and to give their due weight to the arguments and facts which have been advanced in favour of this operation, I cannot regard trephining the spine as brought within the pale of the justifiable operations in surgery.

LECTURE VIII.

LESIONS OF THE THORACIC VISCERA.

Liability of the Chest to Fracture.—Fractures of Sternum and Ribs.—Various Consequences of Injuries of the Chest-walls.—Shock, consequent on Injury of the Chest.—Wounds of the Lung; how caused; their Signs, etc.—Emphysema: Pneumo-thorax.—Pulmonic Hernia.—Rupture of Lung.—Hydrothorax and Empyema.—Concussion and Contusion of the Lung.—Penetrating Wounds of the Lung.

MR. PRESIDENT AND GENTLEMEN,—In civil practice, traumatic lesions of the thoracic viscera are comparatively infrequent and even the hospital surgeon has but rare opportunities of witnessing wounds of the heart or lungs, unless in such a form, or of so complicated a character as to involve speedy if not immediate dissolution. The exception to this remark is in the case of such pulmonary lesions as are occasionally entailed by fracture of the ribs or sternum, of which I shall speak presently. That the class of injuries to which I refer is so commonly fatal, is explained by the immediate importance to life of the thoracic viscera, hæmorrhage or suffocation often anticipating the more dilatory, though scarcely less destructive, consequences of inflammation. Yet remarkable cases present themselves from time to time, in which this expected result is not realized: and although the nature of the lesion is generally well defined, and clearly indicated in most instances by the symptoms or signs which are present, in some exceptional cases the diagnosis is obscure, and a careful analysis of all the circumstances attending the hurt and its consequences is required, in order to

form a probable estimate of the actual condition and prospects of the patient. The prolongation of life under necessarily mortal injury is not infrequently of great moment, even in a temporal point of view. The identification of an assassin, the communication of some important information, the arrangement of worldly concerns, may depend on a correct diagnosis and the means employed to delay a fatal issue.

In contrasting the relative liability to injury of the thoracic organs, and those of the head and pelvis, we find that the source or immunity is due to different causes ; the arched and vaulted form, and the solid, resisting walls of the latter, constituting that protection which is afforded by the yielding and elastic parietes of the former. Each constituent element in the skeleton of the chest is possessed of this pliant quality, either in its own proper construction or derived from its relation to the other parts. Although the individual vertebræ are rigid, the central column which they collectively compose is flexible by virtue of the tough fibro-cartilage which binds the several bones together. The flat plates of bone which constitute the sternum are so designed, from their obliquity of relation to the cavity they help to enclose, as to afford protection against the consequences of direct violence ; but this attribute is greatly helped by the elasticity derived from the connexion of the breast-bone to the costal cartilages. The ribs themselves are essentially elastic, but are rendered much more so by the interposition of the cartilages between their extremities and the sternum, which is the common bond of their union in front. This property of the chest-walls is physiologically essential, to admit of the varying capacity of the cavity during respiration : but it also subserves, in a remarkable degree, the purpose of securing the viscera from the consequences of external violence.

When the sternum is fractured, it is very rarely the result of direct force ; and if such should be the case, the ribs are almost always seriously implicated in the injury, and thus attest the extent and character of the violence which was competent

to produce such an effect. Simple transverse fracture of the sternum is caused by forcible flexion of the spine ; it is bent in its long axis, and gives way usually near its centre. In many instances the strong ligaments in front and behind are only partially torn, and then the diagnosis of the fracture is obscure, and its existence is inferred rather from the nature of the causative accident and from the suffering of the patient, than from the presence of the usual signs of fracture. In some instances, however, fracture is produced by direct violence, as occurred in an omnibus-driver recently under my care. Whilst standing on the steps of his vehicle, a cart backed against him, and, as my dresser's report states, he was jammed against a small step above, and quite twisted round. The sternum was broken across in its upper third, and the right clavicle was dislocated forwards at its sternal end. He suffered from some dyspnœa at first, but recovered without any other untoward symptom.

I recently met with the remark, in a modern French author, that this injury (fracture of the sternum) is rare ; and that, when it occurs, it is usually attended by serious visceral and vascular complications. The result of my own experience is the converse of this. Fracture of the sternum, though not very common, is by no means a very rare, accident ; but it is in very few instances, where the fracture is simple, that I have seen any visceral complications to excite even uneasiness. Indeed I may say that, unless the costal cartilages or the ribs themselves give way, it is, mechanically, improbable that any serious organic lesion could result ; inasmuch as displacement of the broken bone is prevented by its lateral relations, so long as they retain their integrity. But, it must be admitted that the more complicated form of fracture with organic lesion is not infrequent ; torn pleura, wounded and collapsed lung, with their usual concomitants, entailing speedy death. In like manner, simple fracture of the spinal column very rarely injures the heart or

lungs, which are protected in either instance, severally, by the mediastina.

When the ribs are broken the case is different, though only exceptionally so. This injury is, in my experience, far more frequently the consequence of indirect than of direct violence: the bone is bent, as in fracture of the spine, beyond its power of resistance, and then snaps. It is this mode of fracture which is the security, in most cases, against injury of the lung. Fracture from indirect violence may, no doubt, cause laceration of the adherent costal pleura; probably it does so in most instances where there is displacement of the fractured ends; and local pleurisy, with its attendant short cough, is the consequence. But this does not entail wound of the lung; the resiliency of these organs permits them to yield to the encroachment, and secures them from lesion, the adjoining surfaces of the serous membrane soon becoming glued together by plastic deposit. When a rib is broken at the point of impact of an extraneous body, the bone, instead of being fractured outwards, is driven inwards, and the lung is thereby often wounded. This frequently occurs in drunken broils, when a fallen combatant is kicked in the side. The diagnosis of this injury is generally very simple, inasmuch as the escape of air into the areolar tissue is apparent to the touch or sight: and the far more serious extravasation into the pleura is indicated by unmistakeable signs and symptoms.

The higher the fracture, the more serious, generally, is the injury. I have a record of several cases in which the first and second ribs were fractured: and these injuries have been mortal, in consequence of the lung being wounded. When the fracture is quite low down, involving the last two or three ribs, the chest rarely suffers; but the abdominal symptoms assume a prominence which clearly manifests the implication of these viscera in the mischief. This circumstance I shall have an opportunity of exemplifying hereafter.

The experience of civil practice, as I just now remarked,

necessarily limits our practical acquaintance with those more formidable injuries of the thoracic viscera in particular, which are the consequences of penetrating wounds by sharp-pointed instruments or shot ; for, except in this way, instances of deep wounds of the chest are rare. Thus, hæmorrhage to any alarming extent, from the lung into the pleural cavity or into the tissue of the organ itself is, so far as my observation has enabled me to judge, scarcely ever met with. Limited hæmoptysis is not infrequent, resulting from puncture of the lung by a broken rib ; but it is rarely of a character to excite anxiety, except as an indication of the nature of the lesion, and that it entails a local hyperæmia, which may extend. Yet, such topical manifestation of traumatic inflammation is usually limited to the precincts of the injured part ; and I have very rarely had to treat pneumonia in these cases. If present, this condition is revealed by the usual stethoscopic signs ; and we must not trust alone to the rust-coloured sputa, cough, and febrile excitement, which may, and usually do, accompany inflammation limited to the vicinity of the lesion, and are simply expressive of the salutary effort by which repair of the mischief is inaugurated.

Blood-tinged expectoration is not infrequent, after the lapse of two or three days, and without the presence of any signs of pneumonia. In such cases, lesion of the lung, from contusion or laceration, may be inferred ; the extravasated blood is mixed with and dissolved in the mucus, and thus ejected by coughing. But the presence of frothy and bloody sputa, in any quantity, may reasonably excite suspicion that the lung has been torn more deeply.

I have remarked that profuse hæmoptysis is of very rare occurrence in such injuries of the chest as are encountered in civil practice. The following case was supposed, during the life of the patient, to be one of these exceptional instances ; and my reason for quoting it is, that the special feature of the case was delusive, as regards the diagnosis of its source, and that its presence was purely accidental. A carman, of middle age, fell

from a high van, the wheels of which passed over his chest. Several ribs of the left side, the upper six as was afterwards ascertained, were fractured; he had external emphysema, and apparently the same condition of the lung, for there was increased resonance, with faulty breath-sounds and slight crepitation. He rallied from the shock, and was going on tolerably well until the eighteenth day, when he suddenly brought up a pint and a half of scarlet blood, which, as it was pure, was supposed to be from the lung. Broncho-pneumonia existed at this time over the whole chest. A second loss of blood, two days later, proved fatal. At the *post-mortem* examination it was found that this blood was derived from an ulcer in the stomach, opening into the coronary artery.

Wounds of the parietal vessels—the intercostal and mammary—are scarcely ever met with; or, if they occur more frequently than I suppose, it is without the presence of such signs or symptoms as might be expected. Any accumulation of blood within the pleural cavity would be rendered apparent by the attendant dyspnœa and the dulness on percussion, with the absence of respiratory murmur at that part of the chest to which the blood gravitates, and where the lung is consequently displaced; but this complication is of very rare occurrence.

The position of the intercostal nerve renders it probable that it is often, if not usually, pressed upon or injured by the displaced rib, especially when the fracture is far back. I believe that the acute pain, the catching respiration, and short cough, accompanying this accident, are due in a measure to the implication of the nerve in the way described.

The *Shock* which attends the injuries to which I have referred is usually of a transient nature, and referable rather to the general violence or agitation accompanying them than to the local lesion. The reaction is proportionately moderate, and is almost always attended by a short and troublesome cough, which much distresses the patient, and requires tranquillising

remedies to palliate. But occasionally contusions of the chest, when severe, though unattended by fracture, may entail the collapse of severe shock. Thus, in a lad under my care, who was crushed under a falling cart, the weight of which rested on his chest, the collapse was profound, although his entire recovery in a few days proved that there could have been no organic lesion. The local pain, with cough and distress in talking, were exclusively referred to the chest. The lungs had been forcibly compressed; and his condition is accounted for by the functional derangement of these organs, consequent on congestion, as I shall presently explain and exemplify.

Wound of the Lung, in fracture of ribs, is the consequence of the penetration of the organ by the depressed and jagged fragment. So commonly is this complication caused by violence applied directly to the seat of fracture, that the character of the accident may be almost certainly predicted from the presence of the unequivocal signs denoting the organic lesion. Thus, a severe blow received on the ribs, a heavy fall on the side, or the passage of the wheel of a vehicle over the chest, commonly produces this effect, by forcing the broken bone inwards beyond the resisting capacity of the lung:—a property due, partly, to the natural elasticity and resiliency of the organ, and in part to its compressibility by parting with its air. The blow, therefore, which produces this injury must be sharp and circumscribed, or of a nature to compress forcibly the whole walls of the chest. This explanation accounts for the fact that, when the lung is wounded, we so commonly find two or more ribs broken; or, if the injury be limited to one rib, the displacement, from laceration of the connecting tissues, is more obvious than where such fracture is the consequence of overbending of the rib.

The ordinary and pathognomic sign, by which superficial laceration of the lung is characterised, is the escape of air from its tissue. This may occur in two ways: either by extravasation into the subcutaneous areolar tissue, or by accumulation in

the pleural cavity. Although such lesion cannot occur without some laceration of the vessels, I have observed that the presence of blood in the sputa is by no means a necessary concomitant of the escape of air. Probably such extravasated blood passes into the pleural cavity; certainly it is rare to find ecchymosis beneath the skin in the neighbourhood of the fracture. The condition which favours one or other form of escape of the air—which determines whether it be emphysema or pleural extravasation—would appear to be purely mechanical; viz., the correspondence or otherwise of the wound in the lung with the wound in the costal pleura. Such coincidence may be due to the existence of some old adhesion between the adjoining surfaces of the pleura, a circumstance which any one familiar with *post-mortem* examination must be aware is very common; or it may be determined by the degree of distension of the lung at the moment that the fracture occurs. If the wounded lung recede from the position it occupied at the time the injury was inflicted, the breach in its texture is valvular in relation to that of the reflected pleura; and the escape of air, if there be any, is into the pleural space. Probably the occurrence of this form of effusion is not infrequent, when to such a limited extent as not to attract attention; and it may, in part, account for the dyspnœa which characterises, more or less, all these fractures; whilst it is not sufficient to be manifested by signs whereby it is readily recognised when more developed. No doubt such limited pneumothorax is favoured by previous adhesions in the neighbourhood of the wound, if they be not an essential condition of its occurrence.

Circumscribed *Emphysema* is common, and creates but little anxiety, either on account of its presence, or of contingent inflammation in the wounded lung. There is no limit to the extension of such extravasation, except the plastic sealing of the lesion, and the consequent arrest of the escape of air. Even more general emphysema is not, by itself, necessarily an alarming symptom; but if it spread rapidly, this sign may be accepted as

a measure of the gravity of the injury to the lung. Yet I have seen many instances in which air has been diffused over the trunk, face, and extremities, without the subsequent manifestation of any symptoms of pneumonia.

The peculiar crepitation which, on pressure, is indicative of the presence of air in the subcutaneous areolar tissue, may, under certain circumstances, be a source of obscurity, or even of error, in diagnosis. Whenever extravasation is so limited as to have been overlooked until the ear or the stethoscope is applied to the chest, the sound elicited may be mistaken for the crepitation of pneumonia; under any circumstances, superficial emphysema seriously interferes with a satisfactory examination of the lung, until the air is carefully pressed out and excluded from the spot to which the stethoscope is applied. I have realised the embarrassment to which I allude, and, therefore, have mentioned it; probably the obscurity was due to my unpractised surgical ear.

Of accumulation of air in the pleural space—*Pneumothorax*—I have had some few cases under my care where the signs and symptoms were well-marked, and indicated an amount of pressure on the lung which almost entirely suspended its function for a time. The loud resonance of the affected side of the chest with absence of breath-sounds, and accompanied by dyspnœa and a livid tint in the face, indicating imperfect oxygenation of the blood, characterise this condition. The distension of the pleural cavity may even thrust aside the pericardium and displace the heart. I have stood by the bedside, with the instruments ready to perform paracentesis if requisite; but I have never found it necessary in this condition. The fact is that the actual mechanical relations of the affected part, at the climax of the mischief, constitute the essential condition of its relief. When air ceases to enter the lung, it can no longer be pumped into the pleura; the wounded lung has rest; and plastic lymph closes the lacerated opening. The extravasated air is gradually removed; and, *pari passu*, the

healed lung resumes its function. The observed condition of the patient coincides with this explanation ; viz., increasing dyspnœa to an alarming extent ; the continuance of this condition for a period not very prolonged ; and then gradual subsidence of the abnormal signs and symptoms. In other cases, probably by reason of adhesions, the encroachment on the lung stops short of this extreme compression.

In my experience, emphysema, except to a limited extent around the fracture, does not usually occur with pneumothorax. The mechanical relations to which I have referred, account for the absence of one form of extravasation when the other is present ; the following case, however, exemplifies this complication. J. F., aged 43, was admitted under my care about five years since, having fallen from a high cart on to a heap of stones. He did not complain much of his chest at first, having a severe contusion of the hip, which gave him great pain. But in the evening, some emphysema made its appearance over the right side. On the following day, when I saw him, the emphysema had extended over a considerable space, and quickly spread to the neck. The breath-sounds were indistinct towards the lower part of the right side, whereas the resonance on percussion was increased. On the third day the emphysema had extended still further, but there were no general symptoms to create uneasiness. On the fourth day, the breathing became oppressed, the pulse quickened, and the face flushed. The resonance of the right side had diminished, so as to be less than that of the left, and the breath-sounds were still indistinct and there was some cough. Dr. Bristowe saw the case with me at this period, and agreed with me in regarding the pneumonia as local. All the symptoms gradually subsided, and the patient ultimately recovered. I find the following remarks in my note-book appended to this case. In this instance the lung was wounded by the broken ribs being driven in upon it ; air was extravasated into the areolar tissue ; and the increased resonance of the affected side, combined with partially suppressed breath-

sounds, indicated the further complication of extravasation of air into the pleura. When pneumonia seemed imminent, the diagnosis was obscured by the lung receding from the chest-wall as air accumulated in the pleural space; and the pneumonic crepitation was masked, and confused with the superficial crepitation in the areolar tissue—a source of perplexity which was in great measure removed by pressing the air away from the part to which the stethoscope was applied. With the dyspnœa and fever came diminished resonance of the affected lung. The absence of coloured expectoration, and the character of the cough, aided the diagnosis in this complex case.

Occasionally, in severe injuries of the chest, we have the opportunity of witnessing the state of collapse of the lung produced by pneumothorax; and it is remarkable to what an extent the organ is shrunk from the uniform compression; how effectually the air has been pressed out of it, and how shrivelled it appears. I have no recollection of paracentesis for pneumothorax ever having been performed in St. Thomas's Hospital since I have been connected with it; therefore, I conclude it can rarely be demanded. The temporary inconvenience caused by emphysema scarcely ever justifies interference. In one case only do I remember to have observed relief from evacuation of the air; and that was in a child in whom the emphysema was almost general.

What becomes of air thus extravasated? How is it removed? There is no doubt that, whether in the pleura or areolar tissue, it sometimes disappears with surprising rapidity; yet, as far as I can gather, there seems to be but little, if any, accurate knowledge as to the mode in which it is removed. This question would appear to be influenced very much by the nature of the gas which has accumulated, whether it be common atmospheric air which had passed into the tissue from without, or the product of chemical decomposition within. Yet the issue is, in reality, but little affected by these different con-

ditions ; for the habitudes of the gases are so similar in relation to this point, that, whatever their nature, their removal must obviously depend upon exactly the same kind of action, differing only in degree. Absorption is the agency to which such removal is usually attributed ; but probably this process is accomplished only after the gas has been gradually dissolved in the fluids of the parts ; and both physically and physiologically this view appears to be reasonable. The permanent gases are all of them more or less soluble in water ; some to a much greater extent than others, but all are subject to the same law. Gas dissolved in water is so incorporated therewith, that under any ordinary circumstances absorption of the liquid implies absorption of the gas.

According to the circumstances under which they are produced, the gases present may be a combination of oxygen and nitrogen, or of carburetted and sulphuretted hydrogen. The extent to which these gases are soluble in water varies extremely. Thus, 100 cubic inches of water dissolve 300 cubic inches of sulphuretted hydrogen, and only two inches of nitrogen, the relative solubility of the four gases being as 1 to 24, 65, and 120. The low solubility of nitrogen would, according to the supposition named, require a longer period for its absorption ; whereas sulphuretted hydrogen should be much more rapidly removed ; or, in other words, a much longer time would be required for the absorption of atmospheric air, than that of gas, the product of decomposition ; a circumstance which may throw some light on the obscure subject of blood-poisoning, where the conditions for the disengagement of sulphuretted hydrogen are favorable. Yet it would be difficult to erect, out of this comparison, any principle of diagnosis upon which dependence can be placed ; for, in the case of atmospheric air, usually the extravasation takes place in a definite time, and is not renewed ; whereas, in the case of gas disengaged by decomposition, the producing elements, in the form of disorganised tissue or fetid fluid, being still present, there is no

limit to the production of fresh gas, as that which exists is removed.

Before quitting the subject of injury of the thoracic viscera, accompanying fracture of the ribs, I may remark that I have seen one, and but one, instance of a wound of the heart from this cause. I shall again refer to this case in a future lecture.

Hernia of the lung may occur, when there is such a breach in the chest from accident, as to permit it; or if the diaphragm be ruptured so as to allow of the escape of the abdominal viscera into the pleural cavity. This latter form of injury I have seen, *post-mortem*, in rapidly fatal cases; but I have never had the opportunity of diagnosing it during life. No doubt, the laceration of the diaphragm is the most serious element in such a lesion: to this I shall again refer. Of pulmonic hernia I had an interesting instance under my care about a twelve-month since; and, as the case is a good exemplification of this form of injury, as well as of emphysema, I will quote it.

D. B., aged 39, a salt-hawker, with very defective vision, was knocked down in the street by the pointed shaft of some vehicle striking his chest on the right side at the upper part. He was immediately brought to the hospital. On admission, there was some degree of shock; his respirations being 20, and his pulse 92, in the minute. On examining the seat of injury, a peculiar appearance was witnessed. At each inspiration, a large tumour, of the size of the doubled fist, presented itself below the clavicle; and this disappeared at each expiration, leaving a deep depression, capable of containing a couple of ounces of fluid, at the least. On digital examination, I found that a large gap in the chest wall corresponded to the site of this alternating swelling and depression; and its position indicated that this was due to the absence of the second rib, at or near to its attachment to the sternum. The cartilage of this rib had, in fact, been displaced and driven in. There was no emphysema whatever at this time, and the patient did not suffer

from dyspnœa. The chest-sounds were perfectly normal, and there was distinct crepitation in the tumour. On the following morning, the right side of the neck and chest began to show signs of emphysema; and there was a noisy musical sound, during the filling and collapse of the tumour, which was now reduced to the size of an orange. There was also acute pleuritic pain near the seat of injury, but no sign of effusion into the pleural space. There was some congestion of the face; but the lips were well injected. He began to cough; and his pulse had risen to 112, and his respirations to 26. Temperature normal. The emphysema prevented me from using the stethoscope satisfactorily. A few ounces of blood were taken from the arm. On the third day, there was less congestion of the face; but his pulse was quick, and his cough was troublesome. There was loud rhonchus over the right side of the chest, and friction-sound was audible at the lower part. I ordered that a light pad should be applied over the injured part. The emphysema had by this time extended to the trunk, face, and limbs, reaching to the right forearm and knee. He spoke with difficulty, and was easier when laid on the left side and raised in bed. On the fifth day, he was greatly improved in every respect; and the swelling no longer appeared as previously when the pad was removed, though there was an alternate rise and fall at the injured part, synchronous with each inspiration and expiration. On the eighth day, the friction-sound had disappeared; but there was relative dulness generally over the left (opposite) side of the chest, the right being more resonant. Expectoration scanty, and slightly tinged with blood; emphysema diminishing, though still distinguishable in the groins, arms, and face. Gradually, and with many fluctuations, these symptoms subsided; and, at the end of six weeks, the patient was convalescent. The only abnormal sound to be heard over the chest was some dulness on percussion just below the seat of injury. The gap remained, but presented to the touch more consistence than at first. Some plastic deposit evidently

occupied the space ; and the impulse of the distended lung during inspiration was scarcely perceptible.

Many points of interest, bearing on the diagnosis, present themselves in considering this case. The alternative of our having to deal with circumscribed emphysema of the areolar tissue naturally suggested itself, but was rejected, on account of the strictly defined limits of the tumour, and the absence of any tendency to diffusion of the air beyond its boundary, until after the lapse of some hours, and then very gradually so. The lesion was followed by an attack of acute pleurisy and some pneumonia. The relative resonance of the two sides suggested to my mind the probability of there being some air in the injured pleura ; yet the interval of a week renders such an occurrence very exceptional. The displaced fragment of rib must have retained its abnormal position, for it could not be felt.

I have never seen pulmonic hernia resulting from wound of the thoracic walls : indeed, the foregoing is the only case of external hernia of the lung that has come under my observation.

Rupture of the lung from compression of the walls of the chest is occasionally met with ; but I do not remember to have seen this occurrence unaccompanied by fracture of the ribs. Yet the absence of displacement of the broken ends of bone points to compression as the cause of lesion of the lung, as in the following instance. A young man was crushed between the shaft of a cart and a wall, the shaft striking him between the inferior angle of the right scapula and the spine. He was in a state of pulseless prostration when admitted, and continued so during the forty hours that he survived. Dyspnœa was increasingly distressing ; and emphysema had extended from near the seat of injury in the back, over the entire trunk. A large rent was found across the right lung ; and the corresponding pleura contained a quart of blood. The sixth, seventh and eighth ribs were broken near to their angles, but had not penetrated the lung.

A similar condition was manifested in a child under my care, who was run over, and survived the injury only a few hours. The lower lobe of the right lung was torn almost across, and the pleura contained nearly a pint of fluid blood. It is a remarkable circumstance that in this instance, although some ribs were broken, the pleura was not wounded.

The presence of *hydrothorax* or *empyema*, if they occur as sequences of injury of the chest or of its contained viscera, is manifested by the indications which characterise these affections when consequent on inflammation from other causes. Although these conditions have rarely a traumatic origin, the surgeon should be alive to the possibility of their occurrence after acute pleuritis and pleuro-pneumonia; and the disinclination of the patient to lie on one side, the absence of vibration in the walls of the chest on the affected side when speaking, displacement of the heart, loss of symmetry in the chest-walls, and, notably, bulging of the intercostal spaces, would suggest the presence of fluid, even without the aid of the stethoscope. Yet the above signs may be more or less obvious when the pleura is not the seat of mischief, as I shall have occasion to exemplify, in a future lecture, by a remarkable instance in which an enormous cyst was developed below the diaphragm, and in its growth thrust aside all the viscera, both abdominal and thoracic, in its neighbourhood.

May the lung be the subject of *concussion* or *contusion*? I think this inquiry may, in both instances, be answered in the affirmative. Indeed, I have seen instances which might, on first view, be regarded as suggestive of contusion by *contre-coup*, or, at least, of seriously disturbed function in the lung on the opposite side of the chest to that on which the violence to the walls had been inflicted—a result which I shall endeavour presently to explain. It is true that, in many instances, such consequence is due to squeezing of the whole chest, and rending of the suddenly compressed vessels. This would appear to be the explanation of many of those apoplectic clots which are

observed in *post-mortem* examination of injuries of this class. Yet other cases which have come under my notice compel me to believe that simple functional disturbance of the lung may occur as the consequence of force applied, without mechanical lesion ; and also that contusion and other results of the violence inflicted are met with occasionally, as indirect effects of such violence.

I do not believe that bruising of the lung, the chest-walls retaining their integrity, is a frequent accident ; for its own resiliency and elasticity are its protection. And, when it does occur, I am unacquainted with any special diagnostic sign by which to recognise it—apart, that is, from the general indications of disturbed function, and possibly local pneumonia ; unless we may accept as evidence the secondary expectoration—usually after the lapse of forty-eight hours—of blood-stained mucus, where no pneumonia exists. There is, however, no doubt that such lesions as those I refer to may cause local or even general pneumonia, as a consequence of the excessive action excited in the necessary effort to repair the mischief which has been inflicted.

But contusion of the chest-walls, without puncture or external wound, may entail more serious local consequences. Thus, I am acquainted with a case in which a blow from a fist was succeeded by acute local pneumonia, which terminated in abscess, and proved fatal. Similar consequences may be caused by suppurative inflammation, entailed by injury or operation in close proximity to the pleura, without perforation of that membrane. In these instances, I presume that inflammation extends, by contiguity, to the pleura and lung. I may remark, that a congested state of the lung is a not infrequent sequence of a practice which is now, happily, becoming obsolete : I mean pugilistic encounters, in which the chest is often sorely bruised ; and thus the foundation of organic disease is laid, which has frequently proved fatal to those addicted to this practice.

The influence of previous disease, or of chronic functional disturbance in the lungs, should be taken into account in the diagnosis of these injuries and their consequences, and more especially in the prognosis in this class of cases. Such instances are of every-day occurrence in our hospital practice. For example, a bricklayer, fifty-eight years of age, was admitted under my care, having fallen from a height on to his chest, and fractured three or four of the upper ribs on the left side. He had been the subject of chronic bronchitis for a long time. He survived for a week, suffering severely from dyspnœa and inability to expectorate; and pneumonia, with prostration, supervened shortly before death. Recent pleurisy on the right side, with consolidation of the corresponding lung at its upper part, was found. The heart was large, and the left ventricle dilated. In this instance, the opposite lung to that injured was specially involved in the after-consequences.

How are we to explain the phenomena presented by the following case, which is simply typical of many that I have witnessed? A lad, ten years old, was admitted under my care last year, having been run over. There was profound shock, and the breathing was difficult and hurried. There were no marks of bruising on the chest, but the movements of the left side were impeded. There was no fracture; but auscultation detected loud bubbling sounds, as of air passing through fluid; the resonance was diminished. On the right side the respiration was puerile; there was no expectoration. The boy was well in a fortnight.

In the first place, I may observe that this case exemplifies my remark, that serious functional disturbance may ensue as the consequence of mechanical violence, whereas a rapid recovery leaves us no alternative but to conclude that the lung has escaped organic lesion. But in this instance there were abnormal breath-sounds, with impaired movement on the left side, and puerile respiration on the right; or, in other words, partially suspended function in the former, and excessive activity

in the latter. The explanation would appear to be that the left lung sustained the shock, and thus threw the burden of the work on the right—a partially paralysed state of the former, and congested hyperæmia of the latter, being the result. It is in this way alone, I think, that we can account for the apparently paradoxical phenomena which we often witness in these injuries; viz. temporary paralysis of one lung entailing engorgement of the other; for, it must be remembered that a retarded circulation through one set of pulmonary vessels does not diminish the column of blood discharged by the right ventricle into the pulmonary artery; and the process of combustion is disproportioned to the quantity of combustible material supplied to one lung, which is thus surcharged with blood; and the labouring heart is also involved in the disturbance. Of course this condition may issue in acute inflammation, where such predisposition exists, but it generally subsides spontaneously, or may be relieved by local depletion.

The following case is one of peculiar interest, from the remarkable condition of the chest which supervened after severe concussion of the whole body:

J. H., a lad 12 years of age, was admitted into the hospital under my care about three years since. He had fallen about forty or fifty feet; but, with the exception of some bruises about the trunk, the only discoverable injury was a fracture or separation of the epiphysis of the humerus; the shock was moderate. On the day following that on which the accident occurred, I found him with a flushed face, and hurried and oppressed breathing; but, though the dyspnœa was urgent, there was neither lividity nor coldness of the lips or of the extremities. The heart's action was forcible and frequent, but the sounds were normal. Over the left side of the chest there was entire absence of resonance on percussion, and of breath-sounds, and indeed of any sound but the heart's beat, except, perhaps, the feeblest murmur just below the clavicle. The vocal thrill was equally distinct on both sides. On the right

side there was normal resonance on percussion, and the respiration was distinctly audible—indeed, puerile. There was neither cough nor expectoration. Four leeches were applied over the upper part of the affected lung, with almost immediate relief. On the following day the boy was breathing quietly; and in less than forty-eight hours all the above symptoms had disappeared, and the respiratory sounds, on auscultation and percussion, as well as the heart's action, were found perfectly normal.

The condition of this patient seemed so anomalous that I sought the assistance of Dr. Clapton, who was in the hospital at the time, and he entirely confirmed the diagnosis, or rather the presence of the signs I have mentioned; although he was at a loss, like myself, to account for them satisfactorily. The absence of pain, and the continuance of the costal movements, showed that there was no consolidation; indeed, the suddenness of the attack forbade that supposition. The entire left lung was the seat of suspended respiration. The extremely excited action of the heart appeared to indicate serious obstruction in the pulmonary circulation; and the result of the treatment points in the same direction. The lung was paralysed from shock, resulting from the violence done to the chest in the fall; and reaction was accompanied by engorgement of the pulmonic capillaries, due, probably, to the still suspended function of the vaso-motor nerves.

The conclusions I draw from these and similar cases are, that serious functional derangement, without organic lesion, may result from contusion or concussion of the chest; that this derangement may occur without any injury to the thoracic walls; and that it may be transient and subside without any ulterior results: but that, on the other hand, the disturbance in the circulation may be succeeded by inflammation, either local or general, of the affected lung. The vascular disturbance to which I refer appears to be a partial arrest, or retarded flow, of blood in the capillaries, giving rise to engorgement or congestion

—not as the consequence of excess in the supply, but of a passive condition of the vessels, which fail to carry onward the blood received. This condition being the result of shock, it seems reasonable to conclude that the fault or failing is in nerve-supply to the vessels of the lung; that the vaso-motor nerves are paralysed, and thus permit this distension and consequent engorgement of the capillaries—an inference which is consistent with what is known respecting the influence of these nerves over the vessels to which they are distributed. That the condition I speak of, or one allied to it, is occasionally observed in the lung on the side opposite to that which has sustained the injury, may be explained by the presence of a largely augmented supply of blood which is thrown into it, in consequence of the partially arrested circulation in the injured lung; perhaps something may be due to communicated concussion and to sympathy. However this may be, I certainly have noticed that serious lesion of one lung is accompanied, occasionally, by transient vascular engorgement of the other.

Death sometimes occurs rapidly, or even suddenly, under these circumstances; the patient is, in fact, suffocated from blocking of the air-cells and tubes by vascular pressure and accumulation of mucus. The *post-mortem* condition in such instances is exemplified in the case of a patient of mine who died in strong convulsions, struggling for breath. The first rib was found fractured near its sternal extremities, and the third, fourth, fifth, sixth, and seventh, near their necks. There was a little clear fluid in one of the pleuræ, but they were otherwise healthy. Both lungs were gorged with blood, a considerable part of the left not crepitating, and sinking in water. The trachea and bronchi were deeply injected, and contained thick, dark mucus; the surface of the brain also was deeply congested.

The repair of lacerated wounds of the lung seems to be effected by the deposit of plastic material upon and around the lesion; but I have rarely witnessed this to any extent, even where the patient has survived long enough for the lung to be

involved in general inflammation. The following case exemplifies this condition, and likewise a state of the pulmonary arterial circulation which must have been consequent upon its obstruction in the injured lung.

A young man was admitted under my care, over whose chest the wheel of a waggon had passed. Three ribs on the right side were broken; and he was in a state of collapse, with extending emphysema. His lips were dusky; his breathing was laboured and abdominal; the inspirations were catching; and the expirations sudden, brief, and explosive. He survived forty-eight hours; and shortly before death, his chest became dull on percussion, the vocal thrill exaggerated, and the heart-sounds indistinct. The sputa had been only slightly tinged blood. There was found a lacerated wound of the upper lobe of the right lung, around which recent lymph was deposited in a rough granular form; the rest of this lung was barely crepitant. Clots were found in the tissue of the left lung, which was collapsed, emphysematous, and congested. The branches of the pulmonary artery in this, the lung which was *not* lacerated, contained fibrinous, cord-like coagula, prolonged from a clot in the right ventricle of the heart.

In a case of compound fracture of the second and third ribs in a child, which occurred recently at St. Thomas's Hospital, air was audibly driven out of the lung at each expiration, and the integument seemed to be sucked in at each inspiration. He survived six hours; and, on examination after death, a large lacerated wound in the upper lobe of the right lung was found to be closed, by the cementing of its adjoining surfaces. There was no pneumothorax.

Penetrating wounds of the lung are, under any circumstances, serious; and their fatality is much enhanced by the retention of any intruding body. Yet, as I have already remarked, it rarely occurs to the civil surgeon to witness such cases, which are almost always consequent upon gun-shot wounds. Of penetrating wounds from pointed weapons I have seen some few

instances. Occasionally the costal pleura alone is perforated, as I remember witnessing on one occasion, many years since, in the operation of tracheotomy with a trochar; and also in a case of deligation of the subclavian artery. A similar accident occurred likewise in a patient in whom I had opened the trachea for acute laryngitis. A few hours after the operation, the tube was incautiously removed, in consequence of some obstruction in it, and another substituted. Shortly after this, in the night, the clinical clerk's report states that it was noticed the patient was able to speak, and was breathing by the mouth as well as the tube; air entered the canula, which was quite pervious, but was not expired through it. Presently he complained of severe pain in the lower part of the chest; and soon afterwards his face, neck, and eyelids, began to swell and became livid. Cold water was dashed in his face, and artificial respiration was resorted to, but without avail; he died twelve hours after the operation. The symptoms, as reported to me in the morning, perplexed me, for I had left my patient entirely relieved by the operation; I therefore looked to the autopsy with much interest for an explanation. The appearances revealed the fact that the substituted canula had not entered the trachea, but had been pushed down by its side; and the introduction of a feather to clear away the supposed obstruction in its interior had completed the mischief. The patient died asphyxiated; and the lung was compressed by the presence of air in the pleura. Unfortunately, a double tube, obviating the necessity of removing the canula, was not in use at that time.

Local pleurisy, and even pneumonia, may result from injury to the pleura. Thus, a young man was impaled by falling on some spikes, two of which wounded him between the sixth and seventh ribs. The shock was trivial, but he suffered from pain in the side and dyspnœa; yet there were no abnormal chest-sounds during the first week. After this there was pleuritic friction over a limited space, with slight cough and no expectoration. After the lapse of another week, there was some dulness

and indistinctness of breath-sounds over the injured side. He recovered. Probably, in this instance, the lung had receded before the penetrating spike, and was not wounded; and the later physical signs might have been due exclusively to pleural effusion.

The chief danger attending a penetrating wound of the lung from a sharp-cutting instrument seems to be in the early loss of blood: if this peril be survived, the risk of fatal inflammation would appear to be less, under favouring conditions, than might be anticipated. The amount of blood lost varies very considerably; and from this circumstance the direction of the wound may be diagnosed with tolerable accuracy, and the chances of the patient's survival conjectured. The further such wound is removed from the root of the lung, the less serious the mischief inflicted; inasmuch as the bronchial tubes as well as the vessels diminish in size, as they recede from the root and approach the circumference of the lung. A singular instance, exemplifying the rapidly fatal consequence of perforation of the lung near its root, occurred a few years since in a patient brought to St. Thomas's Hospital. A stout woman stumbled in the street, and fell upon the broken end of the handle of her parasol, which pierced the soft parts above the mamma, and entered the chest between the second and third ribs. It was pulled out by a passer-by, and an increased gush of blood from the mouth proved almost instantly fatal. On examination, the wound was found to extend to the root of the lung, and allowed of the little finger being passed between the pulmonary vein and the bronchus.

The pneumonia which succeeds a wound of the lung does not manifest a tendency to spread far beyond the track of the instrument by which it was inflicted; although, as I shall presently show, this inflammation entails permanent obliteration of the air cells in the lung tissue involved. These injuries are not always simple, nor confined to the thoracic viscera: the oblique entrance of a pointed weapon, or the position at which

the lesion is inflicted, may involve some part of the abdominal contents likewise, thereby complicating the diagnosis. A sea-captain recently under my notice, whose case I may have occasion to refer to again in a future lecture, was the subject, apparently, of such an injury. He was stabbed by a Malay on board his vessel, the knife being thrust backwards and upwards, from the point of entrance four or five inches below the right nipple. The wound was transverse, and an inch and a half wide at its point of penetration. He was exhausted from loss of blood; and, there being no surgeon on board, the wound was closed with a pledget of lint dipped in Friar's balsam, for which adhesive plaster was substituted after two days. He had but little pain, and no subsequent discharge, the healing process being completed in fifteen days. He had neither cough nor hæmoptysis. Five weeks afterwards, when on shore, a swelling which had appeared near the wound was lanced, and a quantity of yellow fluid escaped, which stained his linen of an ochre colour; and this discharge lasted for some time, gradually becoming paler and more limpid. When I examined him, he complained of soreness round the wound and some oppression, in breathing, low down on that side of the chest. The lower lobe of the right lung was solid, as manifested by the dulness on percussion and total absence of breath-sounds at that part. But for this last sign, and the position and direction of the wound, it might be doubted whether the lung was really wounded; for, it will be observed, there had been neither hæmoptysis nor cough. Probably the breadth of the wound, and the free discharge of blood externally, until syncope ensued, may account for this circumstance, which is certainly unusual. From the other symptoms I conclude that the liver was implicated in the injury; and of course the diaphragm must also have been included. The permanent consolidation of the lung exemplifies the fact to which I just now referred; viz. that the fibrinous deposit in the lung, from traumatic inflammation, is not absorbed without obliteration

of texture, as is the plastic deposit in non-traumatic pneumonia. This, indeed, is what we should expect, in considering and comparing the pathological condition under the different circumstances. There is breach of texture in the former, including the air-tubes and cells, and the inflammation and its consequences extend to and involve all these tissues in the reparative effort. Not so in the latter. There is no necessary disintegration of tissue; and, whether the deposit be interstitial or intra-cellular, or both, its absorption leaves the affected textures *in statu quo ante*—in their previous, actual, and functional integrity. I may remark, incidentally, on the very sensible and judicious treatment adopted in the early period of this case. The Friar's balsam (compound tincture of Benzoin) has been much disused of late, but is really an excellent styptic for hermetically closing a wound; and it thus fulfils the, perhaps, not least important function of the modern carbolic acid treatment.

The following case likewise exemplifies the pathological point last referred to in the preceding. J. W., aged 49, became a patient at St. Thomas's Hospital, after the healing of a wound which he received in the following way: A garden-fork, with long, flat prongs, was thrown at him, and one prong entered the back of the chest, immediately below the inferior angle of the scapula; a second prong made a smaller wound lower down. The depth to which the upper prong penetrated is, of course, conjectural; and the patient's assertion that it entered three or four inches is probably an exaggeration. He stated that he did not lose much blood from the wound, but that he afterwards had hæmoptysis. This must have been succeeded by pleurisy and hydrothorax, for there was an abundant flow of serum from the wound two months after the accident: this continued for a few hours only, and soon afterwards ceased entirely. He did not suffer much pain at any time; and the wound was quite healed at the end of three months. On examination with the stethoscope, in conjunction with my

colleague, Dr. Clapton, I found that there was neither resonance nor vesicular murmur in the neighbourhood of the wound, and the respiration was bronchial: there was evidence of adhesion between the adjoining surfaces of the pleura at the injured part. As this last examination was made nearly two years after the accident, we may conclude that the condition described represents the permanent state of the lung.

In the College Museum is a representation of a sailor, who was transfixed by the pivot of a heavy trysail-mast, which passed obliquely through his body, entering above and to the inner side of the left nipple, and coming out at the upper part of the loin on the same side: he was otherwise seriously injured. The patient was under Mr. Andrews' care in the London Hospital, and recovered in five months so as to be able to walk about; and he ultimately resumed his sea-faring occupation. Probably the lung was perforated, in this instance, at some distance from its base; and it is doubtful whether the diaphragm could have escaped.

The preparation from our museum, which is on the table, is the anterior wall of the chest of a stout man, who was transfixed, transversely and horizontally, by the shaft of a gig. It entered the thorax on the left side, between the second and third ribs, fracturing the former, as well as the cartilages of the third and fourth; and, crossing the anterior mediastinum, made its exit at a corresponding point on the opposite side, fracturing the third rib. He was fixed in this position till assistance arrived; and, when liberated, breathed deeply and freely, and was not faint until he was prepared for bed, having walked to his house, close by. He survived ten years. The preparation shows the repair of the fracture and the adherent lung.

LECTURE IX.

LESIONS OF THE NECK AND THROAT.

Penetrating Wounds.—Cut Throat :—Shock.—Contusion of the Larynx.—Scalded Throat.—Foreign Bodies in the Larynx and Trachea.—Tracheotomy.—Foreign Bodies in the Pharynx and Œsophagus.—Wounds of the Heart.—Parallel between Injuries of the Brain and Lungs.

MR. PRESIDENT AND GENTLEMEN,—The diagnosis of traumatic lesions of the air-passages, either from accident or by design, is, generally speaking, simple and evident, in consequence of the palpable character of the injury, or of the unequivocal nature of the attendant signs and symptoms. The same may be said, with some qualification, of the pharynx and œsophagus ; and of all it may be remarked that an early fatality often attends the lesions of parts so essential to life.

The proximity to each other of the organs referred to, associates them in some respects in the performance of their functions, and renders them obnoxious to injuries affecting them simultaneously. Thus, the special provisions existing for the security of the larynx and trachea are imperilled by the ingestion of food, when the functions of either part are interfered with by wound or other injury ; and the arrangements for modifying the asperity of the external air, and of filtering from it the floating particles which abound in it, are likewise suspended when that air is admitted to the lungs by an artificial

and more direct channel ; and a source of irritation is thus occasioned, which is often productive of serious harm.

The various and important structures, which are packed in so small a compass in the neck and upper outlet of the chest, are all liable to injury from external violence ; and the consequence of such violence is, therefore, not infrequently of a complex character. The wound inflicted by the would-be suicide, or the stab of the assassin, may thus involve the air-passages, the great vessels, and the nerves of the neck ; and the well-known fatal plunge of the dagger behind the clavicle may not only sever nerves and vessels, but may penetrate the lung itself.

The treatment of penetrating wounds of the neck, accompanied by profuse arterial hæmorrhage, is dependent on the correctness of the diagnosis as regards the wounded vessel or vessels ; and this diagnosis is by no means easy, when a pointed weapon with a cutting edge has passed obliquely and deeply into the cervical region behind the angle of the jaw. By such a wound either the external or internal carotid may be laid open, or some branches only of the former may yield the blood. A careful dissection might, no doubt, display the source of hæmorrhage ; but the circumstances are not such as to admit of this investigation ; and I know of no other means of acquiring with certainty the required information.

Two such cases have come under my care, and in each I pursued the same course, that of placing a ligature on the common carotid trunk. The injury was inflicted in the same way, and with the same form of instrument, in both instances ; a pointed table-knife was plunged downwards and inwards behind the angle of the jaw. The bleeding was in each case controlled only by direct pressure with the fingers in the wound ; and whilst this pressure was maintained, I tied the artery. Not an untoward symptom accompanied or followed either of these operations. In one, a salivary fistula continued open for some time, in communication with the original wound ; but

this was closed by a single application of heated wire. The only other point of interest which struck me, in connection with one of these cases, was the sudden and profuse gush of arterial blood, which immediately followed the removal of the pressure, after the ligature was applied; but this was only a single rush, and then it ceased. The absence of any symptoms, indicating such lesion, led me to conclude that no nerves of importance were implicated in these injuries; and no cerebral symptoms were observed during the period of convalescence or subsequently.

It is somewhat remarkable how constantly the large vascular trunks of the neck escape injury in self-inflicted wounds of the throat. The prominence of the larynx in the median line, and of the sterno-mastoid laterally, contribute to this result; and the protection afforded by the muscles is probably favoured by their excited spasmodic action during the suicidal attempt. No doubt the popular conviction, that the speediest mode of destroying life is to open the wind-pipe, aids in producing this result; yet, I have known many instances in which the wound was both long and deep, where similar immunity has existed in behalf of the large vessels and nerves. The thyroid and lingual branches of the carotid are most frequently wounded; yet, without these being implicated, the venous bleeding is often very profuse, and is succeeded by syncope and suspension of the hæmorrhage. It is at this stage that these cases are usually brought under the notice of the surgeon; and it behoves him not to be deceived by the signs of arrested bleeding. It is rarely that patients succumb to the first loss of blood, unless a large trunk is involved: but if this interval be lost, and recurrent hæmorrhage come on with reaction, the second collapse is often fatal. The track of these wounds, and the parts implicated, are rarely doubtful, except in respect of the minor vessels involved; and the thyro-hyoid space is the most common line of incision; but its position may be either above or below this point. It is very rarely, in my experience, that

the trachea is laid open, although I have frequently seen the throat, or rather the cavity of the mouth, exposed by an excision above the hyoid bone; and other cases in which the determined hand of the suicide has partially divided the posterior wall of the pharynx. The hæmorrhage is generally greater when the incision is above the hyoid bone, one or both lingual arteries being severed with the base of the tongue: the epiglottis is not necessarily implicated, the line of separation usually leaving it below; but the injury of this valve does not entail the serious consequences which a consideration of its functions would suggest.

The intrusion of blood into the air-tubes is indicated by irritation and a sense of suffocation, requiring the precaution of leaving the wound freely open: and the diminished sensibility of the glottis, under these circumstances, is manifested by the occasional introduction of food into the larynx—a sign which, therefore, is not to be accepted as a proof that the pharynx is implicated, when the wound is below the entrance to the air-tube. If the wound be above the thyroid cartilage, symptoms of apnœa may be due to œdema of the glottis; but this is a rare complication, so far as my observation enables me to judge.

Difficulty in deglutition is often superadded to the other consequences of these wounds, and necessitates artificial feeding for a time. Not infrequently the suicidal attempt is frustrated by cutting on the thyroid cartilage, which may be notched and jagged in the effort to divide it: and if any doubt exist as to whether the air-tube is implicated, the exit of air or the occurrence of emphysema sets the question at rest.

The later occurrence of bronchitis and pneumonia is indicated by the usual symptoms attending these affections, and is a common cause of mortality, when patients have survived the earlier risks consequent on exposure of the air-tube to the direct ingress of air. I do not mean that a fatal issue from this cause is a common occurrence, for these cases, as a rule,

recover, if the patients survive the first few days ; but when death does occur at a later period, it is usually the consequence of lung-mischief.

When the wound is low down, just above the outlet of the chest, the contiguity of the thoracic viscera may determine their implication in the resulting inflammation. This circumstance is exemplified in a case which occurred during last year in St. Thomas's Hospital. The cricoid cartilage was cut partially through and wounded in several places, and the connecting membranes were divided above and below it. The patient died on the fourth day from pleurisy ; the areolar tissue behind the trachea was infiltrated with pus from the wound in the throat, and the pleuræ had become inflamed from contiguity to the burrowing abscess. In another case which occurred about two years since, and in which the incision extended deeply above the hyoid bone, death resulted in about twenty-four hours—dyspnœa, from some unexplained cause during life, coming on gradually, and increasing until life was extinct. At the autopsy, the blood in the heart was found churned up and frothy, and there were several isolated patches of recent hæmorrhage and consolidation in different parts of the lungs. Further investigation at the seat of injury suggested that a half-divided vein, which had been ligatured only on its distal or bleeding side, had slowly absorbed air, the admixture of which with the blood had proved fatal.

The amount of *shock* which accompanies these wounds varies very considerably ; and this is due to circumstances which demand the consideration of the surgeon. The previous mental condition and habits of the patient greatly influence this result ; and neglect in attending to these antecedents may seriously mislead the surgeon in his subsequent treatment. Thus, in a case in which, during a drunken frolic, the throat of a patient of mine was severely wounded by one of his comrades, who attempted to cut off his beard with a table-knife, though the bleeding was profuse, the shock was trivial ; and,

as no important parts were injured, he soon recovered. Yet, in other cases I have known death to result from shock where the hæmorrhage was not abundant: but, in these instances, the moral depression of the patient, complicated, as is often the case, with habits of intoxication, leaves him a prey to shock which is, no doubt, due partly to loss of blood, but chiefly to depressed vital power. A remarkable case, belonging to this class, was referred to in my former course of lectures, when I was discussing the subject of shock generally. The patient was a middle-aged man; and we had no proof of his having lost very much blood from the wound in his throat, no vessel of sufficient size to require a ligature having been opened. Yet, one hour afterwards, the temperature had sunk to 91.2 deg., and all the symptoms of collapse were well-marked. In eight hours the temperature had regained its normal standard; and, after the lapse of twenty-four hours, it had risen more than two degrees above that standard. This patient's mental condition was very depressed and desponding; but he recovered.

In the other cases which I have collected, belonging to this category, I find that although, in almost all, the general symptoms of shock were pronounced, the temperature did not descend below 96 deg., and never exceeded 101.5 deg., the maximum being attained in about twenty-four hours; with the exception of one fatal case, in which the trachea and half of the œsophagus were divided. In this instance, the temperature rose to nearly 103 deg. at the expiration of thirty-two hours; but the patient died eight hours afterwards.

The accidental co-existence of certain states of the system with these self-inflicted injuries should not, therefore, be lost sight of, as the actual condition of the patient may be thereby importantly influenced, and the diagnosis rendered perplexing. Sometimes long-continued and concealed bodily suffering may determine the suicide to take the rash step of striving thus to end his sufferings, of which I have seen many examples: and

moral depression in most cases aggravates the consequences of the deed. In a recent instance where the wound was superficial—had implicated neither larynx nor trachea, the patient died with symptoms of pericarditis: and it was this disease which actually destroyed life, as was verified *post-mortem*. But it had also been ascertained, before death, that the precordial pain was so intense as to induce the poor fellow to seek relief in suicide. The seat of suffering, in these cases, is not infrequently selected for the self-inflicted injury.

An analysis of eighteen cases of cut-throat, which have been admitted into St. Thomas's Hospital during the last three years, fairly represents the results of my observations extending over a lengthened period. Fifteen of these patients were male, and three female; eleven recovered, and seven died. In five the wound was only superficial, neither trachea nor larynx being involved. One of these is that to which I have just alluded, as complicated with pericarditis, and the only one of them which proved fatal. In six cases the wound was above the hyoid bone, and in four of these the injury was fatal; and of the remaining two, one was a case in which only the muscles of the tongue were divided, but neither larynx nor mouth was laid open. Of the four fatal cases, one died from shock and delirium one day after admission; two died from hæmorrhage soon after they were received into the hospital. In one of these, a patient of my own, the left lingual artery was divided, the right just escaping; in the others, only some smaller branches required ligatures. One was the case referred to, in which air was imbibed by the open mouth of a partially divided vein. In five cases the wound was through the thyro-hyoid membrane, and all the patients recovered. I may remark that, in one of these, which was under my care, the primary hæmorrhage was very profuse, though no artery of importance was cut; and being, therefore, principally venous, there was no recurrent bleeding. The wound in this case extended obliquely upwards, and severed a portion of the epiglottis; but,

the skin overlapping, the patient soon began to breathe by his mouth, and recovered his voice in about a week; though deglutition continued, for a time, painful and embarrassed, and he had a distressing cough, but no bronchitis.

In one case, the thyroid cartilage was notched in several places; and the patient, a woman, died on the second day from shock, combined with previous loss of blood. The last case was that in which the cricoid cartilage was cut, and which proved fatal from pleurisy. In no one of these cases was any fistulous opening left in communication with the air-passage. Indeed, according to my observation, such consequence is very rare.

I may observe that the general remarks which precede these very limited statistics were founded upon a much wider basis than the foregoing cases afford; but the analysis I have given support these remarks, which were written before I obtained it.

Severe contusions or fracture of the larynx are not of frequent occurrence. The protection afforded by the symphysis of the lower jaw, and the mobility of the air-tube on the front of the neck, probably account for the rarity of such injuries as entail serious interference with the functions of the parts. A female, of middle age, was admitted into the hospital, under my care, about two years since, whose case exemplifies this condition. She had been struck violently on the chin with a fist—I am afraid it was that of her husband;—she did not know whether she was struck on the throat. The chin was bruised, and there was great tenderness over the temporo-maxillary articulation. Manipulation of the larynx caused great pain, and so likewise did the effort of deglutition: aphonia was complete. No irregularity could be detected when the thyroid cartilage was examined; but, during deglutition, a peculiar sensation was communicated to the fingers, as if a piece of the cartilage were detached towards its upper part; and, at the same time, the saliva was heard to gurgle loudly in the throat. There was no blood in the sputa. In about ten

days she began to recover her voice ; and in three weeks was quite well. I am disposed to doubt whether there was in this instance more than severe contusion, though I believe it quite possible that severe injury may be inflicted on the larynx by the lower jaw being forced violently back against it. But the patient recovered rapidly ; and functional disturbance would account for most of the symptoms, including loss of voice. As regards the sensations communicated to the touch, in moving the larynx from side to side on the cervical spine, or in deglutition, the manipulator may be deceived, especially when the larynx is large and in elderly persons, by the peculiar feeling of roughness or inequality which is thus elicited. This simple circumstance should not be lost sight of in the diagnosis of these injuries.

Another form of lesion which I may notice here as of not infrequent occurrence, is that produced by the contact of hot water with the fauces and throat. This accident occurs in young children, who attempt to drink from the spout of a tea-kettle. Whether, under these circumstances, the mischief primarily affects the lower part of the pharynx, or whether, indeed, any of the scalding water is actually swallowed, I have not been able to satisfy myself ; but I think not. The condition of the mucous membrane of the mouth, fauces, and tonsils, which is produced by the contact of water at a high temperature, is neither aphtha nor vesication, but a white, patchy appearance, indicating destruction of the surface of the membrane. The local suffering is not commensurate with the extent or amount of lesion ; but the shock is generally considerable. The fatality of this lesion is due to obstructed respiration from inflammatory swelling in the neighbourhood of the glottis, or from subsequent pneumonia.

Of the beneficial effect of tracheotomy in these cases I am very sceptical, judging by the results of such as have come under my observation ; although I do not doubt that, in threat-

ening suffocation from œdema, it may be the only expedient by which life can be saved. Of the actual condition of the lungs, and of the cause of that condition, I am not prepared to speak positively; but I am disposed to call in question the commonly received opinion, that extension of inflammation from the injured parts is the true explanation of the pulmonary symptoms. As these points are well illustrated in the last case of the kind under my care, I will relate its history.

About half-past one in the day, a little boy, rather more than four years old, attempted to drink some water at boiling heat from the spout of a tea-kettle. After much crying he went to sleep, and in about an hour the mother noticed a rattling in his breathing; he had much dyspnœa, and was brought to the hospital. The house-surgeon did not think the symptoms then sufficiently urgent for the child's admission, but he was received on the following morning, and I saw him immediately afterwards, and twenty hours after the occurrence of the accident. His feet and hands were cold, pulse 156, temperature 99 deg. The breathing was hurried, and there was excessive action of the muscles of inspiration, but the chest was not filled, as shown by the falling in of the epigastrium and intercostal spaces. The lips and nails were slightly dusky, the nostrils dilated, and the eyes staring and dull. The little patient was not insensible but listless. There was a white, soddened appearance, in patches, of the mouth and fauces, with some swelling of the latter. I carefully examined the chest, and found much rattling and loud rhonchus in the trachea; and these sounds seemed to be transmitted to all parts of the chest; there was also large crepitation, especially on the right side; vocal sounds normal; breath sounds puerile on both sides, and resonance nearly equal. Inspiration was suddenly checked by a croupy catch as the breath was drawn.

During the examination, and subsequently, whilst I remained in the ward, these symptoms became aggravated, the temperature rising to 102.8 deg.; and, though not entertaining a

favorable opinion of tracheotomy, I felt compelled to offer this alternative to the parents, who were present, fearing the child might speedily succumb, in consequence of the obstruction to the ingress of air. Their consent was refused; I therefore ordered beef tea and wine to be immediately administered, and these were swallowed without difficulty. I also directed that a large linseed poultice, with a twelfth part of mustard, should be placed over the chest, and hot bottles to the feet. Very speedy relief followed these remedies: in two or three hours, the child was able to speak easily, to cough with strength, and to breathe more freely.

The croupy catch in inspiration continued, except after coughing, which seemed to clear away the obstruction in the larynx. The pulse, however, was so rapid that it could scarcely be counted, and the temperature had risen to 104.3 deg. Small doses of liq. ammon. acet. and nitric ether were given with some ipecac. wine at intervals. On the following morning, both the pulse and temperature had sunk; but the face was flushed, and there was small crepitation over the right lung. On the fourth day, all the symptoms were subsiding, and the child seemed cheerful and disposed to take food; but on the sixth, he had a renewal of the previous condition, suggestive of broncho-pneumonia, which soon disappeared under the application of linseed meal and mustard, as before. On the seventh day, there was only slight dulness and deficiency of breath-sounds, and of movement of the ribs on the *left* side, but there was neither crepitation nor evidence of bronchitis on either side, though he had a hacking cough. From this date he rapidly recovered, and was dismissed well on the fourteenth day. The mouth required no special treatment.

I have narrated this case somewhat at length, because some important practical considerations suggest themselves, in connection with the diagnosis of this class of injuries. Was there, at any time, inflammation, properly so-called, of the lung-tissue or of the bronchial membrane? and, if so, how was it

produced? If propagated by continuity of surface, the larynx would have been first affected, and the symptoms and signs would have been longer delayed and more persistent. But the crepitation was never very marked, and the dulness and indistinctness of breath-sounds shifted from one side to the other. It was evident that a severe shock had been sustained, and fell principally on the lungs. I am disposed, though I speak with diffidence on this *Medical* subject, to regard the condition of the little patient as denoting nervous shock to the lungs;—by which I mean that the vaso-motor nerves, and probably the pneumogastric filaments, were so impressed, and their functions so disturbed, as to cause congestion and its consequences, with other functional derangements which induced the condition noticed, and which was relieved in so marked a manner by the simple means employed. The croupy catch in inspiration seemed to be due, in part, to spasm, and partly, at a later period, to accumulation of tenacious mucus in the larynx.

I have the record of a similar case in a younger child, which occurred about five years since, and which I treated in a similar way, with success: the breathing was rapid and noisy, and the little patient half comatose; but he rallied after remaining two or three days in a critical condition, and was soon convalescent. I think it very probable that if tracheotomy had been performed at the time I contemplated it in the former case, it would have proved fatal, as it has been under similar circumstances, from the entailed consequences of broncho-pneumonia. I cannot regard the opening of the air-tube, especially in children, as an unimportant operation, or as expedient except under urgent circumstances; but I shall return to this subject presently.

Foreign bodies are sometimes introduced into the nostrils, and may remain, entangled in their sinuosities, for an indefinite time, giving rise to irritation and symptoms resembling ozæna. I am acquainted with one instance of this sort, in which a button remained so lodged and impacted for years, producing irritation which was subject to aggravation from accidental

causes ; it was ultimately discovered and removed. In another instance, a gentleman brought to me his child, who was suffering from a suppurative discharge from the nose, which could not be accounted for. I concluded that it was due to a strumous tendency in the child, and directed that a mild astringent injection should be used. A few days afterwards, a black mass was washed out, which proved to be part of a skein of floss silk ; and then the little fellow acknowledged that, having watched his grandfather take snuff, he was ambitious to imitate him, and selected the above material, which he introduced into his nose in the same way as he had watched the old gentleman take his snuff.

Both my hospital and private practice have been singularly unproductive in cases in which foreign bodies have been introduced into and retained in the air-passages. Indeed, I think I may say from my personal knowledge that, during the last forty years, not more than two or three cases, coming strictly within this category, have been under treatment within the walls of St. Thomas's Hospital.

I do not include cases in which speedy relief has been obtained without surgical interference—cases in which the inhaled extraneous body, of whatever nature, has been speedily expelled. With such a limited personal experience, I must content myself by making a few observations which occur to me, in illustration of the diagnosis in this serious class of lesions.

It is well known that death may be the immediate consequence of the impaction of a foreign body in the air passage, or that the fatal issue may be delayed until after the lapse of weeks, or months, or even of years. In the former case, a large body is usually lodged and immovable in the larynx ; and death results from apnœa, partly, though probably not wholly, due to the direct obstruction to respiration thus occasioned ; but, probably, also in a measure, the consequence of superadded spasm in the orifice of the larynx. The delayed fatality of these

cases is owing to a variety of causes ; of which the site and form of the foreign body, as well as its magnitude, are the most important. Thus, impaction of a body in the *lower* part of the larynx, when neither of sufficient size seriously to impede respiration, nor of such form nor asperity of surface as to produce mechanical injury where it is located, may remain quiescent for a considerable time, without producing much irritation ; for the lining membrane of the larynx is by no means so sensitive here as it is higher up. Again, the constantly shifting position of a smooth object prevents early local irritation from resulting, and gives rise to symptoms which vary according to the position of the intruder—sometimes threatening immediate suffocation, at others leaving the patient tranquil and almost free from inconvenience. In dealing with these cases, it should not be forgotten that inflammatory and spasmodic affections of the larynx are often, in many of their symptoms, allied to the consequences of these accidents ; and that the converse is also true : but it must very rarely happen that, after a careful examination of all the signs, as well as symptoms, and an investigation into the history of the case, the intelligent surgeon can be deceived. Yet, there are, sometimes, perplexing and complicating circumstances, which may mislead even the most wary. Food may pass into the larynx during intoxication ; or, as occurred in a case of my own, which I narrated in one of my earlier lectures, the same accident may complicate the consequences of injury to the head. The patient to whom I refer, was buried by a fall of earth in a drain. As soon as he was dug out he was brought to the hospital. I extract the report of this case from the Lecture to which I refer. “ When admitted, he was insensible ; his pupils were contracted and sluggish ; his breathing was stertorous, and he was convulsed. His respiration became intermittent, and at shorter intervals ; and he died comatose after six hours—his heart continuing to beat for some time after respiration ceased. There was not any injury found in the brain or spinal cord ; but a part of the

contents of the stomach, identified by comparison, had found its way into the trachea, and had blocked up many of the bronchial tubes." This case appeared to be one of suffocation complicated with concussion. How and when the contents of the stomach were transferred thence to the lungs, we have no evidence to show. It might have occurred at the moment of the injury, in consequence of the pressure to which the distended stomach was then subjected ; or it might have occurred in the act of vomiting before he reached the hospital. But certainly the rarity of such a coincidence might excuse the erring diagnosis which failed to identify the cause with the symptoms. Happily, the oversight could not affect the issue.

Pressure, from any cause, on the exterior of the larynx or on its supplying nerves, may occasion symptoms similar to those produced by the presence of a foreign body in the air-passage. Again, the lodgment of a morsel of food in the upper part of the gullet, may so obstruct the aperture for the ingress of air, as to threaten suffocation. I remember a young child, who was brought to the hospital many years since, being almost immediately relieved by a dose of ipecac. wine, which I, then a student, administered under the direction of Dr. Williams ; a large fragment of meat was ejected, and the lividity and struggling immediately ceased. I shall presently refer to a fatal case of the same nature.

It is a dangerous practice to permit patients to inhale chloroform in operations involving the interior of the mouth, although the risk is diminished if the sitting posture can be maintained. The intrusion of blood into the larynx, in any quantity, can scarcely fail to prove fatal under these circumstances ; the admission of even a small quantity is sufficient to excite apprehension.

In forming a diagnosis in the class of lesions to which I am now referring, particular inquiry should be made into the history of the case, and the circumstances under which the alarming symptoms first made their appearance ; and this should be

succeeded by a careful scrutiny of the chest. The actual position of the foreign body, if present, may be thus ascertained. It is possible that one lung may retain its normal resonance, while the absence of breath-sounds proves that air is not passing into and out of it. In such case, the conclusion would be that the corresponding bronchus is blocked. Or these signs may be limited to a portion only of one lung; and thus the site of the extraneous body may be still more accurately determined; at the same time that all doubt may be removed as to its actual presence, by the shifting character of these indications. It is an unquestionable fact, explained by the relative anatomy of the parts, that the right bronchus is very commonly, and the left very rarely, the seat of such obstruction, a foreign body passing more readily into the former than into the latter. But the size and form of the body have much to do with the resulting symptoms; thus, a coin, when impacted edgewise, may allow of respiration being readily performed; but with a change of position, by which its circumference becomes adapted to that of the trachea, symptoms of impending suffocation may immediately declare themselves. Other unnatural sounds are heard in breathing, which are due either to the passage of the air over the intruding object, or to the accumulation of mucus around or behind it.

The later history of these cases, where a fatal issue is delayed, is replete with variety in its details, though all pointing to those structural changes which mark the abortive, and therefore destructive, effort which nature makes to repair the lesion; for it rarely happens that the extraneous object, whatever it may be, is so enclosed in a capsule of low organisation, as to secure to the rest of the lung immunity from the effects of its presence.

The following case was watched by me with much interest whilst the man was an inmate of St. Thomas's Hospital; and I am indebted for the autopsy to Mr. Solly, under whose care the patient remained until he went home.

J. S., æt. 49, an excavator, of tall and robust frame, was at work with a pebble in his mouth, about the size of a marble. This was drawn into the trachea during a fit of laughter, and he imagined he had swallowed it.

When he applied first to a local medical man, his symptoms were not of a character to excite alarm; his breathing was more frequent than natural, and sonorous, and the period of each respiration was diminished; he was also troubled with a short, hacking cough. The expansion of the chest, viewed both anteriorly and posteriorly, appeared to be uniform on both sides. At a spot behind the sternum, he complained of a dull pricking sensation; and when the stethoscope was applied here, a whistling and cooing rhonchus was heard; the breath-murmur was described as heard, at that time, over most parts of the chest; but masked by the other loud sound.*

He was sent to the hospital; and, when admitted, it was observed that, whilst recumbent and at rest, he suffered no inconvenience; but, when turned on the left side, great dyspnœa and cough were induced. Respiration was loud, but otherwise natural, on the *left* side; there was a loud cooing sound about four inches below the *right* clavicle; below this, over three square inches, the breath-sounds were inaudible; but percussion elicited a clear resonance; sometimes air entered the chest at all parts.

The patient was bound to a plank, inverted, and struck on the back and chest, but without effect. Tracheotomy was subsequently performed, and the above experiment was repeated; bronchitis succeeded. He afterwards left the hospital, and suffered from severe fits of dyspnœa and suffocating cough; and the expectoration was profuse during the last week of his life. There were physical signs which indicated that, subsequent to his leaving the hospital, and after a violent fit of coughing, the pebble had changed its position from the right to the left side of the chest.

* These notes were supplied by Mr. Passmore, of Potter's Bar.

At the *post-mortem* examination, a large collection of pus was found in the *left* pleura, whereby the lung was compressed, but it was not otherwise diseased. The right pleura was healthy; but there was a circumscribed abscess in the anterior part of the middle lobe of the corresponding lung, containing three ounces of pus; the bronchial tubes on the same side were inflamed. Just at the first division of the *left* bronchus the pebble was found firmly impacted: in the division of the right bronchus, the spot where the foreign body had previously lodged could be identified: the mucous membrane throughout the larger bronchi on both sides was free from ulceration. The patient survived the accident two months; and died about a week after leaving the hospital.

The importance of *Tracheotomy* is very differently estimated by surgeons;—I do not mean in regard to its applicability in various conditions suggestive of its employment; but I speak of the operation and the risks which it may entail. My experience has induced me to regard it as, in itself, fraught with much danger, and as involving, therefore, a serious complication in diseases of the air-passages, especially where, by continuity of surface or otherwise, the lungs are disposed to sympathise in the morbid action. I have already remarked on broncho-pneumonia being a frequent cause of secondary fatality in attempted suicide by cutting the throat; and this arises, apparently, from the direct ingress of air by an artificial inlet. In children, probably from their greater susceptibility, the results of tracheotomy, performed for various reasons, are far from satisfactory or encouraging, so far as I can gather from the various sources of information at my command. I may speak more favourably, from my own personal experience, of tracheotomy in adults: the result has certainly been, in a great many instances, the protraction, in not a few the preservation, of life; and, in two or three, the restoration of suspended animation. Yet, these have been, for the most part, cases of acute or syphilitic laryngitis,

or other conditions in which the lungs were in no way implicated. I am, therefore, quite prepared to admit, to its fullest extent, the value of this operation ; but I do not the less appreciate the risks attending it, under the conditions alluded to. It is my conviction that an artificial opening into the air-tube should not be made except under circumstances of urgent necessity ; and that, in all cases, the condition of the lungs should be ascertained before resorting to it. I am aware it may be objected that the physical signs are masked by the obstructed ingress of air ; yet I have not found it so to an extent sufficient to preclude the detection of abnormal sounds, either in the bronchial tubes or air cells ; and by such physical examination, the fault may, perchance, be found to exist chiefly in the lung itself. The hasty performance of this operation, in anticipation of evil which may occur, is to be deprecated. Indeed, I think that every available expedient should be resorted to before this ultimatum is adopted. The attendant risks of the operation are not limited to the manipulative procedure itself, nor to the direct admission of air to the lungs. The presence of the tube often excites mischief externally as well as internally ; and the wound becomes unhealthy, and ulceration and suppuration extend, even to the lung itself. Cases of scalded throat, treated by tracheotomy, are very far from being uniformly successful, even though temporary relief be obtained ; the actual cause of death being due to pulmonary changes, which may be referred with more show of reason to the operation than to the original lesion. Since writing the above remarks I have had the opportunity of witnessing the autopsy of a child on whom tracheotomy had been performed for scalded throat. I saw the patient, apparently doing well, some days after the operation, whilst the tube was still worn. Subsequently the tube was removed, and the child died with symptoms of broncho-pneumonia. On examining the air-tubes and lungs, ulceration was found at the front of the trachea, corresponding to the spot where the extremity of the tube would impinge. There was inflamma-

tion, with some deposit of lymph, extending thence throughout the bronchial tubes, with infiltration and consolidation of the lungs generally. The child died evidently of broncho-pneumonia, the consequence, I have very little doubt, of the operation, and not of the original lesion. The mechanical irritation caused by the presence of the tube accounted, in part, for this result, which is suggestive of the need of some change in the form of the tube, or in the mode of keeping patent the opening for the admission of air. Indeed, two or three instances have come to my knowledge where fatal hæmorrhage, in children, was consequent on ulceration extending through the trachea into the innominate artery. In the above case, the general infiltration of the lung could scarcely be attributed to a morbid action propagated from the inflamed trachea; though there was no interruption to the continuity of the inflammation, as it spread thence throughout the bronchial tubes.

If, in these cases of scalded throat, it be ascertained that life is threatened by œdema of the glottis, and the risk is imminent, relief must be given; but the surgeon should first satisfy himself that the dyspnœa is not due to any other cause. Probably spasm, superadded to inflammatory swelling, is often the immediate cause of death. If introduced, the tube should be dispensed with as soon as possible; though it is an unquestionable fact, that the opening of the trachea necessitates the retention of a tube for a much longer period than would have been requisite for the recovery of the glottis without such opening. The comparative insensibility of the glottis, when the trachea is opened, seems to render it less inclined to fulfil its normal functions when the most important of them is thus artificially and vicariously performed.

The value of antimonials, without tracheotomy, in these cases of scalded throat, has been repeatedly tested, as well as in other inflammatory conditions of these parts, and with a favourable result.

I may notice a rare interference with the completion of

tracheotomy, which, however, nearly proved fatal in one of my patients, whose condition did not admit of delay. He was an old man, in whom the rings of the trachea were rendered so resisting by ossification, that the knife would not divide them. A short blunt-pointed pair of scissors is, under such circumstances, the most available instrument to lay open the air-tube.

I have remarked that the *Pharynx* is occasionally involved in wounds laying open the larynx and extending to the back part of the former tube, without necessarily implicating the larger vessels or other important parts in the neck. Such injury does not entail any serious consequence in itself, although the determined nature of the self-inflicted injury implies such an amount of lesion as is likely to prove mortal. The same remark may be made respecting other accidental wounds of the pharynx, from the intrusion of foreign bodies, which may penetrate or lacerate the back of the throat, such as fish-bones or a tobacco-pipe; but it should be remembered that these lesions may be complicated by the wound of neighbouring textures of importance. Thus, fatal bleeding may result from puncture of a large vessel; or deep-seated suppuration may follow, and entail secondary hæmorrhage.

I recollect, when I was a hospital apprentice, a singular instance of attempted suicide, occurring during my week of "taking in." A woman had recourse to the curious expedient of forcing a large door-key into her throat. Happily, it was held fast in the pharynx, within reach of a pair of forceps, and was extracted without much difficulty, and without producing any worse result than a sore throat for a few days. This specimen (1077) from our College Museum is identified with a similar case; it is the handle of a punch-ladle, which was taken from the throat of a maniac who proposed to commit suicide by swallowing it. He experienced no subsequent inconvenience from this eccentric use of his punch-ladle.

The accidental blocking of the pharynx by the lodgment of

food within it has proved fatal by suffocation. The accompanying preparation from the Museum of St. Thomas's Hospital exemplifies this fact. The patient, a man who was engaged in taking a meal at an eating-house, was seen to be suddenly seized with convulsion, as if struggling for breath, and was, of course, supposed to be in a fit. He died speedily; and, when examined after death, a large morsel of unmasticated meat was found wedged in the pharynx, and it had thus arrested respiration.

Of accidental wound of the *Œsophagus* I have never seen an instance, except in association with division of the trachea in attempted suicide; and this, in my experience, is an infrequent occurrence. An incautious penetration of the trachea in tracheotomy might cause, and I believe has produced, a similar result. Egress of food or drink, or the symptoms consequent on their introduction into the air-tubes, would indicate the probable nature of the injury; though, as I have already remarked, these results may be due to the imperfect closure of the glottis when respiration is performed through an artificial opening below the rima. Not infrequently, surgeons are consulted respecting the supposed lodgment of foreign bodies in the *œsophagus*. I think there is no doubt that occasionally abrasion of this tube perpetuates the uneasy sensation, which the patient interprets as a proof of the presence of some extraneous body; and, if deglutition can be completed without difficulty, it is unwise to interfere. The cautious passage of a probang may, if required, satisfy the importunity of the sufferer. Again, this impression may be the first indication of some commencing serious organic disease, such as cancer. If deglutition be really obstructed, of course this sign, together with the history of the case, may indicate the reality of the patient's suspicion, and demand decided interference to afford relief. I remember an interesting exemplification of this state which occurred to me a few years back in St. Thomas's Hospital. A young man applied at the Surgery, stating that, in eating some soup a few days

previously, he had inadvertently swallowed an irregular fragment of bone. He pointed to the exact position where he believed it had lodged, adding that he was starving, as he was incapable of swallowing even liquid food. The pain he suffered, which was not acute, was aggravated by the effort at deglutition; and he added, that he was conscious of the bone passing into his throat, but too late to arrest it; and his subsequent efforts to return it were fruitless. There did not appear to be any marked change of position after the first day. I tested the accuracy of his statement by giving him some milk, and he complied with my request that he would attempt to drink it. A certain quantity was imbibed, and then the whole, apparently, was regurgitated. Under these circumstances, I decided to pass a probang; and at the spot indicated by him—viz., about the middle of the mediastinum—its further progress was arrested by firm resistance. I was now so persuaded of the correctness of his representation, that I did not hesitate to press the instrument onwards, and soon had the satisfaction of feeling the obstruction give way; and the probang passed on into the stomach. On its removal, I requested the patient again to make an attempt to swallow some milk. He was sceptical of the utility of repeating this experiment, as he felt sure, from his sensations, that the bone was still lodged in the Œsophagus. His gratification at finding that he was indeed relieved was proportionate to his previous despondency; and, as I did not again see him, I presume he had no further trouble, beyond the soreness which I told him to expect for a short time.

The following is a remarkable instance of permanent relief following the simple operation of passing the Œsophagus-tube. A servant of middle age, residing in my family, had been the subject of dysphagia for eighteen years. It was with difficulty that she could swallow any solid food during this entire period; and latterly her fellow-servants were so alarmed by her rapid loss of strength and almost entire abstinence, that the subject was mentioned to me. There was no serious obstruction to

the passage of an ordinary stomach-pump tube ; and the relief was immediate, complete, and permanent. I cannot explain the *modus operandi* of the remedy. I believe the case to be entirely genuine, and free from the suspicion even of hysteria ; and I quote it for what it is worth.

Not long since, I noticed in print a case in which a half-crown had been swallowed, and remained lodged in the œsophagus for some months, when death resulted from ulceration extending into the aorta. The story of the man, who was, if I remember right, a criminal, was not credited ; and no attempt was made to relieve him.

The following interesting case, communicated to me by Dr. George Johnson, of King's College, exemplifies the value of the laryngoscope in the diagnosis of the class to which it belongs. A child, aged twenty months, had, according to the account of his parents, swallowed a penny. At first he was nearly suffocated : but, when seen by Dr. Johnson two days afterwards, he breathed freely ; yet the respiration was accompanied with a moist rattling noise in the throat. He could swallow only liquids ; and that was difficult, and excited cough. The mucus discharged was occasionally tinged with blood. These symptoms, and the general distress of the child, satisfied Dr. Johnson that the coin was impacted in the throat. The laryngoscope revealed its position in the upper part of the œsophagus—the surfaces directed forwards and backwards, and the upper margin just below the opening of the larynx. It was readily removed with a pair of long slender forceps. The early signs of suffocation in this case no doubt corresponded with the passage of the coin over the base of the tongue and epiglottis.

The removal of foreign bodies impacted in the œsophagus is not often called for ; and, when required, the surgeon would usually be guided by the prominence of the object upon which he is cutting. Our senior Vice-President, Mr. Cock, has twice successfully performed this operation, and has given an interesting record of the cases in the 'Guy's Hospital Reports.'

Traumatic stricture of the œsophagus is occasionally met with, as the result of textural lesion from the contact of some irritating matter swallowed accidentally or intentionally; but such obstructions are not characterised by any peculiarities, and are recognised by the diagnostic signs common to all strictures in this tube. I have a record of two cases in which the patients had fallen into a vat of soap-lees. In one, I had the opportunity of witnessing the early escharotic effect of this solution—the mucous membrane of the lips, tongue, and fauces being destroyed in patches; and dysphagia being the most distressing consequence of the accident. The other case came under my care six weeks after a similar accident; and he applied at the hospital in consequence of the difficulty he experienced in deglutition. He was relieved by the use of a bougie.

The remarks which I made in reference to the infrequency of traumatic lesions of the thoracic viscera, in civil practice, apply with special force to the Heart and the great vessels immediately connected with it. The relations of these parts, and the protection thereby afforded to them, preserve them from injury in any of the ordinary casualties which come under the notice of the hospital surgeon; and, when such injuries do occur, they are usually so immediately fatal, that there is no opportunity of associating with them the particular diagnostic signs or symptoms by which they may be identified. Indeed, the survival of the patient, under circumstances which might be supposed to implicate this vital organ, may be generally accepted as proof that it has escaped injury; yet many remarkable instances have been recorded, in which even serious wound of the heart has not proved immediately fatal; nay, in which the patient has so far recovered as to live for a considerable period, and the real nature of the lesion has not been verified until after death. One such instance I alluded to in my last lecture as having come under my own observation many years

since. A patient was admitted into the hospital with fractured ribs, and survived the accident several hours. At the *post-mortem* examination, one of the fractured bones was found to have transfixed the pericardium, and penetrated into the left ventricle of the heart. As this very rare accident was not suspected, unfortunately no special record of the symptoms during life was preserved.

The presence of such a wound may be conjectured from the direction taken by the penetrating weapon or missile; but the attendant symptoms, being dependent chiefly on the loss of blood and embarrassment of the heart's action, are necessarily equivocal, as they are equally indicative of other and less serious injuries; and information derived from the stethoscope is scarcely more certain. External violence, such as sudden and forcible compression of the chest, may rupture the heart or one of its large vessels, as occurred in a case which came to my knowledge, in which the aorta was lacerated by the fall of a heavy cask on a man's chest.

In such instances, no doubt, the force acts either by compression of the column of blood within, or by excessive displacement and longitudinal extension of the artery; perhaps by both combined. Survival even for a limited period after these wounds must be due to the obliquity of the opening, or to the sudden syncope which ensues, and the consequent closure, by clot or otherwise, of the laceration or opening. More limited injuries may, for a time, be unattended by symptoms to create alarm, or even to excite suspicion of their existence, as is illustrated in the following instance, which occurred about two years since in St. Thomas's Hospital.

James C., aged 7, was brought to the hospital about mid-day, with the history of having had a fall three hours previously. He was examined by the dresser on duty, who fancied that he detected a fractured rib, and applied a flannel bandage. The child looked pale, and his respiration was somewhat embarrassed, but he did not complain of pain. He was taken home, and

seems to have been tolerably comfortable during the afternoon and evening, his condition not exciting any alarm in the minds of his parents. About midnight he began to complain of some uneasiness about the chest; and at 2 a.m., fifteen hours after the infliction of the injury, he rose up to make water, but fell back fainting, and almost immediately expired. At the *post-mortem* examination, it was discovered that a needle had passed through the cartilage of the fifth rib. About an inch of the pointed end had been broken off, and was found free in the pericardium, where it had rested, and had lacerated the apex of the heart; and from the wound thus caused hæmorrhage had taken place into the pericardium, to the amount of six or seven ounces. A second part of the needle was embedded in the cartilage of the rib, not projecting on the pericardial aspect, but slightly on the cutaneous. The third part of the needle, including the eye, was not found. A most careful examination of the skin failed to detect the aperture by which the needle had entered. The body was pale and anæmic, but otherwise healthy. The cause of death was evident, viz., embarrassment of the heart's action from the presence of blood in the pericardium: its suddenness was due, apparently, to the abrupt change of position, acting directly on the heart, and indirectly on the brain.

The following very interesting case of a similar injury, but in which recovery took place, has been forwarded to me by my friend and former pupil, Mr. Moreton, of Guildford, in whose practice it occurred about a year and a half since: the record of the symptoms is a valuable contribution to the diagnosis of these injuries.

M. M., aged 17, a schoolboy, of phlegmatic temperament, was accidentally stabbed with a penknife by another boy, whilst at play. On receiving the wound, he felt scarcely any pain; only a little catch when he drew a full breath. There was scarcely any bleeding from the external opening. Immediately after the accident he went into school, and remained an hour,

feeling, as he expressed it, "all right," but hoping he should not be "put on." At the expiration of an hour, feeling faint, he went out, and then vomited and fainted. Upon recovering he returned into school, but was soon obliged again to leave, in consequence of a return of the nausea and faintness.

At seven o'clock in the evening, three hours after the injury was received, he was seen by Mr. Moreton, having confessed the cause of his illness. When Mr. Moreton entered the room, he immediately rose and walked to meet him. His face was deadly pale, his lips bloodless, his skin cold and clammy, and pulse almost imperceptible. He had been vomiting frequently since his first attack of faintness. The heart was acting very feebly, with a scarcely perceptible impulse: the sounds were muffled, but there was no bruit, nor was there any increased cardiac dulness to be detected on percussion. The wound was a puncture, three-eighths of an inch wide, made by an ordinary penknife an inch and three-quarters long from point to handle. The situation of the wound was between the third and fourth ribs, an inch and a half from the centre of the sternum, and two inches to the right, and an inch and a half above, the left nipple: the edge of the knife was turned downwards.

There was no hæmorrhage from the external wound, which was at once closed with collodion. He was placed in bed, and, there being no attempt at reaction, hot bottles were placed in contact with the feet and body, and ice was given him to suck, in the hope that it might allay the distressing sickness. He complained of no pain except on deep inspiration, and even then he did not seem to suffer much. There was no cough nor spitting of blood.

At one o'clock on the following morning reaction commenced, and the vomiting was less frequent. Four hours later he had slept a little, and his skin and feet were warm. At nine o'clock, fourteen hours after the accident, the pulse was more distinct, and 120 in the minute. The heart's action was still feeble, and irregular in the force of its beat, but not intermit-

tent. At the close of twenty-four hours reaction was complete, without fever. On the fourth day the pulse had fallen to 90. He had no dyspnœa, but the respiration was still quick, and he complained of slight pain in the chest.

A fortnight later, the report states that he had been gaining strength, though the heart's action was still very feeble, and much quickened by any excitement or exertion. There had not been any abnormal sounds or precordial rubbing up to this date, when his pulse ran up suddenly from 84 to 96, and a loud bruit became audible over a limited area, having the seat of the puncture as its loudest point. It was not heard over the apex of the heart, nor in the carotid arteries, but was apparently superficial, and yet difficult to separate from the first sound of the heart; and it was not a to and fro sound.

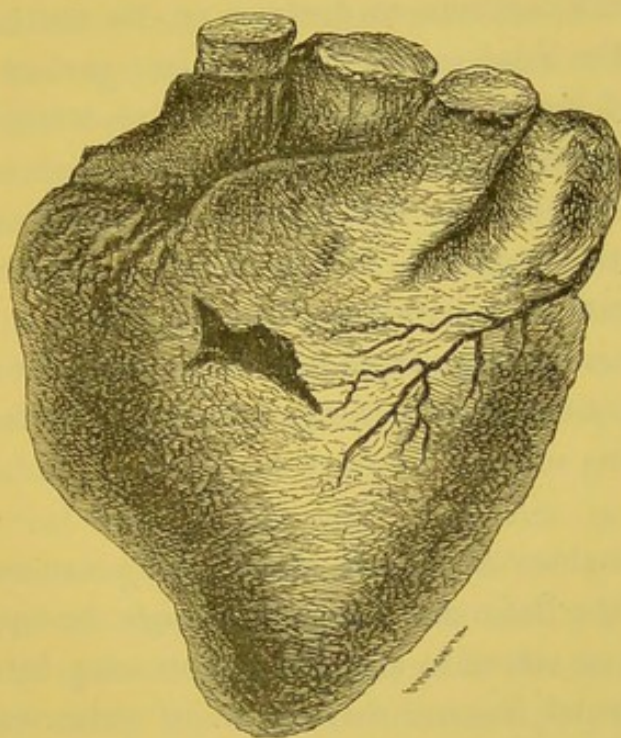
At this period the boy was removed home, and thus passed from Mr. Moreton's observation: but he appears to have had no further serious symptoms, although, at the expiration of three months, his medical attendant reported that he could not satisfy himself that the heart was quite free from impediment in its action. The only stethoscopic signs then present were, indistinctness of the first sound and undue clearness of the second, the interval of repose being lengthened. After the lapse of seven months, all traces of the accident had disappeared.

From the position and depth of the wound, and from the symptoms, which are such as we should look for under such circumstances, there can be little doubt that the pericardium was penetrated in this case, and probably the heart itself punctured. The early faintness, pallor, depressed circulation and sickness, were those of shock, and of too profound and protracted a character to admit of explanation, considering the nature of the violence inflicted, except on the supposition that some vital organ was injured. The position of the wound indicated the organ; and hæmorrhage to an extent sufficient alone to account for this condition would have been fatal, from

the embarrassment of the heart's action which would have been inevitably entailed. The bleeding into the pericardium must have been limited. Reaction was unaccompanied by any striking change in the heart; and more than a fortnight elapsed before pericarditis was manifested by the pain, abnormal sound, and constitutional disturbance. Whether this was followed by any adhesion of the adjoining surfaces of the serous membrane is doubtful; but the negative evidence is opposed to such a conclusion.

By the great kindness of the owner of this preparation, I am enabled to show a remarkable exemplification of the possible protraction of life after the receipt of an injury usually regarded as immediately fatal. The interest associated with the specimen is enhanced by the fact that the heart was taken from a soldier who fought at Corunna, and that the veteran surgeon, Mr. Fuge, of Plymouth, who has kindly permitted me to exhibit it, was the attendant on the wounded man when he was landed at Plymouth just sixty years ago. His story is this. He was struck down by a ball which entered his chest, the wound being to the left of the sternum, between the second and third ribs. He thought he might have been insensible for half an hour. One of his companions, who helped to remove him from the field, said that the loss of blood did not appear to have been copious at the time. He was carried on board a line-of-battle ship, crowded with wounded soldiers, and sent to England: receiving, on his voyage, no surgical attention beyond the application of a piece of plaster. Mr. Fuge found the external wound healthy-looking and suppurating. A probe was introduced nearly its length without meeting with any resistance. His countenance was pale; respiration frequent and laboured; pulse 120, feeble but regular; temperature nearly natural; distressing restlessness; inability to sleep, and a craving for opium. He complained occasionally of an obtuse pain, but was unable to point to any particular part of the chest as its site. He had also colliquative diarrhœa. He remained in the same con-

dition for two days, and then his intellect became confused, and he was less tractable. He got out of bed for some purpose and nearly fainted. His restlessness increased, and he expired on the following morning, nearly fourteen days after the receipt of the wound, and on the third day after landing.



On examination of the chest, the left pleura was found to contain two quarts of sero-sanguineous fluid, its costal surface exhibiting evidences of acute inflammation, and the lung, shrunk to a small solid mass, was adherent to the spine. The thickened and distended pericardium contained half a pint of the same sort of fluid, and the surface of the heart was covered with a thin layer of adhering lymph, a small clot of blood being attached to its apex. The right ventricle presented a transverse opening about an inch in length, which penetrated to its interior, near the origin of the pulmonary artery. On removing the heart, by cutting through the great vessels, the ball was sought for, and found lying loose in the pericardium. By

tracing its course, it became evident that it must have remained in the right auricle, as the tricuspid valve had a circular, lacerated opening in it, near its attachment to the ventricle. The right pleura and lung were healthy.*

The singular problem to solve in this case is, that the hæmorrhage did not immediately destroy life, and that the ventricle could continue to contract on its contents without discharging the blood into the pericardium: perhaps this result was hindered by the laceration of the valve, which allowed of partial regurgitation of the blood into the auricle; and the action of the ventricle would tend rather to contract than to expand the opening. If the coronary artery had been wounded, death must have been instantaneous.

This case is not singular, as regards the nature of the wound; but it is very remarkable, if not unique, in the fact that the patient so long survived so grave an injury.

There is a closer analogy in the condition and consequences of lesions of the Brain and Lungs than might be supposed, from the contrast in structure and function existing between these organs. Parietal fracture may occur in either case without involving the contained viscus; contusion is represented in each instance by apoplectic extravasation—if I may be permitted this generic but questionable use of the word—on the surface, or in the interior of either organ. Even concussion of the nerve-centre would seem to have its parallel in those functional disturbances which result from mechanical violence offered to the lung, without organic lesion; as exemplified in the effects of blows and of compression. Hæmorrhage into one or other viscus may be fatal from interference with function; and the consequences of mechanical injury correspond, inflammation endangering the integrity of the organ and the life of the patient in either case, though usually fatal in injuries of the head, and rarely so in injuries of the chest. Lastly, the pleura,

* This case is reported in the 'Edinburgh Medical Journal,' vol. xiv.

as the arachnoid, is obnoxious to the usual consequences of inflammation; and in each instance life may be jeopardised by encroachment of its products on the contained viscus.

The vicarious performance of function, dependent on the duality of each organ, is more effective in preserving life in lesions of the lung than in those of the brain; but the relative mortality, in either instance, is due rather to the facility with which the disintegrated tissue and the products of inflammation are discharged from the chest than from the skull. I may observe also, in following out this parallel, that there seems to be a greater tendency, in lung-injury, to limitation of inflammation to the proximity of the injured part; whereas, in brain-lesion, the fatal issue from secondary causes is almost invariably the effect of extension of inflammation, and consequent disorganization of texture, involving some immediately vital part of the encephalon.

The mutual relations and interdependence in function of these important organs is brought out into bolder relief by the lesions to which they are subject. As the respiratory effort fails under privation of nerve-force, so do the functions of the brain languish when it is starved of its due supply of oxygenated blood, at once its stimulant and its food. Each organ is invoked at times to perform extra duty, under the coercive influence of necessity; and each has its interval of comparative repose. The unremitting activity of the lungs is more apparent, though scarcely more real, than that of the brain. In both, their voluntary functions have rest in sleep. Each has its own peculiar susceptibilities; but it is rarely that these are rudely aroused in the one without the sympathy of the other being awakened. Shock is experienced when either is seriously hurt; but this appears to be incidental rather to the general concussion caused by the violence, than to the appeal made directly to the organ;—though certainly more apparent, the degree of violence sustained being taken into account, in injury of the lung than in that of the brain.

That lesions of the heart are attended by profound collapse, and are more certainly and speedily mortal than those of either brain or lungs, is readily intelligible, when we consider its large supply of ganglionic nerves, and the immediate importance of its uniform function to the vitality of every other organ. Its irregularity or intermittent action is alarming; and even the brief suspension of its rhythmic beat is death.

LECTURE X.

LESIONS OF THE ABDOMEN.

The Construction and Function of its Walls.—Lesions of the Diaphragm.—Contusion of the Abdominal Walls.—Concussion and Contusion of the Abdominal Viscera.—Shock and other Symptoms.—Vomiting.—Hæmorrhage.—Tympanites.—Peritonitis.—Muscular Lesions.—Wounds of Parietes, lacerated and penetrating.—Conclusions.—Comparison with similar Injuries to the Head and Chest.—Results of Penetrating Wounds.—Contrasts in the Pathological Consequences of Traumatic Inflammation in the different Serous Membranes.

MR. PRESIDENT AND GENTLEMEN,—The special adaptation to their several functions which are observed in the skull and chest, likewise characterises the walls of the abdomen in their relation to the contained viscera, and indirectly so to those of the thorax. The capacity of adjustment to varying degrees of distension of these organs, and the faculty to exercise active compression, are the most important of their functions; and these attributes are not only compatible with, but assist importantly in, free movement of the spine, in the various inflexions of the body. Yet these conditions, and others of secondary importance, entail a certain amount of exposure to injury which is due to the intrinsic properties of the abdominal parietes, and to the accommodation of their structures to the passage of various textures into and out of the cavity; the walls are weakened at such points; and this circumstance is instrumental in permitting a class of lesions, for the relief of which the surgeon's interference is frequently claimed.

The complicated apparatus employed in the assimilation of food resides principally within the abdomen; the vascular supply of the organs thus employed is abundant; and their innervation is derived chiefly and specially from the cycloganglionic system. The muscular parietes of the containing cavity are under the guidance of volition; but the motor power of the viscera themselves, with the exception of the urinary bladder, is derived from the scattered nerve-centres which abound in this region. The solid and part of the membranous organs are, comparatively, though not absolutely, fixed in their several positions; but the greater length of the bowel is loose and moveable, varying, to a certain extent, its relations according to its exigences. Yet, even the relatively fixed viscera accommodate themselves to the encroachment of neighbouring organs, dependent on their temporary distension or permanent enlargement; and it is remarkable to what an extent this may take place without serious disturbance of function, as demonstrated by the presence of ovarian and other tumours.

Forming the roof of the abdomen and the floor of the chest is the musculo-membranous septum, the diaphragm. Each surface of the muscle is covered nearly throughout by a serous expansion; and the central aponeurosis has closely adhering to its upper surface the fibrous layer of the pericardium. These relations and connexions are most important in the diagnosis of lesions in this region; for a penetrating wound, of even very moderate depth and of but slight obliquity, may involve the liver and lung, and possibly also the pericardium and heart, in its progress. From such wounds the anterior wall of the abdomen offers but little protection; but they are infrequent, happily, in our country, as they very rarely occur except as the act of the assassin, or, occasionally, of the suicide. The same lack of protection is apparent in abdominal contusions; yet the gravity of these is often mitigated by the yielding nature of both parietes and viscera. It should be remembered, however, that those membranous organs which are most liable to periodical

states of distension are most protected, such as the stomach in the hypochondrium, and the bladder in the pelvis.

Injury of the Diaphragm, by rupture or wound, is not of frequent occurrence. From time to time, after severe and speedily fatal mischief by compression of the abdomen, we meet with such lesions in our hospital *post-mortem* rooms. The passage of a heavy wheel over the waist, crushes the ribs and forces part of the abdominal contents into the chest; but we rarely have an opportunity of witnessing, during life, a condition which can be diagnosed as rupture of the diaphragm.

In my eighth lecture I narrated a case, in which there appeared to be conclusive evidence that a knife had been thrust through the diaphragm, and both the liver and lung seemed to be implicated in the injury; but the position was such as to prevent the intrusion of the contents of the abdomen into the chest, and to render the muscular lesion a feature of minor importance. In rupture of the diaphragm on the right side, no hernial intrusion into the chest could occur, unless the rent be large, as the liver would be an effectual barrier against such result.

In rupture on the left side, hernia is a very probable consequence; and the physical constitution and relations of the thoracic and abdominal viscera necessitates the intrusion of the latter into the cavity of the former; for the arched tension of the diaphragm is a necessary condition in respiration: when this is spoiled, the lung is no longer distended; but the space is occupied, when the chest is expanded, by the viscera nearest to the rent; and the lung, therefore, cannot descend into the abdomen.

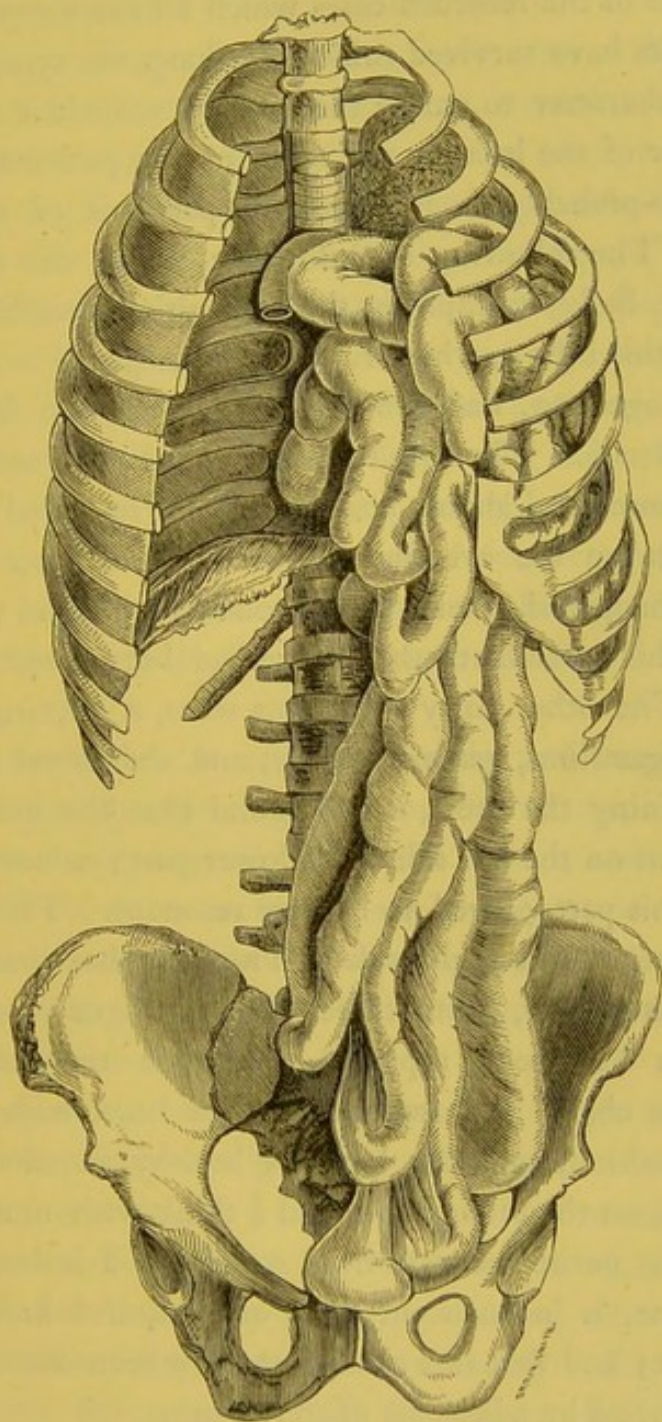
The diagnostic signs of such an injury would be obscure, and would vary according to circumstances. Pain and dyspnoea would be present; and the physical signs, by auscultation and percussion, must depend upon the nature and extent of the hernia. If the stomach be thrust upwards into the thoracic region, as occurred in a case of large abdominal cyst resulting

from injury, which I shall relate in a future lecture, there would be even abnormal resonance at times in this region; or there would be dulness, if the stomach (or colon) were distended with solid contents. The preparation I have on the table, which is from the museum of St. Thomas's Hospital, exemplifies this class of cases.

A patient about fifty years of age, who had formerly been a railway porter, was admitted into the hospital in May 1862, with fever, and died, with pulmonary complication, in three or four days. It was noted, during his treatment, that there was entire dulness on percussion in the left dorsal and lateral regions, with bronchial respiration. The *post-mortem* examination showed the results of broncho-pneumonia on the right side, and revealed the following remarkable condition on the left. The lung was very much collapsed, reduced to a small size, and displaced to the upper and posterior part of the pleural cavity, and attached by *firm* adhesions to the parietes. The transverse and descending colon, and a very considerably enlarged and softened spleen, were also lying in the left pleural cavity, with a large proportion of the small intestines, which had escaped from the abdomen through an aperture in the tendinous portion of the left side of the diaphragm, sufficiently large to allow the hand to pass through. The abdominal cavity contained only the lower portion of the ileum, the cæcum, with portions of the ascending and descending colon and its sigmoid flexure, in addition to the glandular viscera. The stomach was entirely above the diaphragm, and occupied the posterior and lower part of the left side of the chest. The kidneys and liver were not disturbed from their natural position. (See wood-cut.)

The antecedents of this patient did not allow of a very reliable history of his previous life being obtained: but a woman, with whom he had been recently living, said he told her that, about two years and a half since, whilst employed on a railway, he had been squeezed between the buffers of two carriages. He suffered acute pain and great difficulty of breathing for

some time afterwards, but had no medical advice, and—I do not say *propter hoc*—soon recovered from the immediate effects of the injury. But he seems to have been the victim of



physical depression, to relieve which he had recourse to drink, and became a confirmed drunkard. His general health appeared, from the account given, to be deteriorated; and he became

dyspeptic, and suffered from continual thirst, which induced him to drink a large quantity of water, in addition to the strong liquors which he imbibed.

In some of the recorded cases which I have met with, where the patients have survived sufficiently long, the symptoms were not of a character to enable the medical attendant to diagnose the nature of the lesion : and some of the patients have died suddenly—probably from spasm or paralysis of the injured muscle. The following doubtful case, under the care of my friend Mr. Solly, exemplifies the difficulties attending the diagnosis of this injury, where recovery takes place.

A. C., aged 29, had two ribs on the left side fractured by direct violence. The injury was immediately succeeded by great dyspnœa and almost fatal syncope. He rallied after some hours ; but on the evening following the day on which the accident happened, there was secondary collapse, which suggested to his attendants that there had been internal hæmorrhage. The other early symptoms were, a burning sensation in the epigastrium, general distress, and abdominal respiration. On examining the chest, it was found that the breath-sounds were absent on the left side at its lower part ; whereas, on percussion, this part proved to be very resonant. The heart was thrown over to the right side. The inference drawn, by the medical attendants, from these physical signs was, that the diaphragm had been ruptured, and that the stomach had entered the chest. In two months the heart had resumed its normal position, and the lung its healthy function. It was contended, on the other hand, and I think with much show of reason, that entire recovery from so serious a lesion, and in so short a time, is inconsistent with our acquired knowledge on the subject ; and that this case must have been one of pneumothorax, limited by adhesions of the pleura.

The recent condition of the parts involved was well illustrated in a case of which I have a record—the patient dying soon after his admission into the hospital. A large quantity of

blood was found in the left pleura; and the diaphragm was torn on the same side, to an extent sufficient to admit through the aperture the entire stomach and the left lobe of the liver, which occupied part of the left pleural space. The lung was correspondingly compressed, and the heart was so displaced as to be thrown to the median line above its normal position.

A similar condition prevailed in another recent case, the injury resulting from the passage of a waggon-wheel over the chest, and the patient surviving only two hours. The left pleura contained a quantity of fluid blood, and a large rent in the left muscular portion of the diaphragm extended into the pericardium. In this instance the stomach, spleen, a considerable portion of the transverse and descending colon, with some omentum, were in the left pleural cavity. Hæmorrhage, in these cases, combined with obstructed respiration, was apparently the immediate cause of death. In the instances I have on record, the left side of the diaphragm was usually the seat of laceration.

I am tempted here to narrate a singular and interesting case of injury specially affecting the muscles of respiration, and dependent on contusion of the nerves directly associated with this act. It did not occur under my own observation, but the notes were kindly supplied to me by my friend and former pupil, Mr. Wagstaffe, who attributes the symptoms to contusion of the phrenic nerve.

T. F., aged 23, received a kick on the right side of the neck over the anterior edge of the sterno-mastoid in its lower third, about an hour and a half before he was visited. When seen, he was suffering from urgent spasmodic dyspnœa, could not speak, had constantly recurring spasms, with temporary cessation in breathing, the diaphragm being visibly contracted spasmodically during each attack of apnœa. In the intervals between the attacks he was quiet; and, after taking some hot stimulant, he could speak between the paroxysms, which were not diminished in frequency. The attacks were ushered in by a

dreamy state of expression, gradually merging into complete cessation of respiration. The injury had been directly over the right phrenic nerve, but there was no bruising here of the surface, and there was no evidence of injury to the large vessels, the circulation being normal in the arteries beyond. The heart's sounds were healthy; pulse fair, at 96; there was some difficulty in swallowing, and tenderness on pressure over the seat of injury. Early on the following morning, the convulsions were renewed with increased severity, threatening to cause death by asphyxia. Pulse weaker; surface colder; pupils sluggish. He was relieved by morphia and chloric ether, with mustard to the nape and feet. Later in the day he had numbness in the right hand and arm, succeeded by a sensation of "pins and needles." This soon passed away; and from that time he rapidly mended, without further relapse, and was well in a few days. The last attack of dyspnœa was on the fourth day; and dysphagia remained as the latest evidence of the injury.

Such a case as the above is, of course, open to much speculation. Probably the nerve injury was complicated, and both the pneumogastric and sympathetic may have been involved in the production of the symptoms, as there seemed to be a lack of intelligence between the lungs and the excito-motor centre, centripetally, as well as a convulsive action of the muscles of inspiration, and of those commanding the aperture of the air-tube.

In consequence of their readily yielding to pressure, contusion of the abdominal walls is not accompanied often by circumscribed extravasation of blood; a condition which is so frequent in the gluteal region as a consequence of falls or blows. Over the pubes we occasionally meet with such blood tumours, but rarely higher up in the abdominal wall. Extravasation not infrequently presents this character in the labia of the female; but in the male, when the scrotum is contused, the effusion assumes usually the character of diffused ecchymosis.

Contusions of the abdomen, although unattended by any organic lesion, are often characterised by an amount of *shock*, which can be accounted for only by the impression made on the contained viscera. In many instances, so profound is the attendant collapse, as to suggest a mortal injury; and in some cases I venture to affirm that it is impossible to determine, at an early period, whether the patient be the subject of visceral lesion or not; in some few cases this doubt may not be solved until after the lapse of two or three days; and occasionally the uncertainty is indefinite. The shock of which I speak must not be confounded with the faintness and depression which results from internal hæmorrhage. In the latter class of cases, the patient usually refers his suffering to some isolated spot, where fulness, or dulness on percussion, or both, may be detected. Shock, from simple contusion, may, as I have remarked, remain masked; *i.e.* retain the characteristics of the same condition resulting from organic lesion, for forty-eight hours or longer; for the reaction following these injuries is sometimes deferred, and is rarely proportioned to the previous amount of depression. Moreover, the belly not infrequently becomes tympanitic and tender, without the development of peritonitis. The impression made on the great cyclo-ganglionic nerve-centres explains the profoundness of the collapse in abdominal injuries, as compared with similar lesions of organs in other regions; the appeal is specially and more directly made to the system of nerves that controls the functions of organic life, which are, therefore, primarily affected. In the earlier stages of these lesions, I am unacquainted with any diagnostic sign by which we may predicate whether shock exists primarily, apart from, or as expressive of, actual breach of texture. The absence of any special indication of local mischief, such as pain, tenderness, swelling, or bloody urine, may be accepted as negative proof, so far as it goes, that the case is one of simple shock; but the perplexity is sometimes enhanced by the early absence of collapse, as I shall have occasion to point out, where

the lesion is organic and of a character even to prove speedily fatal. Time alone, in such instances, can develop the true nature of the case, either by renewal of vigour, with restored circulation, or by the development of fresh symptoms, if the patient survive to the stage of reaction. Happily the diagnosis, in these circumstances, does not influence our early treatment. Caution in the use of stimulants, entire repose, both muscular and visceral, together with warmth to the surface, and evacuation of the bladder with a catheter, is the safe expectant treatment whilst doubt still hangs over the nature and extent of the injury; the subsequent management of each case must be guided by symptoms as they arise. I will now briefly exemplify the above remarks.

A child, seven years of age, was admitted under my care, having been run over by a cart, both wheels of which passed over the chest and abdomen. He was pulseless, and in profound collapse. On the following day, the abdomen became tympanitic but not tender. Moderate reaction was succeeded by convalescence; and the child left the hospital well, after six days.

A navvy was wheeling a barrow down a steep plank, when he fell, striking his abdomen against the handle of the barrow. He was admitted in a state of collapse, but there was no positive sign of ruptured viscus, although there was an ecchymosis where the blow was received. He soon recovered, and had scarcely any abdominal tenderness at any time.

A boy, ten years of age, was admitted after the wheel of an omnibus had passed over his abdomen. The shock was considerable, but not attended with insensibility. There were no marks of contusion. He had dyspnoea, and complained of great pain and tenderness in the iliac region, where there was dulness on percussion, extending half way to the iliac crest. His intelligence was impaired, suggesting the probability that his head had been injured. He rallied slowly, but was able to leave the hospital at the end of the third week.

In the former two of these cases, the condition was one of simple shock from abdominal contusion, from which the patients quickly rallied; in the latter case there was, apparently, extravasation of blood and the further complication of some injury to the head; but there were no indications of serious visceral lesion in the abdomen.

The occurrence of *vomiting* in these cases of simple abdominal contusion is not constant; and its presence, when persistent, is suggestive of some organic lesion. Yet, in some instances, I have known repeated vomiting and a protracted state of semi-consciousness followed by slow recovery. Occasionally, in abdominal contusion, a relapsing state of collapse will occur, which naturally excites alarm, as it may usher in more serious symptoms indicative of lacerated viscus; but this cause of anxiety may also pass away, and a healthy reaction may be established. In some instances the convalescence is deferred and more protracted; and a doubt may still remain as to whether any visceral lesion actually existed. As I have already remarked, I know of no diagnostic sign by which this suspicion may be supported or verified, except the presence of local pain, dulness on percussion, bloody urine, or some disturbed function; yet even these can scarcely be regarded as conclusive when the patient recovers, as I shall endeavour to exemplify presently. On the other hand, more or less *general* peritonitis may follow contusion without lesion; but this complication is, I think, rare; and the recovery of the patient is no proof that such lesion was not present, for the acuteness of the symptoms is not necessarily a measure of the severity of the organic injury. The following cases briefly illustrate the foregoing remarks.

A middle-aged man was struck on the abdomen by the handle of a crane. He immediately became sick and faint, and, when admitted into the hospital, was in a state of extreme collapse, and complained of acute tenderness over the abdomen. His water was drawn off untinged with blood. On the fol-

lowing day he vomited whatever he took, and complained of great tenderness over the abdomen, not localised at any particular spot. On the third day he had somewhat improved, but solid food was still vomited, however light its character. This patient rallied very slowly, and continued to suffer much pain and tenderness in the belly. He had fits of vomiting at intervals, and was much prostrated; but the pulse always remained quiet. He left the hospital after six weeks of perfect repose, still much enfeebled. In this instance the local signs of peritonitis were present; but the circulation was never excited, and I felt it impossible to affirm that there was no organic lesion inflicted. The succeeding case exemplifies other features, but belonging to the same category.

A young man, aged 20, was knocked down by a horse on to a railway, in front of some carriages which were in motion down an incline; he was thus squeezed before the wheels for some five or six yards, and had the right side of his chest and abdomen severely contused. On admission, he was in a state of extreme collapse, and vomited. I examined him carefully, but could not detect fracture either of the chest or pelvis. He rallied during the night, but became again extremely prostrated on the following day. His breathing was chiefly thoracic and short, but he referred his suffering to the abdomen, and especially to the hypogastric region. He was able to micturate naturally, and his water was clear. On the third day he was sick; tongue coated; skin hot; pulse quick and hard; respiration rapid. On the fifth day, the report states that the pulse rises and falls without apparent cause; complexion sallow; conjunctiva tinged yellow; abdomen distended. Shortly after this he began to rally, the yellow tinge of the complexion abating, and the abdominal distension subsiding. The right hypochondrium continued tender for some time, and his tongue was foul. The treatment was confined to gentle aperients after the first few days; he left the hospital at the end of three weeks. Some of the symptoms in this case suggest hepatic lesion, but

the patient's early recovery seems scarcely consistent with that belief; though I may remark that it has come within the sphere of my observation that superficial lesions of the liver may heal very quickly.

The immediate consequences of abdominal contusion vary from transient shock to profound and fatal collapse. Cases of the latter class are recorded, but I have never examined one, *post-mortem*, which was unaccompanied by organic lesion. It is difficult to assign this fatality to its true cause, further than by surmising that, as in similar injuries in the cervical region, the functions of the organic nerves are irrecoverably suspended; and there is nothing unreasonable in the supposition that such is the case, when we consider how profound and protracted such collapse sometimes is, accompanied by pulseless unconsciousness, and every evidence of the low ebb to which vitality is reduced in both organic and animal functions. For an obvious reason, these instances of sudden death are not often brought under the notice of the hospital surgeon; and when they occur they are probably due to some complicating cause, such as feeble health, strong mental emotion, or, possibly, some pre-existing organic deterioration or disease. Indeed, I may refer to the remarks which I made in one of my earlier lectures, when speaking of the possibility of death resulting from cerebral concussion, without organic lesion. In such cases, if they occur, doubtless shock, communicated from the cerebro-spinal to the ganglionic nerve-centres, is the cause of death. So, in the more direct appeal to the latter in abdominal contusion, the brain is secondarily affected; and in either the result is, perhaps, determined by some accidental concurrent circumstance, or antecedently existing condition, by which vitality is depressed below its normal standard.

In cases of severe abdominal contusion with shock, I have generally noticed the occurrence of *tympanites*, accompanied by constipation of the bowels, as a sequence. To what is this due, assuming that there is no visceral lesion? My conviction is

that it is referable to the injury inflicted on the ganglionic nerves. The shock sustained by the nerve-centres of this system produces temporary suspension of their active function; and paralysis of the peristaltic movement of the intestines is the consequence.

The concurrence of *hæmorrhage* with shock, as a consequence of abdominal contusion, is usually indicative of more or less serious visceral lesion; I mean that hæmorrhage rarely occurs except from some lacerated or ruptured viscus. Yet such injury is by no means necessarily fatal. The complication in question is one which it is impossible to distinguish with certainty from simple shock in its early stage; for even protracted semi-consciousness and acute local pain may be present without either hæmorrhage or organic lesion.

Local peritonitis, as a sequence of abdominal bruise, is not very uncommon; *i. e.* if we may accept the evidence afforded by topical pain and tenderness, with febrile excitement, as a proof of such effect, in the absence of more positive signs of visceral injury. But *general* peritonitis consequent on contusion is, in my experience, rare; its presence, therefore, may be regarded, in most instances, as highly suggestive, though not positively conclusive, of organic lesion.

I have a record of one case in which a middle-aged man was knocked down in a crowd and trampled on. He survived three days, with a distended and tender abdomen, and constant vomiting. His breathing was thoracic, and he never rallied from the shock caused by the abdominal contusion. The peritoneum contained three pints of turbid fluid, and some traces of lymph; but there was no visceral lesion. These cases are rare; and the injury, in this instance, was peculiar.

Retention of urine usually accompanies this class of cases, but the bladder generally recovers its tone as the symptoms of shock subside. In fact, this condition, as well as sleeplessness and indifference, or restlessness, are to be regarded rather

as indicative of shock, *per se*, than of shock specially associated with abdominal contusion.

Muscular laceration from abdominal contusion, but without cutaneous lesion, is occasionally met with. Such instances are, however, infrequent and exceptional. Rupture of the rectus may, at an early period, puzzle the surgeon; but afterwards it becomes apparent from the depression bounded, above and below, by the retracted fibres of the severed muscle. The history of the accident will also assist in the diagnosis of these cases. In an instance which recently came under my notice, this injury occurred in a female in whom the recti muscles were previously separated, allowing of partial protrusion of the central viscera.

Lesion of texture in the abdominal walls may present all the varieties of such injuries in other parts; they may be either incised, contused, lacerated, or punctured wounds. The special interest of such cases is dependent entirely on the doubt which must, in most instances, exist as to the probability of the contained viscera being involved in the injury. Yet, without such implication, these injuries, if severe, are serious, and sometimes fatal. In one case of attempted suicide under my care, an incised wound of the abdominal wall placed the patient in a very critical condition for some time, though it was doubtful whether even the peritoneum was injured. The wound, which was between the ensiform cartilage and the umbilicus, and to the left of the median line, was inflicted with a razor, and the patient suffered from all the symptoms of collapse, followed by abdominal tenderness and fever. He had been induced to commit this act in consequence of acute epigastric pain which had long tormented him. He recovered slowly; and informed me, before he left the hospital, that he was almost entirely relieved of his pain: this operation had effected a cure.

A singular *gun-shot wound* of the abdominal wall occurred in a patient of mine some years since. He was climbing a bank and drawing his gun after him, with the muzzle towards

his body, when it exploded, and the entire charge of shot was lodged in the epigastric region. I concluded that the patient's condition was hopeless, as he was in a state of profound collapse, and it was impossible to ascertain the extent of the injury inflicted, as there were no special symptoms to guide me. This patient recovered; and I was enabled, at various times, to extract the shot and several fragments of clothing from the large suppurating cavity, which remained open for many weeks. The oblique direction which the charge took saved the man's life; for neither of the three serous cavities in the neighbourhood could have been implicated, if I may judge by the negative evidence afforded by the absence of symptoms which would indicate such injury. He was compelled afterwards to wear an artificial support, to compensate for the entire loss of all sustaining textures in the epigastric region, except the skin.

Laceration of the abdominal wall, if severe, is a serious complication in abdominal shock. This occurs occasionally in buffer-accidents, and I have known it to prove fatal, without penetration of the serous cavity.

The abdomen affords no exception to the general rule, that *punctured* wounds are the most serious in their remote, and often in their immediate, consequences. It is scarcely necessary to observe that a penetrating wound in this position must be either very shallow, or its direction very oblique in relation to the plane of the surface injured, for the cavity of the abdomen not to be entered: but the lesion of some one of the contained viscera is not a necessary consequence of such a complication. The obscurity attending the diagnosis of these cases is great, owing to the amount of shock which often accompanies them, and the impolicy of making exploratory examinations for the purpose of settling this doubt. I have already pointed out that the severity of the shock is no measure of the gravity of the lesion, where no wound exists; and I may add that its persistence sometimes misleads the surgeon. These remarks apply with at least equal force to penetrating wounds

of the abdomen, especially when accompanied with much violence ;—such as a fall from a high window, and the consequent impaling of the body on the spikes of area railings. These injuries are brought under our notice from time to time in our hospital practice ; and I have had some instances under my care in St. Thomas's. One such I have already had occasion to refer to, in illustration of another subject. The following case exemplifies the form of injury I am speaking of, and also the obscurity which envelopes the diagnosis of these lesions.

A middle-aged man was repairing a house, when the ladder on which he stood broke, and he was precipitated from a considerable height on to some area railings : two of the spikes, which were conical at the point but not sharp, penetrated the abdomen, and were broken off. One of them was picked up by a looker-on. He had bled freely before he was admitted into the hospital : on admission, he was cold, blanched, and nearly pulseless ; and, although restless, appeared almost unconscious of what was going on around him. One spike had entered the abdomen close to the left anterior superior spine of the ilium, grazing the bone to some depth ; the other had penetrated about an inch above the umbilicus : venous blood was oozing from each wound. He complained of no pain in the abdomen. On the following day there was sickness, thirst, and tenderness, with some reaction. He survived about sixty hours. The autopsy betrayed scarcely any signs of peritonitis. The spike which penetrated close to the ilium pierced the iliacus muscle, and splintered the subjacent bone. The fragment of the missing spike, four inches in length, was found lying across the rectum : it had pierced the tissues perpendicularly, and indented the third lumbar vertebra, by collision with which it had evidently been broken off. The right iliac vein was torn, from which a large quantity of blood had been poured into the pelvis ; but there was no laceration of any viscus.

In this case the symptoms of loss of blood as well as of shock

were present; and the two combined proved fatal. Yet, in contrasting the results of such an accident with others of severe abdominal injury produced in a different way, we are led to the conclusion that accidental concomitant circumstances, and particularly the accompanying general violence, have often an important influence in determining the intensity of the shock. I remember the case of a railway-guard who was admitted into the hospital, having been squeezed between the platform and a luggage-train in motion. The result was extensive separation of skin from the subjacent textures, with limited external laceration below Poupart's ligament, yet allowing access to the interior of the abdomen. But the patient was neither collapsed nor sick when he was admitted. He died on the third day of peritonitis.

In reviewing the observations I have made on abdominal contusions and parietal wounds, they appear to me to justify the following conclusions.

1. Shock of the most profound character is often the consequence of simple contusion of the abdomen; and the intensity of the symptoms of collapse is no standard by which the nature of the injury can be determined.
2. The continuance of this state of collapse for two or three days is not necessarily conclusive as to the existence or otherwise of organic lesion.
3. Severe localised pain, and even general and continued abdominal tenderness, are not to be accepted as proof of organic injury, and are quite consistent with ultimate, and even with early, recovery.
4. Tympanites and constipation, from temporary paralysis of the muscular coat of the bowel, are the consequence of shock or concussion of the cyclo-ganglionic nerve-centres.
5. Vomiting generally follows the severer forms of contusion of the abdomen, without reference to the part struck: it is sometimes persistent, but it is not a constant symptom.

6. Retention of urine is a common accompaniment of these injuries; and is usually attended by more or less insensibility to the presence of urine in the bladder.

7. Internal hæmorrhage, as a complicating circumstance, may occur in these injuries, without its presence being ascertained from the early symptoms: but a state of syncope, as distinguished from shock, especially if accompanied with local pain and swelling, and dulness on percussion, with much thirst, may be regarded as highly probable evidence that internal hæmorrhage has occurred.

8. Penetrating wounds, especially with blunt implements or missiles, do not necessarily involve textural lesion of any viscus; but they are often fatal, nevertheless; primarily from shock or hæmorrhage, or the two combined, or secondarily from peritonitis.

The concussion, and consequent paralysis, to which the membranous abdominal viscera are obnoxious, is similar to that of which I spoke in a previous lecture as characterising the effects of violence, without organic lesion, inflicted on the lung. In fact, severe commotion (if I may borrow the French expression) of either cerebro-spinal, thoracic or abdominal viscera, seems to be followed by the same result of disturbed or suspended function. In the head, the centre of volition and sensation is directly appealed to, and the cyclo-ganglionic system is sympathetically affected: in the spine, the excitomotor functions are disturbed in common with those of which the cord is the intermediate conductor to distant parts: in the chest, probably the vaso-motor nerves and centres are directly acted upon: in the abdomen, the larger cyclo-ganglionic centres of this region are implicated. And these results are independent of, or rather superadded to, another disturbance of function which is due to the same cause: defective oxidation of the blood, and consequently suppressed or scanty secretion—especially of the excretory organs, as the bile and urine—under the influence of shock, manifests the interruption to which the

functional integrity of this important division of the nervous system is thereby subjected.

In an earlier part of this lecture I alluded to and exemplified some of the difficulties attending the diagnosis of contusions and penetrating wounds of the abdomen, as distinguished from those more serious injuries which implicate the viscera themselves in organic or structural lesion. Indeed, in many instances, this obscurity is enhanced by the absence, for a time, of the symptoms of profound shock which accompany simple contusion or concussion,—an apparent anomaly which admits of explanation, as I shall presently point out.

Many circumstances combine to determine the consequences of injuries which lay open the peritoneal cavity without visceral lesion. Some of these are apparent, others inscrutable, probably because dependent on occult predisposing causes, which may be natural and inherent in the individual, or purely accidental. As an exemplification of the apparent caprice which governs the results of incised wounds of the abdomen, I will quote two cases which, no doubt, have their parallel in the experience of most hospital surgeons. I was requested, some years since, by the late Dr. Waller, to assist him in a case of ovarian disease. The period I allude to was that during which tentative operations were performed, in the hope of discovering some means, less fatal than extirpation, for the cure of ovarian tumours. The experiment which Dr. Waller proposed to try was that of inducing inflammation of the adjoining surfaces of a limited portion of the peritoneum, hoping thus to procure adhesion, as a preliminary step to tapping and draining the cyst. I exposed the serous surface of the cyst in the median line to the extent of about an inch, and placed a pledget of lint between the edges of the wound. The patient, a young woman in tolerable health, survived this, in one sense, trifling operation little more than forty-eight hours. She sank speedily

in a state of collapse, and without symptoms of any acute peritonitis.

The other instance to which I refer is a case of ovarian tumour, on which I operated about twelve months since. I give an abstract of a narrative of this case, as it was sent by our Registrar to one of the medical journals. The patient was a married woman, thirty-three years of age, in fair health: the measurement of the abdomen, at the level of the umbilicus, was forty-eight inches; and the wave transmitted, on percussion, from side to side, was very distinct. An incision from near the umbilicus to the pubes exposed the tumour, the contents of which were found to be gelatiniform matter of a remarkably tenacious character. One hand alone was almost useless in the prolonged task of emptying the large cyst; it was requisite to introduce both hands simultaneously from opposite sides, and then to lock them together, in order to remove, little by little, the firm and glutinous colloid contents, which amounted to upwards of three gallons. Numerous smaller cysts were treated in the same way, and the universal adhesions were broken through all round. The omentum in front, the mesentery behind, the stomach, liver, and intestines, had severally to be cautiously separated. The aorta and iliac arteries were felt pulsating behind the fingers, as they were carried downwards from the abdomen into the pelvis. Ultimately the pedicle was included in a clamp; and, after some bleeding vessels were tied, the ligatures being cut off close, and the pelvis cleansed with a sponge of the fluid which had gravitated into it, the edges of the wound were approximated and fixed with an uninterrupted suture. The patient was under chloroform for an hour and a half, vomited at an early period, and respiration ceased on one occasion for a few seconds. The subsequent history of this difficult and therefore tedious case may be included in the simple statement that she had not a single untoward symptom: even sickness did not recur after she was placed in bed, although she had been

frequently subject to bilious vomiting previously. She was sufficiently recovered to return to her home twenty-four days after the operation was performed.

So remarkable a contrast in the results of two such different operations, as regards their relative magnitude, suggests many interesting and important considerations, which have a more or less direct bearing on the diagnosis of these injuries. The subject is one to which my attention has been often directed, and to which I shall revert when speaking of the causes of mortality after other operations in the abdominal region.

The frequency of mischief resulting from the exposure of a healthy serous or synovial surface, seems to indicate the remarkable susceptibility of these membranes in their normal condition ; but I venture to affirm that the converse is likewise true. Moreover, it is not necessary that morbid action should have altered the organic structure of these textures to produce this effect : it may be noticed even where only inflammation with changed secretion is present, or in congestion consequent on mechanical interference with the circulation ; but more especially is the susceptibility of these membranes modified by chronic inflammatory changes in their physical condition and relations, as in the latter of the two cases just narrated. Indeed, the contrasted organic sensitiveness, in the different conditions alluded to, is exemplified generally, so far as I have been able to observe, in the very class of cases to which reference has been made.

I believe, if other accidental and complicating circumstances could be eliminated, that these operations, which involve the protracted exposure of the peritoneum, are successful in proportion to the changed condition of the serous membrane—its permanent degradation, if I may so term it, below its healthy standard. No doubt the delay, coupled with necessary violence in separating firm adhesions, counterbalance, in a measure, these advantages, especially if any visceral lesion be superadded. But the progressive plastic change, during which, under these

circumstances, adjoining surfaces of a serous membrane lose their normal character and properties, and by which they become agglutinated together, must not be viewed in the light of a morbid process tending to a mischievous result; and, if gradual, such change is unattended by the symptoms and signs which characterise peritonitis, and does, in fact, often take place without satisfactory evidence of its occurrence, as proved by the difficulty attending the diagnosis, in such cases, of the presence or absence of adhesions. On the other hand, in the healthy membrane, is it not possible that its altered secretion—the presence of an excess of the saline ingredients in the out-poured serum, which is induced by exposure to the air or by traumatic irritation—may account for the often sudden and rapid diffusion of inflammation under these circumstances? A somewhat analogous consequence of what may be termed anticipated vascular derangement is witnessed in the temporary action of nitrate of silver on the skin. Erythema may often be circumscribed and arrested by the caustic application, as a spreading combustion may be checked by burning the parched grass of the prairies; although I have never seen any good result from the use of the escharotic in cellulitis: the cutaneous vessels are occupied, if I may so express myself, in the action induced by the caustic, and therefore refuse to take part in propagating the spreading inflammation. But I shall have the opportunity of further exemplifying this interesting subject in my next Lecture.

We are apt to regard organic lesions of the abdomen as almost necessarily fatal; and such, indeed, is very near the truth, with certain conditional reservation, in as far as the membranous viscera are concerned. But probably breach of texture in the solid or glandular viscera is more frequently recovered from than our opportunities enable us to demonstrate. I infer that such is the case, from a comparison of symptoms attending instances of undoubted structural lesion, as proved by

post-mortem examination, with those which I have witnessed in patients who have recovered; and also from the not infrequent evidence which I have observed, when engaged in making autopsies and in dissecting, of antecedent lesion in the liver, as indicated by linear or puckered cicatrices. In other instances, in which the patients have recovered, I have entertained but little doubt, from the attendant symptoms, that the kidney has been the seat of similar laceration or partial rupture.

That laceration of the membranous viscera should be so commonly fatal is scarcely to be wondered at, when we consider the varied and irritating qualities of their contents, and the great susceptibility to acute inflammation of the serous sac into which they are poured. Rents of the glandular viscera, although dangerous to a more limited extent from the same cause, are often fatal from abundant hæmorrhage—a risk which does not usually attend the former class of lesions. Yet, in many instances, fatal breach of texture in the membranous viscera does not induce sufficient inflammation to be, by itself, mortal: the vascular reaction is not adequate to produce this effect; and we are compelled to view the lesion as, in these cases, operating through the ganglionic nerves. The early prostration is succeeded by an abortive effort at reaction; extravasation of the visceral contents produces renewed collapse; and the patient sinks under the secondary shock thus communicated to the visceral nerves and ganglia, in which, indirectly or by sympathy, the functions presided over by the cerebro-spinal centres are involved. Nature, as I have heard that Mr. Abernethy used quaintly to remark, stands by and shakes her head, and then leaves the patient to his hopeless fate.

That shock to the ganglionic nerve-centres is the explanation of the frequent fatality of peritonitis, would seem to be confirmed by many considerations: for this result is not peculiar to the traumatic, as distinguished from what is usually termed the idiopathic, form of the disease. They run very much the same

course, and a state of collapse precedes dissolution. The fatality of inflammation in other serous membranes is due either to the entailed consequences, which operate, chiefly mechanically, on the organs they envelop. Thus, the copious effusion of serum or the deposit of pus within the arachnoid is speedily destructive of life : and in fatal pleurisy, this result, though often deferred, is chiefly due to obstructed function from pressure. The pericardium is no exception to these remarks : for here, likewise, death may speedily ensue from the mechanical compression of copious serous effusion, as manifested by the embarrassment of the heart's action, and all the signs of impeded circulation : or, if the patient survive, the probable occurrence of adhesions induces organic change in the structure and cavities of the heart, which become atrophied and dilated, and are thus rendered incompetent to perform their functions, as in health. In the peritoneum, on the contrary, as indeed is partially the case in the pleura, extensive adhesions are not inconsistent with functional integrity ; although they sometimes entail, accidentally, serious and even fatal consequences.

LECTURE XI.

LESIONS OF THE ABDOMEN—*continued.*

Injuries Involving the Abdominal Viscera Generally.—Symptoms: Collapse; Tympanites; Vomiting; Suppression or Retention of Urine; Temperature; Hæmorrhage; Pain; Peritonitis.—Rupture of Particular Viscera, Membranous and Solid.—Penetrating Wounds Involving Different Viscera.—Traumatic Cyst in Abdomen.—Fluctuation.—Consequences of Injury to Chest and Abdomen Compared.

MR. PRESIDENT AND GENTLEMEN,—The diagnosis of wounds penetrating the peritoneum is rarely a matter of difficulty or doubt. The protrusion of any portion of the visceral contents is conclusive. But, even apart from this demonstrative evidence, the nature of the wound and the mode of its infliction generally indicate whether the abdominal wall has been entirely penetrated. Yet, in some instances this circumstance is doubtful; and, if so, the welfare of the patient forbids any inquisitive attempt to solve the doubt: unless, indeed, the suspected presence of a foreign body prompt the surgeon to seek for it, with a view of removing it. Such doubt existed in the case of gun-shot wound which I mentioned in my last Lecture; and a similar difficulty existed in an instance of self-inflicted mutilation which was under my care. The patient to whom I refer had stabbed or cut himself across the abdomen, and remained for some time in a precarious state, but ultimately recovered. The far more important inquiry, and one which it is often both necessary and judicious to leave in abeyance is, whether any

viscus is implicated in the injury. As the consideration of wounds, attended by simple protrusion of the abdominal contents, is unnecessary so far as diagnosis is concerned, I will now proceed to make some remarks on traumatic lesions, from various causes, of individual viscera.

Every organ within the abdomen may be the subject of wound or laceration; and these injuries may result from compression, by which they are ruptured, or they may be caused by cutting or pointed instruments, or by penetrating missiles. Thus, these lesions resolve themselves into such as occur without external wound, and such as are the sequence of an injury implicating some part of the abdominal wall. It may be convenient to consider each class separately; although, as regards the diagnostic symptoms by which they may be identified, they belong essentially to the same category.

I have already remarked that no dependence is to be placed on shock as an index of visceral lesion: and I may here observe further, that depressed temperature at an early period is no reliable guide; but it is to be interpreted simply as a measure of the severity of the shock, without reference to the complication of organic lesion. The shock, indeed, in abdominal injury is proportioned entirely to the impression made on the ganglionic nerve-centres; simple visceral lesion, unaccompanied by any great violence, is not necessarily attended by symptoms of collapse, primarily: and the absence of the usual indications, which manifest this state, may thus be very deceptive during the early stage of such cases. But, in their subsequent and sudden supervention, these symptoms derive a significance from the delay, which, in most instances, admits of but one interpretation, viz.: that extravasation of foreign matter of an irritating quality has occurred, and has communicated, through the sensitive serous membrane, that deleterious influence and consequent impression on the ganglionic nerves, which the simple laceration of the viscus had failed to produce.

I may take this opportunity of remarking, also, that the

temperature in abdominal lesions appears to be more uniformly low than in head injuries; and the chief feature seems to be the steady fall in the temperature after the injury, lasting for a greater length of time in the former than in the latter, before reaction ensues. So far as the cases examined justify the conclusion, the temperature varies directly with the amount of injury received; primarily indicating the intensity of the shock, and subsequently the severity and fatal character of the visceral injury.

In many respects, for purposes of diagnosis, organic injury of the abdominal viscera, whether as the consequence of a penetrating wound or of rupture, may be regarded as identical. The usually fatal character of these lesions, and the causes of that fatality, are the same in both cases, though occurring under different circumstances. But it is the circumstances in question which render it desirable to notice these several forms of injury separately; inasmuch as the manner of their infliction is, in the one case, often presumptive proof of the nature of the lesion; whereas, in the other, no such conclusion can be drawn from the same source of information. It is often matter of pure speculation, when the abdomen has been forcibly compressed or violently struck, what viscus is injured, even when the symptoms are of a nature which leaves little or no doubt of the existence of some organic lesion. Certainly the mode in which the force was applied, and the spot which chiefly experienced its violence, rarely suffice to clear up this doubt, if unaided by any local sign of mischief. The remarkable variety of injury that is met with, under apparently similar circumstances, is often difficult to account for, especially in regard to the solid viscera. The actual state of the membranous viscera, as regards repletion, often determines their rupture, and thus affords a clue to a probable diagnosis, which other symptoms may serve to confirm. This remark applies especially to the stomach, duodenum, and urinary bladder; and in a minor degree to other parts of the intestinal canal.

It is probable that many structural lesions of the solid organs of the abdomen are healed, without our being able to form more than a conjectural conclusion that such a serious injury had been inflicted; but this is very rarely the case with the membranous viscera: speedy fatality in these cases is the rule, and recovery the rare exception.

Yet, it is not to be inferred, as I have already observed, that the breach in the texture of the organ is, in itself, mortal or irrecoverable. We know, indeed, that the colon, and even the stomach may be opened, without producing any marked constitutional or general disturbance; but, immediately the contents of any membranous viscus are diffused in the peritoneum, the symptoms of mortal shock succeed, and the patient sinks at once under its prostrating influence, or survives just long enough for peritonitis to have a share in determining the fatal issue.

The difference, as regards fatality, between penetrating wounds and rupture of a membranous viscus is certainly in favour of the former; for the lesion may be of a character—say a puncture—which admits of repair, without extravasation of the contained matter; and we know that the construction and organization of a musculo-membranous sac or canal is by no means unfavorable to repair; but that, under propitious circumstances, a ready activity and varied resource is manifested; and that security is thus often acquired in an unexpectedly brief period: even the products of inflammation which autopsies betray are proof of the unavailing and wasted effort to heal a hopeless breach. But in rupture, from pressure however exerted, the rent, from its nature and extent, is usually of a character that does not admit of repair: and, moreover, the frequent determining cause, as regards locality, viz: repletion, ensures a speedy extravasation of the matters contained within the torn viscus.

For obvious reasons, the hospital Surgeon, in civil practice, meets more frequently with visceral lesions from rupture than

from penetrating wounds: and he is, therefore, more often called upon to form his diagnosis, where he has but little to guide him beyond the general symptoms of his patient. Fortunately his decision can have but little influence on the result, in that it is impossible for him, in most instances, to affirm at an early period, whether such lesion exist or not; and his practice should, in doubtful cases, be conducted on the assumption that some organic injury may be present.

In illustration of the difficulties attending the diagnosis of these injuries, I will narrate a hospital case which came under my care, whilst engaged in writing these remarks: it is simply typical of a class which is of frequent occurrence in hospital practice.

A boy, nine years of age, was knocked down and run over by a butcher's cart, the horse, it was said, treading upon his belly. I saw him about an hour after his admission, and found him in a state of profound collapse. His surface was cold, the temperature being little more than 97 deg.; pulse rapid, and scarcely perceptible; tendency to sickness; respiration rapid and jerking; intense thirst. By this time, the abdomen had become tympanitic all over, the parietes being tense from the epigastrium downwards; there was much tenderness, especially just below the umbilicus and in the right hypochondrium. The boy had taken his breakfast of bread and milk a short time previous to the accident. I should remark that the back was also contused by the wheel of the cart.

I did not attach much importance to the collapse in this case, as an isolated symptom; but, in association with the manner in which the accident occurred, the distended stomach, the rapidly tympanitic state of the belly, the thirst and nausea, and the pain, I was disposed to regard the case with anxiety, and suspected that I had to deal with a ruptured stomach or duodenum, accompanied with internal hæmorrhage. The introduction of a catheter proved that the bladder was not implicated, as limpid urine was readily drawn off. Reaction was gradual. The boy

was starved for two or three days, and then allowed only a little bread and milk. The tympanites subsided, but the bowels remained perfectly inactive, and there was no power to evacuate the bladder. The same points in the abdomen continued very tender on the sixth day. The bowels were permitted to remain unmoved for a week, and were then relieved by an injection; after which he was allowed more food. About this time, also, he began to recover voluntary power over the bladder. This boy continued in the hospital for a short time subsequently, during which he still complained of tenderness in the parts first especially affected.

In the early stage, then, of injury to the abdomen of the character which I have described, it may be affirmed that, in most instances, it is unsafe to venture on a diagnosis of the nature of the hurt, or to predict its probable issue. The absence of shock immediately succeeding a mortal lesion may, as I have already remarked, lull suspicion, as its presence may, in simple contusion, excite alarm; for, if the violence have been insufficient to impress the ganglionic centres, and yet, from special circumstances of a mechanical nature, visceral rupture have been produced, the symptoms of prostration may be deferred until extravasation of the visceral contents has taken place. And it must be always borne in mind that laceration may be of such limited extent or so placed, that, under favorable circumstances, a patient may be on the way to recovery; and any relaxation of the requisite watchful and expectant treatment may be fatal. I shall have the opportunity of exemplifying this remark presently, in a case of penetrating wound. It was this impulse to exercise caution, which induced me to persist in the treatment by abstinence and rest of bowel for so long in the foregoing case.

But, usually, the lapse of a few hours enables the surgeon to speak more positively, where actual lesion of a membranous viscus is present. The suffering of the patient becomes intensified as some vascular reaction takes place: this may be

localised, but more often extends over the whole abdomen ; the features and general aspect, instead of presenting the comparatively passive expression of simple collapse, are pinched, anxious, and distorted with pain ; vomiting and tympanites ensue, if they be not already present : and the patient may then pass into a state of secondary collapse more profound than at first, or linger on for an uncertain interval in anguish more or less acute, until exhaustion closes the scene by death.

It is commonly said that patients, under these circumstances, die of peritonitis : yet this is scarcely correct. Inflammation here, as in other traumatic lesions, is simply an effort in the direction of repair ; and the products of this action are a measure of the activity of the effort, which is not in itself destructive. The patient dies during this stage, it is true ; but he succumbs to the shock that is perpetuated by the presence of irritating matter in contact with the peritoneum, and which thus acts upon the ganglionic nerve-centres.

I have generally regarded the period at which *tympanites* occurs as a valuable, though by no means a decisive, guide, in the diagnosis of membranous visceral lesion, as distinguished from simple contusion. In the latter injury, accompanied by shock, tympanites is generally deferred for twenty-four hours ; in organic lesion, it is earlier in its appearance. But this is by no means invariable, and is, therefore, not to be trusted by itself as a diagnostic sign ; indeed, its early appearance is sometimes simply significant of the intensity of the shock, as exemplified in the instance just now recorded.

What is this tympanites, and how is it produced ? In wound of stomach or intestine air may, no doubt, be extravasated into the peritoneum, of which I have some recorded cases ; or its presence in the same position may be subsequently accounted for by the disengagement of gas from decomposition. In shock, I regard it as chiefly intra-intestinal, and dependent on the atonic or paralysed condition of the bowel, by which both the generation and accumulation of gas are favoured ; for the

secreting function and motor power of the intestinal canal are both under the sway of the cyclo-ganglionic system : and the failing control of these nerve-centres is witnessed in the tumid belly which denotes progressive organic death in many diseases. The rapid generation and speedy subsidence of tympanites, under some circumstances, are remarkable facts, and are suggestive of the gas being derived from the circulation, and accumulating in the peritoneum—containing, probably, in solution, a considerable quantity of watery vapour produced at a heightened temperature ; and the fact that a rigid contraction of the abdominal muscles, sometimes noticed in these cases, controls or prevents tympanites, would seem to favour this conjecture. I have certainly observed the subsidence of tympanites without, so far as the patient's testimony could be relied on, the escape of gas from the bowel. In abdominal shock, indeed, entire inaction of the intestine is usual for a considerable period—a condition which it is injudicious to disturb. And how often is the converse condition noticed in other affections, viz.: frequent diarrhœa, with persistent tympanites. Whether this capability of exhaling gas be not, under certain conditions, a normal attribute of serous membranes admits of experimental inquiry ; and I hope to pursue this subject, in which I have already been engaged, now that more leisure time will be at my disposal. I am not indisposed to think that such a property may subserve important physiological purposes.

Vomiting, as I have already noticed, is by no means an invariable or even ordinary concomitant of contusion, though a sense of nausea is common. But, in ruptured stomach or intestine, the effort of retching is usual, and blood may be thrown up or passed by the bowel.

Suppressed or scanty secretion of *urine* is usual in organic lesion of the abdominal viscera. But I have already remarked that this sign is present in simple shock, and its continuance may, therefore, be regarded as indicative of the persistence of

collapse. *Retention* of urine is not, by itself, demonstrative of anything but disturbed nerve-influence; for it is met with under various circumstances in which the voluntary motor power is implicated, either directly or by sympathy, in an injury; it may be present alike in severe shock and in organic lesion.

As regards *temperature*, I cannot say I have been fortunate enough to obtain any results which satisfy me of its value in determining the presence of visceral lesion, and still less the locality of that lesion. Of the fact that the temperature is depressed in these injuries, as well as in contusion, there can be no doubt; but I have not succeeded in verifying, from my own observation, the remarks of the writer of an article on "Animal Heat in Surgical Diseases," in the *Nouveau Dictionnaire de Médecine et de Chirurgie pratique*, viz: that the depression of temperature is in proportion to the proximity of the lesion, be it from internal strangulation or other cause, to the stomach. Certainly the intensity of the shock seems to bear a direct ratio to this relation; and, inasmuch as depressed vitality is accompanied by a proportionate degradation of temperature, in this way the observation referred to may be explained. I shall, probably, notice this subject again in my next lecture, where it will find more appropriate illustration.

The manner in which rupture of an abdominal viscus is produced is insufficient, as I have already remarked, to determine the locality of the injury, or even its extent. It may be the result of direct pressure, as between the buffers of two railway carriages; or it may be consequent on some peculiar twist of the body, when it is doubled up, as in falling from a height. In looking through and collating many hospital cases, I am unable to associate the special lesion with any particular form of accident. The violence or pressure seems to be uniformly distributed through the viscera, and some accidental circumstances determines the seat of injury. Even the kidney is not an exception to this remark; for I have found it lacerated

under various circumstances, and from different accidents ; though, probably, more frequently from a doubling up of the body, than the other abdominal viscera.

A singular exception to the above remark occurred in a case of which I preserved a record at the time. A large fibro-osseous tumour was shown at the Royal Medical and Chirurgical Society, many years since, by Mr. Arnott, the aged patient from whom it was taken having been killed in a curious way. She was thrown down in the street by a dog, and a fold of small intestine, crossing in front of this tumour, was found ruptured by compression against the abdominal wall.

The occurrence of copious *hæmorrhage* is, for obvious reasons, more likely in rupture of the solid than of the membranous viscera. Usually, indeed, this is the cause of death, where the injury is speedily fatal. In one instance of complicated injury, in a lad, involving liver, spleen and kidney, I find a record in my note-book that the abdomen was so distended with blood as seriously to compress one lung. The diagnosis of internal hæmorrhage, *plus* shock, is by no means easy. When to the ordinary symptoms of collapse, great restlessness and distressing thirst are added, with suspension of, or confusion in, the functional activity of the senses, the presence of internal hæmorrhage may be suspected ; and this suspicion may be supported by the existence of fulness or dulness over some region of the abdomen, which is likewise the seat of tenderness. The concurrent operation of these two causes may, and does occasionally, prove fatal at an early period, without mortal visceral lesion, or even without any discoverable breach of texture. Thus, I have the record of a *post-mortem* examination of a patient who fell from a considerable height, and did not long survive the accident. There was no appearance of external violence, and no visceral lesion ; but the right half and transverse meso-colon were distended with blood, as was also a considerable portion of the mesentery ; but there was no blood loose in the peritoneum. Hæmorrhage, combined with shock, proved fatal.

Pain is an uncertain sign by which the nature of an abdominal injury can be judged of : at least, experience has taught me to attach less importance to it than I formerly did. The pain immediately attendant on rupture of a membranous or solid viscus is not necessarily or generally marked or severe, so long as the injury is unaccompanied by the escape of foreign matter into the peritoneal cavity. It has not infrequently happened that patients, on whom this mortal injury has been inflicted, have complained but little at first : but the intense localized suffering which accompanies the subsequent accession of collapse is very suggestive under the circumstances, if not absolutely conclusive, of organic lesion. On the other hand, the most acute pain and tenderness at some particular spot are not infrequently present, where the subsequent history of the case does not admit of the supposition that any visceral injury existed. Thus, a mail-cart driver was admitted into hospital under my care, who, in consequence of his horse falling, had been thrown violently on his left side in a bent position. He was in a state of collapse, with a blanched face expressive of great suffering. He writhed in apparent agony, and referred the pain exclusively to the left hypochondrium. His suffering continued, with scarcely any abatement, for two days, and the abdomen became tympanitic. The application of leeches gave relief, and he soon recovered. Another patient under my care had fallen from a high scaffold. In the course of a few hours, when reaction after collapse came on, he began to complain of pain deep in the splenic region, which increased till he rolled about in agony. Opium was given freely and repeatedly ; and, after the lapse of about thirty-six hours, the pain had entirely subsided, and he made a quick and good recovery. I should add that this patient passed bloody urine during the continuance of the pain, but not afterwards ; and the pain was not aggravated, but considerably relieved, by firm pressure on the part complained of.

I do not pretend to explain the phenomena in such cases as

the above, further than to suggest that there may be some analogy between the immediate consequences of mechanical violence to serous and synovial membranes; and that the severe pain of a wrenched joint may have its parallel in the forcible tension, and, possibly, laceration, of the peritoneum.

The continuance of localized pain and tenderness for a considerable period after convalescence has commenced, as in the boy whose case I narrated at an earlier part of this lecture, renders it probable that some trifling organic lesion has existed, which is progressively undergoing repair. I have seen many instances suggesting this explanation.

It must, however, be admitted that acute pain is usually the immediate accompaniment of lesion of a distended membranous viscus, whether stomach or intestine. I have witnessed this condition in many instances where the breach has resulted from violence as well as disease: it is rarely limited to any particular spot, but is rapidly diffused over the whole abdomen. Occasionally I have noticed a lethargic condition, not natural to the patient, succeeding these obscure injuries. It is not an encouraging symptom, but is not associated, apparently, with any special lesion.

In survival for a sufficiently long period, after ruptured stomach or intestine, the reparative effort is indicated by the presence of *peritonitis*. Yet the accession of this condition is rarely attended by any marked change in the condition of the patient, either general or local. The collapse continues, the pain is unabated, though scarcely aggravated, and the force or frequency of the pulse is not materially altered. I may add, the quality and amount of the inflammatory product found after death cannot be measured, so far as I have observed, by the symptoms and signs during life. But the proofs thus afforded of fruitless activity are an encouragement to the surgeon not to relax his efforts, or rather his precautions, even under such adverse circumstances.

The occurrence of a small perforating wound of intestine

may, under favouring conditions, be closed by plastic deposit, if the injured part be kept at rest. It is well known that eversion of the mucous membrane, in these circumstances, aids mechanically in the occlusion of the aperture thus made. This preparation, (No. 1179) from the Hunterian Collection, exemplifies the condition alluded to. The patient from whom it was taken had fought a duel in Hyde Park, and was shot, on the third exchange of fire, in the abdomen: and Mr. Hunter, who attended him, remarked, with his usual accuracy of observation, that the languidness in the eye made him suspect something more than an ordinary wound. The subject of the injury survived it twenty-four hours. The jejunum was found perforated by a bullet; but this large opening is partially closed by the thickening and eversion of the mucous membrane, and the deposit of plastic lymph. A similar case occurred under my observation in St. Thomas's Hospital, to which I shall have to refer as exemplifying the value of continuous rest under these circumstances. This preparation (No. 1180) also illustrates a similar condition of the intestine to that which I have just shown. The injury in this instance was caused by the kick of a horse in the epigastrium, the result of which was a rupture of the jejunum.

When the laceration is extensive, this eversion, accompanied by retraction of the edges, facilitates the escape of *fæculent* matter from the bowel,—a condition I have witnessed in instances of both single and double rupture of the jejunum, of which I have a record.

I have remarked that organic injury of the solid viscera of the abdomen is by no means so fatal as that of the membranous. If the first effects of shock and hæmorrhage are survived, recovery from lesion of the liver or kidney are probably not infrequent. I say probably, because, in such cases, the nature of the injury can be only conjectured. Whether the spleen may be placed in the same category I think doubtful, on account

of its peculiar texture and vascularity. Such a laceration as is here shown in the *Liver* must, from its extent, be necessarily fatal (No. 1391); it is wonderful, indeed, that the patient, who was crushed, should have survived two days, with a rupture extending completely through the organ. In such cases, profound collapse, with abdominal extravasation, indicates the serious nature of the lesion, without, however, pointing accurately to its site. Many such, though rarely to this extent, have come under my notice. The most extensive injury of the liver which I have on record among my cases, is that of an adult who survived his admittance into the hospital, and in whom a large mass of the crushed right lobe was torn away and thrust to the left side of the abdomen. The right kidney was also broken into several fragments. I may remark that, in superficial lacerations, I have found almost invariably that it is the under surface of the liver that is torn.

Although the time at my disposal does not permit of my illustrating the diagnosis of these injuries so amply as my case-books would permit, I am tempted to relate one instance of hepatic lesion, which is interesting from the protraction of life, and the fluctuation of the symptoms which were presented during the progress of the case.

A drayman, aged 22, was admitted into hospital under my care, having been jammed between the shafts of his dray and the wheel of a van. There was no external appearance of injury; but the collapse, thirst, constant sickness, and severe pain across the epigastrium, suggested the possibility of some serious organic lesion. The urine was drawn off, free from blood. On the third day the symptoms had, for the most part, abated, with the exception of thirst and abdominal pain. On the sixth day he was more feverish and restless; and increased abdominal pain was accompanied by tenderness. The face was jaundiced and anxious. It was evident that diffused peritonitis was commencing. On the eighth day there was abdominal effusion to a moderate extent, but the general condition was

improved. During the succeeding week the patient's condition varied, and the effusion into the abdomen was diminished in quantity, and the jaundice had abated. Afterwards increased tenderness ensued, with tympanites; and he at last sank rapidly, and died on the eighteenth day after the accident. On examination, the peritoneal cavity was found to contain a considerable amount of somewhat turbid fluid, coloured with bile. There was a large quantity of soft lymph effused about the surface of the liver, and the serous covering of the intestines was thickened by similar deposit. The peritoneal lining of the anterior wall of the abdomen was rough and congested. The abdominal contents were remarkably free from putridity. The liver, which was large, presented a laceration on its lower surface, passing from the anterior margin backwards, close to and parallel with the gall-bladder. In the posterior part of this wound the right hepatic duct was seen to be torn nearly across at its commencement from the common duct, the left branch being uninjured. The gall-bladder and cystic duct were also entire, but the latter was much contracted. Some pale coagulum lay beneath the serous covering of the right kidney. There was no attempt at repair in the lacerated wound of the liver.

The protraction of life and temporary amendment in many of the symptoms, succeeding so serious a lesion, are unique in my experience, and exemplify the difficulty attending the diagnosis of these injuries.

The following case, recently under my care, is an example of a similar injury, but complicated with further lesions, and proving fatal at an earlier period. S. G—, aged 51, was getting down from a heavily laden wagon which he was driving, when his foot became entangled in the rein, and he fell under the wheel, which did not pass over him, but pushed him before it for a short distance before the horses were stopped. When admitted into the hospital he was in a state of collapse; his respiration was almost entirely thoracic, and his urine contained

a large quantity of blood : his chief suffering was referred to the right hypochondrium. On the second day his abdomen became tympanitic and slightly distended ; he complained of feeling sick ; but his urine no longer contained blood. A yellow tint became apparent in his face. On the fourth day the abdomen had become more distended, though not very tender : vomiting was now constant, and the fluid ejected was of a brown colour. He died on the evening of that day.

The *post-mortem* examination revealed the presence of peritonitis, recent lymph being deposited on the intestines, and in some parts gluing them together ; the peritoneum generally was stained with bile. On the lower surface of the right lobe of the liver there was a patch of ecchymosis. The hepatic artery was torn across, and the separated extremities were conical and closed ; there had been but little hæmorrhage from the lacerated vessel. The common gall-duct was likewise ruptured. The right kidney was broken into three fragments, and surrounded by a large mass of extravasated blood, which formed a firm swelling behind the untorn peritoneum.

General peritonitis is not a necessary—I may say, so far as my observation enables me to judge, not even a general—consequence of rupture of the liver. In the record of several of my cases, where the patients have survived some days, I find a memorandum to that effect. Such a lesion may be succeeded by abscess, as occurred in a lad under my care who survived his injury nearly three weeks, and then died with symptoms of acute pleuro-pneumony and meningitis. In this instance there was a cavity, containing several ounces of pus, between the diaphragm and liver, and bounded partly by the ascending colon. There was evidence that the right lobe had been ruptured ; but even in this case there was no appearance of general peritonitis.

A recurrence of the early symptoms in these suspected lesions, after convalescence, indicates probable mechanical interference with repair, attended by hæmorrhage. I have met with a few such cases as the following. A patient was the

subject of a severe contusion of the side, followed by acute pain in the right hypochondrium, with collapse. On the third day he rallied, and these symptoms subsided, leaving him with a jaundiced skin; when he imprudently got up and made some effort, and suddenly had a recurrence of collapse, accompanied with great tenderness in the hypochondrium. From this relapse he rallied more slowly, and retained his sallow hue for a long time.

Extravasation of blood in the subserous areolar tissue around the *Kidney*, is by no means uncommon, without laceration of the organ; but I apprehend there can be little doubt that lesion of the kidney itself does often occur without proving fatal. Limited bleeding from the kidney is a frequent consequence of contusion or pressure; and, when a transient symptom, proves nothing more than rupture of some vessels which pour their blood into the pelvis of the organ. But when the hæmorrhage is copious and persistent, or recurrent, accompanied by pain, and especially if followed by suppuration, there can be little doubt that a more serious injury has been inflicted. Of this class of cases I have many recorded; but I will refer briefly to only one or two. Thus, a painter, aged 37, was admitted into the hospital under my care, having been struck down and run over by an omnibus, the wheel of which passed across the abdomen in a direction obliquely upwards from the right groin. He was in profound collapse, without pulse, and his eyes were glassy. A catheter was passed, and a small quantity of bloody urine was drawn off. With slight reaction, constant sickness ensued, and much abdominal tenderness. On the fourth day the symptoms were somewhat improved, and blood was no longer mixed with the urine; but, on the following day, blood again appeared; the sickness continued, with intermittent abdominal pain, some distension, and great tenderness. These symptoms remained unabated for two or three days, the tension of the abdomen increasing with perceptible fluctuation; and he was delirious. But a clean, moist tongue encouraged me

in adopting a more sustaining plan of treatment, and the patient slowly rallied, the symptoms gradually subsiding, but with occasional relapses; and he was convalescent in six weeks, though still pale and feeble.

In some instances the blood is in sufficient abundance to clot, after it is withdrawn from the bladder. Sickness is always more or less persistently present in these injuries, and the lumbar pain survives the bleeding. Another symptom which I have noticed in some cases of kidney lesion I cannot account for satisfactorily: it is the presence of dulness on percussion, extending from the hypochondrium to the iliac fossa, and accompanied by tenderness, apparently, in the track of the ureter. It may possibly be due to subserous extravasation of blood.

The following is another case of the same type, but of a more complex character. I was summoned to see a gentleman whose horse had fallen with him in the hunting-field, and had crushed him by partly rolling over him. He was carried home in a state of collapse: his suffering, which was severe, was referred to the left hypochondrium and loin. The contents of the bladder, when first withdrawn, appeared to be pure blood; and copious hæmorrhage continued for some days. At the expiration of about a fortnight pus was substituted for blood, and continued to be mixed with the urine, in gradually diminishing quantities, for more than two months. This patient remained an invalid for a long time, but ultimately recovered. One remarkable symptom in his case, and which lasted for some time, was the acute pain occasioned by eating, evidently attributable to the pressure or traction of the distended stomach; for it subsided as digestion was completed.

The appearance of blood in the urine, in suspected injury of the kidney, does not always follow the infliction of the injury immediately, but on the following day. I have not learned to attach any particular importance to this circumstance. Recurrent hæmorrhage, especially if the blood be fresh and bright in

colour, is a more serious sign, as indicating the probable dislodgment of fibrinous plugs in the lacerated vessels; yet these cases may recover. Mr. Hilton has made some interesting and valuable comments, in the volume of the 'Guy's Hospital Reports' for last year, on the form which clots assume, as diagnostic of the part from which they are derived. By floating them out in water, he has pointed out that they may be identified as to their source; coagula formed in the bladder being "somewhat irregular in outline, mostly circular flattened masses, bevelled off and fimbriated:" they may thus be distinguished from those which form in the pelvis of the kidney, and such as take the tubular cast of the ureter. I think the character of the urine in some of these cases can be explained only by the supposition, that clot deposited in the bladder is gradually dissolved in and passed with this excretion.

Rupture of the *Spleen*, from contusion or pressure, is not infrequent; and, if extensive, is probably usually fatal from hæmorrhage. Yet, copious bleeding is not a necessary consequence of this lesion; for in a patient recently under my care, who sustained this and other injuries, and survived for some hours, there was not more than two ounces of blood in the abdomen, though there was an extensive rent in the spleen. In one of my cases, a deep linear cicatrix on the convex surface of the spleen seemed to indicate the position of a former wound, but the patient died of a more recent injury.

I have on record but of one instance of laceration of the *Pancreas*, which occurred in a lad who was the subject of other severe internal injuries, that speedily proved fatal. I am not acquainted with any special signs by which these two organic lesions can be identified; unless, indeed, the situation of the pain or the presence of dulness to an abnormal extent in the left hypochondrium, may be regarded as suggestive of injury to the spleen.

The rapidity with which the adhesive form of inflammation occurs, in injuries of the abdominal viscera, I have seen

exemplified in many instances,—plastic lymph gluing neighbouring portions of the peritoneum together, when the patients have not survived more than thirty-six or even more than twenty-four hours. But this result is very uncertain ; and, so far as I have been able to observe, it bears no constant proportion to the acuteness of the symptoms or signs, which are evinced during the period which elapses between the receipt of the injury and the death of the patient.

Penetrating wounds of the abdomen by blunt or sharp instruments are occasionally met with, but not frequently so, in civil practice. A wound of a viscus by a blunt missile, such as a bullet, except when small, very much resembles the condition of a laceration or rupture, and would, in most instances, be denoted by the same indications. I have already referred incidentally to this subject. Recorded instances of recovery, after a penetrating wound of the abdomen with a sharp instrument, are rare ; and such fatal result, as the general consequence of wound of intestine, when in communication with the peritoneal cavity, is in accordance with the issue of experiments which have, from time to time, been performed on the lower animals, and especially recorded by Mr. Travers, and more recently by Dr. Gross, of Philadelphia. For, the conditions suppose the escape of some portion of the intestinal contents, whereby acute peritonitis is established ; and from this cause, as in similar lesions otherwise produced, fatal collapse follows. I have already remarked on the circumstances which favour recovery without serious consequences, after wound of the peritoneum ; and I shall have occasion to revert to this subject before I conclude.

Further, we know that the stomach or the colon may be opened, or the bowel may be accidentally wounded in operating for hernia—for such cases have occurred—without serious effects, *quoad* the wound, provided regard be had to the security of the peritoneum from the ingress of foreign matter ; therefore

we may fairly conclude that such visceral lesion is not, in itself, destructive; on the contrary, we know that, under favouring circumstances, it is capable of repair. On the other hand, in a penetrating wound of the bowel, a necessary preliminary to a cure is, such a closure of the aperture by protrusion and eversion of the mucous membrane as shall, the parts being left at rest, be a security against the extravasation of its contents. These conditions are, unfortunately, rarely fulfilled, and hence the usual fatality of such injuries.

Therefore, the general symptoms and local signs of incised or punctured intestine—apart, that is, from demonstrative evidence by sight or touch—do not differ from those of ruptured bowel. The nature of the former class of lesions is such as to hold out a better prospect of recovery, small though it be, than the latter; but this advantage is chiefly due to the possibly limited extent of the breach rather than to any other circumstance. In both, the escape of the intestinal contents into the peritoneum is the chief source of danger, and the explanation of the fatality which attends these cases.

There is every reason to believe, as I remarked in my last lecture, that lesions by rupture of the solid viscera are not infrequently repaired, the obvious explanation of the relative immunity from peritonitis in such cases being, the absence of that source of irritation which is supplied from the membranous viscera. Laceration of the texture of the liver, and even of the kidney, does not usually include the tubular or membranous portions of these organs; so that the escape or extravasation of their special secretion into the peritoneal cavity is exceptional. Moreover, the presence of bile in the serous cavity does not seem necessarily to entail the amount of mischief which might be anticipated from its acrid properties. The presence even of urine in the pelvic peritoneum does not, in many instances, produce the rapidly fatal consequences which its escape into other tissues would, by analogy, lead us to expect. The speedy coating of any such textural lesion with plastic lymph arrests

the tendency to extravasation in the solid viscera, and limits the consequent inflammation to the seat of injury. The displacement of this important element of repair, by some accidental or incautious movement, would appear to offer a satisfactory explanation of those symptoms of relapse which I have not infrequently noticed, and on which I have already commented.

Probably the repair of these lesions of the solid viscera is, under favouring circumstances, rapidly accomplished, as we should anticipate in parts so highly organized. In one instance, in which I saw the liver wounded on its surface to some extent, there was no trace of the injury a week afterwards, when the patient died. Incised or penetrating wounds of the liver, if of any depth, are likely to be attended by considerable hæmorrhage; and this may be external, as occurred in a patient of mine who, in a fit of delirium, inflicted several wounds upon himself with a butcher's knife. He had bled profusely, and was cold and exsanguine when admitted into the hospital. A distinct fissure made by the knife in the liver could be felt. His symptoms included occasional spasm of the muscles of the back and abdomen, with eructation and nausea: the respiration was quick, feeble and shallow. The oozing of blood continued until his death, which occurred in less than twenty-four hours. One hour before death his temperature sank to 93 deg.—an unusually low degree. The pleuræ and pericardium contained blood-stained serum, but were uninjured: the peritoneum contained fluid blood. Both omentum and liver were penetrated by the knife. Hæmorrhage, occurring in a maniacal subject, was the cause of death in this instance; for no other organ was injured, and there was no trace of reparative effort visible. I may remark, in referring to this case, that it rarely occurs that we are able, before death, to identify a lesion of this description. In an earlier lecture I related an instance in which recovery took place, where there was good reason for believing that both the liver and lung were involved in a

similar injury. The following case exemplifies the condition usually observed in penetrating wound of the abdomen, implicating the intestine.

B. G—, aged 44, was admitted under my care, shortly after he had been stabbed in the abdomen with a knife. He was in a state of profound collapse, with cold surface and depressed temperature, and that peculiarly anxious expression of face which accompanies, though it can scarcely be said to specially denote, a mortal injury. The wound was two inches long, and just below and to the left of the umbilicus; and through it portions of the small intestine, colon and omentum protruded. He had several attacks of shivering and vomiting, with frequent eructation, and severe twitching of the muscles. A small wound of the intestine was closed with a silk suture, and the bowels were returned. He survived twenty-six hours, without signs of reaction. At the *post-mortem* examination, the intestines on the left side were found somewhat glued together, and a few flakes of lymph were distributed between their coils elsewhere. There was some turbid reddish fluid in the pelvis, but no trace of fæcal matter could be detected. A piece of the ileum was glued by recent lymph to a pouch between the transversalis and internal oblique muscles, opposite to the wound. Close to its mesenteric attachment was the part of the bowel which had been wounded. The opening was half an inch long; but its edges were so perfectly united, that no leakage occurred when the gut was distended with water. The early agglutination and consequent closure of the wound in the intestine is an interesting and encouraging circumstance: this case further exemplifies a remark which I made in my last lecture, and which I have repeatedly verified, that the reparative effort occurs very early, and often without those symptoms which denote reaction and acute peritonitis.

In a more extensive injury of the jejunum under my care, where the patient also survived about twenty-four hours, there was gas as well as foetid fluid in the peritoneum, and the

intestines were rough with lymph. But in the case of a pregnant woman who was the subject of a lacerated wound near to the duodenum, and who survived only nine hours, there was no evidence of hyper-vascular action in the peritoneum. I infer, therefore, from these and very many similar cases which I have examined, that the reparative process, as evinced by local hyperæmia and the deposit of plastic material, may be initiated and proceed satisfactorily, without any general reaction following the mortal wound ; and that unmistakeable tokens of this effort are manifested after the lapse of from twelve to twenty-four hours.

In these instances of penetrating wounds of the abdomen, the most satisfactory condition is indicated by the absence of symptoms which evince excess of local action accompanied with general prostration ; and this is more likely to be secured by absolute rest than by any other means. The following case, though ultimately fatal, illustrates this remark, as well as the obscurity involving the diagnosis, from symptoms, in these injuries.

H. T—, aged 19, was admitted into St. Thomas's Hospital with a wound from a small pistol-bullet, which entered the abdomen one inch below and to the left of the umbilicus. The pistol was fired from the bottom of a flight of stairs, at the top of which he was standing. There was but little shock. The treatment consisted in giving opium internally, applying ice to the abdomen, and keeping the patient on a spare liquid diet. At the close of a week, during which interval he had remained perfectly at rest, and was almost entirely free from febrile disturbance, he felt so well that he got out of bed to pass urine. Immediately afterwards, symptoms of extravasation into the peritoneum came on rapidly ; and he died within twenty-four hours. At the autopsy, a small cicatrix marked the spot at which the bullet had entered. A quantity of gas escaped from the distended peritoneum, which contained also recent lymph, pus, and turbid fluid. The omentum and abdominal wall were

adherent together ; fæcal matter escaped when this adhesion was separated, the intestines being glued to the omentum. The small intestine was perforated in six places ; and there were two apertures in the sigmoid flexure of the colon ; from one of the former the fæcal matter had chiefly escaped. There was no lesion in the posterior wall of the abdomen or the pelvis ; but the bullet was not found.

In the succeeding case there is a reasonable probability that the bowel was wounded, or at any rate contused, though the patient's recovery did not permit the verification of this conjecture.

A groom, thirty years of age, of moderate development, was admitted into St. Thomas's Hospital with a penetrating wound of the abdomen, which had been pierced horizontally and transversely, from right to left, with the prong of a stable-fork. There were two wounds, about five inches apart and two inches below the umbilicus, of which the right was the larger. Very little blood had been lost, and he was in a state of collapse. He was kept under the influence of opium for a week, the wounds discharging very little ; the tenderness was almost entirely confined to the neighbourhood of the wound. At the expiration of ten days an abscess formed between the wounds, from which fæcal matter subsequently escaped. The discharge continued for three or four weeks, when the openings finally closed, and he entirely recovered. It is certainly possible that in this instance, as the patient had not a prominent abdomen, the intestine may have escaped injury. There was not even demonstrative proof, though very little doubt, that the peritoneum was perforated, as there was no indulgence in the pernicious practice of probing the wound. But it is quite possible that the blunt point of a pitchfork may have pierced the serous membrane and pushed the bowel before it out of the way. Of the subsequent adhesion of the intestine to the peritoneal wall in front, and of its communication with the abscess, there was positive evidence ; yet this result does not prove that the bowel

was implicated in the original injury, though I think it probable that such was the case.

Before quitting the subject of abdominal lesions, I am tempted to mention a remarkable instance of the development of an enormous cyst succeeding an injury.

In October last, I was requested by Mr. Stedman, of Guildford, to visit a patient at the Surrey County Hospital, to which I have the honour of being consulting-surgeon. The following is a condensed history of the case before I saw the patient. H. F., a coachman, aged 25, was kicked by a horse midway between the ensiform cartilage and umbilicus. The injury paralysed the diaphragm for some seconds, but did not render him insensible. His suffering being great, he had an anodyne draught at night, which he rejected; this was the only occasion on which he was sick. At the expiration of two weeks, the pain continuing, he perceived a tumour in the epigastric region, after which the suffering increased, especially in movement; but he had neither sickness nor rigor. He then came to the hospital pale and feeble; and lay curled up in bed, or resting on his hands and knees to obtain relief. A tense, elastic tumour, dull and fluctuating, occupied the epigastric region; it was tender, and descended with inspiration; the skin was not discoloured. A grooved needle was introduced, and a few drops of sero-sanguineous fluid escaped. The swelling steadily increased, and a fortnight later it was tapped, five pints of claret-coloured albuminous fluid being drawn off. The sac speedily refilled, and ten days later four pints of fluid of the same character were removed. He suffered from dyspepsia, but had no sickness. After the lapse of another month the cavity was again tapped, with the same result as before. This was repeated on three succeeding occasions, and an ineffectual effort was made to keep the opening patent. Six months from the date of his admission I saw him. There was then a hemispherical swelling, extending in a vertical direction from

the ensiform cartilage, which was pushed forwards, to near the umbilicus; and laterally it was lost beneath the ribs of either side. It was slightly conical in the centre, dense and resisting, but fluctuating. In the sitting posture, the intercostal spaces below the seventh ribs were bulging, especially on the left side, to which the swelling somewhat inclined. The ribs were widely expanded, abnormal breadth being given to the lower part of the chest by their divergence. On tapping with the finger the lower intercostal spaces, a distinct wave was felt across on the opposite side of the chest, below the seventh rib. The breath-sounds were distinctly audible above this line; but not below, where there was complete dulness on percussion, except high in the left hypochondrium, which was abnormally resonant, from the presence of the displaced and distended stomach. The heart was pushed upwards, its apex beating between the third and fourth ribs. There was no dyspnœa, but imperfect oxygenation of the blood, as evinced by the pallor and slightly livid hue of the complexion. I made an incision, about an inch long, in the median line, over the summit of the tumour, dividing in succession the rectus and the posterior layer of its sheath. I could discover no separation between the peritoneum and the sac, which was then opened, and at least twelve pints of serum were allowed to escape. I then introduced my finger, and swept it over the interior of the sac; and, so far as I could reach, I could discover no communication with any serous cavity. The sac extended across the epigastrium, was adherent to the diaphragm above, and stretched deeply into both hypochondriac regions, displacing all the surrounding viscera, none of which could be felt, except the heart pulsating against the phrenic wall, and the aorta indistinctly beating behind. The interior of the collapsed sac felt like that of the urinary bladder—soft, uneven, corrugated, and thrown into folds. The ribs had fallen, and the complexion was improved by the more free expansion of the lungs, after the operation. A small quantity of iodine was injected, and the opening was retained by the

introduction of a piece of lint. It is unnecessary to relate the subsequent details of this case. I received, from time to time, an account of the patient, who gradually rallied from the slight constitutional disturbance and local inflammation following the operation. The opening was never allowed to close; and, according to the last account received after he had left the hospital, and three months subsequently to my seeing him, he was looking healthy and growing stout. There was still a trifling discharge; but no appearance of tumour remained, a little thickening alone marking its original site. The respiration could be heard quite to the base of the lungs on both sides, behind. In front, the liver appeared to be permanently displaced, so as to encroach on the right lung; and the left lung could not be heard lower than the apex of the heart, in consequence of the stomach still retaining its former position. All the assimilative functions were healthily performed, and the patient was quite free from pain.

The possibility of our having, in this instance, to deal with a large hydatid cyst naturally suggested itself; but the character of the fluid contents, and especially its microscopic examination, forbade this conclusion. Moreover, the direct association of the tumour with the accident seemed to point to a traumatic origin. The examination of the interior of the sac proved that it was developed in the abdominal serous membrane; but in what way and under what circumstances must be matter of conjecture.

I have spoken of *fluctuation* as an important element in the diagnosis of abdominal tumours. But I may remark that this sign, in its most unequivocal form, is not diagnostic of the actual nature and quality of their contents. The slightest impulse will convey as perfect a wave across an ovarian cyst containing thick gelatinous matter, as across one containing limpid fluid. Even the subdivision of the tumour into many cysts does not interfere, in any appreciable degree, with the

presence of this sign. In a case in which I recently performed ovariectomy, the mass of the tumour consisted of numberless endogenous cysts, the contents of which were various, some being occupied by puriform matter, others by colloid, and again, others by limpid or thick and grumous fluid; yet the wave across the distended belly could be elicited in any direction by the gentlest tap. I may also remark, in reference to this particular case, as, indeed, in others with which I have dealt, that the previous history did not induce me to expect the universal adhesions which I found; so insidious and unmarked is that form of vascular action which leads to this result.

In comparing the consequences of mechanical injury to the viscera of the chest and abdomen, and to their serous envelopes, the points of contrast are more striking than are those of similarity. It is true that inflammation of the serous membranes exhibits, in its results, the same tendencies, whether in the head, chest, or abdomen; but these results operate very differently in the several regions. Even the milder forms of effusion in the pericardium and pleura are serious, from the mechanical impediment which they offer to the functional activity of the organs they envelope; whereas, the peritoneum may be enormously distended without the contained viscera suffering importantly from the pressure thereby exercised upon them. The difference in question is, of course, due chiefly to the contrast in the yielding character of the walls of the two cavities; and this feature, as I have already remarked, operates still more potentially in the cranium, where the pressure tells exclusively upon the delicate texture of the organ within. What is true of the milder forms of inflammatory products, is not less so of the consequences of acute inflammation; but there are also other elements of considerable importance here introduced. In the chest the tendency to complication, in the inflammatory action, of the lung-structure and pleura, is greater than in corresponding inflammation in the abdomen: and the peritoneum is more

susceptible to the presence of its own morbid products than is the pleura; a circumstance apparently referable to the same cause as that to which the relative susceptibility to shock of these membranes, severally, is attributable.

In contrasting the effects of injury to the organs themselves contained in these two cavities, such comparison can be instituted only between the solid viscera of the abdomen and the lungs; as there is no analogy between the anatomical relations of the trachea with its bronchial ramifications, and the membranous viscera of the abdomen. Hæmorrhage is the most frequent cause of fatality in wounds of the lungs, liver, spleen and, perhaps, of the kidney; but such bleeding always kills by exhaustion when derived from the latter organs; whereas, it may be destructive by suffocation when occurring in the first named, either by obstructing the air-passages, or by accumulation in the pleura, and compression of the lung-tissue from without. The diagnosis is, therefore, more simple, from the physical signs present, in thoracic than in abdominal hæmorrhage.

The effects of shock, from contusion or concussion, on the lungs and abdominal viscera, are manifested through the same system of nerves, but in a different way. Vascular congestion, the consequence of suspended function in the vaso-motor nerves, characterises the former; paralysis of the muscular coat of the bowels, and disturbance in the functions of the excretory organs, are witnessed in the latter; and the duration of these symptoms is generally proportioned to their intensity.

The means by which nature cures these lesions are similar in the lungs and in the solid viscera of the abdomen; and in each, as a rule, the consequences of structural injury are limited, ultimately, to the neighbourhood of the breach. That the arrangements existing for the security of the various vital organs against injury are not perfect, is due to their mechanical requirements in the healthy performance of their functions, and to the necessary structure of their containing cavities in relation to these offices. For, neither in organic mechanism, nor in

pathological processes or results, are we to expect incompatibilities, or to look for special provisions for every emergency. But we find the adaptation of the existing material and means to varied circumstances as perfect as the perplexing influence of disturbing elements will permit. And if the curative results are not always commensurate with our expectation or desire, it is because we do not give their full weight to the character and violence of the injury inflicted, nor attach due importance to the various predisposing and existing causes, which tend to mar the natural remedial efforts. Perhaps we may, without an excess of humility, confess that, from the imperfection of our science and art, our own endeavours to render assistance have fallen short of our good intentions; and it is not surprising if honesty sometimes compel us to admit, that a better acquaintance with the actual condition of our patient, and a more judicious reading of Nature's indications, would have saved us from the mortification of learning, when too late, how to render that timely assistance which might have been successful in protracting or preserving life.

LECTURE XII.

LESIONS OF ABDOMEN:—continued.

Intestinal Obstruction from Various Causes—Internal and External Strangulation: Symptoms and Signs.—General Observations on Hernial and other Obstructions.—Fatality of Operations for Hernia, and its Causes; Practical Conclusions.—Foreign Bodies in the Stomach and Intestines.

LESIONS OF THE PELVIC VISCERA.

Fractures of the Pelvis and their complications.—Rupture of Bladder; Is it always fatal? Effects: considerations suggested thereby.—Rupture or Laceration of Urethra: Causes and Symptoms.—Traumatic Lesions of Rectum.—Shock in Pelvic Injuries, and in Certain Morbid Conditions of the Uterus.—Recapitulation.—Indications Premonitory of Dissolution or Convalescence.—Conclusion.

MR. PRESIDENT AND GENTLEMEN,—It would be difficult to meet with a more apt illustration of the remark with which I commenced this course of Lectures than in the subject of intestinal obstructions. The essential conditions under which such obstruction from strangulation occurs, whether internal or external, may be identical, yet one class of cases is assigned to the physician and the other to the surgeon. But the diagnosis of these conditions in the two classes is by no means equally simple; and the surgeon has the advantage in the presence of tangible and visible signs, which rarely admit of any equivocal

interpretation. So obscure, indeed, are the symptoms, in many instances, by which internal strangulation can be recognised, so as to identify either its locality or its proximate cause, that it has been the effort of the physician to place himself, as nearly as possible, on a par with the surgeon, by exploring the abdomen, in the hope of obtaining the aid of physical signs to guide him in his diagnosis. And I cannot pass by this remark without a tribute to the memory of my late colleague, Dr. Brinton, whose sagacity and philosophical acumen in the investigation of this obscure but interesting subject, have an appropriate and enduring record in his admirable posthumous work on 'Intestinal Obstruction.'

The indications by which obstruction in the bowels is recognised, whatever its source or position, may be classified under two heads, viz : general and local ; and it is upon the combined presence of both that the surgeon founds his diagnosis of strangulated hernial protrusions. It is for this reason, and because such general symptoms and local signs rarely co-exist under other circumstances, that the diagnosis of strangulated rupture is usually so simple, as to leave the surgeon without excuse for overlooking its presence and neglecting the appropriate treatment. But, *separately*, the local signs and general symptoms are inconclusive. The presence of a tender swelling in the groin is suggestive of various conditions which have nothing in common with rupture, such as inflamed glands, abscess, malignant tumour, undescended testicle : and many circumstances may, either separately or in combination, produce constipation and persistent vomiting, besides the strangulation of an external hernia ; such as intus-susception, internal strangulation, a malignant tumour, stricture, impacted fæces, and other causes : but the presence of a tender swelling in the groin, accompanied by the characteristic pain and sense of constriction across the epigastric, or umbilical region, together with constipation, vomiting, and the history of a hernial descent, may be regarded as conclusive. It is true that there

may be many disturbing causes in operation, which modify the symptoms or complicate the diagnosis. Even simple inflammatory swellings may be attended by constitutional symptoms, somewhat resembling those which characterise rupture; but such coincidence is accidental: or perplexity may arise from the concurrence of internal strangulation with an irreducible hernia: and occasionally the local signs are inconsistent in character and intensity with the general symptoms; as where a mass of omentum is the solitary occupant of the sac; and still more so in the not infrequent complication of the presence of a small recent intestinal protrusion behind an old and irreducible omental rupture.

The symptoms which characterise internal strangulation and recent hernia are very closely allied; and for the obvious reason that these conditions are in all essentials identical, differing only in the accidental circumstance of locality. Some of these symptoms are due to the compression to which the bowel is subjected, and these are the earlier and more acute; such as pain, which is both topical and more or less general over the abdomen, and often assumes the character just now referred to, of a sense of painful dragging and constriction across the umbilical region; rejection of the contents of the stomach, excited immediately anything is swallowed; tenderness in the swelling if external, or at some particular spot if internal. Small recent herniæ are most liable to strangulation; and in such cases the strangulation is usually most acute: but the topical signs are much modified in old ruptures; for the accustomed descent of a hernia renders it less susceptible of pain, and may lead to its being overlooked even when the general symptoms have declared themselves. Indeed, when acute local indications usher in strangulation in an old hernia, the explanation is probably to be found in the accidental addition of a small knuckle of intestine to the ordinary omental contents of the sac,—a form of rupture which, as I have already remarked, is frequent, especially where the omentum is adherent

and therefore irreducible. I would observe that this occurrence may mislead the inexperienced operator; for the intestinal addition is often very small and entirely hidden, until sought for; and its return, during or immediately prior to an operation, accounts, as I believe, for the apparent anomaly which I have met with, of symptoms of acute strangulation coincident with the presence of unconstricted omentum only in a sac.

At a later period the character of the vomit becomes altered, as the point of departure of the reflected stream recedes from the stomach. But this feature—*fæcal* discharge by the mouth—characterises a stage distinct from that in which the mechanical irritation of constriction is the cause of sickness: the regurgitant vomit is the consequence, as already explained, of obstruction and accumulation in the intestine; and the rapid development of this sign is, to a certain extent, a measure of the distance from the stomach of the seat of strangulation.

The prostration which marks the latter stage of strangulation is very variable as to its period of access; the chief conditions influencing it being the position and tightness of the constriction, the treatment of the patient, and his general power. The pinched and anxious countenance, the parched tongue and hiccough, are added to the usual symptoms of earlier collapse: in fact, the state of the sufferer is identical with that which accompanies gangrene, though the actual annihilation of vitality in the strangulated bowel have not taken place. And this period brings relief to the patient, both as regards the acuteness of his suffering and the continuance of vomiting: but the apparent amendment is fallacious, and is in fact the harbinger of death.

General peritonitis is not usual in internal strangulation or in hernia: and the pain and tenderness which attend these lesions is due to this cause only in exceptional instances. Death usually results from prostration, consequent on the shock of a persistent violence done to the bowel, aggravated by the de-

pressing influence of constant vomiting and inanition. Perforation of the bowel and extravasation of its contents are followed by collapse, and, if the patient survive sufficiently long, by peritonitis, as in rupture from violence.

It is well known that the late Dr. Brinton opposed the previously received hypothesis that intestinal regurgitation is dependent on antiperistalsis, and substituted his own theory, that those particles of the liquid contents of the bowel "which are in contact with the inner surface of the tube, are propelled onwards by the muscular contraction of its wall. And this propulsion is necessarily accompanied by a backward current in those particles which occupy the axis or centre of the canal." I believe this explanation to be correct in most instances; but I doubt its accuracy in all. For, unquestionably, regurgitant vomiting does occur sometimes when there is no obstruction to account for the mechanism of Dr. Brinton's explanation. But, whatever the cause of such regurgitant action may be, there can be no doubt that, combined with constipation, this sign is of great value, especially when the period of its occurrence is considered in relation to the question of time as applied to other symptoms, and also to the topical evidence afforded by distension, tympanitic resonance or dulness, and similar physical signs. Thus, fæcal vomiting occurs, for an obvious reason, at an earlier period in obstruction of the small intestine than of the large; and the delay is protracted beyond what the larger interval of space would account for, by the necessity, as pointed out by Dr. Brinton, that an extreme degree of distension of the lower end of the ileum must exist before the ileo-cæcal valve can be thrown open.

The course and progress of the symptoms, marking the *fatal* tendency of insuperable obstruction, vary very much in different cases; and, other things being equal, the rapidity with which the more acute symptoms merge in collapse is a measure of the rigidity and tightness of the strangulation, whether external or internal. The first sign of *pain* may be an index of the

probable course the attack will take. If sudden and intense, the strangulation is correspondingly acute; and this characteristic is more often found in recent and small herniæ;—a class of cases, therefore, demanding the speediest relief by operation. Yet, the kind of pain of which I am speaking is also present in sudden extravasation of the contents of the bowel from ulceration; and I have met with cases in which it was impossible, at an early period, to assign the agonising suffering to its true source. But the collapse is earlier in ruptured bowel; and the pain is continuous, and not of that paroxysmal type which accompanies obstruction and is synchronous, in its periods of access, with the peristaltic movement of the intestine, which may be noticed even externally.

The seat of internal strangulation may be often conjectured,—in some instances identified,—by the physical signs of *distension*, *dulness* on percussion, and the visible and tangible *movements* of the bowel. But these signs are more valuable in their bearing upon the large than upon the small intestine; for the tympanitic distension of the colon may define the actual locality of the obstruction.

It is with obstruction of the small intestine that the surgeon usually has to deal; and in these cases indications of strangulation are generally more acute and earlier in reaching their culmination: the pain is more intense, the vomiting earlier; and there is a peculiar sense of distressing constriction across the umbilicus: whereas, in colic obstruction, the seat of suffering is often localised in the right iliac fossa.

In diagnosing the seat of obstruction, some importance has been attached to the quantity of *urine* secreted, which is usually less in proportion to the proximity of the seat of strangulation to the stomach; and under these circumstances it is assumed that the intestine itself pours out fluid more abundantly. The many exceptions to this rule in great measure negative its diagnostic value; though unquestionably there is, as might be expected, a relation between the quantity of urine secreted and the

amount of watery vomit, which I have known to be, in some instances, almost incredibly abundant.

Irremediable *paralysis* precedes gangrene, and is often, by itself, a cause of fatality, even when relief has been afforded by operation. Indeed, every practical surgeon knows that it is one of the chief difficulties with which he has to contend after liberating the strictured gut; and it is a condition which tests his forbearance in the after-treatment of his cases. This consideration is one which should exercise its influence in determining him not to delay affording relief by operation when his decision is required. A rapidly distended bowel is most obnoxious to paralysis; and I believe that paralysis with its usual concomitant, distension, is a ripe source of fatality in strangulated intestine.

The question of surgical interference in internal strangulation is necessarily influenced importantly, if not entirely ruled, by the special diagnosis. The performance of a serious operation, in itself threatening to life, has its only justification in the more menacing character of the disease for the relief of which it is undertaken: and in internal strangulation it is often very difficult to decide on the chances of spontaneous relief, even when the diagnosis as to the nature and seat of the constriction is determined. These two circumstances constitute, in fact, the bar to operating, as a rule, in such cases: viz., the obstacles to forming a correct diagnosis; and the uncertainty which invests the prospects of the patient, even when the nature of his malady is ascertained. An early operation is not justifiable; a late one is useless: and under either condition the operator may fail in accomplishing his purpose. These considerations govern the decision of surgeons in the majority of such cases: and my own conviction is, that abstinence from interference, as a general if not universal rule, is judicious: for, judging by the *post-mortem* examinations which I have made and witnessed in cases of internal strangulation, or of sudden obstruction from other causes, I should say that a large majority would have

been irremediable, even had gastrotomy been performed : either the seat of the constriction was inaccessible, or its consequences were beyond repair.

A few remarks more especially applicable, severally and in succession, to Intestinal Obstruction and to Hernia, must close the present brief allusion to this extended subject.

In forming a diagnosis of the site of intestinal obstruction from whatever cause, its position, if low down, may be indicated by the quantity of fluid which the bowel will receive, or even by the length of tube which may be passed into it : but I cannot say that confident reliance can be placed on these guides, which may be rendered deceptive by the presence of accumulated *fæces* in the bowel, and from other causes. It is certainly only in obstruction of the large intestine, that complete constipation is prolonged, sometimes through many weeks ;—the distension becoming very great, and not infrequently accompanied with peristaltic activity in the small intestine, in its fruitless effort to pass onwards its contents. In obstruction of the smaller bowel, from whatever cause, the symptoms are more acute, and the cases are more rapidly fatal.

I just now remarked that regurgitant intestinal vomit is not necessarily dependent on obstruction : the arrested peristalsis may be the consequence of paralysis of the bowel. Thus, after relief of strangulation by operation, stercoraceous vomiting may continue for a time, and yet the patient may recover. The following is a typical instance of this condition. A middle-aged female was admitted under my care with acutely strangulated crural hernia ; the intestine was deeply congested and of dark port-wine colour. On the fourth day after the operation the belly was tumid and tympanitic ; the colon could be traced, and the vomit was stercoraceous. Prolonged friction over the abdomen and an injection were employed, after which the bowels were relieved, and she recovered. This condition was,

doubtless, due to the persistent paralysis of the intestine, which is, in many instances, irrecoverable, and the cause of death. A case recently under my care, exemplifies this remark. A boy was admitted into the hospital with strangulated congenital hernia, which was entirely and readily reduced; yet stercoraceous vomiting ensued, and he died exhausted. The knuckle of bowel was deeply congested, but found free from all constriction. I have seen this state induced, apparently, by cold, exhaustion, or suppressed secretion, and characterised by gaseous distension and offensive vomit. Such instances of persistent constipation, with vomiting, I have examined *post-mortem*, without discovering mechanical obstruction from any cause: in other similar cases relief has been obtained, without any evidence, so far as could be gathered from the character of the dejecta, that faecal accumulation had caused the obstruction. This paralysed condition of the bowel is not infrequently relieved by long-continued friction, castor-oil being employed as the medium of its more effectual employment.

A condition of partial obstruction from stricture may become complete, in consequence of the contracted canal becoming accidentally plugged by some part of its contents. The suddenness of the attack may induce the belief that internal strangulation is the cause of the constipation; especially as aperients merely aggravate the symptoms, without affording any relief, whereas the lower bowel may be unloaded by an injection. Two cases of this class have come under my notice and partial care. In one, that of a middle-aged female, there was complete constipation for a fortnight before death, with the exception of an evacuation which was obtained by injection. The iliac regions were tumid and hard; perspiration was abundant; urine high coloured; constant stercoraceous vomiting for the last twenty-four hours. The small intestines were found to be much distended with gas and fluid faeces: the same condition prevailed in the large intestine, as far as the junction of the transverse and descending colon, at which spot a large ulcer involved the

whole calibre of the bowel ; and the part was so contracted that an orange-pip, which plugged the orifice, could not pass. In the other instance, occurring also in a female of middle age, the previous health had been good, and no suspicion of disease existed until within less than a month prior to death. Obstinate constipation was present, although an injection brought away *fæculent* matter : all *ingesta* were returned, and the vomit occasionally had a *stercoraceous* character : the abdomen was tumid and tympanitic, but not tender ; and much rumbling with violent pain came on in paroxysms. A long tube was passed without assisting the diagnosis : the patient died exhausted. The autopsy betrayed evidence of commencing peritonitis. The whole alimentary canal was greatly distended, as low as the termination of the sigmoid flexure of the colon : here, close to the upper part of the rectum, was a contraction which would not permit fluid to pass downwards : but when water was poured in below, a dark shrivelled body was washed out, resembling a raisin. In neither of the above cases was the acute suffering of internal strangulation present : but in many respects the symptoms were so nearly allied to this condition as to bring under discussion the propriety of gastrotomy ; which, however, I discountenanced in both. The seat of obstruction was not sufficiently defined to suggest the propriety of colotomy.

It is scarcely necessary to remark that, in such cases as the above, and in others in which obstruction is consequent on various causes, the evacuation obtained by injection is due entirely to the clearing of the lower bowel ; and is not to be accepted as any indication that the obstacle to peristalsis, whatever that may be, has been removed. The favourable signs on which dependence may be placed are, ability to discharge *fœtid* gas from the bowel ; subsidence of sickness and abdominal tension ; the varying position of any localised fulness, hardness, or resistance ; the diminishing intensity and shifting site of the pain ; and cleaning tongue : some, or even all, of

these symptoms may be present, before any solid relief from the bowels is obtained.

Obstructions in the rectum are rare, except from the presence of accumulated and indurated fæces; *i.e.*, apart from the constrictions which constitute genuine stricture;—a form of disease which, I may remark, is often spoken of as more common than, so far as my observation has enabled me to judge, it really is. My experience relative to the presence of foreign bodies in the rectum is in accordance with that of our President, who remarks that he has been rarely called upon to interfere in such cases: but I have met with some remarkable instances of protracted constipation, dependent, apparently exclusively, upon the accumulation of hardened fæces in the rectum, giving rise to distressing symptoms, resulting from enormous distension of the abdomen. The longest period of constipation that I have relieved, by breaking down the solid hindrance, is six weeks; the belly of the patient, a young man, being larger than that of a pregnant woman at her full time. Complete relief speedily followed the removal of the indurated mass, by manual disintegration and repeated injection. I may add that in one case of imperforate anus, on which I operated a long time since, this process was required periodically for many years, in consequence of the constant tendency to fæcal accumulation in the *cul-de-sac*, in which the rectum terminated at some considerable distance from the manufactured anus; the communication between the two being by an intermediate canal which it was difficult to keep open. The diagnosis of this form of obstruction is usually simple, if the obvious precaution of making an examination *per anum* be not overlooked nor neglected.

Many sources of obscurity may invest the diagnosis of strangulated Hernial tumours; though, as I have remarked, the existence of symptoms of constriction, combined with the external presence of a tender swelling where a hernia usually

occurs, rarely leaves the nature of the malady in doubt. A hernia may be rendered irreducible by its size or distension, or by adhesions, or by the presence of thickened omentum, without strangulation : or symptoms of constriction may exist for a time, as I have already noticed, and disappear without apparent change in the physical characters of the tumour, in consequence of the temporary descent of a small knuckle of intestine. I have also found such supplementary rupture contained in a perfectly distinct sac.

Various complications which are, however, comparatively rare, may perplex the operator ; but with well-pronounced symptoms of strangulation, he should not be deterred from pursuing his exploration, until perfectly satisfied that there is no strangulated rupture within his reach. The size of a hernial protrusion cannot always be measured by the magnitude of the tumour, which may be augmented, in the crural variety, by the presence of enlarged glands, or by thickened and infiltrated tissues, or by an accumulation of fluid in the sac. The history of a hernial descent may likewise mislead the surgeon, if he expect that violence is an essential element in its production. I have known acute strangulation in a recent rupture succeed an apparently trivial exciting cause, such as the act of rising in bed. But in such instances the force applied acts at great advantage directly upon the abdominal contents.

The impulse on coughing, said to be propagated to a strangulated rupture, is sometimes spoken of as the means of distinguishing an inguinal from a femoral hernia ; but the fact is that, in such constriction as produces symptoms of strangulation, no such impulse is communicated to the contents of the sac : the position of the neck of the sac is the chief reliable guide. The exact seat of stricture is not an important point to be ascertained before operating ; and in most instances it is conjectural, if any deviation from the normal or ordinary disposition exist.

Sometimes a hernial descent may take an unusual course, as

where an inguinal rupture spreads itself between the layers of the oblique muscles. I remember being consulted in an instance of this embarrassment, occurring in a young man, in which the form, position, and other local signs were very suggestive of a diffused parietal abscess; but the history and general symptoms left no doubt on my mind that the tumour was hernial, and I advised an immediate operation. The protruded bowel was spread out beneath the aponeurosis of the external oblique muscle; and its congenital form and sudden descent accounted for this peculiarity.

Even in the after-treatment of hernial operations the symptoms may suggest to the surgeon that he has overlooked some strangulated bowel; whereas, the explanation may be the formation of an abscess in near relation to the seat of operation, especially if a conduit for drainage have been neglected, by attempting primary union of the entire length of the wound. But these complications and sources of perplexity are too numerous to admit of further illustration, or, indeed, of more than a cursory notice.

Any part of the movable contents of the abdomen may be found in a hernial sac. I operated on one case in which the cæcum, with its vermiform appendix, was so placed. The stomach, and even the distended fundus of the bladder, have been found occupying a hernial sac; but the special symptoms by which such rare occurrences may be identified are not clearly defined; nor, indeed, is it of any importance that they should be.

Age is no bar to this accidental strangulation of a rupture, nor to its successful relief. The oldest patient on whom I have operated is a lady of eighty-four: the youngest a male infant of eleven months. In both instances the usual symptoms were strongly pronounced, and the stricture was very firm: in each the patient made a good recovery.

In association with this subject I may call attention to the fatality, and its causes, in operations for hernia.

1. In reviewing my hospital experience, extending now over more than a quarter of a century, I cannot recall any instance where I have operated, in which I could reasonably attribute a fatal result to the operation, although my habit is, with rare exceptions, to open the sac.

2. I have never had occasion to regret operating too soon ; but very often to deplore that the opportunity has not been afforded to me of operating earlier. In all doubtful cases the patient should have the advantage of an exploratory operation.

3. Acute general peritonitis is rarely the cause of death ; but patients die most often exhausted, and without rallying from the intestinal paralysis and prostration induced by the antecedent strangulation and vomiting ; or the contents of the sac may slough.

4. Such antecedent condition is not to be measured, as regards its intensity, by time ; in many instances, a hernial descent of a few hours' duration may be so tightly constricted as to entail an irrecoverable condition of the bowel ; whereas, in others, the persistence of strangulation, in a minor degree, for two or three days, may not seriously imperil the vitality of the intestine.

5. Inflamed and sloughing omentum may cause death, whilst the bowel remains pervious.

6. The most serious complications are entailed by rough and unskilled employment of taxis :—consequences which not only directly aggravate the risk to the patient, but likewise enhance the difficulties attending careful and well-directed efforts to afford relief. That hernia is a rife cause of death, is attested by the Registrar-General's Report ; for he assigns to this cause an average death-rate of eight hundred annually.

The conclusion which I draw from these facts is, that delayed operation is the most prolific cause of fatality in strangulated rupture ; and that the operation itself, including

opening the sac, is not, when necessary, a dangerous proceeding. On these grounds I cannot refrain from insisting on the importance of early operative interference in strangulated hernia; and from expressing my conviction that the danger attending the exposure of the interior of a hernial sac and its contents is, in great measure, imaginary. When the constriction is sufficiently firm to necessitate operation, there is, in my opinion, no increased risk in opening the sac, unless, indeed, the descent be very recent, and the stricture can be easily and securely divided externally. But I am persuaded that, in many instances, the peril of the patient is seriously augmented by refraining from so doing, for the surgeon remains in ignorance of the actual condition of the contents of the sac; and the products of congestion and inflammation are shut up within the peritoneum, and left to work their deleterious influence on this susceptible serous cavity.

Although the recorded cases of foreign bodies being introduced by the mouth, and lodged in some part of the alimentary canal, are remarkable for their variety and extraordinary nature, their comparative rarity affords but scanty opportunity to individual surgeons to add importantly to the list, or to our acquaintance with the indications by which a correct diagnosis may be formed.

When foreign bodies, thus introduced into the mouth, are arrested within reach of the finger, or are within sight, as in some instances which I related in my last lecture, or when pins or fish-bones stick in the fauces or gullet, the proper course for the surgeon to adopt is at once indicated. Respecting the minor form of injury here alluded to, I may repeat that the sensation produced by the presence of a pin or a fish-bone in the throat often long survives its removal; and the representations of the patient may thus mislead the surgeon.

Many solid and indigestible objects pass the alimentary canal, producing but trifling and temporary inconvenience, or no in-

convenience at all, such as the stones of fruit, or even coins. But pointed bodies, such as pins and needles, often create prolonged suffering before they are discharged. The irritation which they produce may occur at any part of the canal through which they pass, from the pharynx, where they are sometimes arrested, to the rectum, from which they have been occasionally removed. Whilst I write, I have a young woman under my care, in whose œsophagus the presence of a pin has created the most distressing irritation ; and dysphagia, accompanied with profuse expectoration and constitutional disturbance, are apparently in part dependent on this cause.

In the intervening space, the stomach or some part of the bowel is frequently transfixed by these delicate bodies, which thence find their way to the cutaneous surface, and are discharged. The effects produced by this spontaneous perforation are very various, according to the accounts of different observers : sometimes they pass through the entire course of the bowel, as I have known, without producing any irritation ; at other times they give rise, especially when they are numerous, to extreme pain, coinciding apparently with the period of their perforation of the stomach or intestine, and occasionally causing death by inflammation of the peritoneum or by being retained. In most cases where we are called upon to remove pins or needles from beneath the skin, there is a distinct history of their piercing the surface, though it may be at a distance from the spot where they present themselves ; but occasionally the absence of such history and other circumstances point to the conclusion that they were most likely swallowed unconsciously with the food. A little girl was brought to me last year, whose parents had noticed a conical prominence in the left hypochondrium, for which they could not account. Feeling persuaded that it was a foreign body, I divided the skin and removed a needle. I infer that this was probably swallowed, from the position at which it presented itself ; and as the child was well cared for, being the daughter of affluent parents, the fact of its introduction

through the skin would probably not have been overlooked. In a youth who was admitted into the hospital with injury to the spine, of which he died, a blackened pin was found imbedded in the left lung, lying lengthwise close to the anterior edge. There was no trace of aperture of entrance, and it was adherent to the lung-tissue. This also might have perforated the stomach and found its way through the diaphragm to the lung. A pin, with its head on, is not readily driven through the skin.

Larger objects, such as knives, forks, or spoons, have passed through the entire length of the alimentary canal without destroying life, but necessarily producing more or less severe suffering, especially if the body be pointed. We have on the table some specimens from our museum belonging to this class, but in which the patients were not so fortunate. This (1140) is a knife, or rather the remnant of one, taken from the stomach of a man who had swallowed it some months previously. The handle is dissolved—in fact, digested; and the blade has been partly destroyed by oxidation. Again, here (1184) is a dessert-spoon, which had been swallowed by a lunatic, and, after traversing the small intestine, finally lodged in the cæcum. This patient also survived his feat for a considerable time, I think some months.

In other instances, such objects have perforated the bowel—sometimes early, sometimes late—causing death by collapse or peritonitis. Occasionally they are felt through the abdominal parietes, and, under these circumstances, have been extracted by incision, or after spontaneous ulceration of the superficial textures. If retained, deteriorated health results from the constant irritation and functional disturbance of the organs of digestion, caused by the presence of the foreign bodies; and, if fatal inflammation do not ensue, the patient sinks exhausted.

When I was, on a certain occasion, dining with a party of medical gentlemen in the country, the following professional anecdote was told and authenticated by one of them. At a convivial meeting, an individual present undertook not only to

drain his glass, but likewise to eat it. He accordingly proceeded deliberately to masticate and swallow it. The consequences were much suffering and constipation, which nothing relieved; and he was sinking into a state of exhaustion. Being a keen sportsman, the ruling passion, strong in death, prompted him to express a desire once more to be raised from his bed, dressed, and lifted on to his horse; and he insisted upon this apparently hazardous whim being gratified. The jolting motion, however, to which he was subjected, was the means of saving his life. The obstructing mass shifted its position, and was soon afterwards discharged, to his permanent relief. There is nothing improbable in this account, and the above is not the only instance in which this absurd eccentricity of glass-eating has been enacted with impunity.

When local abscess results from the entanglement and retention of any small body within the intestine, the issue of the case depends upon the position of such abscess. The lower part of the rectum is the most frequent seat of local inflammation arising in this way, and terminating in suppuration; and probably the occurrence of abscess, succeeded by fistula, is more often attributable to this cause than is apparent, in consequence of the material source of irritation escaping, and thus eluding observation. In one instance, I remember discovering quite a nest of orange-pips in a rectal abscess; and was enabled, after laying it freely open, to trace the aperture by which they had escaped from the bowel; one of the seeds occupying, at the time, the ulcerated opening.

Another not infrequent seat of abscess, from the lodgment of small foreign bodies, is the vermiform appendix of the cæcum; and these cases are usually fatal. The diagnostic signs of such an accident are by no means clearly defined. The peritonitis is generally limited, at an early period, to the neighbourhood of the seat of mischief, the right iliac fossa; but may afterwards extend. In most other respects, the symptoms are similar to those which indicate strangulation of the bowel in some part of its

course. The early localization of pain in the region of the cæcum, the history of the attack, and the absence of an external hernia, would suggest the mischief referred to, but only in common with other internal sources of inflammation, especially where constipation is present. The size of the large intestine, when healthy, usually permits the ready passage of objects which have passed the portal of the ilio-cæcal valve.

A remarkable case is recorded by our President, Mr. Quain, in which hæmorrhage into the abdominal cavity was the cause of death. On examination, *post-mortem*, it was found that the blood was derived from the common iliac artery, which had been perforated by a pin, that lay in a small abscess communicating with the vermiform appendix. (*Diseases of the Rectum*, p. 326.)

The conclusions, as regards diagnosis, to be drawn from a record of cases belonging to the general category under consideration, are, unfortunately, not very satisfactory. In a collection of such instances in the 'Guy's Hospital Reports,' accumulated by Mr. Poland with his usual indefatigable industry, this able surgeon speaks of the symptoms, induced by the presence of foreign bodies in the alimentary canal, as vague and uncertain, and as affording no satisfactory clue to their situation, nor even reliable proof that the patient's narration of his case can be depended on. The symptoms may, in fact, partake of all the characters which appertain to simple inflammation of any part of the canal, resulting from any other cause; and this may terminate in perforation, collapse and death. Or, again, the foreign body may become impacted in the intestine, and cause permanent obstruction which, in the resulting symptoms, is undistinguishable from obstruction by internal strangulation, or consequent on other causes, such as internal concretions or morbid growths.

One physical sign is mentioned by observers, which I have not had the opportunity of witnessing; it is that, when the object swallowed is partially or entirely composed of iron, the

excreta are coloured by the admixture of ferruginous matter. No doubt this is a valuable corroborative evidence of the correctness of a diagnosis founded upon the representation of the patient, and the concurrent existence of other signs and symptoms of the presence of a foreign body in the stomach or bowels. That metal will waste by oxidation, as well as digestible material disappear by solution, we have demonstrative proof in the preparation before me, to which I just now directed attention.

LESIONS OF THE PELVIC VISCERA.

The character of protection, afforded by the pelvis to its contained viscera, is more allied to that of the skull in relation to the brain, than to that of the abdomen or chest to the organs occupying, respectively, these regions. The arrangement of the rigid and irregular arch of bone, which encloses and forms the walls of the pelvic cavity, is adapted to resist external violence by its sheer strength; whilst its large outlets permit of the expansion and evacuation of its membranous contents. When these membranous and muscular organs rise, by their own distension, above the brim of the pelvis, they become obnoxious to injury, from which they are comparatively secure whilst within its protecting walls. Thus, in lesions of the urinary bladder, with rare exceptions, two conditions seem to be necessary, namely distension and extrusion from the pelvis, which conjointly favour this result. The usual history of these cases is, that the patient has been indulging in free libations, neglecting the calls of nature, and then by some accident,—often a quarrel with a boon companion,—the abdomen is forcibly compressed, and rupture of the bladder is the result. It is somewhat remarkable that these injuries are not more frequent than they are; and this circumstance is a proof of the natural power of resistance of this membranous viscus. Accidents in which the pelvic bones are crushed, gun-shot

wounds, and other still less frequent forms of injury, may involve the bladder. But ordinary fractures of the pelvis are very rarely complicated by this lesion; more frequently, though, in my experience, still rarely, its excretory duct, the urethra, is lacerated.

Fractures of the pelvis are met with in every variety, from the simplest to the most complex. They are always occasioned by great violence either of momentum or of weight, as in heavy falls, or in ponderous wheels passing across its walls. I have the records of numerous cases, some without displacement, others including dislocation of the fragments of bone, or even of the pelvic symphysis, or of the sacro-iliac synchondrosis of one or both sides. In the detection of these fractures, the outline of the pelvis should be carefully scanned, including the often broken ischio-pubic ramus. Pressure, alternately with either hand, on the anterior spine of each ilium, will usually elicit any mobility which may result from loosening of this bone from its attachments. I would remark, however, that these fractures sometimes escape very careful examination; and I have long since learned the importance of assuming the possibility of pelvic fracture, where it is suggested by the nature of the injury and other circumstances, although it cannot be detected in the usual way. I could relate some remarkable instances of this class, if the time permitted; but no doubt the experience of other hospital surgeons is very much the same as my own. These obscure injuries of the pelvic bones not infrequently lead to unexpected consequences; especially where the body of the pubes is fractured, or the pubic symphysis is separated: such as sloughing of the areolar tissue between the bladder and bone, or burrowing abscesses in the same position. It is remarkable to what an extent the pubic bones are sometimes divided in these cases, as is exemplified in the preparation I have on the table, which was taken from an old man, the subject of a contusion on the pubes, who survived the injury some weeks. I have a record of several instances, in which

the separation varied from one to between two and three inches, the sacro-iliac junction being also torn apart on one or both sides. In some of these, the patients—often young—have died collapsed, without visceral lesion, and in some cases without serious hæmorrhage, or even laceration of any part of the peritoneum. The simpler forms of fracture of the pelvis admit usually of easy repair. A remarkable illustration of this was recently presented in one of my patients, a female, 84 years of age, in whom a loose fracture of the ilium was firmly united in six weeks.

I have never met with, or perhaps I should say more correctly I have never verified, an instance of recovery after rupture of the bladder. The structure and function of the organ are such as to make any reparative effort very difficult; and the qualities of the urine are of a character to render this fluid very obnoxious to the parts amongst which it is extravasated. Yet, I must admit that I have, on several occasions, been surprised that the symptoms attending this lesion have not been more positive. Hæmorrhage, sickness, painful or impossible micturition, abdominal pain and tenderness not necessarily acute, are the chief symptoms in these cases, but are not, even in the aggregate, pathognomic of the lesion. It is true that the suspicion that the bladder is ruptured may be fortified by the history of the accident and the condition of the patient at the time of its occurrence: but many instances are recorded, and some I have seen, where no certainty could be entertained as to the actual presence of this lesion, or where it has not even been suspected;—circumstances which induce me to doubt whether the generally-received impression respecting the irritating quality of the urine in relation to the peritoneum may not be over-estimated. The symptoms I have referred to, accompanied with scanty urine and constipated bowels, have suggested uræmic poisoning, or even intestinal obstruction or strangulation: but the condition of the urine in the one instance, and the absence of fæcal vomiting and painful peristalsis in the

other, are diagnostic distinctions which are aided by the history of the case. I will place, side by side, the leading features in two cases exemplifying the above remarks.

A man was admitted under my care, over whom an omnibus wheel had passed, taking a direction from the right groin upwards and outwards. The abdomen was severely contused, and he was in a state of collapse. Bloody urine was drawn off. On the following day he had severe pain in the belly and back: fresh blood was mingled with the urine; and there was a noticeable variation in the temperature of the stream: constant sickness was present. On the third day urine flowed through the catheter slowly, but free from blood, and was not accelerated by pressure on the abdomen. On the fifth day there was constant abdominal pain: pressure excited vomiting; and the abdomen was distended: he was delirious at night. On the seventh day it was evident that the distension was partly due to effusion: he said his belly felt like a furnace. During the succeeding week he varied, but on the whole his symptoms somewhat abated: the urine was more abundant and clear. On the twentieth day the fluctuation in the distended abdomen was more distinct, and he suffered from frequent sharp pain: the urine was albuminous: the tension of the abdomen was diminishing. On the thirty-first day there was a sensation communicated to the hand as of some solid body in the lower part of the abdomen gliding away under pressure: the tenderness had ceased. In six weeks he was well.

The other case is that of a young veterinary surgeon who, when intoxicated and riding, suddenly curbed his horse sharply, which reared and fell backwards on him. When admitted he was semiconscious and restless, but not much collapsed, and not sick. I drew off six or eight ounces of bloody urine, without clot. He complained of constant desire to micturate, without the ability to do so. On the following day there was general tenderness over the abdomen, especially on the left side: a pint of bloody urine was drawn off twice with relief. The

desire to micturate continued, and he was sick for the first time after taking some tea. The temperature was 96 deg. On the third day the urine was only slightly discoloured, and he appeared better: but on the fourth the pain and tenderness in the belly became very severe, though there was no abdominal distension: he suffered from bilious vomiting, and perspired profusely: his pulse was rapid, and the temperature of the surface varied from 96 deg. to 99 deg. On the sixth day he again rallied, and passed urine himself, slightly tinged with blood. On the seventh day he continued to pass his water: but the pain extended, though the sickness had ceased. He sank gradually, and died at midnight, his intellect remaining unimpaired to the last. The *post-mortem* examination revealed a lacerated wound in the back of the bladder, about an inch in length. The bladder itself was contracted and almost empty. Its outer surface and the edges of the torn opening were cemented to the adjacent rectum and peritoneal folds, by a considerable exudation of plastic lymph; and the intestines were attached to each other, to the omentum and to the parietal peritoneum, by recent adhesions. The pelvis contained a pint of turbid, brownish fluid; and a catheter, passed along the urethra, found its way, through the rent in the bladder, into this space.

The foregoing representative cases are suggestive of many interesting considerations. The nature of the lesion in the former instance is necessarily conjectural; but for some days the symptoms were such as to induce me to suspect injury to the bladder; and the nature of the accident rendered it not improbable that such was the fact. Indeed, the favorable issue of the case alone points to an opposite conclusion. But, is that conclusion of necessity justified by the result? I do not feel sure that it is. Assuming, as I have stated I am disposed to believe, that we over-estimate the irritating effects of urine on the peritoneum, by knowing how destructive it is when diffused through other tissues, I see no insuperable obstacle to the ob-

literation of a small rent in the bladder, if favorably placed for such result, by plastic effusion and adhesion to neighbouring textures,—a condition which was exemplified in the second and fatal case, where the connective lymph was broken down in a large rent, by the passage of the catheter after death. And this conjecture is confirmed by the retentive and expulsive power of the bladder in the fatal case, towards its close. But what becomes of the extravasated urine, that which finds its way into the peritoneal cavity? Probably it becomes absorbed. Indeed I know not how else to account for the absence of urine, which is a not infrequent occurrence in fatal cases; and I am not aware of any insuperable obstacle to this event. There is sufficient analogy between the secretion of a serous membrane (especially when surcharged with saline ingredients in inflammation,) and the urine, to permit the absorption of the latter by the peritoneum, even including, I apprehend, the special ingredients of urea and uric acid. But, whether this speculative opinion be correct or erroneous, still the fact remains, that in some, I may say many, instances, the quantity of urine discharged is very scanty: and although catheterism may relieve the pelvic cavity of urine which accumulates in it, a cautious use of the instrument, or its retention in the bladder, may give the patient a better chance, by not disturbing the process of repair, if any such effort be made.

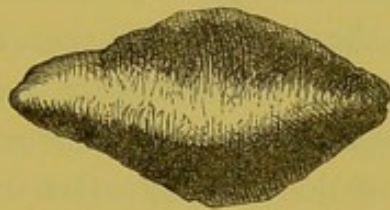
In many cases, no doubt, the history of the accident, the general condition of the patient, and the introduction of the catheter with little or no result, point to the nature of the lesion. The constant desire to micturate and evacuate the bowels, accompanied by the disability to perform these acts, are very suspicious symptoms; and such likewise, is the continued presence, though in diminishing quantity, of blood in the urine; for I believe the bladder rarely bleeds except it is rent or rendered hyperæmic from irritation. Restlessness, an anxious countenance, lumbar pain, a rapid pulse and low temperature, are usually present in this injury. Yet, on the contrary, I have

known some instances in which the urine has been voided spontaneously, and some where it has become quite clear and free from blood before death. Tympanites or abdominal effusion is frequent, but not constant, in ruptured bladder, and the *post-mortem* signs of peritonitis vary exceedingly. The patient from whom this bladder was removed had very little water in the viscus after the accident, but much blood; and the secretion continued very scanty during the five days that he survived, though it became quite clear, and he was able to pass it spontaneously on the third day: yet there is a large, ragged laceration, through which a hen's egg might be thrust, in the posterior part of its fundus. The man had been thrown violently in wrestling, whilst his bladder was distended; and although he survived the injury for five days, the abdomen shewed no signs of peritonitis, except the presence of four pints of straw-coloured fluid, and a small patch of lymph on the bladder. Mr. Drake, of Stratford, who kindly sent me this preparation, asks, "What became of the urine that was in the bladder at the time of the accident, and how was it possible for a bladder with such a rent in it to empty itself? which it did most assuredly, and the urine was quite natural for two days before his death. Moreover, there were scarcely any signs, *post-mortem*, of peritonitis." The answer to some of these inquiries may be found in the remarks I just now made.

When rupture of the bladder is consequent on fracture of the pelvis, the injury is usually very quickly fatal. The shock is greater, and the urine finds its way beyond the peritoneal cavity. Indeed, it would appear that patients die rather from the effects of shock, perpetuated and renewed in ruptured bladder, from whatever cause, than from peritonitis.

The position of the urethra, as it emerges from the pelvis, renders it especially obnoxious to laceration either from fracture or from external contusion; but separation of the pubic symphysis is not necessarily, nor indeed usually, accompanied by

any lesion of this canal. Persistent hæmorrhage from the urethra, after injury, characterises laceration of its walls: when the blood does not find a ready exit by this channel, it will accumulate, in the form of ecchymosis, in the perinæum; but not otherwise. Occasionally the urethra is completely severed from the bladder—a fatal injury in my experience. Even simple laceration of this duct often produces collapse; but it is of a transient nature. The lodgment of a calculus in the urethra is a well-known source of obstruction and of retention of urine. It rarely occurs that it is allowed to remain so long intact as to attain such a magnitude as this phosphatic stone, which I cut from a man's urethra, immediately in front of the scrotum, where it had been lodged for three or four years, until, by increment, it occasioned complete retention, and inflammatory swelling of the scrotum and penis: it is an inch and a quarter long, and three quarters of an inch in diameter.



The source of hæmaturia in cases of abdominal injury is often very obscure, and especially so when the blood is mixed with the urine, and we are thus deprived of the advantage of examining the form of the clot. In such cases the blood may find its way rapidly from the kidney, without coagulation, presenting even a fresh and florid appearance, as I have seen where the symptoms unequivocally pointed to the kidney as its source. In other instances, the reddish-brown opaque fluid which is drawn from the bladder, with gradually diminishing depth of colour, suggests the presence of a large clot there, which is undergoing gradual solution,—a condition which may be occasionally verified at an early period, by the impediment it offers to the abstraction of the urine through the

catheter. In some cases of injury I believe the blood is derived from the distended veins of the prostate, in elderly persons; and I cannot see the objection, which I know is entertained by many surgeons, to this interpretation of the class of cases I allude to; viz. that the blood cannot retrograde, and thus find its way into the bladder: the fact I believe to be that enlarged prostatic veins may bleed directly into the bladder. Hæmorrhage from the urethra, where the prostate is enlarged, may be accompanied by blood in the urine; and this I have known to occur persistently for some time after an injury. If the blood—and the same remark applies to pus—precede clear urine, there can be no doubt that its source is urethral or prostatic, as exemplified in rupture of the urethra, or where a prostatic abscess is burst in attempting to pass a catheter.

Superficial injuries of the Rectum, in the neighbourhood of the anus, are of not infrequent occurrence, and are readily recognised and usually manageable; but deeper lesions from external violence are, in my experience, rare, and are difficult of diagnosis, and beyond the reach of active treatment.

A severe injury of this class, of which I have a record, was produced in a singular way. A young man was brought to the Hospital, who had been crushed between the buffers of two railway carriages which he was uncoupling. He was suffering from shock; and the only external injury was a laceration of the skin, extending backwards from the anus two and a half inches, and forwards into the perinæum. On further examination, the rectum was found almost severed from its attachments, and retracted, being held at one point only by a small strip of the mucous membrane. There was an extensive space behind containing clots, and here the sacrum and coccyx were denuded. No fracture of the pelvis could be detected: the urethra was uninjured, and the urine was clear. He did not rally, though some reactionary hæmorrhage took place after the lapse of a few hours. On the third day, air was extravasated, emphysema

extending round the pelvis, and as high as the scapula on the left side : ecchymosis was co-extensive on the right side. The collapse continued : he did not suffer much, but became restless and wandering, and died on the fourth day. In addition to the injuries described, the skin was found separated over the sacral, lumbar and gluteal regions. The pelvic bones and the other viscera escaped ; and even the rectum was only detached as described, and was not lacerated.

A more extensive and complicated injury occurred, but in a different way, to one of my patients, which was speedily fatal. In this case the rectum was ruptured, and fæces were extravasated into the pelvis. The bladder was likewise ruptured, presenting a long rent, extending from its upper part to the prostate gland in front. A similar laceration, but shorter, was found in the front of the bladder ; and the urethra was completely torn from the prostate gland. There were also several fractures of the pelvis, involving the acetabulum, as well as separation of the sacro-iliac synchondrosis, on either side, and of the pubic symphysis to the extent of four inches.

Lacerations of the vagina and female perinæum from external violence are occasionally met with, but offer no particular point for comment in relation to their diagnosis, which is usually simple.

In connection with the subject of shock accompanying abdominal injuries, I may be permitted to refer to some interesting facts to which my friend and colleague, Dr. Barnes, has directed my attention. In a clinical lecture on the subject, published some time since, he points out that the prolapse of a large polypus from the interior of the womb may entail severe shock, which he attributes to the sudden violence done to the structures connected with the uterus ; and observes that this form of uterine hernia is analogous in its effect, in some respect, to the twisting of an ovarian tumour on its axis. The same accurate observer records some interesting cases, in which

the decomposing and purulent contents of the uterus, having found their way along the Fallopian tubes into the peritoneal space, produced sudden and fatal collapse, precisely identical, in its phenomena and fatal results, to perforation or rupture of intestine, by the intruding poisonous matter coming into contact with the peritoneum. This condition may follow abortion, where the decomposing remains of the ovum are not cleared out speedily; but it may occur in the unimpregnated uterus, when the products of inflammation are retained within its cavity, and find an exit either by the open orifice of the Fallopian tube, or by an ulcerated aperture in its wall.

Is not this a probable explanation, in some instances, of the rapidly fatal collapse with peritonitis which occurs in the puerperal state? Sudden collapse may also occur from rupture in early tubal gestation, or in rapidly formed pelvic hæmatocele. The bursting of an ovarian abscess or cyst may produce the same result; but not necessarily so, as I once had the opportunity of witnessing in a patient to whom this accident happened in St. Thomas's Hospital, by the sudden descent of a lift in which she was being lowered: in this instance the sudden rupture of the cyst was followed by a permanent cure.

In one instance only has it occurred to me to have the opportunity of performing the Cæsarean section at the full time of gestation: in this instance the shock, consequent on exposure of the abdominal cavity and section of the uterus, did not appear to be great.

I trust, Sir, that the alliance of these remarks with the subject I have been discussing, may be my apology for thus travelling off the surgical groove of my discourse.

In reviewing the preceding observations in relation to visceral lesions involving the large serous membrane of the abdomen, I feel myself committed to the following opinions.

1. That the fatality of the injuries in question is due chiefly to the prolonged collapse, dependent upon the impression made

on the cyclo-ganglionic nerve-centres, and terminating in death.

2. That this fatal impression is due usually to the extravasation of the intestinal contents, and only exceptionally so to the actual lesion, *per se*, of the bowel; and that rupture high up in the intestinal canal is, other things being equal, more rapidly fatal than lower down.

3. That lesions of the solid viscera in the abdomen are rarely succeeded by general peritonitis; and that these lesions, unless extensive or complicated, and attended by the operation of other depressing causes, are reparable, and are not usually fatal.

4. That when fatal, hæmorrhage is the most usual cause of death, in injuries of the solid viscera; but that rupture of an excretory duct, as the hepatic or ureter, is a most serious, if not necessarily mortal, complication.

5. That rupture of the bladder, with extravasation of urine into the peritoneum, is not usually accompanied by collapse so profound as that which marks rupture of the stomach or intestine and the escape of their contents: that in some instances the presence of urine seems to be tolerated almost passively by the serous membrane; and that, as a rule, it is not resented so actively as is the presence of fæculent matter from the bowel.

6. That the period of survival, after rupture of the bladder, usually exceeds that of rupture of the stomach or small intestine; and that the pelvic peritoneum, being far removed from the great ganglia and nerve-plexus of the abdomen, is thereby less susceptible to the consequences of inflammation.

7. That it seems not improbable that urine may be absorbed by the peritoneum.

Lastly, I would remark, in relation to traumatic peritonitis, that this form of hypervascular action is most variable in its presence, intensity, general features and consequences, as well as in the signs by which it may be recognised. The fickleness of its occurrence seems to defy any general classification, but is to be explained by peculiarities, both intrinsic and operating

from without, in each particular case. Those extraneous causes which may excite intense vascular activity in one instance, arouse scarcely any in another. A few patches of lymph, or the presence of some turbid fluid may, in one case, indicate, *post-mortem*, that such action existed; whereas, in another, the abundant production of plastic matter, agglutinating together all parts in contact, and floating, in its redundancy, in a sero-purulent menstruum, testify to the active peritonitis which, perhaps, a trifling cause may have sufficed to light up.

But one remarkable feature is, that not only may general chronic peritonitis run its course unsuspected, when excited, for example, by a growing ovarian cyst, but even in the acute form, the signs and symptoms during life are by no means uniformly commensurate with the results which are witnessed after death. It is true that this circumstance may be, and no doubt in many cases is, accounted for by the depression of shock from injury under which the patient is labouring; and this is often no bar to increased local vascular action: yet, in many instances, I have no hesitation in affirming that traumatic peritonitis may be present in an active degree, with scarcely any of the characteristic signs by which it is usually described as recognisable. I say traumatic, because it is with this form of serous inflammation that I have been dealing in the preceding remarks;—a condition which, under these circumstances at least, I cannot regard as a disease, but purely as an effort, perhaps misguided and uncontrolled, in the direction of repair. Whether the so-called idiopathic form of peritonitis has, in practice, that constant type, and is uniformly characterised by those active signs which are usually ascribed to it, I must leave to more competent judges than myself to decide.

The symptoms and signs which indicate convalescence, or are premonitory of dissolution, are naturally watched for with deep interest in visceral lesions, as in other cases of doubtful issue. Many circumstances to which, separately, not much

importance would be attached, assume, in concert, a significance which scarcely admits of doubtful interpretation. Such are, a rapid and feeble action of the heart; depressed or abnormally elevated temperature; a parched tongue; hurried respiration; tympanites; muscular spasm; aggravated or arrested pain; the colour and expression of the face; even the earthy odour of the skin; the raving of delirium, or the wandering of inanition,—these and many other well-known signs possess, in more or less complete or varied combination, a significance which cannot be ignored.

The information derived from varying temperature is not unimportant, and will, no doubt, assume more value as our study of the facts connected with this subject becomes more accurate and extended. In acute sthenic diseases, the temperature continues to rise usually till the time of death; and it is higher, as I had occasion to remark in a former lecture, in inflammatory action following brain-injury, than in other cases, according to the record in our surgical wards. The highest death temperature registered is 106° , in a case of traumatic abscess of the brain which I narrated last year; the lowest is 89° , in a case of fracture of the base.

(Since this lecture was delivered, a very remarkable instance of high death temperature has occurred in one of my patients. An educated young man, subject to attacks of mania, endeavoured to commit suicide, and was brought to the hospital with both feet crushed. Double amputation was performed at the ankle-joint. Defective power, after reaction, entailed sloughing, and the maniacal fit continued, but without violence. On the eleventh day he suddenly became more excited, and at noon his temperature had risen to 105.0° , and in the course of seven hours afterwards had reached 110.0° . A quarter of an hour later he died; and the temperature was not again taken until a quarter of an hour *after* death, when it was found to be 110.8° . One hour after death it was 110.0° ; and after the lapse of nearly two hours, it was 108.4° . Towards the close of life he

became placid, and finally insensible. The membranes and structure of the brain were much congested. There were purulent deposits found in one knee and in one sterno-clavicular articulation.)

In cases which belong to the category which I have recently been considering, sudden transitions in the general phase of the symptoms, the result of accidental or unforeseen causes, often baffle the calculations and anticipations of the medical attendant. But the onward march—the progressive development—of such signs as an increasingly rapid pulse and quickly changing temperature, with a dry and glazed tongue and a tympanitic belly, is alarming; and, when the stomach rejects, not only what it receives, but, its own secretions and those of the upper bowel, there is not much hope for the patient, though the cerebro-spinal functions may manifest but little sympathy with these evidences of fast-failing power and of ebbing life. The appeal is to and through the cyclo-ganglionic centres of organic life; and, till the pitcher and the wheel are broken, the silver cord and golden bowl may retain their integrity.

Among the signs of recovery, I have more confidence in a moist tongue and a tractable and willing stomach, than in any other indication or combination of signs; and herein especially is the agency of the judicious practitioner witnessed, in that he does all he can to humour this susceptible and fickle organ, whilst he avails himself to the utmost of its capabilities for good.

In my present course of lectures I have experienced, even more sensibly than in my last, the difficulty of compressing within a given area even a digest of the materials which an extended hospital experience has placed at my command. I have, indeed, felt painfully conscious of the obscurity which is necessarily associated with a condensed style in lecturing; and I have been as frequently embarrassed by the abundance of illustrative matter, as by the alternative of selection or entire exclusion. I therefore feel the more beholden to you, Sir, and

to other members of the Council and professional friends, for your indulgent attention to my discourses.

The materials I had collected, for the purpose of illustrating the extended and important subject of intestinal obstructions from various forms of strangulation and other causes, I have been reluctantly compelled to omit from my course. But it became evident to me, as I advanced, that some such sacrifice must be made, to secure the lectures from degenerating into little more than a series of surgical aphorisms.

Yet it was neither my intention nor ambition to furnish a systematic treatise on the subject I have undertaken, but rather to throw into a suggestive form what I have observed, and the conclusions I have drawn from my observation. It is in this reading of Nature from various stand-points, and in the interpretation of her language by different minds, that our store of knowledge is extended ; and he who works in an honest spirit, even though he fail to read her lessons aright, may still have done some service in helping forward the cause of Truth.





