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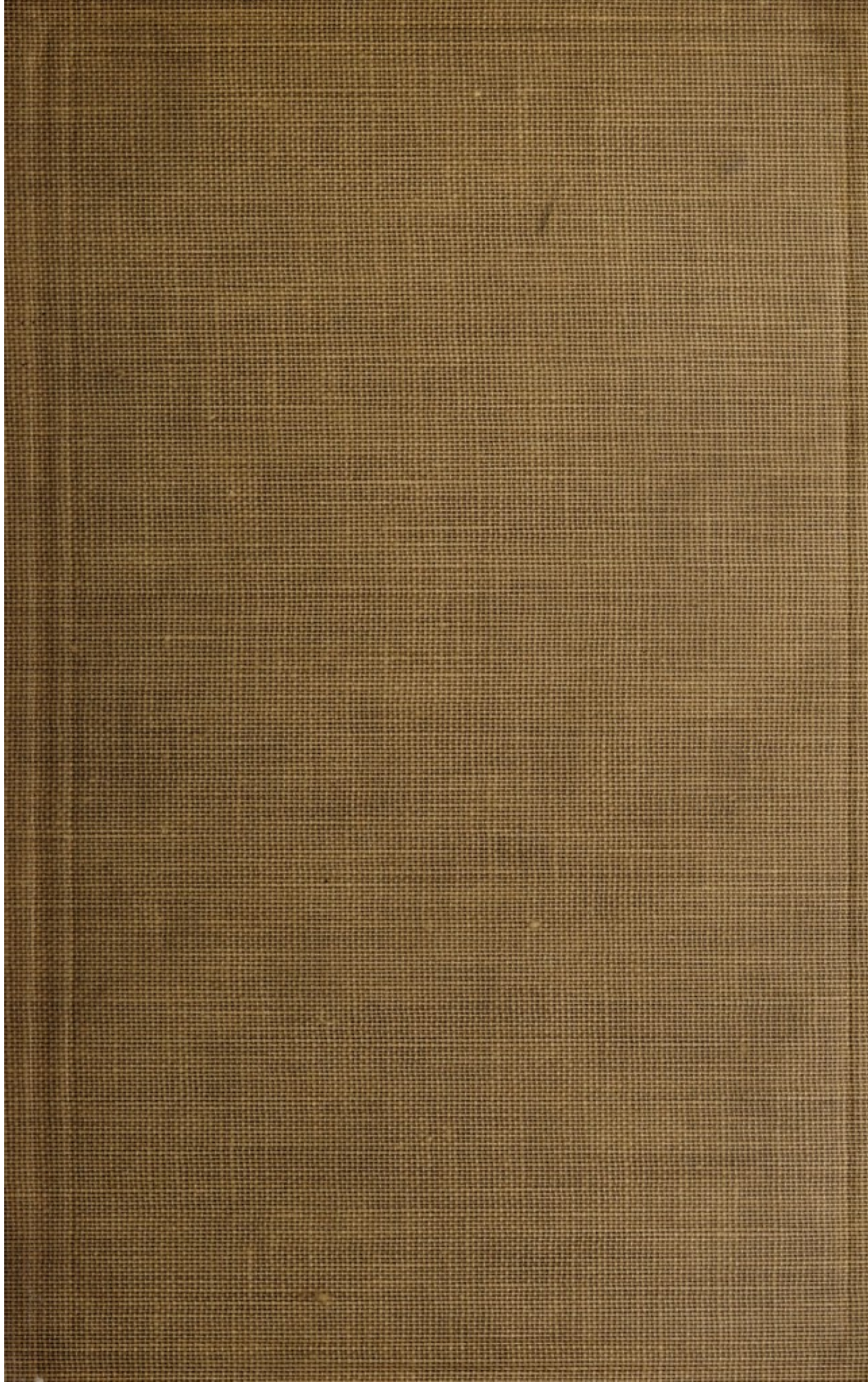
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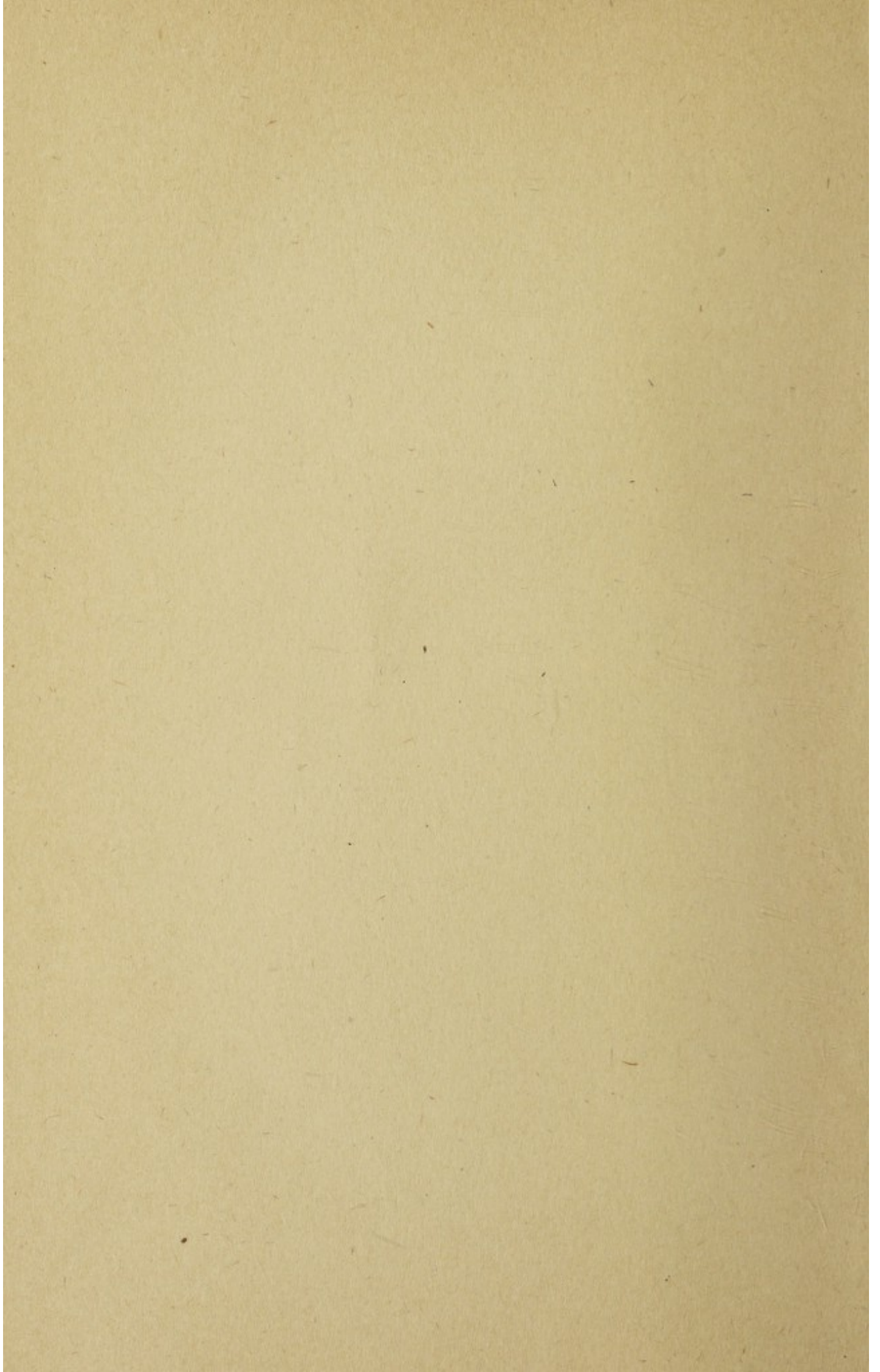



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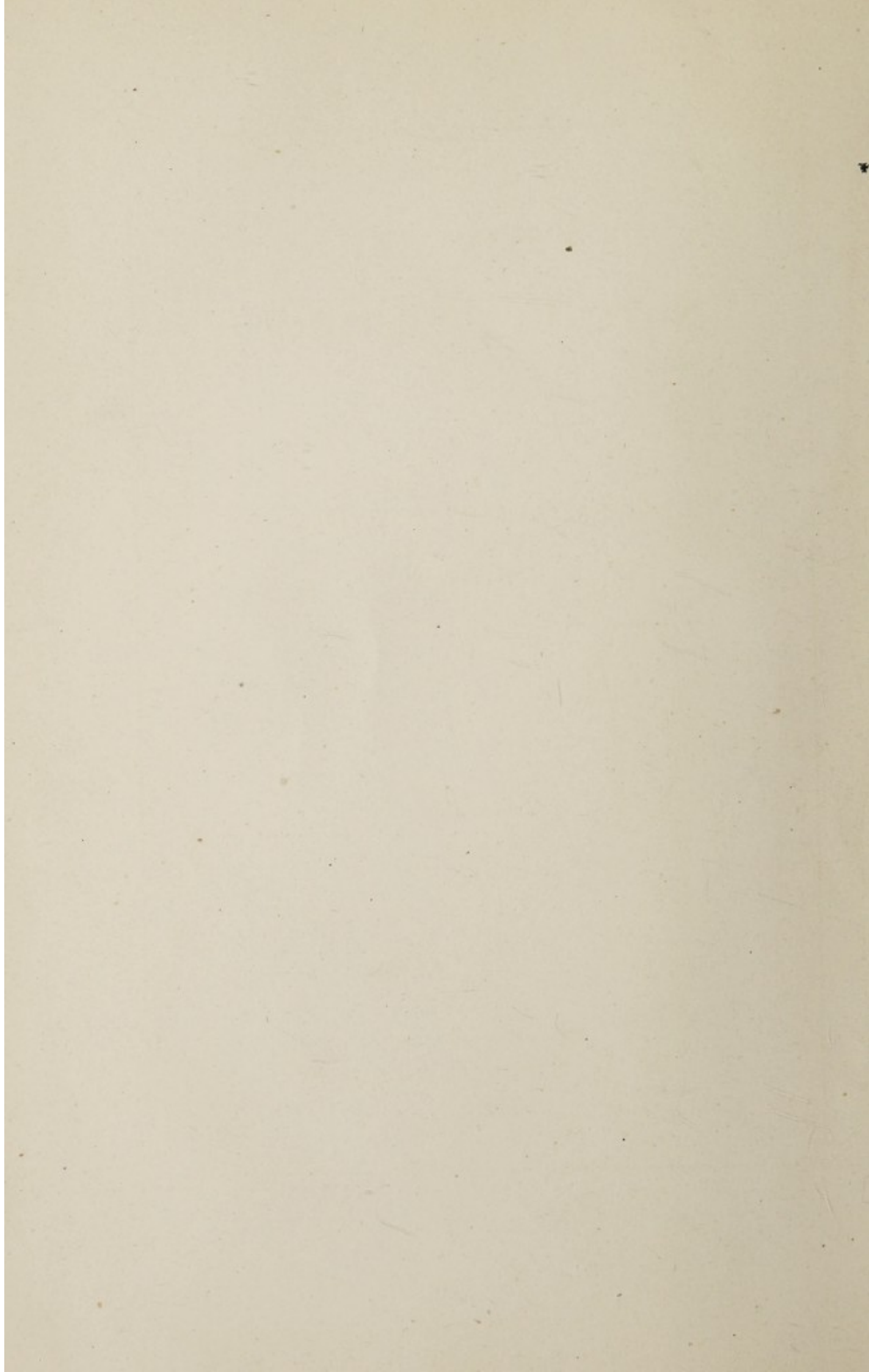
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Essays on Surgical Subjects

By
SIR BERKELEY MOYNIHAN
K. C. M. G., C. B.
Leeds, England

Illustrated

Philadelphia and London
W. B. Saunders Company
1921

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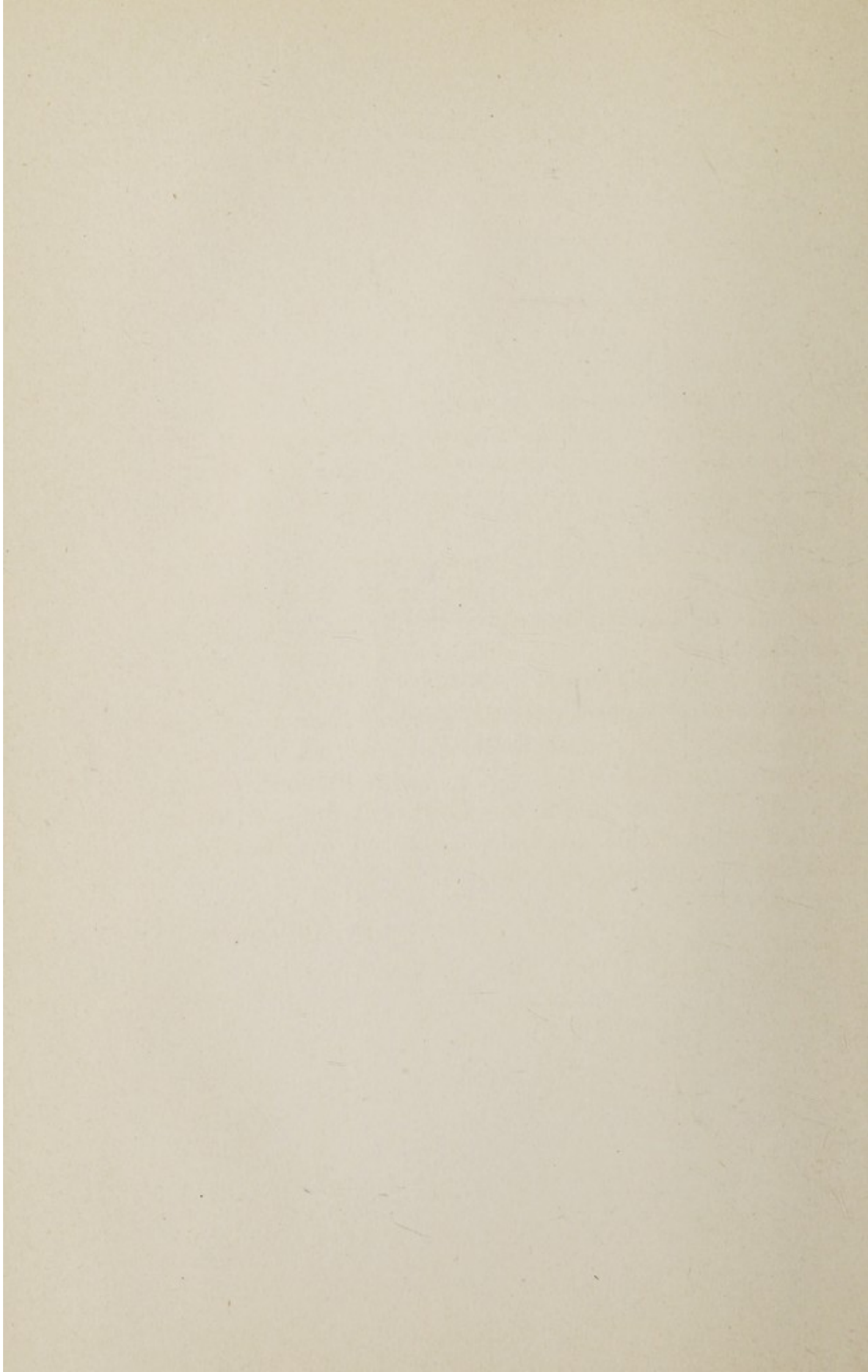
To

DR. W. J. MAYO

DR. C. H. MAYO

AND

My friends at the Mayo Clinic
A small acknowledgment of a
great debt



P R E F A C E

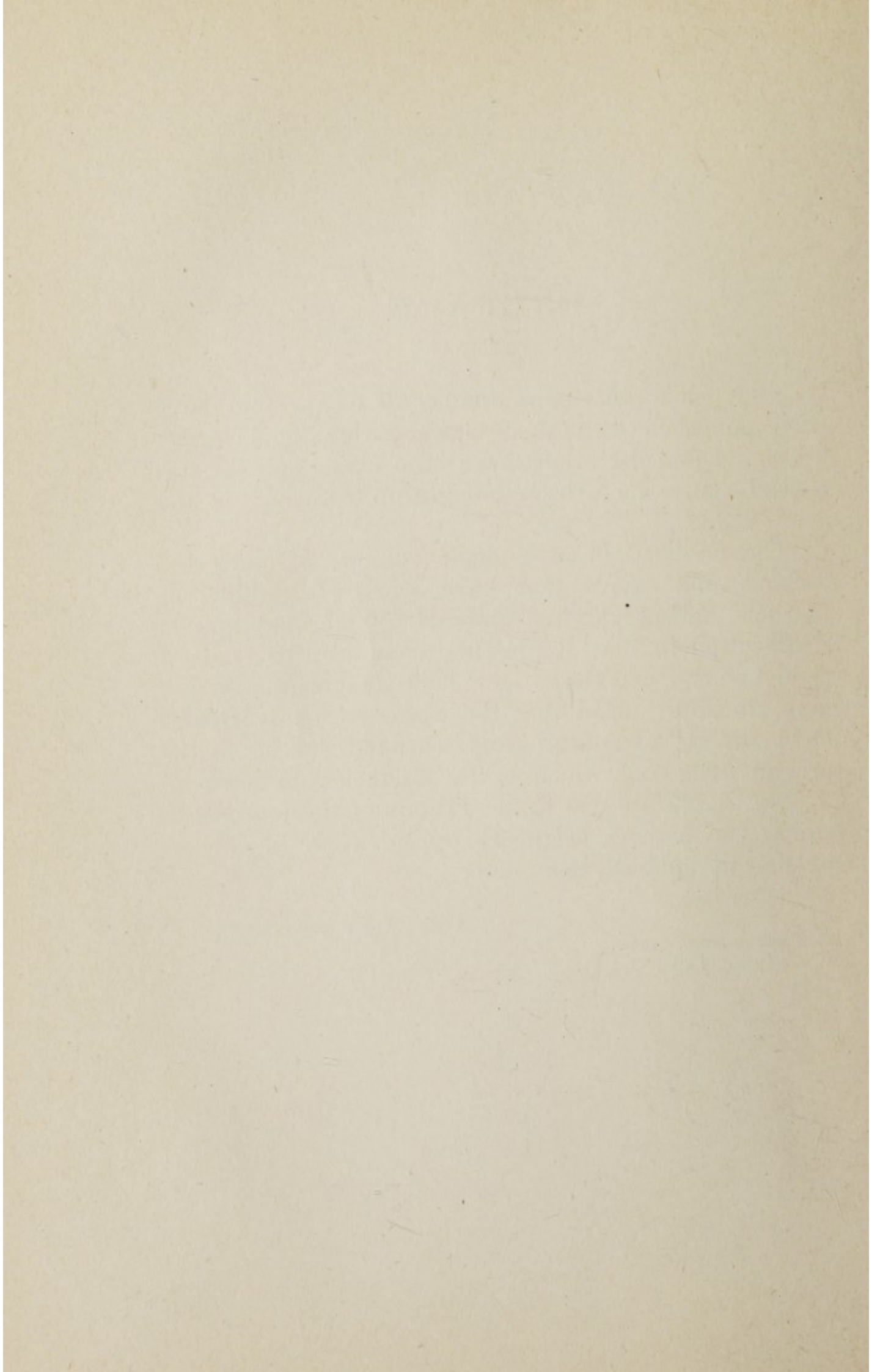
THIS book contains a number of essays that have been published at various times during the last few years. A few alterations have been made, and the statistical figures have been brought up to the end of the year 1920.

The publication, in a single volume, of addresses, lectures, and essays that have appeared in different journals, and at varying intervals of time, may find its justification in that it presents a consecutive train of thought and experience for final judgment. And I may truthfully plead that the wishes of many friends have led me to collect these scattered articles in the present little book which I offer for their consideration.

My thanks are due to the Editors of the journals in which the articles originally appeared for their permission to republish them here.

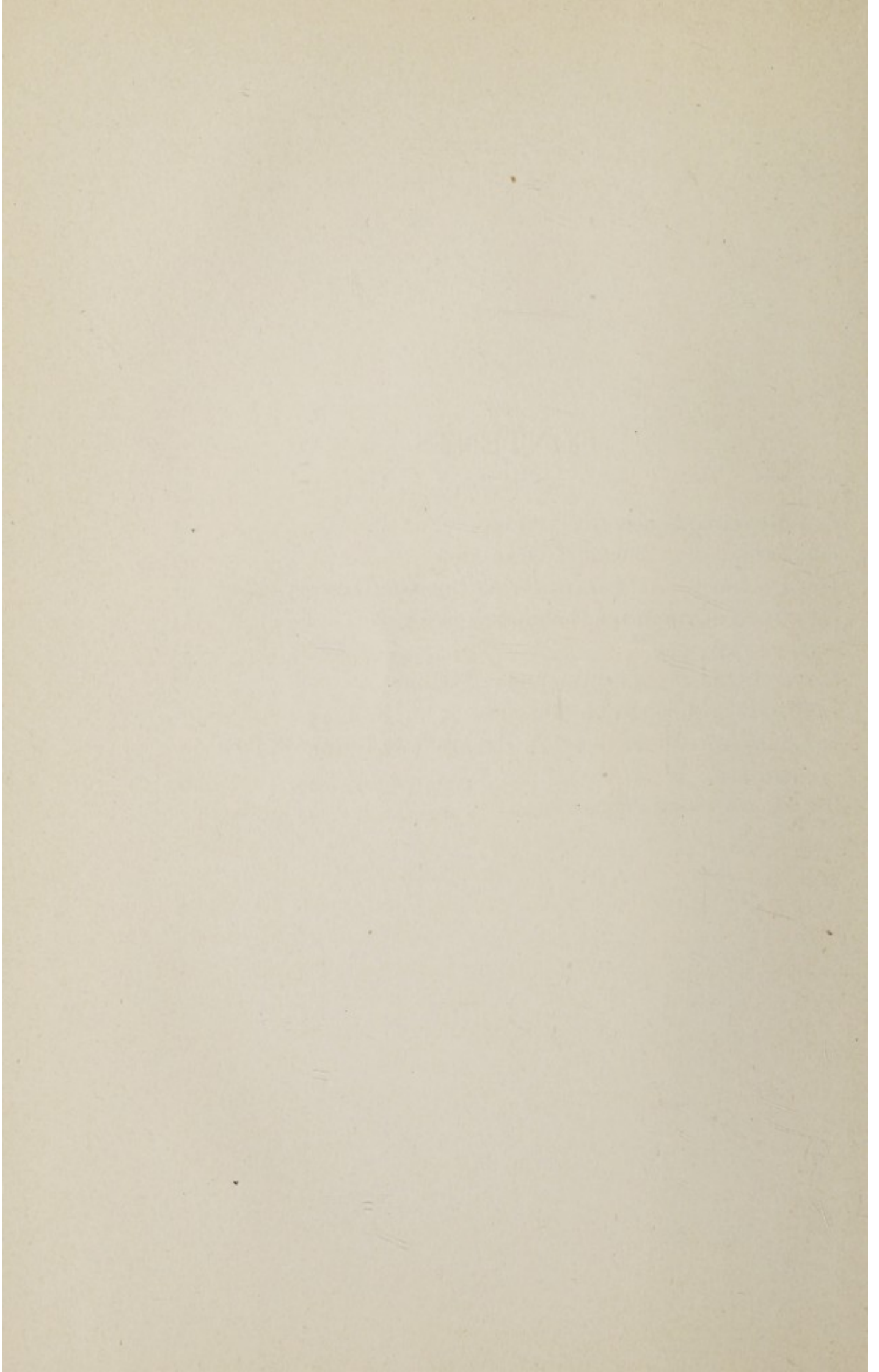
BERKELEY MOYNIHAN.

33, PARK SQUARE, LEEDS,
August, 1921



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ESSAYS ON SURGICAL SUBJECTS

THE MURPHY MEMORIAL ORATION*

"The moral of the whole story is this: that we should do all that we can to partake of Virtue and Wisdom in this life."—Socrates is speaking.

THIS is a day of remembrance. We have come together to do honour to one of the founders of this College, a great surgeon whose loss we mourn. You have laid upon me the duty and the high privilege of offering in your name and in my own, and if I may for the moment assume a wider responsibility, in the name of all the surgeons of his time, a tribute to the illustrious memory of Dr. J. B. Murphy.

John Benjamin Murphy was an arresting personality. Even after the briefest intercourse with him there were few people who did not realize that he possessed a curious and subtle power of impressing a sense of his character upon them. His very handsome face, his tall, spare, almost gaunt figure, his high-pitched and vibrant voice, his burning and quenchless enthusiasm for life in all its manifold activities, his power of complete self-expression, all clamoured for notice, and caught and held the most eager attention. His outlook was grave and serious; he seemed always in earnest. The little quips and sallies, the friendly taunts, the provocations to repartee, the illuminating anecdote, which in the United States dis-

* The first Murphy memorial oration delivered before the American College of Surgeons, at Montreal, October 11, 1920.

tinguish the cordial intimacies of daily life, did not seem to play around him as freely as around other men. Even in a crowded room of busy men, or when a debate was keen he would steal a few moments for a whispered conversation, held aloof, on some topic that for the moment filled his thoughts. Among those who knew him well he was admired and deeply respected, rather than loved. Except to a very few he was not genial or responsive in friendship. His intellectual attainments were so considerable, and his position in the judgment of his contemporaries so secure, that jealousy hardly touched him, except perhaps in his earlier years and from a few among his seniors whose supremacy he challenged. Such jealousy is perhaps the tribute paid to youth for successful enterprise in thought or in action by minds which suffer from the atheroma of advancing years. We are reminded of the aphorism of Sir Walter Raleigh

"For whoso reaps renown above the rest
With heaps of hate shall surely be opprest."

Murphy was beyond question the greatest clinical teacher of his day. No one who listened to him can ever forget the experience. Before his audience arrived he had everything very carefully prepared, diagrams in order, microscopes ready, the patients examined, and all relevant literature at his finger ends. There he stood in the middle of the circle, in the theatre, with his assistants and friends in the first row and the other benches packed to the roof with eager students, or with medical men, who came again and again to learn from him afresh. As he began to speak one felt a strange sense of disappointment, and even of dismay. For while the handsome face and upright figure were things of real beauty, the voice in

which he began to speak was quite unpleasant. It was harsh, even raucous, high pitched, shrill, apt to wander into other keys. It seemed strange that a man of Irish descent, and of so gracious and commanding a presence, should have a voice so lacking in softness, one which not only did not appeal, but actually displeased and almost repelled every listener. But as he continued speaking the voice gradually ceased to distract, it became smoother, quieter, and more evenly pitched, and all thought of it was now lost in rapt attention to the matter. For things were happening even while one's first emotions were roused. Questions were being asked and answered, often with great rapidity, then would come a pause, in which with marvellous directness and power the lesson to be learnt therefrom was driven home. The rally began again. A poor answer came, or an assistant responsible for the clinical notes had omitted to inquire upon some relevant point; raillery came in torrents, never ill-natured, never rancorous, but with just sufficient sting to leave a memory which would stimulate all future work. The discussion warmed imperceptibly; gradually the coherent chain of argument lengthened, as link after link, forged under our eyes, newly appeared; slowly there came a sense of excitement; of impending revelation; all inquiry, all disclosure, all arguments, were leading up to something that we now ached to learn. Old observations and ancient truths were taking on a new complexion; relations hitherto unsuspected were here declared and explained. The whole intellectual mechanism underlying a great subject was being shewn both in detail and in all the majesty of many moving parts. Perhaps as we drew near to the end, when the whole story would be laid bare, a question barked at one of his audience would fail

to be answered. With voice more clamorous, and almost menacing, with face strained and eager, with figure reaching forward and arm outstretched, he would hurl the question at others. Hearts beat faster, the spiritual anguish could hardly be borne. At last the answer would come, and after a final swift induction or brief summary, when the clinical journey was over, we sank back in happiness and mental repletion to wonder if Stevenson could really have been right when he said, "It is a better thing to travel hopefully than to arrive," for this journey had been happy, though anxious enough, but the haven was a rest of tranquillity, and wonder and content.

And then Murphy would operate. Now of operators there are many types, and like every other work of art, an operation is the expression of a man's temperment and character. There are still among us "brilliant" operators, from whom I pray to be spared when my hour has come. For them it is the mere quality of effort that counts. Their ideal of operative surgery is something swift and infinitely dexterous, something to dazzle the beholder, and excite his wonder that such things can so be done by human hands. The body of a man is the plastic material in which an artist works, and no art is worthy of such a medium unless it has in it something of a sacrament. Surgery of the "brilliant" kind is a desecration. Such art finds its proper scope in tricks with cards, in juggling with billiard balls, and nimble encounters with bowls of vanishing gold fish. But Murphy was of the true faith. He believed in safe and thorough work rather than in specious and hazardous brilliance. He was infinitely careful in preparation, and compared with many was inclined to be slow; but every step in every operation which I ever saw him do was completed deliberately, accurately, once

for all. It led inevitably to the next step, without pause, without haste; that step completed, another followed. "In sequent toil all forwards did contend." And so when the end came a review of the operation shewed no false move, no part left incomplete, no chance of disaster; all was honest, safe, simple; it was modest rather than brilliant. During the whole operation Murphy talked; not wasting time, but expressing and explaining aloud the quiet, gentle, dexterous movements of his hands and the purposeful working of his mind. The operation over, he would draw his stool near to the front row of the benches, cross one leg over another, rest his elbow on his knee and talk, as only he in all the world could talk, of surgery in general, of this case in particular, of his faults, of any experiment made to clear a doubtful issue. In these quiet talks there was none of the earlier passion which had gleamed through him, and which, caught up by his audience, had made them throb and tremble with suspense or joy. In them all his former experience, all that he had learnt by contact with men and books, all his native ingenuity of mind, were now bountifully displayed: the vast resources of the keenest surgical intellect of his day were now disclosed, not with ostentation or with florid pride, but in such a quiet manner as to shew that he rejoiced in the privilege of sharing with others so many fascinating and wonderful things. If in answer to a request a little intellectual gift were made to him, it was welcomed with frank, almost boyish enthusiasm, and with a delight and humility obviously genuine.

Murphy as a writer and as a speaker was prolific. Whenever he spoke men made haste to hear him. His audience, or so it always seemed to me, were often held back from quick appreciation. He was not like other

men instantly attractive as an orator. Yet, as he developed his argument, little by little, and step by step, the audience warmed to him, he interested them, he intrigued them, he dominated them, he fired them; intellectually he roused them to breathless interest; emotionally they were at times at the limit of self-control. No one could bear to miss a word, and while Murphy spoke no man left his seat. For his meaning was conveyed in pellucid language and though he might speak with the vehemence of raging conviction his thought was never obscured in a smoke of words. Such an intellectual lodestone was he that appointments were missed and hunger and thirst and fatigue were forgotten. For while Murphy expounded his gospel everything else seemed to fade in importance, overshadowed by the lessons which were now being learnt so eagerly.

I often wondered, as I listened, in what degree he resembled Lincoln. The tall, gaunt frame, and the harsh and meagre and strident voice were the same. Murphy must have been one of the handsomest men of his day; Lincoln's features were haggard, plain and homely, but his deep and glowing, sad and tender eyes no man could forget. Murphy had no such command of language as Lincoln, certainly one of the greatest orators who has ever spoken our language. But in effect they must have been alike. For they made everything else seem commonplace when they spoke, and they seemed to be delivering a message charged with truth and pregnant with confidence and hope. Lord Charnwood in his most excellent work on "Abraham Lincoln" writes of him: "His voice when he first opened his mouth surprised and jarred upon the hearers with a harsh note of curiously high pitch. But it was the sort of oddity that arrests attention, and

people's attention once caught was apt to be held by the man's transparent earnestness." How exactly was this the case with Murphy also! No one who heard Murphy speak ever doubted his sincerity. One might not agree; one might indeed profoundly and confidently disagree with some statement he made, perhaps as though to provoke a challenge, for there was much in Murphy which justified his patronymic, and which discovered his ancestry; but there was never a thought that Murphy himself was speaking other than his deep and tried conviction. He never looked at truth askance or strangely. One who heard Lincoln speak at Peoria wrote: "Beyond and above all skill was the overwhelming conviction imposed upon the audience that the speaker himself was charged with an irresistible and inspiring duty to his fellow men." Such an impression was often felt by audiences while Murphy was addressing them.

One thing Murphy lacked; in one respect he grievously failed. If we consider the qualities which go to the making of the greatest surgeons, a foremost place must always be conceded to the capacity to train great disciples. The teaching, the diligence, the general outlook upon surgery and a finished technical skill can all be drilled into the minds, and imposed upon the methods of an earnest student. But it is the inspiration, the lofty sense of a sacred mission worthy of all the best that is in you, the dedication with humblest and fullest devotion to the cause of scientific truth, and of loyal service to mankind, that are awakened with a thrill in great men by great teachers. It is here that Murphy fell short. He trained no one worthy to be his successor; no evangelist who could carry into other clinics or to other countries some of his glow, his fervour, his complete devotion, or the full meaning of

his gospel. For this great omission there were perhaps some compensations. There were few clinics in any part of the world in which something taught by Murphy or inspired by him had not crept in and found a home. His name was often on the lips of surgeons in all lands. His views impressed themselves on men's minds. His methods were closely copied. But when Murphy laid his mantle down there was no one ready and worthy to take it up. When we remember how the pupils of Turner, of Edinburgh, became professors in most of the chairs of anatomy throughout the British Empire, how many men Billroth trained to occupy with great distinction the chairs of surgery in eastern Europe, how Welch is the happy parent of a great school of pathologists trained by him, inspired by him, and looking to him with reverent affection, we cannot refrain from regret that some of the acolytes of Murphy did not grow to the stature of High Priests.

Year by year Murphy grew in intellectual power and in the dominion he exercised over the minds of men. A problem took on a different aspect if Murphy were engaged in it. He touched the common currency of surgical thought and changed it into gold. For no effort of his was meaningless or sterile and all the powers of his mind and of his frail body were spent ungrudgingly in all his work. His well stocked library, and all new literature were searched for him, and dispatches made for his assimilation. He worked as all great men should work, with a clean desk. His great powers were used for worthy purposes and in due season, nothing was wasted in mere hack work, for all that could be equally well done by others was left for them to do. Yet all his life he overworked. He had an inner restless spirit which drove him at full speed. He must work, and while at work

there was only one speed, the highest he could command. "I do not wish to linger after my work is done" he said, and it was exactly what might have been expected from him.

It is useless to wish that men possessed of his qualities and capacities should use themselves differently. A man must do as he must do. If we think that Murphy by spending himself with less lavish extravagance might have prolonged his life another ten years and so have achieved even greater results, to the benefit of all mankind, we are pondering over one who was not Murphy, and who could not in those early fruitful years have been so avaricious for work, or have so generously poured forth the new truths of which he was at once both parent and missionary. Our designs for another man's life are but futile exercises of an imagination lacking in full understanding, and adrift from realities.

Such, then, was Murphy as I knew him. It is easy now to see how great a figure he was in the world of surgery of his day. When all his work is reviewed, when not only its range, but the wonderful sincerity and the permanent and piercing accuracy of so large a part of it are considered; when we remember his unequalled gifts as teacher, his power of lucid exposition and of persuasive, or coercive argument, his devotion for many years at least to experimental research, it is no exaggeration, I think, to say of him that he was the greatest surgeon of his time. Great men are fitted to their times and in many respects are a reflex of them. But as their times pass their work is seen in far perspective and may appear to shrink in significance. It may then seem to have lost all its originality, and boldness, and force, and we who stand afar off, untouched by the magnetism of a great

personality, marvel at its influence in its own day. For there are few indeed who enjoy both celebrity and fame. "Mere talents are dry leaves, tossed up and down by gusts of passion and scattered and swept away; but genius lies on the bosom of Memory." How then will it be with Murphy? Judged by the standard of his contemporaries he was an intellectual giant, but of what stature will he be when judged by the standard of history? May I ask you to bear with me while I pass briefly in review some of the main features of the progress of surgery as science and art and tell the tale of some of the great men who have laboured in it, from earliest days up to the present time, so that at last we may see how Murphy stands and what figure he will make in the Great Procession.

The earliest remains of man known to exist shew that the art of the surgeon was practised upon him. Wherever skulls of the Neolithic period have been discovered the openings made in them by the trepan are seen. Dr. Marcel Badouin, in 1908, found within a tomb discovered by accident at Belleville the remains of 120 human beings. Eight of the skulls had been trepanned, and the edges of the cut bones were smoothly healed over, showing beyond doubt that the patients survived the operation for periods long enough for this to be fully accomplished. The disc of bone removed is supposed to have been worn as an amulet. The operation of trepanning during the Neolithic period, was also performed in England, in Northern Africa, the Canary Islands, Mexico, and in Peru. It is performed today by the natives of New Ireland, to the east of New Guinea, by methods and with results apparently similar to those of the Neolithic age. Dr. Redman has presented to the Royal College of Surgeons of England a group of five skulls

shewing the effects of the operation, the instruments by which it is there performed, and the dressings applied to the wound. And travellers tell us that the operation is still practised in the ancient way, so far as can be judged, by the Quichuas of Peru. Surgery is therefore as old an art as any.

Hippocrates was the first to give form and spirit to the practice of surgery. His observations even when considered with the fuller knowledge of today often bewilder us by their accuracy, insight, and sagacity. His clinical methods judged by our modern standards were broad-based and structurally sound. He recognized not only the nobility of the art of surgery, and the worthiness of its practitioners, but was well aware of the powerful influence which the craft must exert upon the science of medicine. The divorce of hand from brain which modern custom has worked hard to effect derived neither sanction nor authority from any words of his. As he deals with the outward shewing diseases his clinical method is everywhere the same. He observes, reflects, weighs, and judges, considers his former experience of the like or analogous conditions; he suggests or discovers a general truth; he lays down principles for action, and he tells how the craftsman shall work. If the power of wide and accurate generalization be, as I believe it to be, among the supremest accomplishments of the human mind, then Hippocrates may in truth be said to have had few rivals, if indeed he has had any, among all those who in later times, and in all countries, have devoted themselves to the science of medicine. For by his injunctions as to the method of enquiry into the conditions of a patient suffering from any disease he lays down for the first time the principles upon which inductive research is founded. He is the parent

not of medicine alone, but of the inductive method as applicable to all branches of natural science. It is a proud claim that the method found its first application in the science of medicine.

His observations upon cerebral injuries were hardly bettered until our own day, and many of his instructions as to their treatment cannot be neglected even now. He notes the effect of brain injuries upon the limbs of the opposite side. His work on fractures and dislocations has received praise from the greatest of critics. Littrè spoke of it as "the grandest surgical monument of antiquity" and considered that the truth of its principles was eternal. A century ago the most eminent of French surgeons, Dupuytren, published a work on "Dislocations." Malgaigne, whose familiar name justly carries great weight, judged that, in respect of its discussion of congenital dislocations, the work of Hippocrates was the richer and more accurate. The discourse of Hippocrates on "Wounds," which I read once again in the early weeks of the War, seems to have, in more relations than one, a bearing upon our bitter experience of those most grievous times. Certain it is that for 1500 years afterward nothing so apt was written, by no one were the essential problems of wound treatment so well understood. The dressings applied to wounds, he tells us, were to be of new materials; water, if not clean and sweet, was to be boiled and strained before use; care of the surgeon's hands and nails was thought most necessary. Oil and wine were the balsam for a bruised or dirty wound; or for one long neglected. The accurate apposition of the wound surfaces and the exclusion of air were means to secure rapid healing by "primary intention," which was clearly distinguished from "second intention." He dreaded amputation of a limb, especially

near the trunk: these operations today are in respect of their mortality still among the most lethal of all. As Sir John Tweedy has said, "The directions which Hippocrates gives concerning the arrangements of the operating room, the placing of the patient, the position of the assistants, the disposition of the lighting, the care to be taken of the surgeon's hands, the need of ambidexterity, all indicate a careful and experienced practitioner." Hippocrates may count among his greatest glories that he recognized the essential unity of medicine and surgery, or rather that he did not distinguish between them: that he urged and practised the use of all means for the examination of the patient; that he saw no degradation as did so many later ages in the use of a physician's hands in the service of the individual patient, for whose welfare, as Aristotle said, all medicine exists. And his system, which embodied observation, reflection, judgment, all multiplied to make experience which shall decide right action, stands firm until this day. He knew its difficulties, for he tells us that "experience is difficult, verification fallible, observation long and costly, and occasion fleeting." There is one gap, however, a significant one in view of my later contention, in his method. He did not put matters to the proof by way of experiment. The experimental verification or denial of a suggested truth, or the new adventures in thought and action opened up by this method were not for him.

After Hippocrates we may take a long stride in point of time to the days of Celsus, who lived in the reign of Augustus Cæsar. It is interesting to remember that Celsus, the manuscript of whose work "*DeRe Medicina*" written about 30 A. D., was discovered in 1443 in the Church of St. Ambrose at Milan by Thomas of Sezanne,

afterwards Pope Nicolas V, was almost certainly not a physician. He was a noble of the family of Corneli, who wrote works on medicine, agriculture, philosophy, law, and the art of war, in the spirit of an interested amateur. The deep prejudice of the patricians against the adoption, by one of their class, of medicine as a profession was unconquerable. And the internal evidence in all his writings is opposed to the view that he could have practised as a physician; he mocks at the value of medicine, and esteems the empirical methods of folk medicine as of equal interest and value to the academic methods of his time. He tells us that the true art of medicine lies in the correlation of theory and practice, the one guiding and controlling the other; speculation should guide thought but not determine practice. References to surgical matters are found in all the books, but Books VII and VIII are devoted exclusively to the consideration of surgical matters. The great feature of these is that they record all the changes which had occurred in our art from the time of Hippocrates and especially informs us of the great attainments of the Alexandrian school in anatomy and surgery. He describes wound treatment in detail; arrest of hæmorrhage in a wound may be effected by packing and pressure, or by the ligature, which finds its first mention in his work. Sutures are to be used to secure apposition of wound surfaces and edges, and, as a dressing, linen bandages are to be soaked in wine, water or vinegar. He gives in sufficient detail a description of operations for the radical cure of inguinal and umbilical hernia; and for the first time he refers to the removal of the testis as allowing a firmer and more secure closure of the inguinal canal. He mentions translucency as a test for hydrocele, and describes the tapping of dropsies. He quotes a large number of surgical

authors, but among them all only Hippocrates is known to us.

It is evident that by the time of Celsus the boundaries of surgery had been sensibly enlarged, that old procedures had been bettered, as in amputations, and that many new ones had been devised. But progress had been along the old lines, and was achieved by the old methods. He recorded the multiplication and the magnification of old experiences rather than the revelation of new discoveries. He it was who gave us the fulfillment of the promise of the Hippocratic methods.

But great as were these methods, and considerable as was the success attending their application, there had been a slumber of the intellectual and philosophical aspects of medicine. Hippocrates had united in his own person many divergent and opposing tendencies; after his death there was an acceptance of his teaching by various sects, each adopting a part only, and dogmatism with its cramping tendencies crept in and the spirit of investigation died away. There was need now of a philosopher with new vision, and the need was supplied by Galen. Of Galen's life and character we know much, for he was vain and ambitious, garrulous and verbose. He was trained and deeply versed in all the current philosophies. A dream of his father, Nikon, interpreted as a vision from the God of Medicine, decided his choice of a profession. After the death of his father he wandered for nine years, studying in Corinth, Smyrna, and especially Alexandria, which then attracted commerce and patients from all parts of the world. His opportunities were great and his use of them unwearying. He wrote works on anatomical and physiological matters, and attained even in these early years of his a reputation for wisdom and

sagacity. For four years he lived in Rome. His learning, his industry, his friendship with the great and the noble, brought him high repute. But the envy of his colleagues, which he did much to provoke, was his downfall and he fled in fear of his life, to return on the invitation of Marcus Aurelius some twelve years later. But Galen's chief claim to honour, an imperishable one, is that he was the first of physicians to bring experiment to the aid of medicine. As Hippocrates was the parent of inductive method, so was Galen of the deductive. He was the first experimental physiologist. It was he who first discovered and described the cranial nerves, and the sympathetic nervous system; he divided the spinal cord and produced paraplegia; he severed the recurrent laryngeal nerve, and produced the hoarseness and aphonia, which are the constant results of this injury. He discovered the function of a muscle by studying the loss of power which followed its division. He demonstrated the flow of urine from the kidney to the bladder along the ureters, by a series of experiments than which nothing today could be more conclusive. And he trembled at the very edge of a great discovery when he wrote: "If you would kill an animal by cutting through a number of its large arteries you will find the veins becoming empty along with the arteries; now this could never occur if there were not anastomoses between them." Unhappily experiment alone did not content him, nor experiment in close alliance with clinical observation. His knowledge of anatomy, unsurpassed by any of his time, did not keep him aloof from the wildest speculations in natural philosophy. It is interesting to learn from him that the art of dissection was mainly, if not wholly, confined to certain families, among whom tradition and instruction give rise to a *caste* of

dissectors. The members of a family were, from their childhood, exercised by their parents in dissecting, just as familiarly as in writing and reading, so that "there was no more fear of their forgetting their anatomy than of forgetting their alphabet."

Galen's dissections were confined to the bodies of animals, and the facts so discovered were applied by analogy only to the bodies of men. If a physiological hypothesis charmed him, his anatomical observations had to give way to it. His mind ran riot in speculation, often fantastic and far-fetched, but occasionally shewing a gleam of real insight, as, for example, in his belief that there was a close primary correspondence between the sexual organs of the male and female. But the evils were great and lasting. It was his rash conceits rather than the facts of his experiments, or his sound anatomical knowledge, and broad scientific purpose which were remembered, and indeed almost sanctified, by all men for a period of over 1500 years. Though he was the first of experimenters he asserted that speculation should lead experience and he exalted a debased metaphysics to a height exceeding that of strict and sober observation. In the times of intellectual stagnation in the Dark Ages the writings of Galen had an unequalled authority; and it was only by a notable independence that Abdollatif dared to assert that anatomy was not to be learnt from books and that even Galen's observations were less to be trusted than the evidences of one's own senses. The result was the sterility and the abasement of medicine until the experimental methods were revived by his direct intellectual descendant, William Harvey.

In a rather different sense, and in a different scene, the great traditions of medicine were handed on by Avicenna,

who was born in Bokhara about 980 A. D. It was through him that the works of Hippocrates and Galen became widely known through the East, and finally filtered back to Europe through the Arabs and Moors at a time when learning and culture had almost vanished. The Arabian mind was essentially concerned with compiling knowledge from all sources rather than in initiating enquiry; and a great and useful work, in this direction, was carried out by them during the brightest days of the Saracen Empire. The modern world indeed owes much to their careful preservation of knowledge and their multiplication of copies of standard medical works, before the era of printing; even though the science and art of medicine in itself did not, through their efforts, advance one step. In Avicenna we find a mind as keen as that of his great predecessors, viewing the human body and its ailments in his own way, although numerous points of resemblance to the works of Galen and Hippocrates are everywhere evident. He was not an experimenter so much as a philosopher and the power of his mind over so many later centuries is probably to be attributed to his masterly grasp of all sciences as well as of medicine and surgery. In the art of surgery he can hardly have attained the skill of the great founder, as far as can be judged by the records in the Canon. We do not find all those evidences of mastership in technique which shine so strongly through the writings of Hippocrates. As is characteristic of the Eastern today the knowledge which he possessed and, to judge by the records of his successes, utilized with great practical effect, was of a different order, both intuitive and logical, but intuitive before logical. His skill in dealing with fundamental mathematical problems is hardly surpassed at the present day, and in this respect he has been almost

the only instance of a great mind applying mathematical concepts to medicine and surgery, up till the present era.

Of other writers before the sixteenth century, it is not unfair to say that they all, or almost all, were merely recorders, encyclopædists it may be, but devoid of any spark of new thought or of wise generalization. They preserved with reverence the old tradition and the ancient knowledge, they discussed every device, and, at interminable length, the meanings of the old scriptures; they tortured new meanings out of old phrases, they were diligent in dressing old words new, and their scholarship was judged by their ingenuity, or infinite prolixity, in so doing.

The anatomists of the Middle Ages prepared the way for new enlightenment. The oldest treatise on anatomy comes from Egypt. The papyrus dates probably from the reign of Thutmosis I, that is, from before the crossing of the Red Sea by the Israelites. It shews the heart with vessels proceeding from it, the liver, spleen, kidneys, ureters, and bladder. The first of comparative anatomists was Aristotle. The expedition of his pupil Alexander into Asia, which he accompanied, gave him unprecedented opportunities for the study of many animals; the result of his work is contained in several books. The first dissections of the *human* body were made by Erasistratus and Herophilus, of Alexandria. Under the Ptolemies in Egypt were garnered all the fading philosophies and sciences which amid the dissensions and distractions of life in Greece, could no longer flourish there. Alexandria then became the guardian and the host of all the sciences and the literatures of the world. It was here, as we have seen, that Galen learnt much of his anatomy.

After the darkness of succeeding centuries the first

gleam of dawn was seen in the University of Bologna. For over 100 years it had been renowned as a centre of scholastic knowledge, of literature and of law. Mondinus, the father of anatomy as he is always acclaimed, lectured there between 1315 and 1325, and publicly demonstrated the structures of the body as disclosed by dissection. His descriptions are remarkable alike for their extent and their accuracy. The claim has been made for him that he went near to the discovery of the circulation of the blood, for he says that the heart drives or transmits the blood to the lungs. Two centuries later (1514–1564) was born the greatest of all anatomists, Andreas Vesalius, a native of Brussels, a student at Louvain. The difficulties of performing dissections were so great in France that he went to Italy for freer and larger opportunities. "My study of anatomy," he says, "would never have succeeded had I, when working at medicine in Paris, been willing that the viscera should be merely shewn to me and to my fellow students at one or another public dissection, by wholly unskilled barbers, and that in the most superficial way. I had to put my own hand to the business." When twenty-one years of age he was asked to lecture at the University of Padua. His original additions to the science of anatomy were numerous and of the highest importance. He swept away much of the old "analogical" anatomy, the surmises and the errors, hoary with age, and sanctified by their free acceptance by a multitude of authors in the centuries after Galen formulated them. His work on anatomy is adorned with illustrations which for beauty of design and accuracy of execution have never been surpassed, indeed, I think not equalled, since they were published. It is said that the figures were drawn by Titian. Cuvier remarks that if this be not true they

must at least be the work of one of his most distinguished pupils. But Vesalius did something more than all this. He was the first imitator of Galen in experimental work, and though he did little enough, it was sufficient to show that the method was not utterly forgotten. He was the forerunner of those distinguished Italian anatomists who may share with him the credit for the creation of the science of anatomy, of Eustachius, of Fallopius, who in his short life labored to great ends, and of Fabricius, his successor in the chair of anatomy and surgery of Padua, among whose pupils was William Harvey. The presence of folds in the interior of some veins had been noted by Sylvius and Vesalius and others, and those of the vena azygos were particularly described by Canani in 1547, but it was Fabricius who recognized the existence of valves throughout the venous system and who observed that they were all turned towards the heart.

Harvey had been attracted by the fame of Fabricius to Padua, at a time when Galileo was teaching and was engaging in those methodical researches whose influences have lasted to our own day. Harvey said of himself that he felt it in some sort criminal to call in question doctrines that had descended through a long succession of ages and carried the authority of ancients, but he "appealed unto Nature that bowed to no antiquity, and was of still higher authority than the ancients." It was at the instigation of Fabricius that Harvey undertook by experiment to discover the function of the valves in the venous system, and in the year of Shakespeare's death those experiments whose end was to bring about the greatest discovery in the history of medicine were begun. The discovery had almost been made by half a dozen of his predecessors who appeared to have stood upon its very brink. As Cuvier says, we are

often on the edge of discovery without suspecting it. There can be little doubt that the pulmonary circulation had been recognized by the unhappy Servetus, who, with his works, was burned as a heretic at Geneva in 1553 by Calvin.

In 1559, a pupil of Vesalius at Padua, Realdus Columbus, may be said to have suggested the existence of this circulation by inductive reasoning, but to ingenious speculation the minds of men were hardened. It was open demonstration and proof that were needed to press home an opinion so contrary to all accepted teaching.

A discovery is rarely, if ever, a sudden achievement, nor is it the work of one man; a long series of observations each in turn received in doubt, and discussed in hostility, are familiarized by time, and lead at last to the gradual disclosure of the truth. Harvey's discovery was finally due to his application of the experimental method of Archimedes and Galen to a problem of which many of the factors were already known; or, as he himself tells us, the circulation of the blood was held to be completely demonstrated by experiment, observation, and ocular inspection against all force and array of argument. He writes: "When I first gave my mind to vivisections, as a means of discovering the motions and uses of the heart and sought to discover these from actual inspection and not from the writings of others, I found the task so truly arduous, so full of difficulties, that I was almost tempted to think with Fracastorius, that the motion of the heart was only to be comprehended by God. . . . At length and by using greater and daily diligence, having frequent recourse to vivisections, employing a variety of animals for the purpose, and collecting numerous observations, I thought that I had attained to the truth."

The reception of this discovery was generous at home; tardy and reluctant, or openly hostile abroad. But it was everywhere eagerly and hotly discussed. Harvey says: "But scarce an hour has passed since the birthday of the circulation of the blood that I have not heard something for good and for evil said of this my discovery. Some abuse it as a feeble infant, and yet unworthy to have seen the light; others again think the bantling deserves to be cherished and cared for. These oppose it with much ado, those patronize it with abundant commendation."

Riolan, distinguished as an anatomist, and professor at the College de France, denied and derided it. What Harvey felt of the opposition may be learnt from his reply to a friend who urged upon him the publication of his later work, *De Generatione Animalium*: "And would you advise me to quit the tranquillity of this haven, wherein I now calmly spend my days and again commit myself to the unfaithful ocean? You are not ignorant how great troubles my lucubrations, formerly published, have raised. Better it is certainly, at some time, to endeavour to grow wise at home in private than by the hasty divulgation of such things, to the knowledge whereof you have attained with vast labour, to stir up tempests that may deprive you of your leisure and quiet for the future." Nevertheless, compensations and rewards came to him in full measure, and he had the satisfaction of living to see the general acceptance of his discoveries. This discovery, as Whewell said, implied the usual conditions, distinct general notions, careful observation of many facts, and the mental act of bringing together these elements of truth. Boyle wrote: "I remember that when I asked our famous Harvey what were the things that

induced him to think of a circulation of the blood, he answered me that when he took notice that the valves in the veins of so many parts of the body were so placed that they gave a free passage to the blood toward the heart, but opposed the passage of the venal blood the contrary way, he was incited to imagine that so provident a cause as Nature had not placed so many valves without design; and no design seemed more probable than that the blood should be sent through the arteries and return through the veins whose valves did not oppose its course that way. That supposition his experiments confirmed."

But the experimental methods of Galen, revived by Gilbert, physician to Queen Elizabeth and the father of modern experimental science, and practised with such supreme effect by Harvey, was to find as yet no place in scientific surgery. That art it is true was practised with wider scope, with confidence bred of generations of experience, and with a risk that was perhaps steadily, though almost negligibly, diminishing. Safety was rather dependent upon the individual capacity of the surgeon than a quality common to the work of all. Richard Wiseman, who was born three years after the publication of Harvey's discovery, is generally granted the proud title of the Father of English surgery. He was a man "given to the observation of Nature" and became Sergeant Surgeon to Charles II and to James II (who when Prince of Wales and Duke of York were withdrawn under a hedge during the battle of Edgehill, October 23, 1642, when Harvey distracted their thoughts by reading to them), and among his contributions to the craft of surgery may be mentioned his operations for hernia, and his advocacy of primary amputation in cases of injury, by gunshot or otherwise, of the limbs.

Ambrose Parè was to French surgery what Wiseman was to British. The life of Parè is one of the greatest romances in the history of our profession; it tells the story of the progress of the son of a joiner who was groom, gardener, barber's apprentice, until he became at last the surgeon to four kings of France. It was he who was concealed, locked up in a room of the Louvre, and spared from death by special order of Charles IX at the Massacre of the Huguenots on the day of St. Bartholomew. For the King said that it was not reasonable that a man who was worth a whole world of men should be murdered. He is the outstanding medical figure in the Renaissance. He was untaught and therefore in youth at least free from the trammels of ancient lore. Early in life he said: "I make no claim to have read Galen either in Greek or in Latin; for it did not please God to be so gracious to my youth that it should be instructed either in the one tongue or in the other." At last when he read Hippocrates and Galen he surpassed them both in the number and variety of the conditions he had been called upon to treat; and he was therefore the better fitted to approach their teaching in the spirit of an informed and practised critic. "We must not be drugged by the work of the ancients as if they had known all things or spoken all," he writes. Yet in later years he studied diligently, for he was said by Thomas Johnson, who translated and edited his works, to be "a man very well versed in the writings of the ancient and modern physicians and surgeons." He was one of the greatest original minds our art has known, fearless, independent, alert and inventive, and not without a good conceit. "There be few men of this profession," he writes, "which can bring so much authority to their writings either with

reason or experience as I can," and again, "I have so certainly touched the mark whereat I aimed that antiquity may seem to have nothing wherein it may exceed us beside the glory of invention, nor posterity anything left but a certain small hope to add some things as it is easy to add to former inventions." He won for surgery and for those who practised the craft in France a place they had never before attained.

Surgery was still lacking its firm foundation in pathological anatomy. This was to be built by Morgagni and John Hunter and by many others taught and inspired by them. The tireless industry, unwearying care, and profound sagacity of John Hunter gave to an art that was largely empirical a warrant based upon a sound knowledge of morbid processes in all tissues. He was observer, investigator, collector, in each capacity without a rival. He was unceasing in his search for truth by way of experiment. "Don't think, try the experiment," he urged his pupil Jenner. In his own person he did both supremely well. His disregard of the written word was deplorable no doubt, but refreshing after so much barren speculation among his forerunners. "I am not a reader of books," he said; and again, "I believe nothing I have not seen and observed myself." His rebuff to one who accused him of ignorance of the classics is famous: "Jesse Foot accuses me of not understanding the dead languages, but I could teach him that on the dead body which he never knew in any language, dead or living." Often he recounts the details of an experiment, but leaves us to draw the conclusion. He changed the whole spirit of practice and placed knowledge on the throne of authority. The day was gone forever when a pure and dangerous empiricism could be practised; surgery became a science and

its craft a rational procedure. The museum which he founded and which still bears his name in the Royal College of Surgeons of England is unsurpassed in all the world, and his own specimens are still to be seen to bear witness to his incomparable services to pathological anatomy. For Morgagni no praise can be too high. His letters may be read today with delight; though his knowledge of disease is, in the modern view, often steeped in mediævalism, his long array of facts and of relevant instances, his description of morbid parts, his accurate and searching generalizations are among the greatest contributions to medical literature in all the ages.

Such was the progress of surgery up to the early years of the nineteenth century. The discovery of the anæsthetic properties of ether and chloroform completely changed the possibilities of the range of application of surgery to morbid conditions and enlarged also the scope of experimental work upon animals. But in every direction the surgeon's work was hampered and frustrated by the occurrence of infection and all its dire consequences, in the majority of the wounds inflicted. It was for Lister that the world was waiting and his coming changed everything. For, as Carlyle said, "The great man was always as lightning out of Heaven: the rest of men waited for him like fuel, and then they too would flame."

Lister, as every one knows, introduced the antiseptic system into surgery. Before his time the wounds inflicted by the surgeon, or those received in civil life as in cases of compound fracture, became septic almost as a matter of course. The decomposition of the wound discharges was formerly held to be due to contact with the oxygen of the air. Lister recognized that the investigation of many observers, ending with Pasteur, which shewed that fer-

mentative and putrefactive processes depended upon minute organisms, were applicable in surgical work also. In the year 1836, a French observer, G. Latour, had pointed out that the tiny particles of which yeast was composed were capable of multiplication, that they were in fact alive, and that it was by their propagation that the change known as fermentation, the change of sugar into alcohol, was produced. Both Latour and T. Schwann shewed that this process could be suppressed by the application of heat to the yeast. Schwann, especially, called attention to the fact that the putrefaction of organic substances was due to these minute living bodies, and that putrefaction and fermentation were essentially one. The weighty authority of Liebig was opposed to this view, and Helmholtz, after a time of wavering, finally ranged himself against Schwann. It was in 1856 that Pasteur began the series of experiments which demonstrated finally that micro-organisms were the cause of fermentation and of putrefaction, and that for each form of fermentation studied by him—yeast fermentation, lactic acid fermentation, butyric acid fermentation—there was one specific cause, and only one.

Lister had long been working on the problem of inflammation and of the decomposition of wound discharges. When, therefore, early in 1865 he read of the work of Pasteur his mind was prepared to receive the new evidence, and to put it to the proof in the treatment of surgical cases. It is impossible for us now to realize the horrors and the mortality attached to surgical work at the period when Pasteur's papers were written. In almost every case the discharge from a wound underwent putrefaction; inflammation of varying degrees of severity attacked the wounds, pus poured from their surfaces, and hospital

gangrene, erysipelas, and pyæmia, the most desperate form of blood poisoning, occurred with terrible frequency. The clean healing of a wound by "first intention" rarely occurred. A surgeon was more than content, he was eager and gratified, to see a thick creamy discharge of "laudable pus" from the surfaces of a wound. Very few operations were performed, and then, as a general rule, only in cases where death or extreme disability was otherwise certain. Limbs were amputated when smashed, or diseased as to be worthless and dangerous; the mortality from amputations varied from 40 to 50 per cent. In Lister's hands, up to the year 1865, in 15 cases of excision of the wrist-joint by his own method, 6 patients suffered from hospital gangrene and 1 died from pyæmia. Volkmann, one of the earliest of Lister's disciples, had results so ghastly that he decided to close his hospital altogether for some months. Lister's own account of his wards at Glasgow is disturbing and distressing even today. The most vigorous and robust patients were swept away after the most trifling injuries or operations, and septic diseases were so frequent and so deadly that the very name of hospital was dreaded by every sufferer. John Bell, a great surgeon, spoke of the hospital as a "house of death."

In the paper which Lister had read, Pasteur asserted that "the most far reaching of my researches is simple enough, it is that putrefaction is produced by living ferments." He asserted that the oxygen of the air was not the cause of putrefaction, as everyone hitherto had supposed; that indeed some of the causes of decomposition could thrive only in the absence of oxygen. This observation, which distinguishes "aërobic" from "anaërobic" organisms, is of the first importance. Lister at once realized the significance of this work in connection with the

changes occurring in wound discharges and on wound surfaces. In 1867 he wrote: "When it had been shewn by the researches of Pasteur that the septic property of the atmosphere depended not on the oxygen or any gaseous constituent, but on minute organisms suspended in it, which owed their energy to their vitality, it occurred to me that decomposition in the injured part might be avoided, without excluding the air, by applying as a dressing some material capable of destroying the life of the floating particles." He proceeded to make trial of the hypothesis in his own work. At this time he had heard also of the experiments made at Carlisle with the disinfection and deodorization of sewage by German creosote, a crude form of carbolic acid. The administration of a very small proportion of this substance not only prevented all odour from the lands irrigated, but destroyed the entozoa which usually infest cattle fed upon such pastures. This was the preparation he decided, after trying chloride of zinc and the sulphites, to rely upon in his early trials.

Among surgical cases then, as now, the sharpest distinction was drawn between simple and compound fractures; between fractures, that is, where the soft parts are almost unhurt and the skin unwounded, and fractures in which a wound through the skin and soft tissues reaches the broken ends of bone. In simple fractures, life was rarely or never in jeopardy; in compound fractures, putrefaction of wound discharges occurred, septic processes became rampant and the mortality was high. "The frequency of disastrous consequences in compound fractures, contrasted with the complete immunity from danger to life or limb in simple fracture, is one of the most striking as well as melancholy facts in surgical practice."

These were the opening words of Lister's first paper on the "new methods" in the *Lancet* in 1867. The first trial of this method proved disastrous owing to improper management, but the second attempt, on August 12, 1865, proved perfectly satisfactory, and was followed by others which more than realized Lister's most sanguine expectations. Compound fractures healed and united as easily and quickly, and almost as safely, as simple fractures. The method proved by so stern a trial was soon applied to cases of chronic abscess, and by degree to operation wounds. In one of his earlier papers Lister wrote: "Admitting then the truth of the germ theory and proceeding in accordance with it, we must when dealing with any case destroy, in the first instance, once for all any septic organisms which may exist within the parts concerned; and after this is done, our efforts must be directed to the prevention of the entrance of others into it." This statement shews that Lister laid down the two essential principles of antiseptic system, the prophylactic and the therapeutic.

Lister's work, it is evident, was the result of research carried out both by the inductive and by the deductive method, and tested and confirmed by many experiments. He combined in full measure the wide, patient, penetrating inquiry, the comprehensive generalization, and the sound wisdom of the method of Hippocrates, with the demand for experimental illumination or proof afforded by the method of Galen, of Bacon, and of Harvey. He combined in his own work the best of all the schools, and it was no accident that the greatest of all discoveries relating to the science and the art of surgery was made by him.

If a man's services to humanity are the standard by which we measure his value, then Lister may be counted as

perhaps the greatest man the world has ever produced. For he has been the means of abolishing, or assuaging, the sufferings of men and women to a degree which is quite incalculable, and, as I said of him years ago, he has been the means of saving more lives than all the wars of all the ages have thrown away.

As the result of Lister's work the way was cleared for an immense and immediate advance in surgical practice, and for an extension into regions that before had been denied even to the most intrepid surgical adventure. The result is known to all the world. Diseases which were beyond the reach of any are now within the grasp of all surgeons. Operations whose mortality even twenty-five years ago was so heavy as to be almost prohibitive are now performed with a frequency and with a degree of safety which never cease to excite our wonder. But Lister's work did something else; it shewed how research for the future must be conducted if our progress were to be both enterprising and safe. It shewed that clinical research and experiment must forever run together.

The achievements of clinical research have been gigantic since Lister's day. The safety which he brought into all our work resulted in an advancement, little by little, of the attack upon the diseases of internal organs, and it exercised in consequence a very powerful, germinal influence upon internal medicine. If our knowledge of the disease of the abdominal viscera of thirty years ago is compared with that of today the truth of this statement will appear. In connection with the diseases of the gall-bladder and bile-ducts the work of Courvoisier published in 1890 is a complete record: it is, indeed, one of the most monumental works ever produced in surgical literature. What was known then, in comparison with now? Nothing

of the early symptoms of gall-stones, of the relation between them and visceral and other infections, nothing of the symptoms due to the impaction of stones in one or other of the ducts; almost nothing of the possibilities of safe relief by surgery. Lister's work has not only been the means of relief to the patient in his agony, but has been the instrument by which our own most prolific enquiries into the symptomatology, etiology, and, in no insignificant degree, the pathology of this disease has been made. Of gastric ulcer as distinguished from cancer of the stomach our knowledge thirty years ago was trivial compared with what it is today. Much of the teaching of those days is not confirmed by the surgical enquiries of today; and it is now I suppose admitted universally that unless the physician is guided by the principles of diagnosis discovered by the surgeon and the radiographer he will stray wide from the path of truth. So, too, of duodenal ulcer, our present knowledge of which is due entirely to the clinical research made possible by safe surgery. And the list might be greatly extended. Much more remains to be done. We are only on the threshold of our enquiries as to the complementary action of one organ upon another; of the relations, for example, of the pancreas, spleen, and liver to each other; and of all or any of these to parts, or to the whole, of the alimentary canal, and to the organs possessed only of an internal secretion. Clinical research involves and implies the fullest enquiry into the detailed character of all present symptoms; the most searching pursuit after those earliest departures from smooth and normal action which observation can discover, the correlation of all these with the manifest changes observed at all stages in the several organs during operations upon any of them. When all

this knowledge has slowly and patiently been garnered, then the method of experiment must be used to carry our enquiries still further, and to help us to answer the question: "How do these things happen?" Clinical research will tell us of the changes in other organs associated with the one to which our main enquiry is directed, but a process of deduction and an enquiry by experiment are necessary before we can disclose the sequence of events which culminate at last in the disease we set out to study. The clinical research, is beyond question, the more arduous. The factors which enter into it are so many, so variable, so impressed by the changing conditions and moods and circumstances of the patient that only the most indefatigable patience and the most trained capacity can help to resolve the matter into simple terms, to dissociate what may be an infinitely complex grouping of many facts before we can rearrange them in appropriate sequence of process or of time. We must discover the "usual conditions," obtain our general notions, observe carefully a multitude of facts, arrange them in orderly fashion, employ the mental act which will bring them together as elements in a great truth. When this is done, and only when this is done, can the deductive method of Galen be employed to fullest advantage. Experimental research is not so baffling a task. Great ingenuity in the devising of experiments may be found in the supreme masters, Pawlow, Almroth Wright, and a very few others. But each experiment often contains only the one question to which the answer is sought. The answer is "yes" or "no," or is expressed in simple terms, and it is free from those infinite perplexities and changing proportions which distinguish the answer given to any enquiry, even the simplest, in the method of clinical research. When in a

simple experiment the answer is given, a new problem may arise suggesting a further experiment. Thus a chain of experiments may develop each of which answers not only its own question, but contributes in its own degree to the final answer embracing the entire sequence of experiments. The single experiment may be simple. But in respect of a series, each member of which is dependent upon its predecessor, and provokes its successor, and all of which illuminate or decide some problem suggested by clinical research, nothing has been done in surgery comparable to that which in chemistry has been achieved by Fisher and Abderhalden.

These brief glimpses at the progress of surgery shew that its epochs may be considered as three in number.

In the first and longest the writings of Hippocrates and Galen were regarded as an inspired gospel. By them the minds of men were held captive, and their imagination enslaved, and every new adventure in thought or action suppressed or cramped. To seek in them for knowledge was all the effort of every man. What was written in them was truth, what was outside them rank heresy. Where the meaning was not as plain as day the most endless enquiry and discussion ensued. The controversies which then shook the intellectual world to its very foundation are seen now to be only laughable, both in their methods and in their quaint decisions. In later ages to challenge the truth or the final revelation of any teaching of Galen's was almost blasphemous, and it required a rare and reckless courage to say, as did Henry of Mondeville, "God did not surely exhaust all his creative power in making Galen." The prophets and seers, who little by little, and with very needful caution, led the world through this black night, death's second self, into the dawn, were

the anatomist Mondinus, Vesalius, Fabricius, Fallopius, and others. By their work the assertions of the old scriptures could be openly gauged. In gross anatomy a structure stands out for all to see. If Galen's teaching denied the truth disclosed by dissection it was most gently and tentatively refuted, heretical and perilous as such a work might be. And as normal anatomy grew it was joined by morbid anatomy, and at last came Morgagni and Hunter. They established the second great era in which the pathology of the dead was studied with a wealth of care and inexhaustible patience. The gross lesions of morbid anatomy, and even many that were recondite and remote, were examined, described, discussed, and arranged in due order by a mighty succession of able men, whose work today we too lightly neglect. Clinical medicine and surgery were dominated by the knowledge of the morbid processes discovered in this time. Symptoms were correlated with the signs found upon the postmortem table and upon the shelves of museums. Clinical histories were largely devoted to terminal conditions, for it was only these that brought a patient to a hospital where he died, and where an autopsy could be made. But patients do not die in hospital from the diseases from which they suffer long during life. And in consequence severe limitations were set to our knowledge of disease of all kinds.

Lister's work made possible the third era which depended for its swift and notable advance upon a study of the pathology of the living, upon a study, that is, of morbid processes in their course rather than when their race was fully run. By multiplying observations made during operations we learnt, little by little, how to capture a general truth from a series of individual exam-

ples. By slow degrees and grudgingly it was admitted that terminal manifestations of disease and the advanced ravages of morbid anatomy did not constitute all medicine; that earlier symptoms were to be referred to earlier changes in organs exposed during the course of operations. And these changes and symptoms we now realize are themselves but late; still earlier manifestations of aberrant action are being sought patiently and with a success that holds increasing hope for future work.

During all these three periods, through Galen, Vesalius, Harvey, Bacon, Hunter, Lister, there has run a vein of experimental work, testing hypothesis and discovering new truths. Since Lister's day there has been a steadily increasing recognition of the value of such work and of the urgent necessity of continuing it, of enlarging its field so that it may be coterminous with medicine itself. We are, indeed, newly entered upon another stage, the stage of combined research, in which clinical observation, inductive and deductive processes of reasoning, and experimental enquiry are linked together. In its progress, so far, the work of a few men stands out as of the utmost significance. Horsley's work upon myxœdema, cretinism, and on the functions of the thyroid gland; Ferrier's, Macewen's, and Horsley's researches upon cerebral affections and cerebral localization; Senn's work upon the pancreas and upon the intestines; Kocher's work upon cerebral compression and upon the thyroid gland; Crile's work upon shock and upon blood transfusion; and Harvey Cushing's work upon diseases of the brain and the pituitary gland. Since Lister rid all operations upon man and upon animals of their former terrors, many surgeons have turned to experiment in order to perfect and to illustrate their own work, to test an hypothesis, to search for new

procedures or to discover an explanation of clinical phenomena whose meaning was difficult to unravel. In recent days few men have displayed so vast a range of clinical interests, so keen a zest for relevant experimental enquiry, so logical a mind, such frank intellectual honesty as Murphy. He may justly be ranked as one of the earliest and one of the greatest exponents of the method of combined research.

Murphy's first work to attract the attention of all surgeons was that which led him to devise and to perfect the most exquisite surgical implement that has ever been invented, "Murphy's button." Up to the time at which experimental work on the anastomosis of hollow abdominal viscera was begun by Senn, Murphy, and others, the method of securing union was difficult, tedious, and unsafe. I well remember to have seen the operation of "pylorectomy" done in the year 1889. A very niggardly removal of a small "prepyloric" carcinoma was made, and the cut end of the duodenum was united to a part of the divided end of the stomach after the first method of Billroth. We counted over two hundred sutures used to effect the junction. Each suture was of silk; for each the needle was separately threaded, the suture passed, tied, and cut; a wearisome total of movements of the surgeon and his assistants, involving a great expenditure of time. No wonder the surgeons searched for simpler methods. Senn's bone plates, the first mechanical apparatus to assist in an anastomosis, were ingenious instruments not very easy to use, requiring a not inconsiderable degree of skill and patience to secure, that the threads holding them were well and truly tied, and calling also for the introduction of a number of additional sutures. The results following the use of these instruments were some-

times very good and sometimes very bad. While surgeons were struggling with this tiresome and unsatisfactory implement, Murphy introduced his "button." It was the result of a great deal of experimental work done upon dogs, in the early hours of the morning, and in the lean years of his early married life. In this work Mrs. Murphy took her share, giving chloroform to the animals. A few people were privileged to know of the boundless help and inspiration which Mrs. Murphy gave her husband in those hard, but happy days when he was struggling for his place in the world of surgery. His wonderful success was in no small way due to her sympathy, encouragement, and unfaltering belief in him; and to the eager enthusiasm which she shewed in all his work. His fame was her fame also. As I offer to him my tribute of laurel for honour and of rosemary for remembrance, it is an added pride that I can do so in her presence. With the help of Murphy's button operations which had been difficult and perilous at once became so simple that the merest tyro could perform them, and the risk of all operations fell with amazing rapidity. The button was used in every clinic and upon all occasions where visceral anastomoses had to be effected; and the name and the fame of Murphy travelled round the world. But I still think that the great virtue of the button was not in its own direct use, but in the convincing demonstration it gave to us of the essential simplicity of the process of visceral union. By using the button we learned how safely and how rapidly the peritoneal junction took place; there was no need, it was now perfectly evident, for the hundreds of stitches that all surgeons were using. Firm, even approximation for a very few days would lead, the button showed beyond a doubt, to a permanent and secure fusion of the apposed viscera.

The button itself was occasionally a danger. After the operation of gastro-enterostomy it sometimes remained for many months in the stomach; when it passed on to the lower intestine it might cause obstruction, or it might ulcerate its way through the intestinal wall. We learned from the use of the button not that the button itself should be used, but all the secrets of the principles of entero-anastomosis. It is not the least exaggeration to say that Murphy revolutionized the methods of visceral anastomosis, and was partly responsible for giving that impulse to abdominal surgery which in later years has carried it so far.

A characteristic example of his method of approaching a surgical subject to which he desired to contribute is shewn in his work on "Ankylosis," which he began in 1901. Up to that time the treatment of stiff joints was unsatisfactory, and in cases of severe ankylosis, whether bony or densely fibrous, was almost hopeless. Murphy says he proposes to begin the study of his subject by some questions: "What are joints? What is the embryology of joint formation? What is the pathological histology of acquired arthroses, of false joints? What is the pathology of hygromata? (acquired endothelial lined sac) Can they be produced artificially? What is ankylosis? What are the pathologic and anatomic changes included in the term? What tissues are involved? From a practical standpoint, into what classes may it be divided? When ankylosis has formed, what are the limitations of surgery for its relief? Can we re-establish a movable, functioning joint with synovial lining? Can we restore motion, and to what degree? In what class of cases can the best results be secured? Can we for the future

promise better than the flexible, fibrous unions that we have secured in the past?"

He then discusses the development of joints in the embryo, and the method of bursa formation in early and in adult life, shews that hygromata and ganglia are the products of the liquefaction of hypertrophied connective tissue, and indicates that in an artificial development of joints all the facts relative to these processes should be utilized. The formation of "false joints" as a result of non-union in fractures of the long bones led to the recognition of the pathological condition whose counterpart was provoked in the operation of arthroplasty, in which a foreign body was inserted between the end of bones separated at an ankylosed joint, to prevent reunion and to cause the development of a new joint. He then investigates the matter by experiments upon dogs, and proceeds to demonstrate its efficacy upon men afflicted by bony ankylosis of their joints. The whole piece of work is an exemplary instance of the combination of clinical experience and of experimental research leading to the establishment of a new method of treatment in a severe and most disabling condition.

In 1897, Murphy published his article, "Resection of Arteries and Veins Injured in Continuity. End-to-End Suture; Experimental and Clinical Research," in which for the first time he established the principles, and described one of the methods, of arterial suture and anastomosis. As in other articles, clinical needs indicate the lines of his experimental enquiries; and a widening of the bounds of surgical endeavour and practice is the result. In 1898, he delivered at Denver the Oration on Surgery before the American Medical Association and chose as his subject the "Surgery of the Lungs." Independently

of Forlanini he suggested the injection of nitrogen into the pleural cavity in cases of hopeless unilateral disease of the lung. No enthusiastic acceptance greeted the suggestion. Murphy himself extended the method in his later work to cases of incipient tuberculous disease; and recent experience has fully justified all his claims and has given sanction to his methods. He again combined clinical experience and research by experiment in his work on "Surgery of the Spinal Cord," published in 1907, and his final summary on neurological surgery in *Surgery, Gynecology, and Obstetrics*, 1907, iv, 385, was the most accurate and concise survey of our knowledge of this subject which had then been published.

Wherever we turn we find his method to be the same. A wide survey of the subject to be discussed made interesting by the personal magic that he was able to throw into it; a disclosure of the gaps in our knowledge; a suggestion as to the means by which that knowledge or a want in our technical methods can be made good; a record of experiment to elucidate or to solve a difficult point; a wealth of clinical observation and a formidable array of arguments, lead to an inevitable conclusion stated in terms that none could fail to comprehend. In every article of his that we read we can see the working of an orderly mind, of a mind most eager for new truths, and expectant of them. For every subject he seems to have a mental scaffolding by which he guides and arranges the truths as they are fashioned and duly laid in place. He had a zeal for classifications which looked complex, but when carefully considered tended to simplicity and to easy and ready remembrance. Of his other surgical work and of his high-minded endeavour to seek for and to secure the purity and advancement of his own profession

I need say nothing. It is a record of sincere and honest devotion to his duty as he saw it before him. Great deeds are born of great zeal and high resolve; and he was lacking in neither. All that he did is within the recent memory of his colleagues here. My immediate purpose has been fulfilled if I have sketched, however roughly, the giant figure of the man and the surgeon whose work was done among you and whose fame has spread out into all lands.

Our calling by common consent, the noblest of any, dignifies all who join its ranks. The honour of the profession is the cumulative honour of all who both in days gone by and in our own time have worthily and honestly laboured in it. In every generation there are a chosen happy few who shed a special lustre upon it by their character, their scientific attainments, or the great glory of their service to their fellow men; for it is, as Ambrose Parè said, "beautiful and the best of all things to work for the relief and cure of suffering." In our generation Murphy was one who by his full devotion, his complete surrender to its ideals, and by his loyal, earnest, and unceasing work, added distinction to our profession, which, in return, showered upon him the rewards with which no others can compare, the approbation of his fellow workers and the friendship and trust of the best among his contemporaries in every country.

"The mightier man, the mightier is the thing
That makes him honoured."

As we look backward upon the long history of the science and art of medicine we seem to see a great procession of famous and heroic figures, each one standing not only as a witness of his own authentic achievements, but

also as a symbol of the traditions, ideals, and aims of the age which he adorns. The procession is sometimes thinly stretched out, or even rudely broken here and there, but in happier ages it is thronged by an eager and exultant crowd. In medicine the whole pageant is as noble and splendid as in any of the sciences or arts, and it reveals the collective and continuous genius of a band of men inspired by the loftiest purpose, and lavish in labour and sacrifice for the welfare of mankind. They have come throughout the ages from every land. They now belong not to one country but to every country, for they are the common possession and the pride of all the world. They have lost their nationality in death. They are men whose deeds will not be forgotten and whose names will live to all generations. Among such men, few in number, supreme in achievement, John Benjamin Murphy is worthy to take his place.

THE RITUAL OF A SURGICAL OPERATION*

EVERY operation in surgery is an experiment in bacteriology. The success of the experiment in respect of the salvation of the patient, the quality of healing in the wound, the amount of local or constitutional reaction, the discomforts during the days following operation, and the nature and severity of any possible sequels, depend not only on the skill but also upon the care exercised by the surgeon in the ritual of the operation. The "ritualist" must not be a man unduly concerned with fixed forms and ceremonies, with carrying out the rigidly prescribed ordinances of the surgical sect to which he owes allegiance; but a man who, while observing with unfaltering loyalty those practices which experience and experiment have together imposed upon him, refuses to be merely a mimic bound by custom and routine. He must set endeavour in continual motion, and seek always and earnestly for simpler methods and a better way. In the craft of surgery the master word is simplicity.

The ritual of an operation commences before, sometimes long before, the incision is made, and may continue for a long period after the wound is healed. In the transition of a patient from ill health to sound health the operation itself is only one—though it may be the most important—of all the factors concerned in this fortunate event.

* Remarks made at the opening of a discussion at the first meeting of the British Association of Surgeons, held at the Royal College of Surgeons, May 14, 1920. Reprinted from *The British Journal of Surgery*, Vol. VIII, No. 29, 1920.

In this discussion we are not asked to deal with two essential preliminary propositions, the necessity for the most careful clinical inquiry into all aspects of the patient's history and condition, so that accuracy of diagnosis may be achieved before operation; and the exact relevance of the proposed operation in the particular conditions recognized by this inquiry, or discovered during the course of the operation itself. A great many mistakes are still made in both these matters. It is useless, to say the least, to perform the most perfect technical operation in conditions which do not call for it; and the test of a successful operation is not restricted to the healing of the wound, but to the ultimate effects of the procedure upon the disorder of the patient.

When conducting our experiment in bacteriology we must recognize that micro-organisms capable of causing the direst disaster may possibly be everywhere—in the air, on the hands, instruments, gauze, catgut, etc., which may be introduced into the wound, or upon the surface of the patient's body. The possibility of the patient's own tissues furnishing a septic organism is so remote that we may leave it out of account entirely. It is an excuse to condone rather than a reason to explain the occurrence of infection.

Our bacteriological experiment may be conducted with one of two intentions: (1) The exclusion of all organisms from the wound; (2) the destruction of all organisms reaching the wound, by a bactericide applied to the wound surfaces.

It is not accurate to speak of these two methods as those of "aseptic" and "antiseptic" surgery; for to speak strictly there is no "aseptic" surgery. In every operation some antiseptic is used on the surgeon's hands or the

patient's skin. The terms are accurate enough if they are held to apply only to that part of the operation which begins with the incision of the skin. After this point the use of antiseptics in a "clean" case is rarely necessary, is often undesirable, and is almost always of greater harm than benefit. It is to insult tissues and to doubt them, when it would be better to trust their very considerable powers of self-defence.

In speaking of the results of an operation a surgeon may be a prejudiced witness as to his own efforts, and a bad judge of his own merit. When we speak, for example, of "healing by first intention," what do we mean? What is our standard? Let us take extreme examples. In the one we mean a wound which heals within a few days, leaving a thin, straight, narrow line of palest pink. Around this line and the stitch-marks everything appears "cold." There is no redness, no swelling, no stiffness or induration, and at the line itself the most accurate apposition of skin edges is seen. There is no discharge from the wound. There has been neither local nor constitutional reaction following the operation. In the other, we mean a wound which is anything but straight; the edges are jagged, they do not meet accurately at every part, they overlap here and there; the line of healing is broad and irregular, raised and red, a sticky discharge oozes from the unapposed surfaces, and a scab may lie where this discharge has dried. The parts around are raised, tender, doughy, or stiff. The stitches seem to sink into the skin. You may see wounds of this kind in some clinics, and hear a complacent comment that the wound has healed by "first intention." Such wounds are the clearest evidences either of a bad technique or of a clumsy operator, or perhaps of both. If we had a Dr.

Johnson in our profession, and he were asked his opinion of such wounds, what would he thunder in reply? We know what he said when pressed for his opinion of a young lady's verses: "Why, they are very well for a young miss's verses; that is to say, compared with excellence, nothing; but very well for the person who wrote them."

In every discussion it is necessary for the protagonists to agree as to definitions and the exact meaning to be attached to words; otherwise polemics are valueless. We must here discriminate between "perfect" and "imperfect" healing, though both may be classed as examples of healing by "first intention." It is, moreover, not only a question of the healing of the superficial, visible wound which is our concern. With the two types of wound healing I have described there are associated not only the varying chances of life or death but also two types of convalescence, especially in abdominal cases. In the former the patient suffers hardly at all, indeed, as a rule, not at all, unless there have been great technical difficulties in the operation itself, such as remoteness of the parts concerned in a very stout subject.

For example may be quoted an operation for cholelithiasis, in a very fat woman, when the liver lies high, and the gall-bladder is small, bound up in dense adhesions, fixed to the duodenum (perhaps with a fistula into it) and the back of the abdomen. The liver and costal margin may need to be held up, and the abdominal viscera to be dragged downwards, before the sclerosed gall-bladder or a dilated common duct containing a stone can be seen. I know nothing in surgery which approaches such cases in difficulty, or which requires such care, gentleness, patience, and skill on the part of a surgeon. I sometimes hear the operation for the removal of a Gas-

serian ganglion or the avulsion of its sensory root spoken of as "difficult." It is work for a novice compared with that in many a gall-bladder case. Apart from cases such as these, which require firm handling, the amount of reaction is negligible. More than half the abdominal cases, except for a little flatulence, hardly realize that they have had an operation performed. Flatulence is a troublesome complication not only of abdominal, but of other operations also. Its cause is uncertain. My own view is that it chiefly results from the starvation and purgation which are almost universally considered a necessary part of the ritual of deliberate operations. Both are certainly undesirable, and are possibly harmful. Solid food is much like liquid food by the time it gets well on its way in the jejunum. As much fluid as the patient wishes to have should be allowed to within an hour or two of the time arranged for any operation, and as soon as possible afterwards. Operations on the stomach are no exception. An enema generally clears the colon quite as much as is necessary. Aperients increase the number and the virulence of the intestinal micro-organisms, and are apt to deprive the patient of large amounts of fluid and to cause exhaustion: effects which are all most undesirable.

With the latter kind of wound just described there is a far greater general reaction and a higher degree of discomfort or of pain, and there is a greater likelihood of complications, grave or trivial, such as phlebitis, thrombosis, the late discharge of buried ligatures or sutures, or the recurrence of the condition which originally required operation.

Surgery should be a merciful art. The cleaner and the gentler the act of operation, the less the patient suffers, the smoother and the quicker his convalescence, the more exquisite his healed wound, and the happier his memory

of the whole incident, to him probably one of the most important in his life. The results of our ritual are therefore expressed not only in the mortality—where the difference may be slight—but also in the quality of the healing of the wound, and in the quality of the recovery from the operation, in respect of security, rapidity, smoothness, completeness, and finality.

In the ritual of a surgical operation the mysteries are imposed not only upon the high priest and upon the acolytes, but upon the congregation also. Every visitor to an operation theatre takes a part, however remote, in the operation. He is gowned, masked, and his head covered with a cap nowadays in all clinics. But dirty boots and soiled trouser legs, conveying mud, dust, and faecal matter from the streets, are often unnoticed. If the wearer of them moves about the theatre freely, or goes from one theatre to another, the organisms carried in the drying filth are scattered broadcast, as the simplest experiment will prove. Large canvas overalls for the boots and the lower part of the leg, tying just below the knee, as a sort of legging, will afford ample and secure covering to this possible source of infection.

The surgeon and his assistants (the fewer the better) should, of course, change all their external garments before operation. The trousers and coats we all wear are very dirty. What would a pair of tennis flannels look like at the end of a week's wear in London? Our everyday darker garments do not show the same marks, but they carry the same dirt. White sterilized trousers, clean white shoes or overshoes, sterile coat, cap and mask, all are necessary for the perfect outfit. They are much more comfortable to wear in a theatre adequately warmed, and there is a feeling of much greater freshness, both before and

after an operation, when garments are changed. But I am, no doubt, like Jonah preaching to a converted Nineveh. All these matters are now a part of our daily routine.

The method of the preparation of our hands and arms is important. It is still a common thing to see hands washed in a basin of still water. The moment the hands are soaped and rinsed the water is polluted by the dirt washed off the skin. If the washing is continued it is obvious that the hands are being constantly re-infected from the contaminated water. If the water is emptied away, and fresh poured in, the basin, being polluted by the water it formerly contained, defiles the fresh water. And it is really not uncommon to see a piece of soap used to lather the hands, laid down, and picked up again, regardless of the fact that each contact of the soap with something else is a possible method of soiling it. The best of all plans is to wash under running sterile water. Some years ago I had water-tanks made, to hold five or six gallons, fitted with a dispensary tap, and placed over gas-coils, so that the water contained in them might be boiled. When the water boils the tap is turned, and about a gallon of water allowed to run through to sterilize the tap, on the end of which a boiled plug is fitted until the time comes for use. In a hospital installation it is easy to arrange for the tanks to be sterilized by steam and to be cooled by water running through a coiled pipe in the tank. Water can be boiled for a quarter of an hour, and cooled sufficiently for use in five minutes. Over the tank is placed a tap for refilling.

Almost all commercial soaps are sterile. The outer surface, of course, may be polluted, but when this is washed or scraped away the exposed fresh surface of the soap is sterile. Two methods of using soap are simple and satis-

factory: to use a tablet of any household soap which has been lying in a solution of acrosyl for half an hour; or to sterilize some green soft soap in a flat dish in the autoclave, and to rub off, time after time, with a sterile gauze swab, enough of the soap to form a good lather. After washing for not less than fifteen minutes the hands should be gently rubbed with gauze wet in spirit and biniodide solution, or in a solution of acrosyl, which is the antiseptic least likely to damage the skin. There is a great difference in the facility with which a hand can be cleaned; some rough, chapped hands, coarsened by antiseptics, clean with great difficulty; smooth hands, well cared for, are sterile very soon. A surgeon's hand should be always carefully tended; nails should be kept clean and short and smooth, and the skin like satin. Once a week or so a visit to a manicurist is desirable.

Gloves are almost universally worn during operations. I know only three surgeons the world over who are in the first rank who do not constantly wear gloves during operations. The arguments in favour of their use are unanswerable. A glove properly prepared is sterile, and remains so if put on the hand without its outer side being touched by any except the glove of the other hand or a piece of sterile gauze. With practice it is rare to puncture a glove except in bone operations, and for these it is often an advantage to wear thin cotton gloves over the rubber. If a puncture does occur, a finger stall may be put on, or the glove changed in a few seconds. The bare hand is difficult to sterilize in some cases; it is almost impossible to keep it sterile throughout an operation, as the silk-thread experiment of Kocher shows; if it is infected during an operation it can certainly not be used uncovered again with safety during that operation.

A surgeon may say that he uses gloves only for septic cases. Does he always know when an operation, or any stage in it, is to be septic? If he inadvertently soils his hand when a septic area is unexpectedly discovered, does he then put on gloves? Has he them always ready to wear? Or does he use an antiseptic in the hope of combating the infection which he spreads with every touch? Is it not the simpler, safer, more certain way to wear gloves which are certainly sterile, and to change them when there is any doubt as to their defilement?

But about the wearing of gloves a good deal may be said. Often they are a mere fetish. How often are gloves put on without their outer surfaces being touched or stroked by a bare hand? How often are they considered rather a protection for the surgeon than for the patient? I have seen gloves put on carefully, and the gloved hand then used to palpate an abdomen imperfectly smeared with iodine. I have seen a blanket which covered a patient's legs pulled up towards his body by a gloved hand which a few minutes later was inside the patient's abdominal cavity; and I have seen cleaned hands gloved and unclean forearms left bare on more than one occasion. I have seen gloves used in the earlier stages of operation, and removed when a difficulty arose in, say, an operation upon an enlarged thyroid gland, or an operation for hernia. This is a technical sin of the gravest kind. Gloves may be sterilized by boiling, or be placed in the autoclave with the dressings and swabs and used dry. The advantage of the dry glove is that it is more comfortable to wear during a long list of operations, and that the hand being covered by a dry sterile powder is kept free from moisture. A chance puncture of the glove does not involve the escape of a possibly contaminated fluid into the wound. Gloves

should be kept on the hands till the dressing of the wound is complete, and until the coat and sleeves are removed. If gloves are properly sterilized and properly put on, the covered finger may be used to explore a knee-joint or anywhere else with impunity.

The "knife-and-fork" method of operating, in which only instruments are handled for every purpose, including the tying of ligatures, is a confession that the gloves cannot be trusted by the operator. If the bare hand is used during operations there is a risk which approaches certainty that the wound will be contaminated. This contamination may be lessened in its malignancy by the immediate application of antiseptics, or by the free and frequent washing of the hands in a bactericidal solution; but the results either of mild contamination or of the irritation of antiseptics in the wound are expressed in those qualities of its healing to which I have referred. Many years ago, before I began to use "tetra" cloths to cover the skin around the wound up to its edges, we found that when cultures were taken from a wound they became progressively more numerous the longer the incision remained open; but many an infected wound healed by what we were then content to call "first intention." We soon learnt that there was a degree of "clinical sterility" of a wound which was far removed from the "absolute sterility" which it should be our endeavour always to secure, and which alone allows of "perfect" flawless healing and a convalescence free from suffering. Above the gloves worn by all those directly engaged in the operation no bare arm should be seen. Either a long-sleeved gown should be worn, or sleeves which fit firmly round the wrist, there to be covered by the cuff of the glove.

Among the more important questions involved in the

ritual of a surgical operation is that concerned with the preparation of the skin. The skin does not always, indeed does not often, harbour organisms, either on the surface or in the depths of sweat or sebaceous glands, of any special septic malignancy; but one can never be certain to what contact the skin has been subject, and therefore it is always uncertain whether septic organisms or spore-bearing bacilli are present or not. It is always necessary so to prepare the skin for a wide area around the wound to be inflicted that, so far as is humanly possible, no contamination of the wound shall be caused from this source. Infection may be conveyed to the skin of the surgeon's hands by the examination of discharging wounds, by rectal or vaginal or buccal examinations, or during an operation. This possibility should be prevented by the avoidance of any contact with patients, in these circumstances, unless gloves are worn. The principle of "abstinence" is the safest: the surgeon abstains from soiling his hands by contact with any potentially infective agent.

It is exceedingly difficult so to sterilize the human skin that it will long remain sterile, as all the experiments conducted in recent years have shown. When a germicidal solution is applied to the skin, there is a "clean fight," so to speak, between the solution and the germs lying in or on the skin. The value of the solution as a germicide is therefore easy to test, and results obtained by these experiments may be accepted as of great value. It is far otherwise when a germicidal solution is applied to a wound, especially to an open wound a few days old, wherein reparative processes have begun. In such a wound an innumerable number of side contests are introduced; it is no longer a fight between a germ and a germicide. There are the cellular and the fluid contents

of the wound discharge, and the various actions and reactions produced among them, the wound surfaces, the dressings, and the germicide all to be taken into account. It is a matter of interest to consider whether we do not go far astray when we assess the value of a germicide in an experiment *in vitro*, and then expect an equivalent germicidal action to be produced in an open wound. It is, I think, very doubtful whether the "antiseptic" action produced by the addition of a particular chemical substance to a wound is due to those properties which it possesses as a bactericide. It probably possesses other properties also which are not strictly related to its germicidal power. But in the case of the skin no such perplexing problems arise. The efficacy of any germicide can be tested quite easily; and the results of experiments should here guide our practice. A surgeon may say that he is satisfied with the healing of his wounds when he might quite easily have better results by using better methods of skin sterilization. By clinical experience, which is tedious and lengthy, we may at last realize the value of skin disinfection, which we might have determined at once by experiment. By experience we find a short way by a long wandering.

What are the requirements for an ideal skin disinfectant? It should be cheap and easily accessible, simple in its application, non-irritant, capable of penetrating the skin to some depth; it should be effective in destroying in a short time all of the organisms which are found on or in the skin, and it should do nothing to prevent or delay the clean and speedy healing of the wound.

The skin disinfectant most commonly employed is iodine. It is applied in varying strengths, and in different vehicles—spirit, chloroform, acetone, benzine, etc. The

tincture of iodine is the form which is most often used. Both experimentally and clinically the method is clearly of the second rate. The work of Tinker and Prince, Hunter Robb, Stanton, and others, shows that even when the iodine is allowed to remain on the skin which is tested, sterilization is not always indicated by the culture tube; if the iodine is removed by a solution of potassium iodide, and the skin washed with sterile water and examined, infection is demonstrable in over 50 per cent. of cases. A very large proportion of the iodine used often disappears from the skin before the operation is completed. There is nothing then to recommend iodine but the ease and rapidity with which it can be applied and its colouring of the skin; its efficacy is far less than is required, and it is a powerful irritant. Iodine, to be effective, must be applied on a dry skin, which often means a dirty skin. I have more than once seen a smear of iodine applied over grime and filth that could not be sterilized by a dozen similar applications. I have used iodine myself on a great many occasions, and have given it a fair trial; I have seen it in a very large number of clinics; yet I have very rarely seen a wound heal with all those attributes which are necessary before one is entitled to say that it is "perfect" when iodine alone has been applied. Picric acid in alcoholic solution of a 3 per cent. or 5 per cent. strength gives better results than iodine; but it does not penetrate deeply, and it is not of sufficient bactericidal value. The wounds are, again, not up to the highest standard in a large number of cases.

Brilliant green is perhaps the most effective of all the aniline group of antiseptics when applied to the skin.

By far the best method of preparing the skin that I have ever used—and I have tried and tested many—is carried out in three stages: (1) Abundant washing with

soap and water, preferably ether soap; (2) gentle friction with biniodide of mercury and spirit solution 1:500; (3) drying; followed by the application for two to three minutes of Harrington's solution. When the towels are fixed round the operation area a further application of Harrington's solution is made; and throughout all operations the skin is covered with towels so that no friction of the hands against it is possible. It would be well if surgeons the world over took a little more pride in the wounds they inflict. The appearance of a wound is often the best index to the quality of the work that has been done throughout the operation.

The towels, which should surround the operation area as closely as possible, are fixed to the skin by clips. On the surface of the skin left exposed a series of tiny scratches are made by a very thin needle, at right angles to the proposed line of incision. These are for the purpose of indicating where the stitches are to be introduced when the wound is sutured. Unless there is a mathematical accuracy of apposition there is never perfect beauty in a wound or scar, and accuracy of apposition is difficult or impossible unless some method of this kind is adopted to secure it.

In so far as the actual operation is concerned, it is, for the reasons I have given, essential to avoid contact with the skin of a patient as much as possible. The hands should not touch the skin at all, viscera should not be allowed to lie upon it, and the rubbing of instruments against it must be avoided. As soon as the incision is made, cloths of several thicknesses of gauze or towelling are fixed to the skin edges and dip well into the wound. If these "tetra" cloths lie loosely on the parts around the wound, they ruffle up during the movements of the sur-

geon's hands. If powder is dusted on the under surface of them it is soon found to lie in the wound. The towels must, therefore, be held at points distant from the wound, so that they are kept stretched and fixed throughout the operation. When they are removed at the conclusion of the operation, the skin covered by them is washed over with spirit and with Harrington's solution before any stitches are inserted.

The wound is made by a firm, clean sweep of the knife. Any bungling here makes an irregular, ugly wound. A good many of the scalpels made nowadays are peculiarly unfitted for their work. I use only two patterns: one with a deep belly, made for me by Stille of Stockholm originally, and the other Stiles' pattern, which is used for all dissections. All vessels are clipped if possible, as in a hernia operation, before being cut, but certainly the moment they are cut. If blood leaks into a wound it stains the tissues, and makes subsequent dissection along the "white line" very difficult.

I say that "vessels" are clipped. Most of the clips made seize not only the vessels but a mass of tissue surrounding them. When ligatures are applied, all this tissue is strangled in the ligature, and has to be digested by leucocytes in the wound. The tips of artery clips should be narrow—almost pointed—and should seize the very smallest possible portion of tissue with the vessel. If dissection is carried on in a wound, as when glands of the neck, or of the breast in a case of carcinoma, are removed, gentle traction in one direction by the surgeon, and in the opposite by his assistant, will reveal a fluffy layer of thin areolar tissue, the "white line" as I always call it, along which dissection can proceed very easily and quickly, and with the immediate disclosure of all the vessels which must

be seized. This involves the application of many clips, but the wound should always be kept dry and unstained by blood. Kocher was accustomed to put out twenty dozen clips for a goitre operation, and on many occasions he seemed to use most of them. It should be our ideal to complete such an operation, which in my student days was often one involving much loss of blood, without staining the towels round the wound.

Though traction is necessary in gland and goitre operations, it must be avoided in abdominal work. There every pull means a pain. I dislike abdominal retractors intensely. The forcible and merciless retraction of the abdominal wall throughout a long operation cannot fail to cause shock and suffering afterwards. The best retractor is the gentle light hand of a well-trained assistant, used mercifully when it must be used at all. But with adequate incisions, retraction is very little needed during the greater part of most operations.

Dissection may be carried out in two manners: by the knife or by "gauze stripping." If by the knife, the movements should be short, sharp, close together, so that if recorded on a moving drum the picture would resemble a "feather edge." And the knife must be sharp. Big, heavy, clumsy movements with a dull knife hurt the patient, and leave the parts less fitted to heal. Throughout the operation there must be no undue exposure of parts. In a large dissection, such as that required in removal of a cancer of the breast, the dissection extends from the axilla to the umbilicus, and from the opposite pectoral muscle over the latissimus dorsi. With skin flaps turned back, the bared area is very extensive. It should never be seen as a whole. As one part of the dissection is completed, hot moist mackintosh cloths are placed over the

raw surface to prevent drying and chilling, and the chance of contamination. Similarly, in abdominal work, only that part of the operation field should be seen with which the operator is at the moment engaged. There is no need in the operation of gastro-enterostomy, for example, for anything to be outside the abdomen during the suturing of the viscera except that small part of each which is embraced by the clamps. The patient is accustomed to keep his own viscera warm, and he should still be allowed to do so. Crile's work has shown, to my mind conclusively, the need for avoiding cooling or drying of wound surfaces.

All the instruments used during the operation are, of course, sterilized by heat; but it is important to remember that contamination may occur during an operation, and therefore the various clips, scissors, retractors, or other instruments should be resterilized as often as is necessary. If, for example, a pair of scissors are used to open the intestine in a case of gastro-enterostomy or colectomy, or needles to suture viscera together, they are at once discarded, and never used again till they have been boiled. The mucosa may be sterile in a case of gastro-enterostomy, but one can never be certain, and it is safer always to assume that any possibly infected tissue *is* infected.

In operations for malignant disease, frequent sterilization of instruments is most necessary. For example, in removing a breast for carcinoma, many surgeons, of whom I am one, adopt the method suggested by Rodman and Willy Meyer, and complete the axillary dissections first. There are many advantages in so doing which need no mention now. Every instrument used in this dissection—knife, clips, scissors—may possibly be brought into contact with a cancer cell. When once used it is therefore laid aside, and not taken up again till it has been reboiled.

Cancer cells, as Ryall and others have shown, can be grafted on to the patient's own tissues and develop a new deposit of cancer. It is obvious that the graft may be conveyed to any instrument, or on the gloved hand if it is at work in the wound. In all operations I have a red handkerchief placed on the table which lies over the legs of the patient. As soon as any instrument is soiled I place it on this danger spot, and it is at once removed by the nurse to the sterilizer.

As regards the material used for ligatures and sutures which must remain within the wound, certain conditions are essential. Such material should, ideally: (1) Achieve its purpose—be sufficient to hold parts together, close a vessel, etc.; (2) disappear as soon as its work is accomplished; (3) be free from infection; and (4) be non-irritant.

The only material which can be made to fulfil these conditions is catgut. Catgut can be sterilized perfectly. The method of Claudius, which directs that the catgut should be soaked in a solution consisting of iodine 1 per cent. and potassium iodide 1 per cent. in water, ignores the fact that with such a proportion of iodide of potassium all the iodine is not dissolved; much of it lies inert at the bottom of the vessel. I use a solution made in accordance with their atomic weights, iodine in a strength of 1 per cent. and iodide of potassium in a strength of 1.75 per cent.; the whole of the iodine is then taken up, a darker and stronger solution results, and catgut soaked in this for ten days or more is almost black in colour, and so strongly permeated by iodine that it is exceedingly difficult to infect it. I have never known any surgeon use silk and not have trouble from it. Silk for ligatures is not necessary, for catgut will securely tie any vessel. Silk for

intestinal sutures is not necessary. Certainly I have not used any for fifteen years, and I have now discarded linen thread for all but the anastomoses after colectomy. An unabsorbable suture used to effect the junction in gastroenterostomy is possibly a factor causing the development of a jejunal ulcer. But thick chromic catgut also will remain for years at a suture line in such a case. In one patient I have found a piece of chromic catgut over two inches long dangling at the gastrojejunal opening three years and nine months after the anastomosis had been made. It is, of course, as I have before pointed out, the sero-serous suture which is the offender in such instances. The inner mucous suture, no matter of what material, is soon loosened and escapes.

Probably we all use more sutures than are necessary in intestinal anastomoses. In urgent cases I have more than once used a single Connell suture with perfect success. But in surgery, in order to be certain that you have done enough, it is generally prudent to do more than is necessary. Over and over again I put in an additional stitch here and there. I know it is not really needed, but I call it my "hypnotic" stitch; for I sleep better at night when I know it is there.

The most important person present at an operation is the patient. This is a truth not everywhere and always remembered. It is our duty to make the operation as little disagreeable as possible for him. To many patients it is a dreaded ordeal. Our patients today are terrified by the tradition that clings to the word "operation," a tradition started in the days when it must indeed have been a terrible procedure, without anæsthetics other than those stupefying drugs, alcohol and tobacco, with patients strapped down or held by assistants, and all the

other horrible accessories. Today an operation can, and should, be made a very simple matter, devoid entirely of anything repellent or disheartening.

The preliminary use of scopolamine, atropine and morphine, or of omnopon is a very valuable help. One dose of $\frac{1}{120}$ gr. atropine and about $\frac{1}{100}$ or $\frac{1}{150}$ gr. scopolamine and $\frac{1}{8}$ or $\frac{1}{4}$ gr. morphine is needed, according to the patient's age, size, etc. This is given about three-quarters of an hour before operation. In a private hospital the blinds should then be drawn down, the room darkened, and the patient encouraged to sleep. No talking is allowed. The nurse remains in the room, but is warned not to speak, and, of course, no friends are then permitted to see the patient. When the patient is taken to the operation theatre as quietly as possible, a towel covers the eyes and the operation room itself is dark. No conversation is allowed in the theatre, and only the anæsthetist and one nurse, or possibly two nurses, remain. Everything is kept as quiet and orderly as possible. About one-third of the patients subsequently say they have little or no recollection of going to the theatre or of taking the anæsthetic. All abdominal cases are treated by Crile's method of quinine and urea injections into the parietal peritoneum, and into the nerve-trunks running to the area in which the operation takes place. There is no doubt as to the diminution of pain thereby resulting. With shock we are not much concerned. There are very few occasions indeed when shock results from an abdominal operation properly conducted, when the patient is kept warm on the table by one device or another, and when the gentlest handling, the most careful hæmostasis, and adequate protection of parts have been exercised.

Every detail in every operation is of importance, and

should be conceived, practised, and tested with unwearying patience by the operator himself, and by him in conjunction with all his assistants. Was it not Michael Angelo who first said that success depends upon details, but success is no detail? In surgery, at least, success may well depend upon the scrupulous, exacting, and unceasing supervision and close scrutiny of every smallest incident of procedure. In respect of surgical work there may be some truth in Blake's assertion that all excellence is in minute particulars. Surgery is nowadays no longer the work of an individual, but of a "team" in which every member plays his exact part, in which all contribute to success, and in which each may bring about disaster. The well-trained team should display that mastery which is implied by ease in smooth and efficient action. In every phase of its work there should be not merely the casual observance of a ritual the meaning of which is lost and the deeds of which are only a faded counterfeit, but acts of full devotion to principles which have been tried and proved, acts which are the witnesses to a living and perfect faith.

It is, of course, a platitude to say that a good surgeon is not merely one who operates well. The qualities required to make our ideal surgeon are many: gifts of character, leadership, wisdom—even worldly wisdom—compassion, and the finest technical skill. In respect of the latter we remember that surgery is not only a science but an art, work demanding the highest craftsmanship, and a knowledge of all the "tricks of the tools' true play."

In all the movements of the surgeon there should be neither haste nor waste. It matters less how quickly an operation is done than how accurately it is done. Speed should result from the method and the practised facility of the operator, and should not be his first and formal

intention. It should be an accomplishment, not an aim. And every movement should tell, every action should achieve something. A manipulation, if it requires to be carried out, should not be half done and hesitatingly done. It should be deliberate, firm, intentional, and final. Infinite gentleness, scrupulous care, light handling, and purposeful, effective, quiet movements which are no more than a caress, are all necessary if an operation is to be the work of an artist, and not merely of a hewer of flesh. For every operation, even those procedures which are now quite commonplace should be executed not in the spirit of an artisan who has a job to get through, but in the spirit of an artist who has something to interpret or create. An operation should not only bring relief or health to the patient, but should give a glow of keen delight to the artist himself, a thrill of joy and a sense of complete satisfaction to a critical spectator.

Ours has been a necessary profession ever since man's body was subject to enmity and casualty. All who practise it will need the gifts of which Thomas Fuller spoke—"an Eagle's eye, a Lady's hand, and a Lion's heart." Of all of us who labour honestly may it at last truthfully be said, as it was said of James IV of Scotland, "*Quod vulnera scientissime tractaret*"—"He was most skilful at the handling of wounds."

THE DIAGNOSIS AND TREATMENT OF CHRONIC GASTRIC ULCER*

AROUND the subject of gastric ulcer a very extensive literature has accumulated. Every country, and a host of authors, have contributed to it, until there must be many who doubt whether anything really fresh or important remains to be said. Yet I hold a firm belief, based upon an experience the length of which I dread to contemplate, that no small part of what is written requires ruthless revision in the light of the modern methods of inquiry conducted by the radiographer and the surgeon. The wealth of teaching in the text-books is too often impersonal, and represents rather a legacy flowing from one's ancestors than a fortune newly won by hard endeavour. The heritage in respect of gastric ulcer is heavy enough, but not all of the securities are worth their face value.

A gastric ulcer is, of course, an ulcer occurring in the stomach. During development the stomach is differentiated as one part of the foregut from that other part which forms the duodenum as far down as the ampulla of Vater. The foregut terminates at the point of entrance of the ducts of the liver and pancreas; at the end of the second month of fetal life the pylorus marks off the stomach from the duodenum. When development is complete it is, as a rule, easily possible in all periods of life to distinguish the stomach from the duodenum. On palpation the pyloric muscle and valve are felt at once. Exactly in the line

* A paper read at the opening of the Session of the Harveian Society, October 23, 1919. Reprinted from the British Medical Journal, December 13, 1919.

of the pylorus a thin white line is to be seen on careful examination; the line becomes clearer if in the living subject the pylorus is held forward by a finger and thumb placed one on the stomach, the other on the duodenum, and closed to meet in the pylorus. In close proximity to the "pyloric white line" is a vein, the "pyloric vein," which begins at or near the middle of the anterior surface of the pylorus and runs downwards to the greater curvature. The "pyloric vein" is constant, its arrangement variable. It may be single and large, short and branched, or long with only very slender branches; it may be double; it may or may not be met by a smaller vein running up towards the lesser curvature; it may lie on either side of the pyloric white line. The perfectly fair criticism has been made against the acceptance of this vein as a landmark, that veins are very irregular in their arrangement, position, and distribution, and that nowhere else in the body is the position of a vein so constant as this is asserted to be. And it must be frankly admitted that there is a very small number of cases in which the venous arrangement is such that no accurate localization of the pylorus is possible from a surface inspection. But there is no landmark in the body that is invariable. For many years past I have drawn the position of this vein as seen during an operation while the parts were under inspection, and it is quite safe to say that in at least 90 per cent. of the cases the markings I have mentioned may be accepted as accurate. Latarjet (*Lyon Chirurgical*, 1911, vi, 337), after a research conducted for the purpose of deciding the value of the vein as an accurate landmark, concludes in favour of its acceptance.

An ulcer occurring on the proximal side of this vein is a

“gastric ulcer”; an ulcer occurring $\frac{1}{4}$ or $\frac{1}{2}$ inch or more beyond it is a “duodenal ulcer.” It is not merely a matter of academic interest to distinguish them; their symptoms are sufficiently distinct to allow an accurate diagnosis of duodenal ulcer to be made with remarkable constancy; their complications and sequels in respect of perforation and hæmorrhage are very different; cancer develops often upon the base of a gastric ulcer, and almost never upon the base of an ulcer in the duodenum. Gastric ulcer is a disease of comparative rarity; its diagnosis from the clinical evidence alone is difficult; its mimicry by other conditions extremely frequent. These statements may not find a ready acceptance everywhere. For if the text-books of medicine, or the special works of distinguished authors are read, or if the diagnosis made in the out-patient medical clinics are reviewed, it will be found that there is a general agreement that gastric ulceration occurs frequently, and that its symptoms are of a kind hardly admitting of doubt or difficulty in diagnosis. I have spent a great deal of time in reading almost everything to which I could obtain access that has been written about gastric ulcer, and I am compelled to say that when the statements univ ersally made are tested by the experience gained in the operation theatre they are found to be inaccurate. My contention is that a full, clear, and truthful description of the symptoms of gastric ulcer is rarely given, and that the conditions described as “gastric ulcer” are in the majority of cases indicative of other diseases.

What are the symptoms of gastric ulcer, and how may the diagnosis be made?

Ulcer of the stomach occurs twice as often in men as in women; its chief symptom is pain. All the attributes of

this symptom merit and must receive the closest scrutiny. The chief attribute is, I think, regularity. In all cases of gastric ulcer there are periods of intermission, longer or shorter, at one period of the year or another; but when the attacks are present the pain which is then the chief feature always displays regularity. It comes after all meals, even light meals; it is not present after breakfast on one day, after dinner on another, and absent entirely on another day. If a meal is eaten, pain during the attack follows invariably. The interval between the taking of the meal and the onset of pain is fairly constant. As a rule the earlier the pain is felt after a meal, the nearer is the ulcer to the œsophagus. That is to say, if pain comes, regularly, one or one hour and a half after a meal, the ulcer that causes it is in the stomach, it is a "pre-pyloric" ulcer. If pain comes two, three, or four hours after a meal the ulcer lies generally beyond the pylorus. This period of relief from pain after a meal is constant and invariable, both in gastric and duodenal ulcers, until stenosis, subacute perforation, or the formation of crippling and embarrassing adhesions takes place. These conditions may lead to a delay in the time of the appearance of the pain in cases of gastric ulcer, or to the hurried appearance of the pain in cases of duodenal ulcer.

In over three cases in five of gastric ulcer, seen during operation, the pain came within one and a half hours of the taking of food; in rather more than four cases in five of duodenal ulcer the pain appeared two hours or more after food. The pain in cases of gastric ulcer very often disappears after an hour, or even less, and may be completely relieved, indeed, it generally is, before the next meal is due. The pain of duodenal ulcer, on the other hand, appearing later, generally persists, often with a

slowly increasing severity, until the meal is taken. The character of the meal influences the pain. A generous meal of heavy foods causes severe pain to appear at an earlier time in gastric ulcer; it delays the appearance of the pain in cases of duodenal ulcer. Smaller meals of soft, pultaceous food, easy of digestion and easily propelled, produce less pain, and the interval of relief brought by the food is longer. An indiscreet and hasty meal, especially of fruits, or salads, or pastry, may give instant and grievous pain. A bland and blameless diet taken in small quantities at brief intervals may reduce the chances of pain appearing, or even afford complete relief. In a small proportion of cases pain may not be influenced by food in the manner and to the extent now described. When the ulcer is near the cardia there may be no relief from taking food, or pain may immediately be made worse; each of these features is present in approximately 4 per cent. of the cases.

The pain is variously described: it is a deep, "boring," "burning," or "aching" pain; there may be "gnawing" or a sense of acidity and a desire for food or warmth. The pain in a majority of cases is said to be on the left side or high in the epigastrium; in some severe types there may be great complaint of pain in the back. In twenty-three cases in which there was a deep excavation in the pancreas consecutive to a subacute perforation of the ulcer on the lesser curvature or posterior wall of the stomach, seventeen patients complained bitterly of the intolerable aching in the back. As we know, many patients attacked with acute pancreatitis suffer most from pain in the back, and it is an old observation and an accurate one that a deep eroding ulcer of the pancreas may also produce this most distressing symptom.

The position of the ulcer, its freedom from adhesion to neighbouring parts, and its size, all seem to affect the type of pain, its periods of latency, and its time of onset after meals. When ulcers are small and seated high up on the lesser curvature, or just on the posterior surface, the symptoms are shorter in duration, but more prone to recurrence. They are often, as we learn from the radiographic examination, attended by severe forms of local spasm, which are responsible for the sensations of distension, weight, and pressure, which appear to accompany these ulcers more often than those of other types. If the ulcer is large, excavating the liver, or burrowing deeply into the pancreas, or if it is fixed by firm broad adhesions to the abdominal wall or the liver, the symptoms are less likely to show those intermissions which are so characteristic of the earlier stages. If, therefore, in the history of an individual case we learn that the periods of freedom from suffering have become by degrees shorter, and have finally vanished, we may often predict that some of the conditions named are present. If, in addition, there are wasting and especially anæmia, we may be very suspicious of the onset of malignant disease.

Relief from pain is obtained not only from food, but from alkalies, sodium carbonate, "mint drops," or from vomiting. Lavage of the stomach often gives great temporary relief.

The fact that the severity of the pain is so often mitigated by food accounts for the fact that many patients do not lose weight, or may actually gain weight during an attack. Patients with gastric ulcer recognize that heavy meals three times a day bring their own punishment. Lighter meals are taken at shorter intervals, and the total amount of food, much of it of high value,

is accordingly far greater than that usually consumed. Weight is therefore gained.

About one-fifth of the patients who are found to have gastric ulcers complain not only of pain, but of great prostration, feebleness, or lassitude coming on just at the time when the pain is due. On close enquiry this most distressing symptom may be found to have preceded the experience of pain by weeks or months. The periodicity of the two is identical.

It is not possible to emphasize unduly the importance of ascertaining all these various modifications of the one symptom, pain. The constancy of the sequence—food, comfort, pain; food, comfort, pain—is the most important of all the clinical matters concerned with the diagnosis of gastric ulcer.

The next symptom in point of frequency is *vomiting*. In all forms of ulceration of the stomach or duodenum vomiting is an inconspicuous feature, unless obstruction has developed as the result of the cicatrization of the ulcer. Indeed, a degree of obstruction which is by no means trivial may be present, and yet vomiting is very infrequent or entirely absent. It is no uncommon experience to hear a patient say, "I never vomit," and for an operation to disclose an extensive ulcer or a moderate degree of stenosis in the body or near the pyloric orifice of the stomach. Patients seem to have a great capacity for estimating the degree of tolerance possessed by the stomach, and of taking only such foods, or foods in such measure, as will arouse no resentment. In the earlier stages of the development of their malady vomiting is not seldom self-induced in order to ease the stomach of a heavy load, and a sense of pressure and distension. But a very little experience seems to teach the greater number of

patients the quantity of food that is appropriate for them. Thereafter vomiting occurs quite infrequently. It has probably been present on a few occasions in more than half the number of patients who have suffered in many attacks, but it is rare to find that quick reference is made to it when the history is being disclosed.

When in the record of any patient suffering from "dyspepsia" there is a story of frequent vomiting, of the inability of the stomach to tolerate the presence of any foods, of even fluid nourishment sparsely taken being at once rejected, the thought that gastric ulcer is the cause should be driven from one's mind. That type of history, which is commonly heard, is, I find, rarely present in cases of organic disease of the stomach. The vomiting due to the presence of an ulcer is infrequent, and occurs almost always not immediately after food, but after a shorter or longer interval. The meal at first causes relief, and only after that period of relief does it cause disturbance.

Hæmatemesis also occurs far less commonly than is supposed. Hæmorrhage manifest as melæna, or in the vomit, is recorded in less than 25 per cent. of my cases; in the majority of these the amount of blood lost was trivial, and of many in which "hæmatemesis" is recorded it is at least doubtful whether blood was, in truth, present. I think it is true to say that when blood is discharged from the stomach either in a fresh state or as "black vomit," it is commonly believed that a chronic ulcer is present. There is a great fallacy in such opinions. That gastric hæmorrhage occurs, and occurs profusely, in ulceration both of the stomach and duodenum is certain; but the number of other conditions that give rise to hæmorrhage is so large that the possibility of a gastric ulcer being the source of the blood should not be strongly, or ex-

clusively, held. I have so often seen hæmorrhage of the most abundant kind ascribed to "gastric ulcer" which was caused by such other conditions as splenic anæmia, cirrhosis of the liver, appendicitis, and other infective conditions within the abdomen, that in the elucidation of the cause of such a condition as profuse hæmatemesis I seem to turn to other possibilities than gastric ulcer in the first instance. It is true that there may be a confusion as to terms here. For when a patient dies of such hæmorrhage a very close examination of the gastric mucosa may reveal the existence of tiny chaps, or cracks, or fissures from which blood has certainly issued. And when in the old days of unwisdom we operated upon such patients and explored the cavity of the stomach the mucous membrane was said to "weep blood," little trickles of blood could be seen to issue from many points. But these little gaps in the mucosa are not ulcers of the kind that produce clinical symptoms. If a patient has suffered for months or years from dyspepsia, and then is seized with an acute attack of vomiting and hæmatemesis, and if an operation urgently performed reveals the condition of the mucosa I have just described, it is the worst of fallacies to connect the dyspepsia with the "ulcer" or ulcers then supposed to be present in the stomach. The ulcer which has caused repeated attacks of indigestion is always a gross lesion, a lesion in which there are present not only the evidences of destruction, but also of defence; around the crater of the ulcer is an area, greater or less, of inflammatory action, and the serous coat of the stomach is plainly involved. If the breaches of continuity which permit the escape of blood in cases of cirrhosis of the liver, splenic anæmia, and the toxic conditions which, as a rule, have their origin within

the abdomen, are called "acute ulcers," as they often are, it is essential to remember that such ulcers are recognizable by no other clinical evidence than hæmorrhage, or in exceedingly rare instances by perforation; they are never the cause of a continuing or recent dyspepsia. The relation between acute ulcers and the chronic ulcer which is so disabling is not certain. Dr. Bolton, whose work on *Ulcer of the Stomach* is the best of all books on its subject, believes that one is a sequence of the other. He is probably right. Yet the acute ulcer as such gives no other clinical indication of its existence than hæmorrhage or perforation. The diagnosis of "gastric ulcer" in these cases of grave hæmorrhage was held to be confirmed by the after-history and the results of medical treatment. The patients regained health rapidly, soon lost their anæmia, and were able to take food without restraint. But everyone who has considered the history of cases in which there has been a copious hæmorrhage from the stomach will agree that this rebound to full and vigorous health is quite common. It is so even in cases in which at a later operation a frank gastric ulcer is seen.

Such, briefly stated, are the symptoms of gastric ulcer. As will be realized, the chief dependence in making a diagnosis is placed upon the one symptom—pain. What are the other methods of investigation which can help us to a decision? Chief among them I now place the examination of the stomach after a barium or bismuth meal by *x*-rays. In this work I have relied upon my colleague, Mr. Scargill, and I am greatly indebted to him for his most careful and accurate work and for the skill which he shows in the technical sides of it. His methods, which follow closely upon those of R. D. Carman of the Mayo Clinic, show that the possibility of making an

accurate diagnosis of gastric ulcer is greatly increased by the *x*-ray examination; that, indeed, the radiographic examination alone is more accurate than all other methods combined, and that a diagnosis which is proved by subsequent operations to be correct in indicating the presence of the ulcer or in demonstrating its size and position can be made in about 90 per cent. of cases.

The following is his method of examination: After a few hours of fasting, when the stomach is presumed to be empty, a bismuth or barium meal of thin consistency is given, and six hours later the first examination is made. By this time a normal stomach is able to empty itself of the small amount of opaque food administered. If a residue is seen, there is a delay indicating defective action. A second similar meal is now given and the stomach examined forthwith. The radiographic signs of gastric ulcer are*:

I. *Direct*.—The ulcer cavity itself is demonstrated. If an ulcer has penetrated into the walls of the stomach, or eroded the liver or the pancreas, or perforated subacutely and become adherent to the abdominal wall, the crater of the ulcer can be seen filled with the opaque substance of a meal. If the ulcer is near the lesser curvature, it is visible in either an antero-posterior or semilateral view. If the ulcer is on the posterior surface the best view is obtained when the stomach is emptying. An ulcer on the anterior or posterior surface of the stomach close to the pylorus is more difficult to demonstrate.

II. *Indirect*.—In the majority of cases of gastric ulcer a very remarkable and sustained contraction of the circular muscular fibres of the stomach occurs in or near the segment on which the ulcer lies. An inden-

* For full details the work of Dr. Carman should be consulted.

tation of the greater curvature, of varying degree and extent, but often so considerable as to appear almost to bisect the stomach, is most clearly seen. Its appearance, whether on the screen or on a photographic plate, is remarkable. The spasm, in the majority of cases, remains stationary during the examination; it is unaltered by palpation, massage, or by the administration of large quantities of belladonna. It relaxes under a general anæsthetic, and is not seen on the operation table, the stomach wall being then quite soft and flaccid. A similar "incisura" is present as the result of extrinsic causes—causes lying, perhaps, remote from the stomach. The commonest excitants are duodenal ulcer, infection of the gall-bladder, with or without stones, and chronic appendicitis. The spasm due to these causes is variable in position and duration, is modified by massage or pressure, and relaxes almost always after the administration of atropin given in an amount which produces a physiological response. It is also inconstant, present on one occasion, absent on another, and changes capriciously.

The presence of the persistent spasm is strong presumptive evidence of the existence of an ulcer; the presence of an "incisura" on the greater curvature, with a "bud-like" opaque projection on the lesser curvature, is an unequivocal evidence; in every such case an ulcer is present.

The radiographic method is the one certain method of diagnosis, and is now an indispensable addition to the older and far less accurate procedures.

Of the chemical examination of the stomach contents I do not speak with any enthusiasm. For several years my patients were submitted to this form of investigation, but I cannot think that the evidence thereby obtained



Fig. 1.—Very small “niche” type of ulcer on lesser curvature. Involves stomach wall only. No incisura seen in this case. Wire marks costal margin.

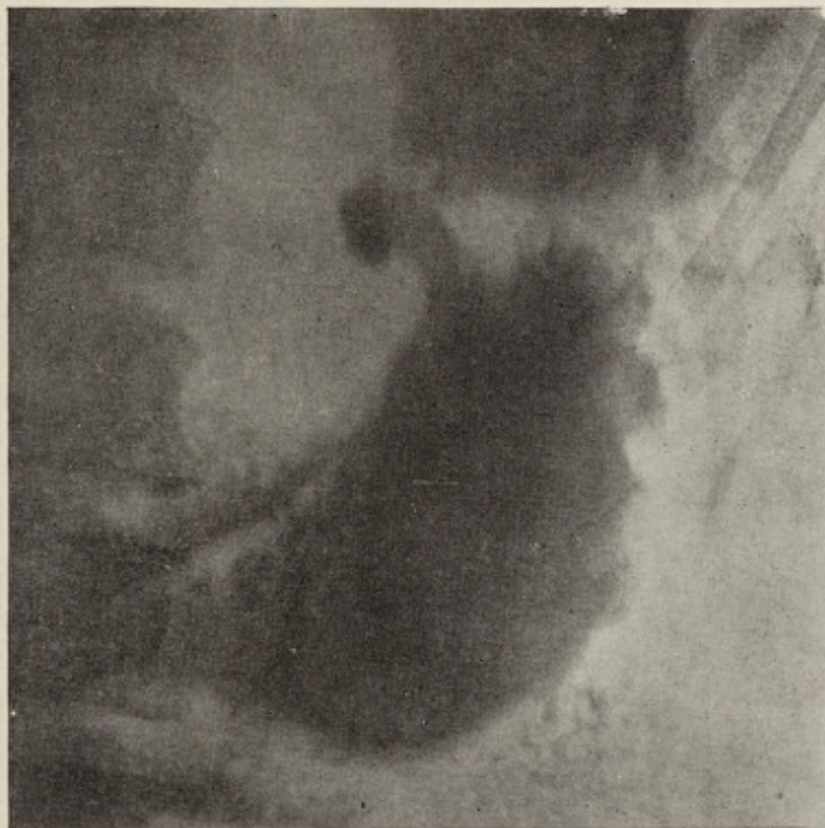


Fig. 2.—Ulcer crater on lesser curvature penetrating into lesser omentum. Well-marked incisura on the greater curvature, almost bisecting the stomach.



Fig. 3.—Ulcer crater on lesser curvature penetrating lesser omentum and adherent to left lobe of liver. Well-marked incisura.

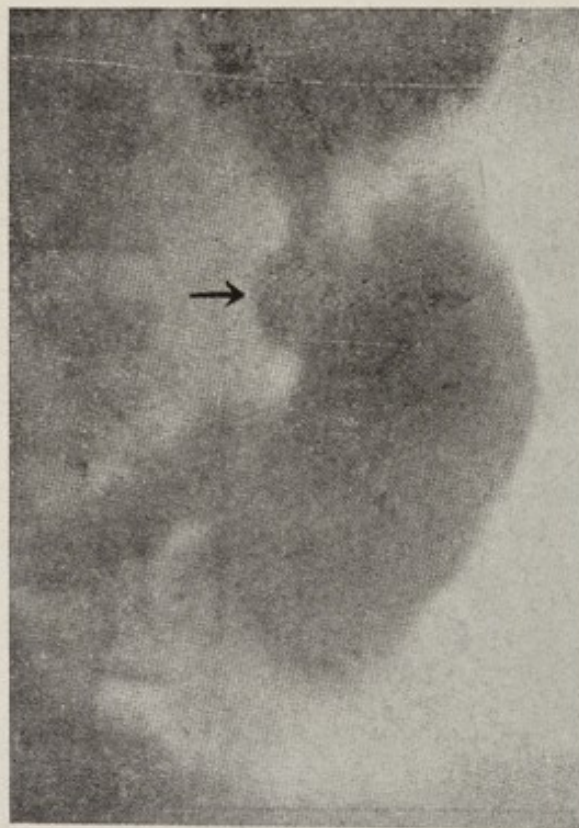


Fig. 4.—Ulcer crater on lesser curvature. Incisura in this case is a little above the level of the ulcer.

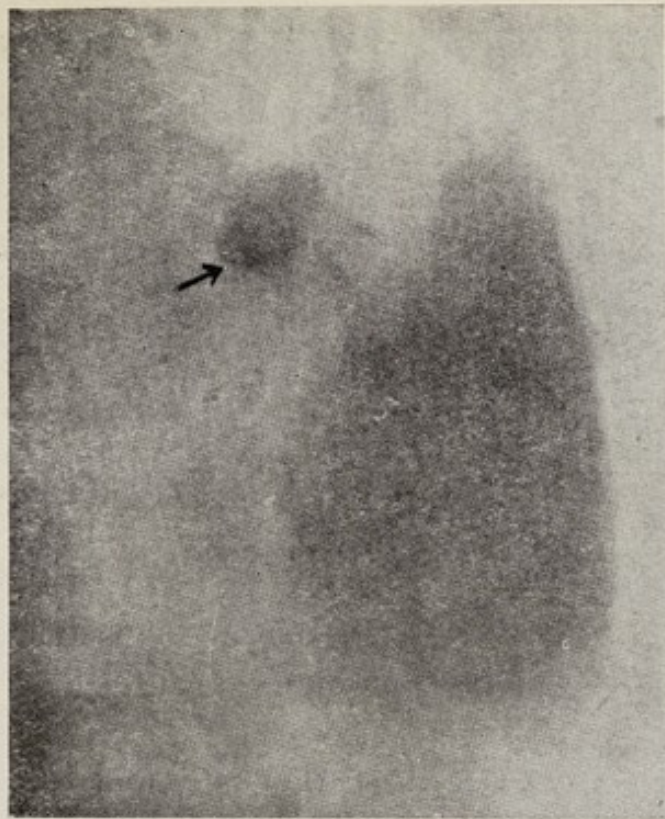


Fig. 5.—Ulcer crater on posterior surface near lesser curvature, only seen when stomach was almost empty. At operation found adherent to pancreas.

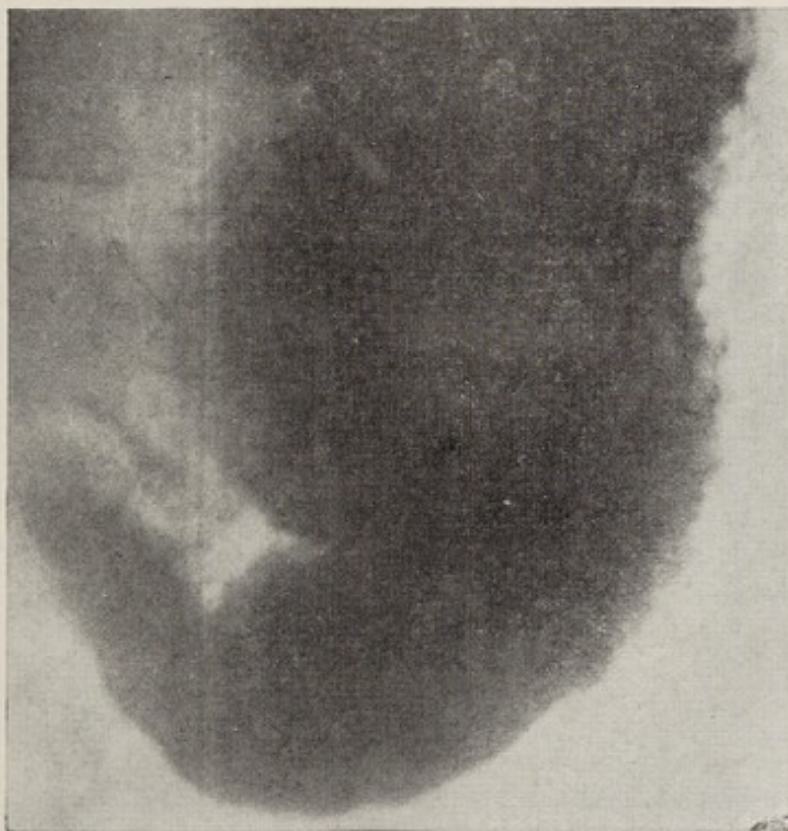


Fig. 6.—Huge ulcer cavity on lesser curvature penetrating left lobe of liver. The cavity was nearly $3\frac{1}{2}$ inches long.



Fig. 7.—Groove-like ulcer on the lesser curvature $1\frac{1}{2}$ inches long. Very well-marked spasmodic hour-glass contraction. No hour-glass at operation.



Fig. 8.—Ulcer crater on lesser curvature with well-marked incisura. (Dr. G. W. Watson's case.)

enabled a greater accuracy to attach to the diagnosis or justified the increased trouble it gave to them. Hyperchlorhydria is present in so many other diseases than gastric or duodenal ulcer that its presence does not offer positive or even contributory evidence of any real value. In rather over 40 per cent. of the total number of cases in which an ulcer is present there is no hyperchlorhydria, and in a small number, estimated at from 10 to 20 per cent., there is a reduction in the gastric acidity. For reasons connected with the war I have rarely submitted patients to this form of inquiry in the last four years, but it will be interesting to discover the relationship, if any, between the degree of gastric acidity and the quality and duration of the gastric spasm due to extrinsic as well as intrinsic causes.

Physical examination, in the absence of obstruction in the body, or at the outlet of the stomach, reveals very little. There is a record of tenderness in the epigastrium in almost every one of the patients who are subsequently found to have an ulcer in the stomach. In ulcers of the lesser curvature I have sometimes found great tenderness high up on the left along the costal margin—tenderness which becomes more acute when the patient breathes deeply. The kind of sensitiveness is then present on the left side which on the right establishes "Murphy's sign." The signs in pyloric obstruction and in hour-glass stomach are, of course, well known.

If all the methods of examination are strictly brought to bear upon the cases commonly referred to as those of "gastric ulcer" it will be found that in a majority the diagnosis cannot be upheld. The diagnosis of gastric ulcer is loosely and inaccurately made; a host of other diseases, functional and organic alike, are so described,

and in consequence the belief is widely held that "gastric ulcer" is a common disease. It would be more accurate to call it a rare disease. Over a series of years I find that for every gastric ulcer seen on the operation table, there are four or five duodenal ulcers, and five to six cases of cholelithiasis. A gastric ulcer is by no means easy to recognize even after the most scrupulous inquiry and examination. More mistakes are made in the diagnosis of gastric ulcer than is the case in any other abdominal disorder.

It must now be generally recognized that many of the diseases arising in connexion with the abdominal viscera are, for months or years, looked upon as cases of gastric disorder. I pointed this out a few years ago in two papers published in the *BRITISH MEDICAL JOURNAL* (October 18th, 1907, "Pathology of the living," and November 28th, 1908, "Inaugural Symptoms"). Up to the time of the publication of these articles it had not been recognized that in cholelithiasis, for example, all the prodromal symptoms were attributed to defects in the stomach, and the medicaments administered were in consequence those used in gastric diseases. The same statement holds good with regard to chronic disease in the appendix, in the small or in the large intestine. We are now familiar, as the result of *x*-ray examination and of the chemical examination of the gastric contents, with the truth that all these conditions express themselves in terms of gastric disturbance, of hypersecretion, and of spasm. And at the time when operations are performed we can discover by inspection of the stomach such conditions as enable one to predict that a lesion will be found on closer manual examination not in the stomach, but in the appendix or its neighbourhood.

If, for example, a patient has had a type of dyspepsia which has led to a diagnosis of gastric ulcer and an operation is performed, the stomach may show no scar, nor can any examination, however careful, display the ulcer whose presence was predicted. If, however, the stomach is closely inspected before it is handled the following conditions may be seen: The pyloric part of the stomach is decidedly redder than natural—there is a “pyloric blush.” That part of the stomach is soon observed to contract eagerly and vigorously; sometimes the spasm is so severe and so prolonged that there may be a suspicion of a tumour, but by degrees the spasm relaxes, and the parts become supple again. The spasm may be irregular, now at one part, now at another; now slow and deliberate, now fugitive. Along the greater curvature the glands are enlarged. When these three conditions are seen the prophecy may be confidently made that the stomach is healthy and that the appendix (or one of its neighbours in the alimentary canal) is diseased. In such cases gastroenterostomy has often been performed, sometimes, it is curious to note, with benefit, but as a rule with disastrous effects. It has been my lot to perform a secondary operation upon many such patients, and to remove a badly diseased appendix or to resect a tuberculous intestine, and perhaps to undo the anastomosis which should never have been made. The work of Cole, Barclay, Carman, and others explains quite clearly how it comes about that these intestinal disorders affect the stomach and cause its musculature to contract in the irregular and painful manner which raises the suspicion, or seems to make certain the opinion, that an ulcer is present. But there is also the infective element in such cases, as Wilkie has shown experimentally, and it is the toxæmia which is its outcome

that leads, as Spencer and Hutchinson have shown, to profuse hæmorrhages from the stomach.

The stomach is an organ full of sympathy for other sufferers. Hardly any of the viscera connected with the intestine, or the bowel itself, can be affected without the stomach playing its part in the disturbance also. This it does by pouring out an excess of secretion, and by tumultuous and irregular activities. It speaks so loudly that its voice only is heard.

The whole subject now briefly mentioned requires close and prolonged investigation. We must seek to find out as accurately as possible the clinical indication that will lead us to diagnose a veritable lesion of the stomach in certain cases, and in others to be able confidently to say that the stomach is intact, and that other organs are telling the story of their own disease in terms of stomach discomfort.

Differential Diagnosis

The very great difficulties in the diagnosis of gastric ulcer are due to reasons which we can now fully appreciate. An ulcer of the stomach does not arouse symptoms merely because of the gap in one or more of the several layers of the stomach. We may be certain of this because, after an "attack" of gastric ulcer is over, and the patient is wholly free from symptoms, an operation may disclose the open crater of an ulcer large or small. The exact cause of the symptoms is uncertain, but, so far as we know at present, other conditions, in addition to the structural defect, must be present before the symptoms appear. These are:

I. Evidences of infection around the ulcer, such as induration, local peritonitis, the deposit of fat in and around the base of the ulcer, and enlargement of neigh-

bouring glands. The "sentinel gland" of Lund is constant in cases of active ulceration.

II. Spasm of the musculature of the stomach. Of the presence, severity, and duration of this condition we had very little knowledge until the methods of examination by *x-ray* became perfected, chiefly by R. D. Carman. We now know that a high degree of spasm is present and constant in examples of ulcer of the stomach, and present, though inconstant and variable, in those cases where there is no primary lesion in the stomach.

III. An increase in the acidity of the gastric juice. This hyperacidity is by no means constant either in gastric or in duodenal ulcer, but it is possibly a factor of importance in the awakening of symptoms.

These three conditions—infection, localized spasm of the gastric muscle, and hyperacidity—are all present not only in true ulcer of the stomach but also, in varying degrees, in most of those distant conditions which are able to arouse a gastric reflex; and it is their presence which causes that mimicry of the symptoms of gastric ulcer by other lesions which may be so exact as to deceive the most expert enquirer. My own strong feeling is that in order to obtain precision where so much has been vague, no diagnosis of chronic ulcer should now be confidently accepted unless the ulcer is diagnosed by *x-ray* examination or is displayed upon the operation table.

The diagnosis of gastric ulcer from a study of the clinical and chemical evidences alone is so uncertain; the various methods of treatment associated with the names of Lenhartz, Leube, Cohnheim, Bolton, Sippy, and others, so helpful in all cases of infection of the alimentary canal, and the physical repose which accompanies the treatment so weighty an influence for good, that no certain con-

clusions can be drawn from even a long series of cases. In order to allow of an accurate judgement to be made of the value of any form of medical treatment we must be certain, in the first place, that a real gastric ulcer is present. The concurrence of the radiographer and the surgeon in the diagnosis is necessary. The mere expression of an opinion, however confident, by a physician, however distinguished, in the absence of this confirmation, is for scientific purposes entirely without value. When the diagnosis is assured and accepted, then medical treatment may be carried out and its results examined. The radiographer should follow the treatment, examining with the *x*-ray say once a month to discover the changes which have taken place, and in the end to assert that healing has, or has not, taken place.

The temporary absence of symptoms, as the surgeon knows well enough, by no means indicates that the ulcer is healed. If it is not healed the radiographer will recognize the fact at once. There is urgent need of some accurate knowledge upon these matters; at present we have little or none.

How great the difficulty in diagnosis really is could not be better shown than by a study of those cases in which the patients have been given over to the care of the surgeon for treatment, and in which the operation of gastro-enterostomy has been performed without benefit. There was a time when this operation was held to be the certain cure for ulcer of the stomach. If its "mechanical" virtues were not urgently needed because of the obstruction caused by the ulcer, its "physiological" effects at least would be salutary. A list of the diseases called "gastric ulcer" by careful medical men, often after consultation with others, and treated by operation,

was considered by me in a paper in the BRITISH MEDICAL JOURNAL (July 12th, 1919). It is humiliating and heart-breaking to ponder over the mistakes in diagnosis which come to light in the records which were considered during the preparation of that article. In many of these cases a diagnoses of gastric ulcer had been made on evidence that was considered adequate by careful practitioners. We cannot rid the matter of error until we realize how very difficult the diagnosis of gastric ulcer really is, and until we decide that, no matter how confident the clinical diagnosis may be before operation, it shall not guide us during the operation too firmly. It is many years since I decided for myself that no gastric or duodenal ulcer existed unless it could be seen, felt, and demonstrated to a sceptical onlooker. It will help to a better understanding of the whole most difficult subject if in future no diagnosis of gastric ulcer is accepted, as a basis for treatment, unless the presence of the ulcer is made certain by *x*-ray examination or by operation. To accept the clinical diagnosis of gastric ulcer and to perform any operation upon the stomach without most clearly recognizing the ulcer is to court disaster. If the mistakes in diagnosis to which I have referred had been followed by medical rather than by surgical treatment, what would be the value of the experience derived from the cases in deciding upon the effect of similar treatment in veritable cases of ulcer? The truth is that we cannot state in terms of accuracy the results of medical treatment of gastric ulcer unless and until we are certain that an ulcer has been present. And, as I have said, the clinical evidences alone are very fallacious.

THE TREATMENT OF CHRONIC GASTRIC ULCER

A. *Medical Treatment*

I hope we may now agree that the results of the treatment of gastric ulcer by any of the systems already mentioned, or by any dietary or medicinal regimen, are vitiated by the lack of accuracy in the diagnosis of gastric ulcer. The most popular of all methods is that introduced by Sippy, which would appear to meet more combatantly those conditions in the stomach which he believes must be controlled before an ulcer can have the chance to heal. It is based upon the wide-spread belief (is it anything more?) that the reduction of the acid in the stomach is the first necessity. This is attained by dilution of food, alkalinization of the gastric contents every hour, by the administration of fats, and by lavage.

The questions which in this connexion require answer are:

1. Does a chronic gastric ulcer ever heal under medical treatment?
2. Does it long remain healed?
3. Does it heal without producing such conditions as need surgical treatment for their relief?

1. Chronic gastric ulcers probably heal sometimes under treatment, or after the exercise of continued care in diet. The scars left by their healing are seen, though very rarely, in the *post-mortem* room and, still more infrequently, in the operation theatre. The discrepancy between the reputed frequency of gastric ulcer and the scarcity of the scars found in the dead-house has not attracted adequate attention. The number of healed cicatrices found in the operation theatre, when the stomach is examined as a routine in almost all operations, is

exceedingly small. This may be due to the rarity with which sound healing occurs, or to the tendency of healed ulcers to break out afresh. All the available evidence strongly supports the opinion that the firm healing of a chronic gastric ulcer is a very unusual occurrence.

2. Do ulcers when healed long remain so? In the majority of cases the answer must be No. The characteristic quality in the symptoms of gastric ulcer is recurrence. There is a succession of "attacks," of changing severity and of variable length. The tendency, on the whole, is towards more serious attacks with briefer intervals. It is not by any means certain that an interval in which there is freedom from suffering means that the ulcer is healed. In hour-glass stomach, where a considerable degree of contraction has occurred in the body of the organ, it is a matter of great rarity to find that the ulcer is soundly healed.

3. When a gastric ulcer of moderate or large size heals there is inevitably some degree of contraction. In this way hour-glass stomachs are produced, and stenosis near the pylorus. We cannot say with what frequency the successful medical treatment of a chronic gastric ulcer produces the conditions which need surgical relief, but it is certainly not seldom, for any large scar wherever placed, and especially if it has contracted adhesions to neighbouring parts, must embarrass the action of the stomach, or cause distress after food. Notwithstanding any or all of these considerations, a really serious attempt to treat all cases of chronic gastric ulcer by medical treatment should be made. It is best to have no half-measures. It is at least arguable that the necessity for surgical relief in many patients is due to a too perfunctory trial of medical treatment in the earlier attacks. The hospital

accommodation in the country is too small to allow of the poorer classes receiving the rest and supervision that is necessary. The pressure on beds is too heavy. The ideal would be to keep the patient under treatment until an *x-ray* examination showed that the ulcer was healed.

B. *Surgical Treatment*

In discussing the surgical treatment of gastric ulcer the first matter for consideration relates to the importance of discovering any sources of still continuing infection which may first have led to the development of the ulcer. The primary infection cannot always be discovered—indeed, cannot often be localized with certainty—but it is a fair assumption to make that any chronic infection of which the evidences are still discoverable may have acted as a cause of the original ulcer, or have provoked a recurrence of it in one or more of those attacks which are a characteristic feature of the clinical history. The causal infection may not be found until the abdomen is opened, for in my view a large number of the cases of gastric ulcer upon which the surgeon must operate are secondary to an infection arising in some part of the intestinal canal, more especially in the appendix. But there are not a few cases in which the infective agent appears to reach the stomach by way of the mouth. Disease of the teeth or gums, of the antrum or other accessory sinuses, or of the nasopharynx, have all been found in cases upon which I was asked to operate. If in any such case the lesion is a gross one, and likely long to continue, it is most necessary that it should be dealt with before any operation upon the ulcer itself is undertaken. If constant search is made for a diseased fang, alveolar abscesses, and septic conditions in the upper part of the pharynx or air passages,

the evidence of serious disease, requiring radical treatment, will be discovered far more frequently than is generally believed. One method of inquiry worth pursuing is the investigation by *x*-ray of the alveolar processes in all patients to whom a barium meal is to be given preparatory to a screen examination of the stomach. One of the factors most certainly causing a recurrence of ulceration in the stomach, or of ulceration at or near the suture line after gastro-enterostomy has been performed, is infection derived from one or other of the several sources here indicated.

The necessity for the surgical treatment of a gastric ulcer is a confession that medical treatment has failed. As commonly employed, it is doomed to failure. It too often consists in the mere administration of a bismuth mixture when the sufferer is treated in the out-patient department of a large hospital. There is not anything approaching the necessary accommodation in hospitals in this country for the patients suffering from gastric or duodenal ulcers, whose successful treatment by medical means necessitates that constant, watchful supervision of every detail which hospital treatment alone affords. A successful operation upon a patient suffering from gastric or duodenal ulceration will depend in part upon careful and adequate preparation. Not a few of the patients are weakly, ill-nourished, and of a low resisting power when first they come under our care. By keeping them at rest for a few days, giving them large quantities of fluid by the mouth, or by rectum, or subcutaneously; by the administration in such fluid of sodium carbonate or glucose; or occasionally by performing a direct transfusion of blood, their condition can be greatly benefited, and the risks of operation correspondingly reduced. The

practise of withholding fluids for a few hours before operation is always, I think, a procedure of very questionable value; in patients reduced in strength by lack of nourishment, or by pain extending over long periods, it is positively a factor pregnant with harm. When the operation is performed the choice in exceptional circumstances of hedonal as an anæsthetic is very helpful. The anæsthesia is quietly induced, lasts long, gives remarkable relaxation of the abdominal wall, and provides two or three pints of fluid at a time when fluid is much needed.

The surgical treatment of a chronic gastric ulcer* may call for the performance of one or other of the following operations:

- I. Gastro-enterostomy.
- II. Excision.
- III. Gastro-enterostomy combined with excision by knife or by cautery (Balfour's operation).
- IV. Gastro-enterostomy combined with jejunostomy (Moynihan).
- V. Resection of a part of the body of the stomach—"sleeve resection."
- VI. Partial gastrectomy.

I. GASTRO-ENTEROSTOMY

The operation which has been the most frequently practised in the past, and is still that preferred by many operators, is gastro-enterostomy. The operation was first practised on September 27th, 1881, by Wölfler in Vienna. He was dealing with a case in which carcinoma of the pyloric part of the stomach was causing obstruction, and the intention was to remove the growth by one of the methods recently introduced by his master, Billroth. Owing to the presence of secondary deposits and the fixity of the tumour, resection was impossible, and the abdomen was about to be closed when Nicoladoni, acting

* Discussion of the treatment of the acute perforation of a chronic gastric ulcer is omitted from this paper.

as assistant, suggested that the obstruction might be relieved by making an opening between the stomach and the small intestine. The success in this, and in many similar cases, was an event of great significance, and one of the most important landmarks in the history of abdominal surgery. It was not long before examples of pyloric stenosis due to the healing of a simple ulcer were treated by the same method. What happened is known to all the world. Patients who had suffered for years from the miseries of the confirmed dyspeptic, who finally had the extreme discomforts caused by the recurrent vomiting of the stagnant and fermenting contents of the stomach, who lived on the most restricted diet in order that their sufferings might be lessened, were suddenly restored to vigorous health, were able to satisfy, without apprehension or unhappy consequences, their keen appetites; rapidly gained health and happiness, and added considerably to their weight. No operation in surgery had ever produced more striking or swifter results. Owing largely to the advocacy and the successful work of Doyen, the operation began to be practised in cases of ulcer occurring in the body of the stomach, cases in which no obstruction was caused either by the open ulcer or by the stenosis resulting from its partial cicatrization.

Results by no means so happy were soon witnessed, and in cases whose number seemed quickly to mount up the ultimate consequences of the operation were disastrous. There were several reasons for this. The chief, perhaps, was the inaccuracy of the diagnosis in many instances. It was not then, it is not now, sufficiently realized that the diagnosis of gastric ulcer is difficult and that the disease is rare. The operation came to be practised for "chronic dyspepsia," and many of the little splashes of thick lymph

so often seen on the under surface of the transverse mesocolon, adherent to the posterior wall of the stomach, were assumed to be the scars of gastric ulcers which had healed. And so in many cases when the stomach was normal, where the lesion causing the symptoms lay elsewhere, the short-circuiting operation was performed, with unhappy consequences. Another reason for the disasters following upon operation was a technical one. The anastomosis was made with a long proximal loop, which, emptying with increasing difficulty, became waterlogged; or adhesions obstructed the efferent jejunum; or the opening into the stomach was badly placed. From one or other cause such difficulties as regurgitant vomiting were frequently seen. Further reasons were found in the inability of the ulcer to heal even after gastro-enterostomy had been perfectly performed in an appropriate case, and in the later development of cancer of the stomach, presumably upon the base of an unclosed ulcer.

A few years ago a revision of my own cases in which a gastric ulcer had been clearly demonstrated showed that the results could be classified into three groups.

1. *The Results were Excellent.*—With the same alacrity that is witnessed in cases of duodenal ulcer, or in cases of pyloric stenosis, the patient lost all discomforts, and made a speedy and excellent return to health. I had not then in all cases indicated in a diagram, made immediately after the operation as I do now, the exact position and the approximate size of the ulcer; and therefore I am not able to say exactly what the condition of the stomach was in this group of cases. But in many cases it is certain that the ulcer was near the pylorus; that the gastro-enterostomy opening was on the proximal side of it. In others the ulcer was on the lesser curvature and was small,

and free from adhesions. It had not, that is to say, perforated the coats of the stomach to become adherent to the abdominal wall, liver, or pancreas.

2. *The Results were Indifferent.*—Some patients were found to have improved, in many cases for periods of months or years, others were known to have relapsed. At a subsequent operation the ulcer was found to be still present; it was then removed by local excision by the cautery, or by the performance of the operation of partial gastrectomy.

3. *The Results were Bad.*—In this class of cases malignant disease developed in the base of the ulcer, and so near the ulcer as to make differentiation impossible. The question of the degeneracy of a simple ulcer into a malignant one is still warmly debated, and there is no approach to an agreement between the several authorities. The evidence considered by the protagonists on either side is clinical and pathological.

In more than half the cases of carcinoma of the stomach treated by operation there is a history suggestive of the previous existence and of the recurrence of a gastric ulcer. No one is more ready than I am to admit that such a history is not a full warrant for asserting that an ulcer has been present. For on the clinical evidences alone a diagnosis of gastric ulcer, however confidently made, cannot always be upheld. The only certain evidence obtained before operation is afforded by a radiological examination, and I do not know of any case in which a diagnosis of gastric ulcer has been positively made with this and other methods in which carcinoma was subsequently found. The clinical evidences, therefore, however strongly suggestive, are not positive proof. In about 25 to 30 per cent. of the cases of carcinoma of the stomach

removed by operation the claim that the malignant change is imposed upon a simple one appears on pathological grounds to be irrefutable; and every surgeon knows that in a small number—not less, certainly, than 10 per cent.—of the cases of gastric ulcer, to all appearances simple in character, a microscopic examination of the specimen removed by operation reveals the early stage of carcinoma. Now, histologists do not always agree as to the conditions which may be accepted as indicating the earliest changes from simple to carcinomatous states. Much of our knowledge of the microscopical appearances of cancer is based upon an examination of specimens long dead, of specimens months or years old, which have been lying upon the laboratory or museum shelves. The changes that occur in such circumstances are not known. But, as I have ventured to urge, an examination of specimens so recently removed as to be hardly yet dead is necessary before we know what conditions in carcinoma are authentic and what are the changes which are merely due to corruption. We must recognize a “histology of the living,” which is probably as far removed from the histology of the dead as we now all recognize the “pathology of the living” to be from the pathology of the dead.

We must finally consider this fact also, that when gastro-enterostomy is performed for a chronic gastric ulcer, the “physiological” results of the operation, though they may not bring about the healing of the ulcer, may yet delay or prevent its progress towards carcinoma. We must take account of the possible effects produced by the change from an acid to an alkaline medium. Nothing is more remarkable than the difference in destiny of a chronic duodenal ulcer and of a chronic gastric ulcer. It

is admittedly one of the great rarities in pathology to find an ulcer of the duodenum that has become malignant; and it is certainly a far more frequent thing, allowing for all reservations, to find an ulcer of the stomach in which carcinoma has developed. Embryologically the stomach and the duodenum as far down as the ampulla of Vater are one. This difference in the prospective changes in ulcers on one or other side of the pylorus may be due to the different reactions of the fluids by which they are bathed.

Those who practise the operation of gastro-enterostomy for the relief of ulcers in the body of the stomach rely upon the so-called "physiological results" of the operation—that is, upon the effect produced by the constant entry into the stomach through the anastomosis of the alkaline bile and pancreatic juice. There is no doubt that these juices are found in the contents of the stomach removed by tubage in all cases after gastro-enterostomy has been performed; and it is possible that the success of the best methods of therapy in cases of gastric ulcer—that of Sippy, for example (in which, however, gastric lavage is a factor of great value)—depends upon the very frequent administration of alkalies, which, it is claimed, neutralize the gastric acidity, and so allow of healing in the ulcer. Much of the explanations given is conjectural, and regard is perhaps insufficiently paid to the effect of the administration of alkalies in provoking a greater output of acid in the gastric juice to overcome the alkali administered. I am very sceptical as to any substantial "physiological" value possessed by the operation of gastro-enterostomy. Its other effects are purely mechanical. The stomach is emptied more quickly through a gastro-enterostomy opening; the pyloric spasm which so often accompanies gastric ulceration is robbed

of its effects, and the persistent local spasm which causes the characteristic "incisura" may either be prevented by a division of the muscular fibres causing it or rendered ineffective by the drainage of the stomach on its proximal side.

The making of an anastomosis between the stomach and the jejunum does not prevent the subsequent development of a gastric ulcer. I have records of one case in which a gastric ulcer, well removed from the anastomosis, developed after the operation and went on to perforation; and of three others in which gastric ulceration developed after the performance of gastro-enterostomy for a duodenal ulcer.

Sherren¹ records a case of carcinoma of the stomach developing in a patient upon whom gastro-enterostomy was performed for a perforated duodenal ulcer. Coffey, a surgeon of great sagacity, in a paper on "Gastro-enterostomy Still the Operation for Chronic Gastric and Duodenal Ulcer," records² two cases in which an ulcer in the stomach developed after gastro-enterostomy had been performed for duodenal ulcer.

In consequence of my experience I have abandoned gastro-enterostomy alone in the treatment of chronic gastric ulcer, for:

(a) The results, even when the operation was "successful," were not so satisfactory as those which now follow gastrectomy. The morbidity was greater, the return to health slower, the ability to take food early and generously was wanting, a more watchful after-care was necessary.

(b) Some cases returned with the ulcer still open, and a further operation was required. In such cases the ulcer had almost always perforated all the walls of the stomach,

and adhesions had occurred to the liver, pancreas, or abdominal wall.

(c) Some few cases returned with carcinoma of the stomach after so long an interval as to make it probable that the cancerous change had occurred after the operation had been performed. Estimates of this sort are, I admit, fallacious, for the chronicity of some forms of malignant disease of the stomach is remarkable. I have recently been consulted, on account of a return of her symptoms, by a patient upon whom four years and seven months ago I performed gastro-enterostomy for carcinoma of the lesser curvature of the stomach, causing obstruction, when secondary deposits were present in many glands, in the falciform ligament (one of these nodules was removed for microscopical examination and confirmed the diagnosis), and the liver.

(d) There is evidence to show that gastric ulcer may develop, even after gastro-enterostomy has been performed, when the stomach itself was normal.

The operation of gastro-enterostomy is made as simple as possible, though it is by no means always easy. Clamps are used, and vertical application of the highest accessible portion of the jejunum is made to the posterior surface of the stomach along a line which is a continuation downwards of the upper part of the lesser curvature. In this way the lowest portion of the stomach is drained by the new opening. Two layers of sutures are used; both are of the finest chromic catgut (six nought). It is never necessary to have more than two layers, nor to use any unabsorbable material, such as linen or thread or coarse chromic catgut. Any large vessel springing from the greater curvature and running directly on to the anastomotic line is ligatured separately. The opening into the

lesser sac is carefully closed by approximating the cut edges of the transverse mesocolon to the suture line. The principles applicable in all operations are observed—gentle handling, absence of exposure or chilling of any parts directly engaged in the operation, and scrupulous care at every step. The mortality in my own hands during the last ten years is 1 per cent., and there has been no death in the last 350 cases of gastric or duodenal ulcer.

II. EXCISION

The operation of excision was introduced with great hopes, which, unhappily, have not been gratified. I have practised excision by several routes, and have removed ulcers of various sizes. A small ulcer on the anterior or posterior surface has been excised, and the opening left in the stomach either closed by interrupted sutures of catgut or utilized to form an anastomosis with the jejunum. Wedge-shaped excision of ulcers on the lesser curvature has been carried out, sometimes with ease, oftener with difficulty, and with a resulting deformity of the stomach. Ulcers on the posterior wall, perhaps burrowing into the pancreas, have also been removed through an incision in the anterior wall of the stomach. I have been profoundly disappointed with the results. My colleague, Mr. Collinson, in a paper read before the American Medical Association in 1914,³ found that in thirty-nine cases of excision there were fifteen in which severe recurrence of symptoms was observed. Eleven patients were submitted to a second operation, and seven of them showed active ulceration at the site of the excision, one had developed a fresh ulcer distal to the original one, and three had extensive adhesions which crippled the action of the stomach. The operation may fail on account of technical

errors. Too small an area of induration surrounding the actual crater may be removed; the hard, stiffened edges of the wound which remain, infiltrated by inflammatory products which have long been there, may not heal kindly or rapidly, and fresh ulceration may start before cicatrization is complete. Of such a condition I found evidence in a case of my own, related by Mr. Collinson in the paper to which I have referred. In other cases a deformity of the stomach may be consequent upon the removal of an ulcer, especially of one which lay upon, or near, the lesser curvature; the normal peristaltic movements will then be checked at the line of scar, as a radiological examination will plainly declare. The use of unabsorbable sutures, especially continuous sutures, may lead to secondary ulceration. All continuous "sero-muscular" sutures probably penetrate to the mucosa in more places than one; if this occurs, the suture will eventually ulcerate its way through to the lumen of the bowel and be discharged, or hang loose at the suture line for months or years. Finally, even with a careful technique, adhesions may form between the suture line and any viscus or the abdominal wall in contact with it, and some embarrassment of the action of the stomach will then certainly result.

For these reasons, and in spite of some very satisfactory results, I have abandoned the operation altogether in cases of gastric ulcer. The disappointments it brings are too many, and are neither easy to foresee nor certainly to be prevented.

III. EXCISION, BY KNIFE OR BY CAUTERY, COMBINED WITH GASTRO-ENTEROSTOMY

At an early stage in our experience of the operation of excision alone it was found that in some instances, after suture of the wound was complete, a considerable degree of distortion of the stomach resulted, the lesser curvature was much puckered, and the whole organ warped in outline. To have left the stomach in such a condition would inevitably have meant that a further operation would soon be necessary in order to overcome mechanical difficulties. And little by little it became the practice to combine with the operation of excision that of gastro-enterostomy also. The results were certainly better than before, but the combined operations, in point of difficulty always, and often in point of time and of danger also, equalled or exceeded the operation of partial gastrectomy. As the technique of this latter operation was steadily improved, it began in my own hands to replace other methods, and I reverted to the practice so ably advocated by Rodman, of "removal of the ulcer-bearing area."

Balfour of Rochester, with that fertility of resource which is one of the characteristics of his fine work, replaced the method of excision of the ulcer by that of its complete destruction by the actual cautery. Balfour's operation has among its many merits that of simplicity. If an ulcer lie upon the lesser curvature, or near it, a little nearer the cardia than the pylorus, or down upon the posterior wall, the operation of excision was apt to be difficult. The method of Balfour makes the treatment very much easier, quicker, safer, and gives results far more satisfactory. I learnt the method in Rochester, where I saw several operations performed by W. J. Mayo.

In ulcers near or upon the lesser curvature there is often a covering of fat, developed probably, as in the case of an infected gall-bladder, as a protection against perforation. This fat is dissected upwards towards the lesser curvature, until the base of the ulcer is seen clearly. The crater of the ulcer is then completely destroyed by the actual cautery, which pierces the entire thickness of the wall of the stomach. The gap which remains is closed by interrupted sutures, in two layers, and the flap of fat turned downwards to cover the suture line like a lid. Posterior gastro-enterostomy is then performed in the usual manner.

Of all methods of dealing with gastric ulcer, short of gastrectomy, I am convinced that this is one of the best; it destroys the ulcer more completely than does the method of excision, for the effect of the cautery extends widely beyond the seared edge of the wound. If by chance there is an early carcinomatous change, it is probable that much of the risk of local recurrence is removed. No more tissue is sacrificed than is necessary, and the suture of the wound offers, as a rule, no difficulty.

My own experience of this operation is small. At the time when I should have been inclined to make it an almost routine procedure for many cases I had been led by my unsatisfying experience of other methods to become more and more radical in the treatment of gastric ulcer, and to consider the removal of the part of the stomach as the operation of choice. There are, however, cases in which everyone will admit the great value of the operation: cases of ulcers difficult of access, in patients for whom, because of recent hæmorrhages, or a degree of pain which has made the taking of food exceedingly difficult, the simplest operation that is sufficient to cure, or relieve the disease, is indicated.

IV. GASTRO-ENTEROSTOMY COMBINED WITH JEJUNOSTOMY

This is a method which I have advocated and practised in cases of grave difficulty. The results have been excellent. There are ulcers of the stomach so large, so awkwardly placed, and so deeply penetrating the liver, or the pancreas, in patients whose general condition is so poor that any operation becomes serious. Such cases may be unsuitable for Balfour's operation, by reason of the size or remoteness of the ulcer; and for the operation of gastrectomy by reason of the extremely feeble condition of the patient, who has perhaps recently suffered from a copious hæmorrhage. In all such cases I perform gastro-enterostomy in "Y," generally by the anterior route. The intestine is cut across about 18 in. below the flexure, the distal end closed, and the side of this distal part united to the anterior wall of the stomach. As large an opening as possible is made proximal to, or in the zone of, the ulcer and extending sometimes over the fundus of the stomach. The proximal divided end of the jejunum is then anastomosed to the side of the distal limb a few inches below the gastro-enterostomy opening. Into this proximal part, at a point about 3 in. above the junction which has just been made with the distal limb, a tube is introduced and fixed by the method of Witzel. The tube passes for several inches down through the entero-anastomosis into the jejunum. It is brought out of the abdominal wall through a small separate incision to the left of the umbilicus. It is through this tube that all nourishment is given for months, or for years, until a radiological examination shows that the ulcer is healed, or until a trial of one month, during which food is given, discloses no return of the symptoms. During this time the

greatest care is taken to keep the mouth clean by friction and frequent washing. I have never had any difficulty with a patient craving for food. The sufferings endured before operation, and the relief immediately afterwards, by their sharp contrast, make the patient disposed to do all one asks. One patient, whose stomach showed the largest ulcer I have ever seen (we described it as resembling the mouth of a letter box through which the hand passed deeply into the liver), took no food for two years and nine months after this operation, though I gave her permission to do so. She took food generously through the tube, and gained over 50 pounds in weight. Since removing the tube, now a few years ago, there has been no recurrence of symptoms. Indeed, up to the present time, in no case in which this operation has been practised has the ulcer returned.

V. RESECTION OF A PART OF THE BODY OF THE STOMACH —“SLEEVE RESECTION”

This operation is, of course, reserved for those cases in which the ulcer occupies approximately the middle part of the stomach. After resection of a cylindrical portion of the organ the cut ends are united. Advocacy of this operation appears to be restricted to a few surgeons, and consequently the number of cases performed is relatively small. I practised it on two occasions only, long ago. In both the operation promised well, but one of the patients returned after four years with an hour-glass stomach, for which a second operation was necessary. The rôle of the operation is necessarily a very limited one. I think I am hardly likely to perform it again. But so far as I can judge of the experience of others it has had a fair measure of success.

VI. PARTIAL GASTRECTOMY

My early experience of the operations already mentioned was satisfactory enough so far as immediate results were concerned; but as time passed patients began to return with one degree of discomfort or another, until I was convinced that many of the methods practised were not justified by their end-results. And by degrees I was brought to realize that gastric ulcer was a far more serious disease than duodenal ulcer. It was soon found to be comparatively a rare disease, far less frequent in occurrence than had been universally believed, and certainly very difficult indeed to diagnose with confident assurance and constant accuracy. The diagnosis so frequently made of "gastric ulcer" in out-patient rooms and in private practice is not sustained when the parts are examined upon the operation table. Other diseases—duodenal ulcer, chronic appendicitis, cholelithiasis, tuberculous enteritis, laxity of the attachments of the colon—are all found in the absence of any palpable or visible lesion of the stomach, and explain the symptoms of which the patient has complained. A host of diseases, organic and functional alike, are called "gastric ulcer." And consequently much of the literature and most of the statistics dealing with the subject of "gastric ulcer" lack that foundation of truth which only an accurate diagnosis can afford.

In the cases of indisputable gastric ulcer, when the ulcer is demonstrated beyond cavil by a radiological examination or by inspection upon the operation table, a far greater seriousness attaches to the disease than to the condition of duodenal ulcer. Operations upon it are more serious, partly by reason of the extent of the opera-

tions themselves, chiefly, I think, in consequence of the less robust state of the patients. Recoveries after operation are fewer whatever the nature of the operation, and the rate of mortality of the patients in the years subsequent to operation, as Balfour has recently shown in a paper of great value and of new significance,⁴ is, in the cases attended in the Mayo Clinic, three times as high as in patients operated upon for duodenal ulcer. This, on reflection, is not so startling a fact as may at first appear; for many of the patients suffering from duodenal ulcer are men otherwise of robust strength and splendid health. I have operated upon international football players, golfers, lacrosse players, and many distinguished athletes for duodenal ulcer. Such people are not often found among those who suffer from gastric ulcer; and, though there are exceptions, the types of stomach found in the two diseases are distinct from one another, as Hurst has shown. The local conditions found in the two diseases are different also. A duodenal ulcer is often a simple round "terraced" ulcer affecting the intestine alone; a gastric ulcer is very prone to extend and to burrow deeply into other parts—the pancreas, the liver, the abdominal wall; and the later history of the two diseases is very different. I lean to the belief that many of the cases of carcinoma of the stomach with which the surgeon can deal successfully have their origin in a chronic ulcer. That is not the universal view, but the opinion of those who hold it is weighty and well founded. Carcinoma is excessively rare in that part of the duodenum affected by chronic ulcer. Prompted by all these considerations, I was gradually brought to view gastric ulcer as a disease requiring direct and radical treatment, and that it was not safe to trust to the indirect method

of gastro-enterostomy, which, whether its action is "physiological" or mechanical, merely produces a condition of things in which healing can more easily take place.

My choice of operation now always falls upon partial gastrectomy, whenever it can with reasonable safety be performed. The risk is not great: over a period of ten years it is not more than 2.5 per cent. All things considered, and account being taken of the five years succeeding operation, it is probably a safer operation and is certainly more immediately satisfactory than gastro-enterostomy alone. It cannot always be practised. The condition of the patient may forbid it. The ulcer may be so large and so placed as to make removal a matter of so great technical difficulty that the immediate hazards are unfair to the patient. But as experience grows the number of such cases diminishes. Nowadays I rarely practise any other operation than partial gastrectomy or gastro-enterostomy in "Y" combined with jejunostomy. The details of the operation of gastrectomy are briefly these: The duodenum is divided just beyond the pylorus, after ligation of the pyloric and gastro-duodenal arteries. An opening is made in the transverse mesocolon, in the arch of the anastomosis of Riolan in order to guide the surgeon in his ligation of the omentum below the greater curvature, so that the middle colic artery may be avoided, and in order that the conditions at the back of the stomach may be early and fully investigated. After division of the great omentum as far towards the left as the point at which the stomach is to be divided, the whole organ is turned over the left edge of the parietal wound, until the coronary artery is brought into view and ligated with great ease at exactly the place required. As soon as this

vessel is cut an anchor is "let go," and the stomach is moved more freely. Then while the stomach is held as a retractor an anastomosis is made between it and the jejunum. I now always apply the end of the stomach to the side of the jejunum.

In my early cases I twice encountered a little difficulty in making the jejunum so apply itself to the stomach as to avoid a kink at the upper end of the anastomosis. In both cases some bilious vomiting occurred. In order to prevent this I now usually divide the jejunum completely across, about eight to ten inches below the duodeno-jejunal flexure, close the distal end, and make an anastomosis in "Y." This takes a few minutes longer, but the expenditure of time is worth while. The results are excellent. The condition after operation is remarkably good; in almost all cases the patients have the most tranquil progress that one could wish. And not one single case I have ever operated upon has had a recurrence of trouble. Once the convalescence is complete the history is without incident.

Whatever the operation from among all those mentioned which may be selected in each individual case regard must always be paid to the power of the patient to bear it, and to its exact application to the particular conditions disclosed when the parts are directly examined. Before the operation commences the surgeon should never reach a definite decision to perform any one procedure; he must apply at the moment of operation the method which best meets the indications in each case. And here, as elsewhere, the little things count. Care in preparation, scrupulous exactitude in every detail, gentleness, deliberation, with such speed as comes naturally from much practice, and is unsought as a special feature—all these

together will sometimes turn what would otherwise be failure into easy and certain success.

Statistics

For the purpose of illustrating my practice in connexion with operations upon the stomach and duodenum I have collected together, with the help of my colleague, Mr. E. R. Flint, and my secretary, Miss Mackill, all the records of cases operated upon by myself since the year 1909, including the very lean years of war. Every case of simple disease of the stomach or duodenum (excepting acute perforation) is included: cases of gastric ulcer, hour-glass stomach, duodenal ulcer, and jejunal or gastro-jejunal ulcer following upon gastro-enterostomy.

The cases of ulceration* are as follows:

Ulceration

	Cases.	Deaths.
Gastric ulcer alone.....	196	7 = 2.7%
Gastric ulcer with duodenal ulcer (including some cases of hour-glass stomach).....	37	
Gastric ulcer alone causing hour-glass stomach.....	23	
Duodenal ulcer alone.....	605	3 = 0.49%
Pyloric ulcer.....	9	0
Jejunal or gastro-jejunal ulcer.....	33	2 = 6.0%

The greater severity of cases of gastric ulcer as compared with duodenal ulcer is strikingly shown; and the serious nature of cases of jejunal ulcer is evident.

* The figures in these tables have been brought up to December, 1920.

Operations Performed

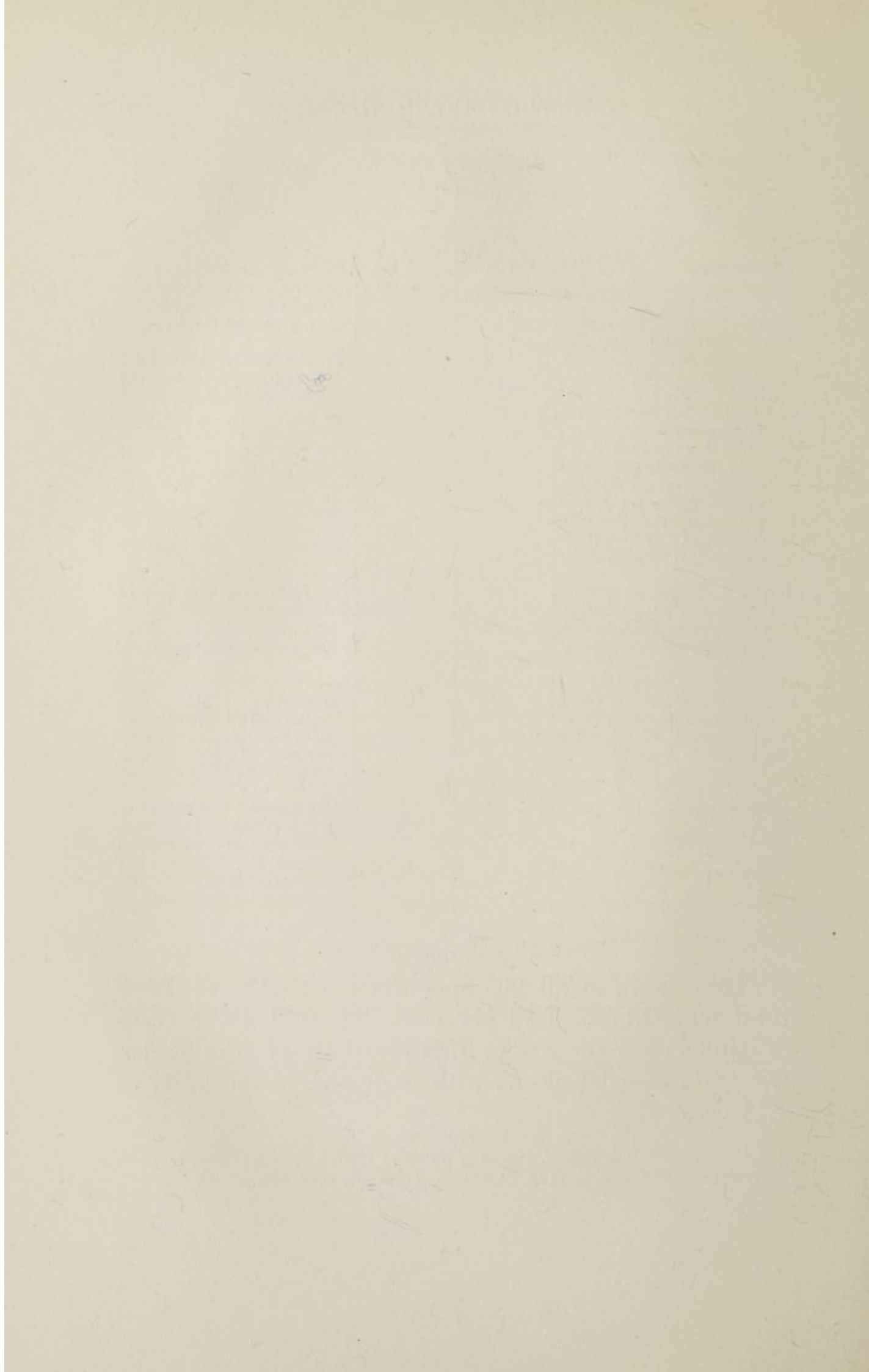
Operation.	Cases.	Deaths.	Remarks.
Gastrectomy	100	2 = 2.0%	One case of almost total gastrectomy for large multiple ulcers, eroding the pancreas and the liver.
Gastro-enterostomy— Posterior Anterior In "Y" In "Y" with jejunostomy With gastrostomy (All these combined in a great majority of cases with removal of the appendix, and several with operations upon the gall-bladder. In two ovariectomy was performed also.)	738	7 = 9%	Five deaths were due to lung complications, associated in one with tuberculosis.
Excision of gastric or duodenal ulcer with or without gastro-enterostomy, including Balfour's operation.	4	1	The fatal case was one of duodenal ulcer; cholecystectomy and appendicectomy were also performed.
Hour-glass stomach (multiple operations, gastro-enterostomy with gastro-gastrostomy, etc.).	19	1	<i>Post-mortem</i> report: "Extreme fatty infiltration of right auricle and ventricle, chronic fibrosis of kidneys."
Jejunostomy	4	1	The fatal case had a gastro-jejunal ulcer of large size, with much induration around it. The patient was exceedingly ill, and suffering intense pain.

Summary

There were in all 905 operations, with 12 deaths—a total mortality of 1.32 per cent. Excluding the cases of jejunal ulcer there were 872 operations on cases of gastric and duodenal ulcers, with 10 deaths—a mortality of 1.14 per cent.

REFERENCES.

¹ *Lancet*, 1920, i, p. 698. ² *Annals of Surgery*, 1920, i, p. 303. ³ *Journ. Amer. Med. Assoc.*, 1914, lxiii, p. 1184. ⁴ *Annals of Surgery*, 1919, lxx, p. 522.



DISAPPOINTMENTS AFTER GASTRO-ENTEROSTOMY

EVERY operation in surgery, even the best, most exquisitely performed, may bring its disappointments. The operation of gastro-enterostomy, carried out in appropriate cases by a competent operator, is probably the most successful of all surgical procedures of equal magnitude, and it is certainly among the safest of those entitled to the description of major operations. In my last series of more than 300 non-malignant cases I have not lost a patient, and in recent years a temporarily unsatisfactory result has been extremely rare.

When we speak of disappointments after gastro-enterostomy, we must first remember that it may not be the fault of the operation but of many other circumstances if things go wrong. The success or failure of an operation may be due not only to the procedure itself but also to its performance in cases which did not need it.

It falls to my lot to see many cases in which the operation of gastro-enterostomy has failed, and in reviewing these I find that they are capable of tabulation in the following manner:

A. THE OPERATION HAS BEEN PERFORMED IN THE ABSENCE OF ANY ORGANIC LESION JUSTIFYING IT

This is by far the most frequent cause. In every ten cases of unsatisfactory results nine are due to this cause and to this alone.

The conditions for which the operation has been needlessly performed are two:

(a) IN FUNCTIONAL DISORDERS OF THE STOMACH

The more we know of organic diseases of the stomach the fewer do those cases formerly considered functional progressively become. It is not so long since a patient suffering from duodenal ulcer, for example, was frequently told that he was the victim of "acid gastritis," or "acid dyspepsia," "hyperchlorhydria," or "neuralgia of the stomach," all of which were said to be functional states.

When I first called attention to the symptoms and to the clinical diagnosis of duodenal ulcer, I found it difficult to persuade many of my friends that I was speaking of a common organic lesion which could be demonstrated during an operation to any intelligent onlooker.

To-day every one agrees that these symptoms are in truth due to a structural lesion and not to a vice in the chemistry or a defect in the motility of the stomach. And this holds good of other "functional diseases" of the stomach also. Inquiry upon the operation table reveals organic causes.

There still remain, however, a number of difficult cases of functional troubles associated with atony of the stomach or prolapse of this and other abdominal organs. Such cases may be difficult to treat by medical means, massage, exercises, and so forth; but they are often made very much worse by the performance of a short-circuiting operation. If such patients vomited before, they vomit still, though the character of the vomit is altered by the addition of large quantities of bile. In a few instances the patients will say that they are neither better nor worse, and I have

known one or two who incline to think their condition a little better than it was before operation. But the exceptions are very few to the rule that in these conditions surgical measures are harmful or disastrous.

In such patients the only further operative treatment which the surgeon should undertake is the reparation of the mistakes of his too enterprising predecessor. The anastomosis must be undone, and the stomach and intestine returned as far as possible to their original condition. If there is a moderate degree of visceral prolapse great relief may be obtained from the application of a Curtis belt or of corsets.

(b) IN CASES OF CHRONIC DISEASE ELSEWHERE

For several years I have endeavoured on many occasions to emphasize the importance of verifying, after the abdomen is opened, the original diagnosis of ulcer of the stomach or of the duodenum, before beginning any operation designed to relieve the patient of his symptoms. An ulcer of the duodenum or of the stomach, if the cause of symptoms so long continued, or so severe as to justify an operation, is always a visible, demonstrable, palpable lesion. If no ulcer is found no operation should be performed. The day is long past when a surgeon is entitled to accept a clinical diagnosis, however confidently made, as a sufficient warrant for an operation. The lesion supposed to exist must be recognized at the time the abdomen is opened before any further steps are taken with the intended operation. This rule, which should appeal to every one, is still violated with no little frequency. If no ulcer is found, a search should then be made elsewhere in the abdomen for a possible cause of those symptoms which have been attributed to a chronic ulcer. Failure to ob-

serve these precautions, and to remember this unalterable rule, has resulted in the performance of gastro-enterostomy for conditions remote from the stomach. The operation of gastro-enterostomy has been performed for the following diseases:

I. CHRONIC APPENDICITIS

This is the commonest of the mistakes in this class. Many physicians and surgeons have long realized how exact the mimicry of the symptoms of ulcer of the stomach or of the duodenum may be in cases of chronic appendicitis. Nine years ago¹ "appendix dyspepsia," a condition in which symptoms closely resembling those due to gastric ulceration were caused by a chronic lesion in the appendix, was described, and special attention was called to the presence of hæmatemesis or melæna in these cases. Hæmatemesis is more common in other diseases than in gastric ulcer, of which it is not a very frequent symptom. The occurrence of hæmorrhage should therefore raise at once a suspicion not only of ulcer, but of chronic appendicitis, splenic anæmia, or cirrhosis of the liver.

II. TUBERCULOUS DISEASE OF THE INTESTINE

Tuberculous disease of the ileum, or cæcum and ascending colon has been present in a small number of cases where gastro-enterostomy had been performed in the absence of any ulcer of the stomach or duodenum.

Tuberculous disease of the intestine appears to be a common disorder in England and in Scotland. The impurity of the milk supply, of course, is responsible for this. Manchester has recently discovered that 35 per cent. of the milk brought to it contains living tubercle bacilli, and

a similar alarming discovery could doubtless be made in other towns if inquiry were instituted. The symptoms produced are, as a rule, clear evidence of tuberculous disease; but occasionally a patient may present such symptoms as make a diagnosis of duodenal ulcer not impossible. There are pyloric spasm, hyperacidity, pain, and vomiting. I have found tuberculous disease of this kind in two medical men who believed themselves to be the subject of duodenal ulcer, and whose belief was strengthened by other opinions. Both were a little dismayed when they learnt that gastro-enterostomy had not been performed; but both, I am glad to say, are cured by their operations. I have had one patient sent to me as a case of "gastric ulcer" upon whom I performed colectomy for hyperplastic tuberculous disease of the cæcum.

III. CHOLELITHIASIS, OR CARCINOMA OF THE GALL-BLADDER

Cholelithiasis, in all cases except those in which a single cholesterol stone is present, declares its presence, even in early stages, by the symptoms of dyspepsia, and often also of hyperacidity. The pain of flatulence and of heaviness comes with fair regularity about half an hour after a meal. There may be vomiting, and there is often much complaint of acidity. A very large proportion of the cases of cholelithiasis, at a time when no colic has occurred, are diagnosed as cases of gastric disease.

The way to prevent this, and so many other mistakes, is to examine all parts of the abdomen likely to be affected by disease, before the purposeful part of the operation is begun.

IV. CIRRHOSIS OF THE LIVER, WITH HÆMORRHAGE

In cirrhosis of the liver there is often dyspepsia; flatulence, heaviness, soreness, frequent eructations, with loss of appetite and a foul tongue, are common symptoms. Hæmatemesis or melæna, or both, may be profuse. The absence of orderly development and precision in the time and character of the symptoms makes the differential diagnosis between cirrhosis and duodenal or gastric ulcer rarely difficult.

V. SPLENIC ANÆMIA

I have known a short-circuiting operation to be performed in this disease. The hæmorrhage is often very abundant. The most copious hæmatemesis I have ever seen occurred in a patient suffering from this condition upon whom I was asked to operate for duodenal ulcer. I have twice removed the spleen in cases of splenic anæmia from patients who were sent to me as cases of duodenal ulcer. In both no ulcer nor any scar was seen.

VI. TABES DORSALIS

I have seen five patients who were operated upon in this disease after a mistaken diagnosis of "gastric ulcer" had been made. The gastric crises, and the other dyspepsias seen in tabetic patients, have so little akin to the symptoms produced by organic diseases of the stomach that there is no excuse for the mistake. I have had one patient who, suffering from tabes, had also the symptoms of duodenal ulcer. I operated upon him, demonstrated the ulcer, and performed gastro-enterostomy.

VII. DISSEMINATED SCLEROSIS

I have seen one patient with this disease upon whom gastro-enterostomy had been performed; the surgeon found no ulcer, though the symptoms had suggested its presence to him. In the crises of the attacks of pain the stomach became greatly distended.

VIII. THE VOMITING OF PREGNANCY

I have known two patients submitted to the operation of gastro-enterostomy for this condition under a mistaken belief that a gastric ulcer was present as the cause of the symptoms. Vomiting is neither a common nor, as a rule, a serious symptom in the great majority of cases of gastric ulcer.

IX. IN LEAD POISONING

I have seen one patient upon whom gastro-enterostomy had been performed when neither open ulcer nor old scar could be found. The evidences of lead poisoning—colics, blue line on the gums, etc.—were quite clear at the later stage.

X. IN PROLAPSE OF KIDNEY

Many years ago Sir F. Treves and Sir William Bennett described a group of cases in which a loose kidney had pulled upon the gall-bladder and ducts to such a degree as to cause jaundice. The same drag may be made upon the duodenum and symptoms of pain and vomiting be produced. Loose kidneys comparatively seldom produce symptoms of any consequence, but there is no doubt of the existence of the conditions just described.

XI. COLIC ADHESIONS

Many patients who suffer from vague dyspepsias, ascribed perhaps to intestinal stasis, or to chronic appendicitis, disclose on the operation table this condition: A membranous band, broad above, where it takes origin from the posterior abdominal wall, the under surface of the liver, the pelvis of the gall-bladder, the cystic duct, and the duodenum, narrows below as it crosses the ascending colon to be lost on the peritoneum, to the inner side of the ascending colon, and on the enteric mesentery. Below this band, which is quite different from a "Jackson's membrane," the cæcum and the ascending colon are distended and soggy. Very often the appendix looks turgid, thick, and stiff. Removal of the appendix, to which the troubles are ascribed, gives little or no relief. Division of the band allows adhesions to re-form. The only practice likely to give good results is the removal of the terminal ileum, cæcum, and ascending colon. The performance of gastro-enterostomy, of course, makes matters worse.

XII. EPIGASTRIC HERNIA

A hernia of this kind, however small, may cause teasing and protracted symptoms. The chief complaint is of indigestion, dragging, heaviness, etc. A careful examination for this condition should always be made.

B. THE OPERATION HAS BEEN INCOMPLETE

It appears to be still a custom in dealing with duodenal and gastric ulcer to perform gastro-enterostomy only, leaving the ulcer itself untouched, and making no search in the abdomen for other conditions. As these ulcers

are probably often, if not always, secondary to some infection which may exist within the abdomen, such a search should be a necessary part of every operation, provided that the condition of the patient will warrant it. Chronic appendicitis is very frequently associated, probably in a causal relation, with ulcers of the stomach and duodenum. It is better, therefore, always to remove the appendix. The division of the membrane which causes a "Lane's kink" may also be practised. The gall-bladder should always be examined for the presence of stones, or of that subserous deposit of fat, especially near the pelvis, and the cystic duct, which is, I hold, the first sign visible from the exterior of an infection of the walls of the gall-bladder from within. Either the removal of stones and drainage of the gall-bladder or removal of the gall-bladder may be necessary.

But, above all, the ulcer itself should be dealt with in such manner as to secure that all large vessels running into it are ligatured, and that the risk of subsequent perforation is lessened or prevented by the infolding of the ulcer, and by the covering over of the first part of the duodenum by the two omenta. Cases of fatal hæmorrhage from a duodenal ulcer, weeks or months after gastro-enterostomy had been performed, are recorded by Kocher, Quénu, Sir F. Eve, and others. And Mr. Corner has related the story of the fatal perforation of a duodenal ulcer in a patient upon whom I had operated three years before. Other cases of perforation in similar circumstances are known to me, and some are recorded in the literature. Merely to perform gastro-enterostomy in cases of duodenal ulcer is therefore to leave open many chances of subsequent disaster. A direct dealing with the ulcer is always necessary. In patients upon whom gastro-enter-

ostomy alone has been performed, there may be a recurrence of all the original symptoms of duodenal ulcer. In such cases one of two conditions is present—either a jejunal ulcer, or a revival of activity in the duodenal ulcer. If the latter, the infolding of the ulcer, and its protection by a double covering of the omenta, will remove the symptoms at once. An *x*-ray examination before the operation will probably show that much of the food passes by the pylorus. I rarely practise either excision of the ulcer, exclusion of the pylorus, or partial duodenectomy and gastrectomy in cases of duodenal ulcer, for the results of the simpler operation of gastro-enterostomy are hardly to be improved.

The infolding of the ulcer of course narrows the pylorus for a time at least, but it is not with the object of producing obstruction that the infolding is done. As A. B. Mitchell has shown, the infolded ulcer very rapidly disappears.

C. DEFECTS IN TECHNIQUE

The operation has been performed, rightly or wrongly, and certain technical errors cause distressing symptoms—pain, vomiting, diarrhoea, etc.

The chief of these occur when—

1.

The anterior or the posterior operation has been performed, and a long jejunal loop has been left. This loop may, with difficulty, be emptied; it may become “waterlogged,” and an obstruction may develop at the afferent opening into the stomach. “Regurgitant vomiting” occurs, only to be relieved by lavage, or in severe cases by the performance of an entero-anastomosis, which checks it at once.

2.

With a short or a long loop the efferent piece of jejunum has been blocked as a consequence of a kink, or from adhesions, between the intestine on the one side, and the abdominal wall, omentum, transverse colon or mesocolon, and loops of small intestine on the other. Regurgitation occurs here also. Regurgitant vomiting means high intestinal obstruction.

3.

A short-loop posterior gastro-enterostomy has been performed. At the time when the jejunum was lifted up to oppose to the stomach before suture, adhesions were found binding it to the under surface of the transverse mesocolon, an exaggeration of the ligament of Treitz. These were divided and a raw surface left on the jejunum, proximal to the opening made to anastomose with the stomach. Adhesions then formed and caused obstruction of the proximal part of the jejunum between the duodeno-jejunal flexure and the opening into the stomach. Mr. Nicoll, of Glasgow, describes this condition.

4.

The jejunum has been rotated round its longitudinal axis at the time when it has been approximated to the stomach. This twist may be quite enough to cause an obstruction.

5.

The opening is too small. I have operated upon patients suffering from pyloric obstruction when a short-circuiting operation had been performed a few months before, and have found the opening too small to admit the tip of my little finger. A gastro-enterostomy opening should always be large; not less than $2\frac{1}{2}$ in. in length.

6.

The opening is badly placed. The opening should always reach the greater curvature and is best placed in line with the œsophagus. Whether the jejunal direction is vertical, as I prefer it, or inclines from left to right or right to left matters very little.

I have found the opening, originally made too small, lying midway between the curvatures, and in one case actually on the lesser curvature at the incisura. In such cases an *x*-ray examination will show the existence of a pool of unemptied stomach contents below the anastomosis. By manipulation the stagnant fluids can be pressed out of the anastomotic opening.

7.

The suture used to effect the anastomosis has embraced not only the cut edges of the stomach or jejunum but also a part of the further wall of either one or other or both of these viscera, so that the new opening made between them is much narrowed. I have found this in one case upon which I did the secondary operation for jejunal ulcer. Walton records (*Proc. Roy. Soc. Med.*, 1920, XIII, 180).

8.

There has occurred a hernia of the small intestine through the unclosed rent in the mesocolon. In one of my early cases (1902) I did not stitch the cut edges of the opening, made through the transverse mesocolon, to the suture line. A great part of the small intestine escaped through the opening into the lesser sac and became strangulated; the patient died. It is, I think, important to close the opening in the mesocolon very care-

fully. One of the ablest surgeons in the world told me of a case in which he did not suture the opening very completely, leaving a gap at the proximal end of the jejunum. A small knuckle of bowel crept in and became strangulated. An operation on the fifth day revealed the condition. The patient recovered.

The edges of the mesocolic opening should be sutured either to the stomach or to the suture line. If they are attached to the jejunum alone the stomach may withdraw into the lesser sac, and so cause a kink or obstruction near the stoma.

9.

The use of unabsorbable sutures—silk, linen, thread, thick chromicized catgut. The work of Wilkie seems to show that catgut is to be preferred to any other suture material. It remains long enough to ensure firm union between the viscera, and disappears in a few weeks' time. The catgut should be as fine as is compatible with adequate strength. I use the finest chromic gut (000000) for both sutures.

In many cases of hæmorrhage occurring some weeks or months after the operation the liberation of an unabsorbable suture may be the cause. Such sutures may be seen hanging from the line of anastomosis when later operations are performed. I have found a piece of stout chromicized catgut three years and nine months after the original operation. Of the two sutures it is, I believe, certain that the outer one, the sero-serous, is the one so long retained. The inner stitch, which apposes the cut edges of the mucous membrane, is probably always discharged within a very few weeks, whatever the material of which it is composed. The use of linen and silk is perhaps responsible in some degree for the development of jejunal

or gastro-jejunal ulcers. The sutures have to work their way out, and so delay healing, or start an ulcer at any point. I have twice found small ulcers near the retained knot of an unabsorbable suture.

10.

The anastomosis has been not seldom made with a portion of the intestine unsuitable for this purpose; with, for example, a loop of the ileum near the ileo-cæcal junction, or even, as in a case related by Walton, with the transverse colon.

11.

The anastomoses in two cases upon which I subsequently operated had been made between the distal pouch of an hour-glass stomach and the jejunum. The operation so far as the mere junction of viscera was concerned had been well done, but as the obstruction into the distal pouch was unrelieved the operation did no good whatever.

12.

Ventral hernia may follow an imperfect closure of the abdominal wound; or after any closure if there be persistent, severe coughing or vomiting.

D. LATE COMPLICATIONS MAY DEVELOP AFTER AN OPERATION PERFORMED, IN A CASE REQUIRING IT, WITHOUT ANY TECHNICAL FLAW.

1. *Jejunal Ulcer*

This is by far the most serious of all the sequels of gastro-enterostomy. The ulcer may be at the suture line, or near it; it is generally small, and, as a rule, is single.

Its causes are not known with certainty. Among them are, probably, the use of unabsorbable sutures, inaccurate

apposition of mucous membrane, bruising of the part of the viscera embraced by clamps with the result that a hæmatoma forms, a continuance of the cause of the original duodenal or gastric ulcer, and a persisting hyperchlorhydria.

It may at least be said that an avoidance of these faults or treatment of these conditions will almost certainly prevent the development of any fresh ulceration. The diagnosis of jejunal ulcer is not, as a rule, at all difficult. There are several clinical types which I have described in my book *Abdominal Operations*. There are several methods of operative treatment, not all of them satisfactory and some of them very difficult. Recently I have performed partial gastrectomy in such cases, removing the stomach up to the proximal side of the anastomosis, and all that part of the jejunum engaged in the junction.

The proximal end of the distal limb of the jejunum is closed and the side of it united to the cut end of the stomach; the distal end of the proximal segment is united to the distal portion of the jejunum just below the anastomosis with the stomach. I have known jejunal ulcer to develop in two patients after gastro-enterostomy performed in the absence of any lesion in the stomach or duodenum.

2. *Carcinomatous Change in a Chronic Gastric Ulcer*

This may occur after an operation which has, for a time, seemed perfectly successful. I have now in my wards a patient upon whom I performed gastro-enterostomy for chronic gastric ulcer thirteen years ago. At the time of the recent operation a carcinomatous ulcer was present at the site of the former simple ulcer. In earlier days I have met with several cases in which malignant dis-

ease developed at the site of a chronic ulcer after operation. In the cases in which the cancer is found within, say, three or four years it may fairly be argued that the growth was present at the time of operation, for gastric cancer may increase very slowly. But in cases occurring later than this the great probability is that the change from a simple to a carcinomatous condition has taken place.

Nowadays I perform, as a rule, only two operations for cases of chronic gastric ulcer. If the ulcer is not near the œsophagus, and is of average or small size, I perform partial gastrectomy. If the ulcer is very large, burrowing deeply into the liver or the pancreas, and near the cardiac end of the stomach, I perform gastro-enterostomy in Y, and into the proximal limb of the jejunum, below the duodeno-jejunal flexure, I introduce a tube, performing jejunostomy. Through this tube the patient is exclusively fed, for few or many months, until an *x*-ray examination suggests that the ulcer is healed.

In the case of the largest gastric ulcer I have ever seen, the ulcer occupying the whole of the lesser curvature and extending deeply into the liver, the patient did not take one spoonful of food or drink by the mouth for two years and nine months. I gave her permission to do so at the end of two years, when the ulcer appeared to be healed, but she prolonged at her own desire the period of jejunal feeding for nine months.

The remembrance of her intense suffering before the operation, and her perfect comfort and satisfaction when she took food only by the tube, weighed with her in making this decision. The jejunostomy opening has been closed for nearly three years, and she remains perfectly well, free from pain, and is now 4 st. heavier than when the original operation was performed.

Symptoms after Unsuccessful Gastro-enterostomy

The symptoms present in cases of unsuccessful gastro-enterostomy are chiefly four—pain, hæmorrhage, vomiting, diarrhœa.

Pain may be due to:

1. A revival of activity in an unhealed ulcer.
2. The presence of a jejunal ulcer.
3. Adhesions crippling the proper action of the stomach or jejunum.
4. The presence of some other disease which has been overlooked at the operation—chronic appendicitis, cholelithiasis, and the other diseases enumerated above.

Hæmorrhage may be due to:

1. The separation of a suture.
2. Continuing activity in a duodenal or gastric ulcer.
3. A jejunal ulcer.
4. The presence of some other disease which has been overlooked, such as splenic anæmia, cirrhosis of the liver, etc., as enumerated above.

Vomiting may be due to:

1. Obstruction as a result of any of those technical defects in the operation which I have already named.
2. Functional causes.

Diarrhœa may be due to:

1. Too rapid emptying of the stomach.
2. Some pathological condition of the intestine, or other viscera, which has been overlooked.
3. The offensive character of the escaping contents.

The too rapid emptying of the stomach is sometimes a cause, or is supposed to be the cause, of many discomforts, intestinal uneasiness and turmoil, and diarrhoea. When a patient suffering in this way is examined by the *x*-ray the stomach is seen to empty itself very rapidly—perhaps in ten or twenty minutes, the food flowing through the opening into the intestine simply by the act of gravity. In the great majority of such cases that have come within my own knowledge the operation of gastro-enterostomy should not have been performed. The stomach which acts or fails to act, is generally a feeble, flabby atonic organ, capable of exercising little or no control on its contents. The fault here is due to the performance of the operation in an unsuitable case. The jejunum below the opening in such cases appears, by *x*-ray examination and on inspection, to be dilated as a result of the rapid filling; its distension may be the cause of great distress.

As I have said, pathological conditions which have escaped notice may be the cause of a continuing diarrhoea; of such cases are tuberculous disease of the ileum or cæcum, or carcinoma of the ascending colon.

Diarrhoea may also occur within two or three weeks of the operation, and last a few days, or even a month or two, rarely more. This is especially noticeable in cases of malignant disease of the stomach causing obstruction, and is probably due to the unchecked escape into the intestine of putrid matter from the stomach, an intense intestinal irritation being the result.

In a few patients upon whom gastro-enterostomy has been performed with the usual striking success an occasional attack of diarrhoea may occur; the stools are liquid and green in colour and irritating to the rectum. In other patients it may be noted that the stools are often clay-

coloured, or almost colourless. In such cases the discomfort is trivial and temporary, and does not detract from the otherwise excellent result of the operation.

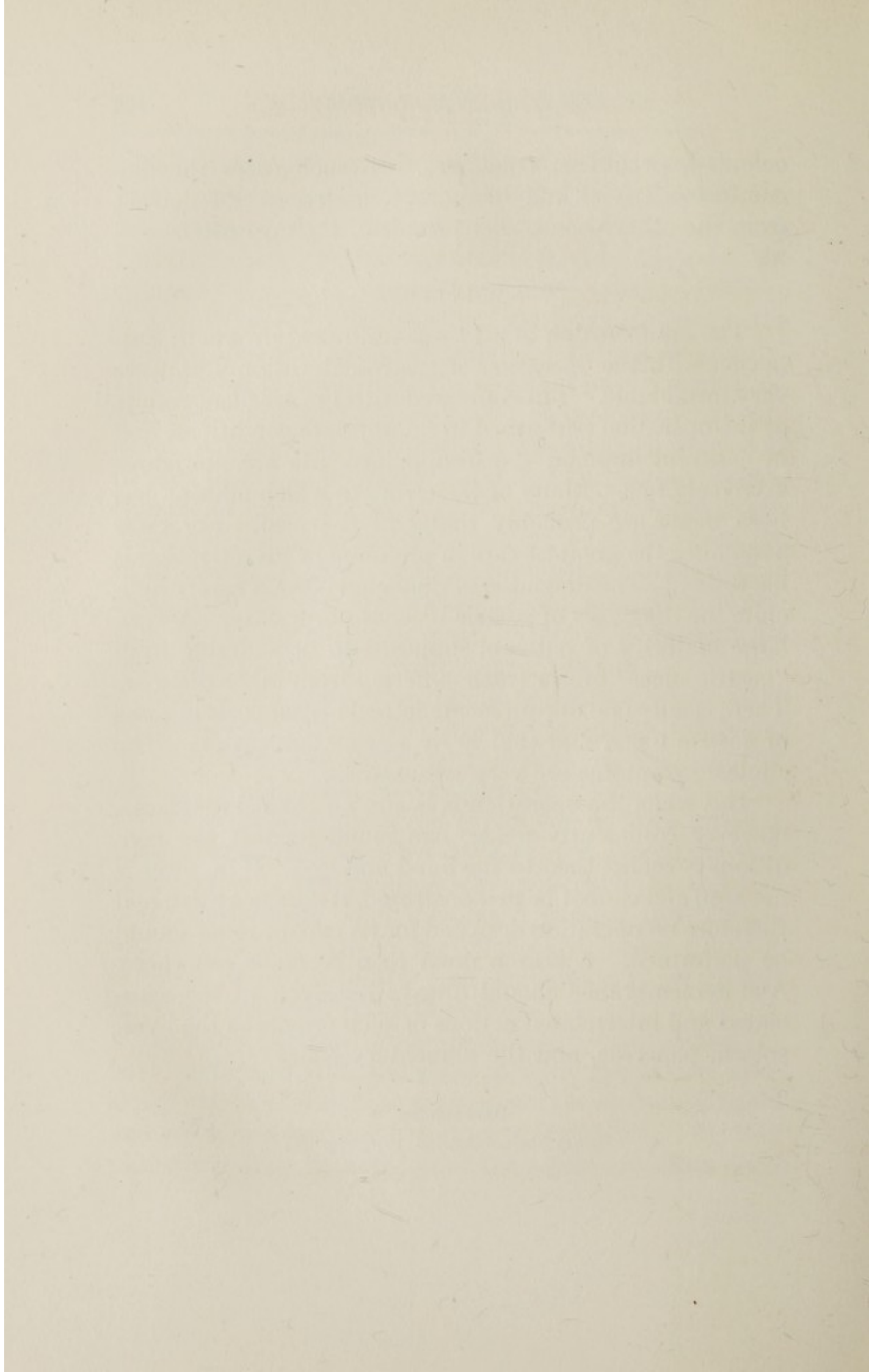
CONCLUSION

The enumeration of all these untoward events in connexion with the operation of gastro-enterostomy appears very formidable. But compared with the excellent results of the operation performed in appropriate conditions, and in a skilful manner, the disappointments are nowadays extremely few. Many of the errors to which allusion has been made are probably things of the past. For their avoidance the greatest care in preliminary investigation is necessary. The diagnosis of duodenal ulcer is rarely difficult; the diagnosis of gastric ulcer is never easy. A very large majority of patients supposed to be suffering from "gastric ulcer" are in truth suffering from other diseases. There is only one unequivocal method of diagnosis in cases of gastric ulcer, and that is by *x*-ray examination. The clinical symptoms are very treacherous.

But when the operation is begun no clinical diagnosis, however confidently made, can stand against the conditions revealed then to the hand and eye. If an ulcer is not seen and cannot be demonstrated, it does not exist, and therefore no operation designed for its cure or relief should be performed. A search must then be made elsewhere. And remembrance should always be given to the associated and interrelated actions of such organs as the liver, spleen, pancreas, and the alimentary canal.

REFERENCES.

- ¹ *British Medical Journal*, 1910, i, p. 241.



INTESTINAL STASIS*

IN a discussion upon "intestinal stasis" a single speaker can touch only very lightly upon any particular aspect of this most interesting problem. The literature which has already accumulated is so vast, and the claims made as to the importance of the condition are so far reaching, that anything in the nature of a close criticism of the matter having regard to brevity is impossible.

It is asserted: (a) that certain bands, webs, veils, or membranes are present at defined points in the alimentary canal; (b) that these adhesions are responsible for delay in the onward transmission of the intestinal contents, and consequently for increased decomposition in them; and further, that the organisms so proliferating, or other noxious products, are absorbed into the system and produce certain deleterious effects; (c) that certain disorders are due exclusively to the toxæmia which comes from such absorption, or from subinfection, and that a very large number of the diseases to which man is liable are also harmfully influenced thereby.

What truth is there in these various statements? Of the existence of various membranous adhesions along the course of the alimentary canal there can be no doubt. Between the duodenum and the gall-bladder or the under surface of the liver, at the duodeno-jejunal flexure, at the end of the ileum, along the ascending colon, at the hepatic and splenic flexures, and to the outer side of the pelvic

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colon they are plainly and frequently to be seen. Their origin is not yet certainly ascertained, and it may indeed not always be the same. Certainly many of them are congenital. When in 1899 I published my work on "Retroperitoneal Hernia," I had examined the abdomens of a large number of foetuses, children, and young adults, in order to discover the number, nature, and extent of the peritoneal fossæ. I found, and there recorded, the fact that adhesions of the proximal jejunum and the terminal ileum were not seldom found in these cases, and that they were due to the condition described by Toldt as "physiological fusion." The membrane which binds the ascending colon so loosely to the posterior abdominal wall—Jackson's membrane, as it is called, though Lane not only described but depicted it—has a vascular supply of such regular appearance that it seems impossible that it should be anything other than a developmental relic. The origin of the band at the hepatic flexure, and of the more obvious and thicker string-like adhesion at the splenic flexure, is probably, as Lane asserts, the result of traction and the effort to restrain or overcome its effects. Of the existence of these several membranes, therefore, there is no doubt. There is little doubt, also, that they are for the most part congenital though mild inflammatory processes; or the response of the parts to dragging force applied to them may be responsible for their increased development. If the supports of the bowel were in need of reinforcement it is probable that strength would be added to membranes already existing rather than that entirely new bands should be laid down. When once these adhesions are formed they may, of course, hamper the free action of the intestine.

It is often said that in cases of intestinal stasis an

obstruction exists at the site of one or another of these bands, and that long delay of the contents of the bowel is caused thereby. This does not tally with the general operative experience. Every surgeon who has much experience of the intestine in these cases will agree that, as a rule, the wall of the gut is thin and almost translucent; it is not, as we see it in cases of veritable obstruction, thick from hypertrophy of its muscular wall. It is feebleness of action rather than impediment which causes the tedious transit of food. The walls of the gut are thin, the membranous supports are of such poor quality that parts normally well-fixed like the splenic flexure can often be withdrawn from the abdomen, and the musculature of the abdominal wall is flaccid and feeble. Everything indicates that a sort of apathy is, as a rule, the cause of stagnation, not an obstruction which is with difficulty overcome.

We may therefore take it as proved that the various bands described in connection with the intestine do exist, though we may dispute as to their origin; we may agree also that undue delay in the forward transmission of the intestinal contents does occur, and that this delay is accompanied either by a form of subinfection, by organisms in varying degrees of attenuation escaping from the intestine, or by a form of intoxication.

What are the clinical results of all this? In the recognition of a certain type of patient whose ills are solely dependent upon intestinal stasis we shall all probably be in agreement. The victim of what we may call "Lane's disease" is now easily recognized, and the symptoms are caused to disappear by appropriate surgical treatment. The symptoms are strikingly repeated in case after case. The patient is generally a woman of unhealthy aspect and attenuated figure. She is lean, cadaverous, flat-

ched, and she has a sour breath and cold and clammy hands. The skin is harsh and of an earthy colour and bears many crops of pimples; its secretion is apt to be distressingly noticeable. She makes complaint of "indigestion," pain after meals, flatulence, and inveterate and incoercible constipation. The abdominal muscles lack bulk and tone. They are flabby and flaccid, and all the viscera which they should hold up are fallen in greater or less degree. Mentally, there is often a complete absence of the joy of life: the patient is a morose, querulous, and often suspicious and introspective person. These attributes are rarely all present together, but so many of them may coexist as to enable a distinct type of patient to be recognized. In the very obvious cases of this kind I do not think the mild measures that can often usefully be employed for the novice—massage, abdominal exercises, and the unrestricted use of paraffin—are really of any value. These sufferers are properly cases for surgical treatment. The colon should be excised in whole or in part. In some, perhaps, ileosigmoidostomy may be done; but in every case, with one exception, in my own series there has been some regurgitation of the intestinal contents upward along the descending colon to the cæcum. The stasis then is worse than before, for a mass of fæcal material that is never wholly dislodged is palpable at all times. The symptoms, which are nevertheless relieved in great measure, are clearly not due merely to the stagnation of the bowel contents. No method of anastomosis, nor any fashioning of new kinks, can wholly prevent this backward flow, though something can doubtless be done to lessen the tendency to it. Personally, I believe that nothing short of colectomy offers a substantial chance of cure. How much of the colon is to be removed?

This invites a consideration of the function of the large gut. It is well known that putrefaction goes on much more largely in the lower ileum than in the large intestine; but it is not improbable that in the cæcum and ascending colon absorption takes place more freely. The liquid contents delivered through the ileocæcal valve are moved backward and forward in the ascending colon and rapidly lose a good deal of the fluid matter. "We drink with the large intestine." The ascending colon has possibly other uses: of excretion or even of internal secretion. The hind gut, which begins in some part of the transverse colon supplied from the anastomosis magna of Riolan, is only for the storage and expulsion of the fæcal masses full of bacteria, mostly dead, delivered to them. The part of the gut that needs removal is therefore, I think, the last part of the ileum, the cæcum, and the ascending colon. Accordingly, in such patients who need surgery I prefer to resect these parts of the bowel.

It is, on the whole, an advantage to have the descending colon and the pelvic colon left. Absorption barely goes on at all from these parts, for we know that a simple injection of saline fluid introduced into the rectum rapidly finds its way around to the cæcum. If the descending colon and the sigmoid flexure are too lengthy, a suggestion of Sir H. M. Gray's may be adopted. Making use of the principles of mobilization and displacement, to which I called attention, he loosens the hind gut from its moorings and displaces it upward; so that what was the pelvic colon becomes now the descending colon, and the latter is made to occupy the place of the transverse colon. This operation is simple, very satisfactory in its results, and in my hands has, as yet, had no mortality. Its advantages over complete removal of the colon appear to be that all

the maleficent part of the intestinal tract is removed, and that enough of the bowel remains to avoid the teasing and troublesome diarrhoea which is known to follow so frequently upon the larger operation. Moreover, the number of raw stumps of ligatured vessels is fewer, and their "peritonization" is far more complete than when all the colon is taken. Finally, some of the omentum is left, and in a territory given over at times to riot the presence of the "abdominal policeman" is possibly a witness to peace. It is known that a great menace, perhaps the greatest, attaching to the operation of complete colectomy is the occurrence of obstruction afterward. The raw surfaces left by so great a denudation of the posterior abdominal wall, and by the vessels which have been tied in the various mesenteries, afford easy opportunity for tethering adhesions to form and cause obstruction. Ileocolic resection allows of very adequate "peritonization" of all the rough places left and closure of the gaps between the divided ends of the mesentery.

The patients whose condition and appearance I have just described very often undergo a most marvellous rejuvenation after operation. They gain in weight and glow with health; life changes its colour, and vivid interest and keen enjoyment succeed to apathy and languor.

In dealing with the clinical aspects of intestinal stasis we are, so far, upon firm ground. We can pick no quarrel with the enthusiasts. What further part does intestinal stasis play as a causative factor in any disease? What influence has it, for example, upon the development of gastric and duodenal ulcer, and upon the various phases of cholelithiasis?

Many surgeons have realized, and some of us long have

taught, that in a great many cases these common disorders of the upper abdomen are not to be considered as isolated and primary diseases; the view should rather be held that they are secondary expressions of a primary lesion elsewhere, and that they are often linked together by a common antecedent, if not evoked by a common cause. There is much evidence to show that they are secondary to some infection, within or without the abdomen. For some years past I have held the view that the appendix is the test-tube in which organisms are propagated which, by a process of subinfection, express their ravages in the form of ulceration in the stomach or in the duodenum. A gall-stone, as we know, is merely an invading army of organisms coated by the missiles with which they have been bombarded. Sir Arbuthnot Lane believes that the chronic inflammation of the appendix itself is also secondary—the result of the causes which are associated also with stasis in the intestine. I regret that I cannot accept his view as tenable, except in a small proportion of the cases. In the great majority we do not find intestinal stasis, nor the Lane kink or veil, nor, indeed, any of the customary evidences of intestinal stasis to which he has called attention, whereas we do find the most positive evidence of appendicular disease. For the last few years when operating for a chronic gastric or duodenal ulcer or for gall-stones, I have made, in all proper cases, a careful search at the site of the various obstructing membranes we now so easily recognize, and I am compelled to assert that the evidence of stasis, or of the demonstrable conditions upon which it so often depends, is not to be found in more than a very small proportion of the cases. Moreover, the recovery of the patient who, for example, has had gastro-enterostomy done

for a duodenal ulcer, is so speedy, so complete, and so enduring that it is a sheer impossibility that any lingering disease remains behind. We must put this matter definitely, for recently I have heard of patients with declared duodenal ulcer who have lost their lives through operations directed to the relief not of the ulcer, but of a wholly suppositious intestinal stasis. For gastric ulcer, for duodenal ulcer, and for cholethiasis no operation should be sanctioned which does not deal directly with the parts involved. To perform colectomy or ileosigmoidostomy in such cases is, I think, to exceed our right and to neglect our plain duty.

So far as concerns a great variety of other diseases, it is claimed that intestinal stasis is either the sole cause or a contributory cause of such significance that all other causes can be neglected or dismissed.

In diseases of the joints, for example, rheumatoid arthritis, or tuberculous disease, stasis is held to be the essential indispensable factor causing the harm, or at least permitting it to take place. And the treatment of the severer forms, at least, of both diseases does not occupy itself with a direct assault upon the joints affected, but with the intestine from which all the evil has started. Cases are reported, and are shown to us, in which such treatment has had an effect beyond all one's wildest imagining. I have myself seen many cases of advanced—indeed, apparently hopeless—tuberculous disease of the hip-joint, or of the wrist or shoulder, in which an arrest of the quickly destructive processes took place almost at once when the colon was removed or a short-circuiting operation performed. And a sensible improvement has followed also in a few cases of rheumatoid arthritis in which, while nothing was done directly to the joint, the

whole colon was excised. Of the occurrence of such events there can be no question. They do not, indeed, stand alone. Rheumatoid arthritis, as we all know, is a disease with many causes, with many aspects, with many vagaries, and with many equal responses to many different forms of treatment. We know little of the disease except that it is often, possibly always, the result of a chronic infective process at work somewhere in the body, producing effects at a distance. In the old days of surgery the earliest certain manifestation in pyæmia was the affection of distant joints. Rheumatoid arthritis is pyæmia moving slowly. Probably every surgeon knows something of chronic joint diseases which undergo striking improvement when factories of infection are closed down. I have cured not a few cases of "rheumatoid arthritis" by draining or removing the gall-bladder, which produced the poisons to which the joints reacted. Of the occurrence of a few equal improvements after colectomy I am fully cognizant; but I am also aware of many cases that have showed little or no permanent relief.

Of the tuberculous diseases of the joints the same may be said. Without question, there is some improvement in some cases, much improvement or even cure in a few. But the bulk of the cases, so far as I can judge, are not appreciably affected by operation upon the intestine. Moreover, I have known of cases in which tuberculous disease of the hip developed after ileosigmoidostomy had been performed, and it is at least of some interest to know that a patient upon whom colectomy was done fell a victim afterward to phthisis, from which, however, recovery took place.

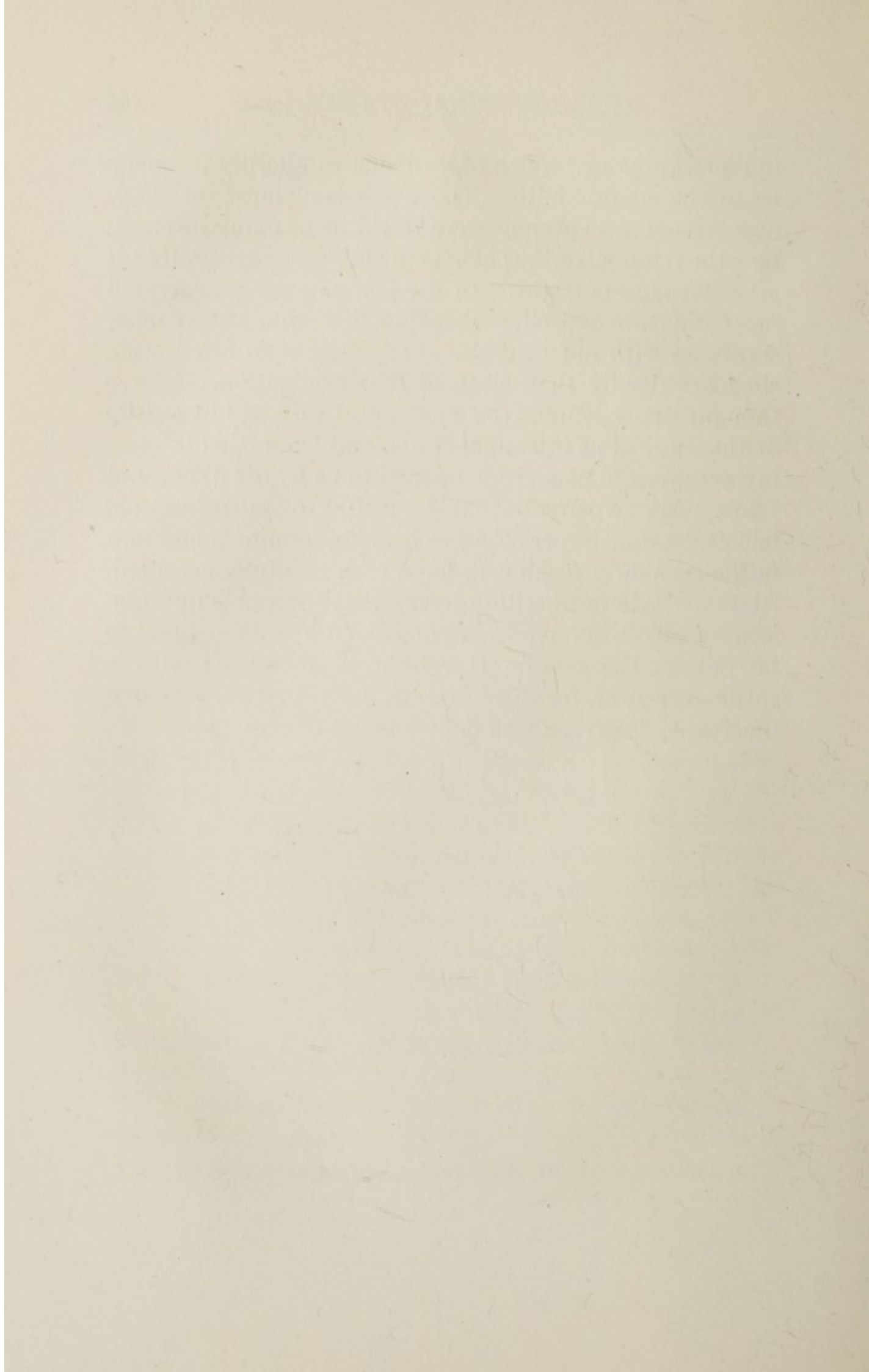
The evidence at the moment available allows us certainly to say that intestinal stasis does seem to stand in

a causal relationship toward some cases of chronic joint affections, and that such cases exhibit a marked and instantaneous delay or even cessation in the destructive processes, after operation upon the bowel, and that a complete recovery of the joint ultimately occurs. What is uncertain is not the existence of such cases, but their frequency. So little has been done in this direction, and so few surgeons have lent themselves to this form of treatment, that we cannot do other than withhold a confident opinion. The experience of the few, however, is worthy of a wider proof at the hands of other surgeons, in carefully selected cases.

But the enthusiasts ask us to travel with them even further than this. We are told that a very large number of diseases need have but little attention paid to their local outcry. This should call attention not to the seat of pain, but to its cause, which lies in the intestine. To name a few of these diseases is to show the length to which we are invited to go. Exophthalmic goitre, trigeminal neuralgia, various forms of functional and organic disease of the heart, diseases of the breast, of the thyroid gland, of the pelvic organs of the female, and finally cancer; these are only a few of the diseases which are due, it is said, to stasis in the intestine. The claims are many, the proofs few. We ask for evidence, and if we know something of the work that has been done and of the really striking results that have already been achieved, we shall be prepared to consider the evidence, absurd though it may appear at first, with an eager anxiety to do justice to new views.

In medicine the new idea is slow to gain currency. We are a conservative race; and we all find criticism a more facile process than creation. Recent experiences

in more than one branch of medicine will hardly persuade us to change our faith. Too much is claimed for every new advance. Vaccines were to rid us of many diseases; now the removal of the colon is to check all diseases that it does not cure outright. In the face of such exaggerated pretensions we do well, perhaps, to go warily; but we must surely go with open minds. For there is no intellectual sin more deadly than sloth of the imagination. I have thought many hours, read much, and worked not a little at this subject of intestinal stasis, and have tried to clear my eyes for the new vision opened to us by Sir Arbuthnot Lane. My experience has been full of surprises: old beliefs, so slow to perish, have been undermined, and new faiths, so slowly fashioned, have been painfully accepted. And now I do not hesitate to say that the whole question is one which will have to be considered by all of us and to be put to the proof. It cannot be dismissed with a shrug or a sneer, for there is truth in the matter. Among much that is dross there lies a nugget of pure gold.



ACUTE EMERGENCIES OF ABDOMINAL DISEASE

THE subject of my address to you to day is one which has been chosen for us by your President, and the choice has my warm approval. It may perhaps be thought by some that it is already rather a hackneyed one, that the matter has been so often and so plainly discussed that little or nothing new or helpful remains to be said, and that hardly any further lessons remain to be learnt. If happily that were so, we should, I am sure, hear less of the matter; we should be less often shocked by the untimely loss of a valued life; and the awful death-roll of abdominal diseases would be greatly curtailed. It is in medicine as in finance—much poverty and much paper may coexist. It is not the settled problems of medicine about which much is written, it is rather concerning those matters of which many things still need to be made clear. And so far as this question of the acute abdominal catastrophes is concerned, I feel that we are not yet in possession of the real secret of prevention, which is most important of all, of early diagnosis or even of treatment. There is much that has yet to be written for our admonition; there is still a great deal diligently to be learnt.

The most formidable and the most frequent of all the acute emergencies in abdominal disease is concerned with the vermiform appendix. An acute attack of inflammation in that organ, attended by gangrene or followed by perforation, is still the most common cause of a catastrophe, placing the life of the patient in instant jeopardy,

and needing for its certain and most speedy relief the immediate intervention of the surgeon. I believe firmly that the serious characters and the terrible fatality of this disease are due very largely, if not exclusively, to the measures which are, with the best intentions but with profoundest unwisdom, directed to the relief of those earliest manifestations of the disease, the full significance of which is hardly yet appreciated.

Of the functions of the appendix we know almost nothing, but that they are of some real significance is probable from the fact that the vascular supply of this little tube is considerable and apparently out of all proportion to its size or manifest importance. The appendix communicates by a valvular opening with the interior of the cæcum at a point an inch or more beyond the ileo-cæcal valve. At this valve and in the lowest part of the ileum there is a development of the circular muscular fibres of the intestine to a degree which results in the formation of a sphincter muscle. The anatomical arrangement of the pyloric sphincter with the opening of the diverticulum of Vater at the beginning of the small intestine is in some degree reproduced here at the beginning of the large, and, though identity of architecture need not mean similarity of function, it seems reasonable to suppose that the glairy mucoid secretion of the appendix possesses some small digestive power. This function, however, is not to be condemned as trivial and without value because ablation of the appendix involves no digestive losses, for I can recall more than one case of permanent biliary fistula in the old days when every drop of bile was discharged on to the abdominal wall and was lost to the economy. In spite of this, there was no apparent diminution in bodily health or weight or ca-

capacity; yet no one was disposed to deny the value of this copious secretion. Because we do not know the use of the appendix and are unable to measure its function, we are not rashly to condemn it as devoid of worth. The position of the appendix at the junction of the small and large intestine is also noteworthy. The small intestine, as we know, is concerned almost exclusively in the digestion and absorption of solid matters from the food. The solid particles which are to be absorbed first by one side and then by the other of the *valvulae conniventes*, as they are waved to and fro (and so filled and emptied) by peristaltic action, must be kept in suspension. If fluid were taken up in the small intestine there would be no vehicle for the conveyance of the solid matter downwards, and vast and various changes would be needed in the structure of the alimentary canal. It is roughly computed that only 10 per cent. of the fluid taken by the mouth is absorbed before the *cæcum* is reached. In the ascending and transverse colon water is freely taken up, and the *fæcial* residue is stored, till a convenient moment for discharge, in the sigmoid flexure. The fore-gut prepares the food, the mid-gut digests and absorbs it, the hind-gut stores and expels it. The mid-gut extends from the second part of the duodenum to the left end of the transverse colon; and the function is so divided that the small intestine appeases our hunger, the large intestine slakes our thirst. It is known that fluid taken by the mouth speedily excites a wave of peristaltic activity in the lowest ileum. In cases of typhlotomy or of enterostomy, in which the *cæcum* or lowest ileum is opened, it can constantly be observed that the drinking of a little fluid excites a considerable disturbance in this region. I have elsewhere quoted instances to prove how excitable this

part of the bowel becomes in response to the swallowing of fluids. If the interior of the cæcum and the mouth of the ileo-cæcal valve be visible (as in cases of typhlotomy) the increasing activity of the appendix, when water or other fluids are freely given, can be constantly witnessed, and never fails to excite wonder and surprise.

It has been shown by Harvey Cushing, Gilbert and Domenici, and others that the bacteria in the alimentary canal are most numerous and of greatest activity at the junction of the large intestine and the small. Harvey Cushing has also shown that starvation will render sterile all those parts of the intestine which can be caused to empty. On the other hand, it is also well proven that the administration of any aperient medicine not only excites a greater tumult of activity in the small and large intestines, but that secretion is more profuse and the bacterial virulence throughout the canal is considerably augmented. These points also can be corroborated by the examination of the patients upon whom typhlotomy has been performed. In order that we may see the bearing of these facts upon cases of appendicitis, let me recount to you the type history of a patient attacked by this disease. The first symptom in an attack of acute appendicitis is pain. It is always pain, and never sickness or vomiting, nor malaise, nor any other symptom whatever. If pain should not be the inaugural symptom in a case of acute abdominal illness, the possibility of the appendix being at fault may definitely be excluded. The pain is absolutely abrupt in onset, it is of varying degree of severity, is often, indeed, usually at first referred to the epigastrium, but after the lapse of a few hours becomes, as a rule, distinctly worse in the right iliac fossa. The pain may be rapidly followed by a rigor or a sharp elevation in temperature, by

vomiting, and frequently by diarrhoea. A slight elevation of temperature occurs without exception in cases of appendicitis in the early stages. The symptoms one and all show a tendency to steady abatement if proper treatment is adopted, if the patient is denied food of all kinds, fluid or solid, and if aperients are strictly and sternly withheld. It seems to be the natural and instinctive desire of the mother, wife, or nurse in such a condition to administer forthwith a brisk purgative. It is held that something has "disagreed" with the patient, and the offending substance is to be sharply expelled. Castor oil is the usual remedy in the district where I practise, and it is administered unsparingly. It is no uncommon thing to be told that because the first dose was vomited (a most proper act of rebellion on the part of the stomach) a second, or it may be a third, has been given. A few hours after the aperient is swallowed, frequently in the early hours of the morning, the patient is seized suddenly with a new and more intolerable agony, vomiting occurs, and diarrhoea may be repeated. The abdominal wall becomes rigid, tenderness spreads rapidly across the lower part of the belly, and at last is everywhere present; the pulse rises steadily, and all the signs and symptoms of an acute peritonitis are ushered in without delay. When an operation is performed, a gangrenous appendix, very probably adherent near its attachment to the cæcum, is found, and the peritoneum, already extensively and severely attacked by an acute inflammatory process, replies to the insult by pouring out freely a thin, clear, sterile, and actively bactericidal fluid. It is now about seven years since I was first brought firmly to the conviction that in cases of appendicitis it is the administration of an aperient that is responsible for the acute

catastrophe of gangrene and perforation which ends in an acute peritonitis. I do not remember one single case that I have operated upon since in which it was not perfectly clear that the same sequence of events—pain, aperient, perforation—had occurred, and I therefore do not hesitate to say that in almost every instance of acute peritonitis due to the perforation of an appendix it is the treatment directed to the relief of the condition that is the cause of the serious and so often fatal catastrophe. The taking of a purgative medicine is something more than an impressive antecedent—it is, in my judgement, a definite cause. The only possible exceptions occur in those rare cases where direct violence gives rise to a rupture of the appendix or the laceration of the adhesions which enwrap it. In cases of appendicitis, however acute their origin may be, perforation followed by an acute general peritonitis does not seem to occur if no aperient is given and if absolute starvation is adopted from the first. The acute spreading or general peritonitis which occurs in this disease is due to treatment; it is a “therapeutic peritonitis.” I am quite prepared to learn that this emphatic statement is received with a shrug of doubt and the tolerant smile of disbelief, but if strict enquiry is made into the intimate details of the history of the cases I cannot think that my experience of this disease will prove to be singular. In appendicitis perforation spells purgation.

§ The facts that I have already stated show that the indications for treatment at the onset of an acute inflammation in the appendix are absolute starvation, so that all peristaltic activity in the intestine is quieted, and the bacterial virulence of the contents of the bowel greatly reduced. The administration of fluids, which must reach

the cæcum to be absorbed, and the turbulent action and the high bacterial malignity caused by an aperient are to be avoided. It is in the cæcum that bacteria are most prolific and most virulent, and the vast increase in both these qualities which comes from the giving of aperients is especially to be avoided when the appendix, which opens into the cæcum, is inflamed.

The theme, then, which I desire to expound in this connexion is that appendicitis is a disease which derives its fiercest activities from the means which are taken to treat it; that acute spreading peritonitis is rarely, if ever, the result of an untreated disease, and that it is the administration of aperients which transforms a simple disease into one of the most serious type. Peritonitis so arising is surely avoidable; the catastrophe is the result of misguided therapeutic activity.

I have come to the firm conclusion that, in spite of the undoubted advantages which may in many cases accrue from the starvation plan of treatment in acute appendicitis, early or instant operation is always desirable. If the surgeon, when he is called in consultation, hears that a purgative has been given, that alone should, in my judgement, decide him to advise an immediate operation. In children especially there must be no exceptions to this law. An acute attack in a child should always be treated surgically, for the usual signs and symptoms present in an adult are conspicuously lacking here. I make, and admit, no exception to the rule that in acute appendicitis in children urgent and early operation is essential. And by some means or another parents should be made to know that the dosing of children with aperients is an evil, and that they must put a check upon those "philo-cathartic propensities" which seem insepar-

able from motherhood. I would like to have the power to write in every nursery in the world in large letters, in the most prominent place, the two words, "Avoid aperients." Or perhaps the warning and appeal might be brought home a little more forcibly in an amended edition of nursery rhymes:

Perforation means purgation
With the appendix kinked and bad;
Both food and drink will worry him,
And aperients drive him mad.

To give aperients to children who have a "stomach-ache" is homicidal, yet so far as I can hear it hardly occurs to a mother or nurse to do anything but this the most disastrous thing of all. While I am speaking of this let me say that the evidence now appears to me conclusive that the "bilious attacks" of children, accompanied by pain of a griping or colicky character, by vomiting, occasionally by diarrhoea, by slight fever, and by headache, and ascribed to the greedy indulgence in "indigestible" foods, are nothing other than mild attacks of inflammation in the appendix. When an attack more severe than all the rest is plainly one needing operative treatment, and the appendix is then removed, nothing is again heard of the recurrent "bilious attacks." In these attacks, however, the appendix undergoes certain changes, for in my experience it is rare to find in operating upon cases of acute peritonitis, with gangrene or perforation of the appendix, that this structure is free from adhesion or obstruction. It is often difficult to deliver the cæcum openly into the wound, because adhesion of the base of the appendix about one inch from its attachment to the intestine is so often found. I believe it therefore to be the rule, both in children and in adults, that an acute attack

of inflammation of the appendix arises in an organ already diseased by reason of milder antecedent attacks, that perforation and the spreading peritonitis which it causes are almost invariably the result of the administration of aperients, and are, accordingly, preventable complications. There is here only one safe therapeutic rule, and it is "in all cases of abdominal pain, avoid aperients." It cannot be denied that in some cases of appendicitis in which the administration of an aperient has caused a perforation there is a history of one or many attacks having been relieved by the remedy which on this occasion has led to dire disaster. There is no difficulty in accepting and appreciating this statement. For there is little doubt that the manifestations of appendicitis are often due to obstruction in the lumen of this tube, and an aperient, by exciting an increased activity of muscular contraction, may at one time expel the obstructing material, and so give relief, and at another time, being powerless to overcome the block, may determine a rupture of the wall of the appendix at or behind the point of difficulty. If the general experience of others should coincide in these matters with my own, the conclusion must be drawn that in a very large proportion of the cases, probably I think in all, the serious complications of appendicitis could be prevented by a timely recognition of the disease, by absolute starvation from the first moment of suspicion, and by the strict avoidance of aperient medicines. But this state of perfection is not yet within sight, and we must accordingly be on the watch for those earliest signals which indicate that perforation has occurred and that peritonitis will be swift to develop. The most significant of all indications is indubitably abdominal rigidity. If a case of gangrenous

appendicitis is seen at the very earliest stage there will be universal rigidity and immobility of the abdominal wall, but the rigidity is appreciably greater on the side and over the area of the lesion. The earliest case of acute gangrenous appendicitis I have seen was one to which I was summoned by Mr. F. H. Mayo:

P., male, aged 36, on January 7th, 1909, had a sudden attack of slight abdominal pain, which did not abate during the day. On the morning of January 8th he was still suffering from an aching pain and discomfort, and was unable to take his usual breakfast. At 11 o'clock, as the bowels had not acted, he took an aperient, and a little later a dose of Apenta water. During the afternoon he tried to attend to business, but had to return home. At 7 P. M. he took a little hot soup, and at 7.30 was seized with a most agonizing attack of abdominal pain, which prostrated him. His father, hearing him cry out, went upstairs to his room and found him lying on the floor, unable to raise himself. Mr. Mayo saw him within a few minutes, and I was in the house at 8.30 P. M. The patient was in great pain, and was huddled up on a couch, the thighs flexed on the abdomen. The pulse was 90; the abdomen was everywhere resistant, but was intolerably sensitive over the right side. The abdomen was opened in a nursing home between 9.30 and 10 P. M., and the appendix was found very much swollen and injected in its distal end. The veins in the appendix and in the mesentery were thrombosed. There was an obstruction in the lumen of the appendix about 1 in. from the cæcum.

This case showed that the sudden onset of thrombosis of the vessels of the appendix, as of the vessels in the enteric mesentery, is indicated by a sharp attack of prostrating pain, and by the instant setting up of a barrier of firmly contracted muscle, to act both as a protection and a splint.

The sudden onset of acute intolerable pain and the development of tense muscular rigidity in the whole belly wall—these two signs and these alone enable one

to say that a serious lesion has occurred in the abdomen which for its most certain relief will need the intervention of the surgeon. A rapid pulse is never present, so far as we know, within the first two or three hours; in all the very early cases I have seen of perforation of any viscus the pulse at first was under 90. The alteration in its character and rapidity are, however, not long delayed, and a steadily augmenting rate, the pulse adding a few beats more hour by hour, is most significant. Nausea, vomiting, and diarrhoea may all be present, but hardly add anything of value to the other features of the disease. A strained and alert anxiety is noticed in the expression, and the breathing is rapid and shallow, and of the thoracic type. The diaphragm is as loath to move as the other muscles with which it forms a wall around the peritoneal cavity. It is, however, never held at first in so firm a contraction in cases of perforative appendicitis as in cases of rupture of the stomach or duodenum or gall-bladder—lesions which are, of course, in closest proximity to it. This is another example of the fact that muscular rigidity, though universal, is most strongly developed in those parts which are most in need of rest and protection.

The catastrophe which in point of frequency comes next to appendicitis is concerned with the perforation of an ulcer of the stomach or of the duodenum. Of these ulcers there are, it is said, two types, the acute and the chronic. The acute is probably toxæmic in origin, and appears when an infection, generally of an unusually malignant character, is present in one part or another. In the course of typhoid fever, in cases of burns and scalds, in acute bullous pemphigus, in pneumonia, in cases of septic infections following operations or independent of

them, and in erysipelas and the like disorders, an acute ulceration of the stomach or of the duodenum, attended by hæmorrhage and perhaps proceeding to perforation, may be found. The frequency with which these ulcers are present in all periods of life is considerably underestimated. For example, Helmholtz,¹ by devoting his attention to the subject of duodenal ulcer in children, found in six months as many examples as were contained in the whole literature up to that time. In approximately 50 cases of perforating ulcer that I have had under my care, once only has an acute ulcer been found. In the rest the ulcer has been of the chronic type, and it has for months or years declared its presence by the production and perpetuation of symptoms as to whose significance no doubt ought to have been felt. Not only does the ulcer which at last ruptures into the general peritoneal cavity give clear and sustained evidence of its presence, but in the few days or weeks preceding the final rent it often declares its greater activity and more pressing danger by a considerable exacerbation in the severity of the symptoms.

It is by degrees becoming more generally recognized that chronic ulcers of the stomach and of the duodenum are conditions that can be diagnosed with an approximation to accuracy which, though it leaves much to be desired in the case of the former, is almost exact in the case of the latter. And increasing confidence is being displayed in the view, which some among us have long expounded, that chronic ulcers are in all cases in need of surgical treatment. We may accordingly have reasonable expectations that with earlier and more confident diagnosis and with a speedier resort to operative measures, the final and often long-deferred catastrophe of perforation in a chronic ulcer may be wholly avoided. Whenever a patient

who has complained at intervals of indigestion begins to suffer in the present attack more acutely than in an earlier one, the signal of impending perforation is being raised and the clear warning should by no means go unheeded.

At the moment when perforation occurs there is the most agonizing and unendurable pain. Patients will afterwards say that there is no pain so horrible in its torture as this. The least movement seems to add something to its severity, so that a patient will perhaps remain for hours almost without stirring. A medical man upon whom I operated told me that the perforation had occurred while he was crouched on his hands and knees in bed in a position which seemed to relieve his pain. When the rupture of the ulcer took place he could not move to reach the bell, and had to wait motionless until help came to him in the early morning. The tense rigidity of the whole body is in striking contrast to the ceaseless unrest of a patient who is suffering the agony of hepatic colic. In him a constant change of position and of pressure seems in some measure to cause abatement of the pain, or, at least, to be imposed upon the patient in the search for relief that never comes. The abdominal muscles are found to be in a condition of inflexible rigidity, but even here some difference in the various parts of the abdomen can be felt. Over the ulcer the stiffness is of the most obdurate character; one might almost think that a disc of metal replaced the supple muscle. This local increase of a general resistance is most definite and distinct, as a rule, and it affords a decided help not only in the diagnosis of the lesion but in its location. The patient's expression is of one who is terror-struck. The approach of a hand to the abdomen for the purposes of examination is quickly resented, and the most piteous

appeal for gentleness is made. The breathing is short, jerky, and shallow, and the patient may indeed cry out that he "cannot breathe." This is due in part no doubt to a spasm of the diaphragm, and in part also, I believe, to that great overdistension of the stomach which is so commonly seen when the abdomen is opened. Though the patient looks generally ill—with pallid face, staring eyes, and sweating brow—the pulse will be found at the first to be hardly altered in frequency or in volume. This is one of the surprises which must not fail to be recognized and remembered. I have often been told by medical men that at the first view of a case they could hardly bring themselves to believe in the occurrence of a perforation, since the pulse was so tranquil and full; and in a case I saw some years ago with Dr. Carlton Oldfield, we deliberately postponed for a few hours any question of operative treatment because the pulse, in rate and volume, was normal. Unhappily, this fact of the unaltered pulse-rate is even now not generally recognized; accordingly delay, which is always serious, may occur. The pulse increases in frequency and depreciates in value very soon, but this is due not to the perforation but to the peritoneal contamination which is the inevitable sequel. No one has any difficulty in recognizing the presence of peritonitis, but our aim must always be to discover at the moment of its occurrence the lesion to which the peritoneal infection is secondary. The symptoms and the signs of the perforation of a hollow viscus are not those of the peritonitis, which make haste to develop.

Among the catastrophes to which attention has been especially directed within recent years, the most remarkable, from many points of view, is that which involves the pancreas in an acute inflammation. For some time after

the remarkable paper by Dr. Fitz in 1889, the condition of "acute hæmorrhagic pancreatitis" was believed to be of great rarity; but, as in so many other cases, the recent investigations of the surgeon have shown that infrequency of occurrence meant inadequacy of observation. I have operated upon 11 cases of the most acute kind, and 7 patients (the last 6 in succession) have recovered. Of the less acute cases which pass over the initial stage, to be operated upon some days or weeks later, I have had several more.

The onset of pain in acute pancreatitis is usually sudden; a moment before the patient may have been going about in comfort, conducting the ordinary affairs of the day. The absolutely instantaneous onset of the very severe pain is constant, but some of the patients will say that they have been conscious for a few hours, or it may be for a few days, of a sense of discomfort or milder pain in the upper part of the abdomen. About one-third of the total number of observed cases have occurred in patients who were the subject of recurring flatulent dyspepsia. The patients are generally stout; women are affected slightly more than men, and pregnancy would seem to be a factor of some importance in the causation. The intense pain, then, is sudden in onset, is confined within the abdomen to the upper portion, but passes almost always through to the back; it is agonizing beyond endurance, and is not seldom the cause of fainting or a profound collapse. The face is drawn and white, though the lips are often blue. In many of the cases I have seen there has been a curious leaden colour of the whole face, a slight but unmistakable and I think characteristic cyanosis. Halsted, an early and shrewd investigator, pointed out that lividity of the face and abdominal wall was often a striking feature of these

cases. The whole appearance and attitude of the patient suggest that death may be imminent, for the extremities are cold, the heart beats with great rapidity, and the quality of the pulse is poor. Vomiting is an early symptom, is frequently repeated, and may last for days or weeks if the patient should survive so long. The food that has last been taken is the first to be ejected; afterwards all the vomited matters are deeply stained with bile, and pure bile, to all appearance, may be brought up in large quantities. This has suggested in several cases a diagnosis of high obstruction in the jejunum. The patient, as will be grasped from this description, presents the aspect and the symptoms of profound poisoning; and the researches of Gulecke, Egdahl, and others make it appear probable that the toxic substances are produced as a result of the digestion of the pancreas by its own escaped secretions. The abdomen, when examined early, presents the most indomitable rigidity and some fulness in the upper part; the remaining parts may be quite soft and flaccid, yielding readily to the hand, or they may be held with some degree of firmness. The upper portion of the abdomen, the epigastric region especially, never ceases to offer the most incoercible resistance, and, however gentle the examination may be, it is grievously resented and is repelled at the earliest occasion. When the records of published cases of acute pancreatitis are studied, it is seen that the number that have been correctly diagnosed before the operation is extremely small; yet I am confident that the symptoms are of such a character as to make a recognition of their cause a matter of very little difficulty. Briefly to recapitulate, there is, perhaps, in a patient inclined to stoutness a history of antecedent dyspepsia which presents nothing

of the characteristic features of duodenal or, indeed, of gastric ulceration, but which suggests rather the presence of stones in the gall-bladder, and jaundice may have been noticed on one or many occasions. The severe pain comes quite suddenly, is beyond the limits of human fortitude to withstand, is associated with collapse of a profound character, and may cause the patient to swoon. The limbs are cold, the pulse extremely poor, rapid, and thin, or even hardly to be felt and not to be counted. The face may be cyanosed. The upper part of the abdomen is exquisitely tender, and all the muscles there offer the most resolute resistance to any examination. Vomiting is an early and often a conspicuous feature. I do not think a group of symptoms at all similar is to be found in any other form of abdominal calamity. There can be no doubt that, as in the case of perforations of the stomach or duodenum, recovery may follow an attack of acute pancreatitis. Every now and again I find the evidence of this in the abdomen. Very extensive fat necrosis in or upon the pancreas, and in its immediate vicinity, is to be seen, and the pancreas itself may show the remnants of old hæmorrhages or contain a cyst, an abscess, or a slough. But these occasional survivals cannot impugn the fact that the safest course here also lies in early operation upon the lines first followed by Dr. Ramsay of Bournemouth. I have recently operated upon a case of acute pancreatitis with Dr. Macklin of Whalley, who had the fortunate opportunity of seeing the patient within a few minutes of the onset of the severe pain. He has kindly written for me the following very graphic account:

The patient was a lady, aged 54, of stout build. When summoned to her, about 3 p. m. on December 7th, 1910, I found the

patient verging on collapse, suffering great pain, and vomiting freely. The vomit was evidently partially digested food of which she had partaken very heartily an hour or two before. There was no relief from the vomiting, and the pain was aggravated on assuming the recumbent position, which I induced her to adopt, and almost immediately she had to resume the semirecumbent position in which I had found her. From the first the pulse was very rapid and very faint and the respiration very shallow and sighing. In about a quarter of an hour or so she became almost pulseless, the features very pinched and pale, although there was a suggestion of cyanosis in her appearance. At this point ether was injected hypodermically, as she appeared to be about to die. The effect of this was seen very quickly as the pulse began to improve and the colour to return to her face. Soon after I had the patient removed to a couch, but she could not assume the recumbent position without aggravating the pain, which had begun to abate in some degree by the time. In the meantime the vomiting had diminished in frequency and profuseness, although from time to time a small quantity of fluid came up which was mostly water (of which she drank from time to time) stained with bile. Previous to my arrival the patient had had brandy, and some more was given by my instructions during my brief temporary absence to procure the ether. About two hours after the beginning of the attack she was removed home, less than a mile off, by motor and put to bed, which had previously been prepared for her reception. On examining the abdomen there was some considerable distension generally found, but more pronounced in the epigastric region, where there was great tenderness, so much so that the patient could hardly bear the slightest attempt at pressure. The lower part of the abdomen was very flaccid and not at all tender. Pain continued very severe and vomiting continued more or less frequently, but in all very small quantities. The pulse became very irregular and weak after the temporary increase during which she was removed home. The degree of prostration continued so great that I considered it advisable to inject an ounce of brandy per rectum from time to time during the night. About 4 A. M. I left her, as the severity of the symptoms had abated somewhat and the pulse had become more regular and stronger, but I felt it safer to leave a hypodermic with ether and strychnine with

the nurse in case of emergency. At 9 on Thursday, the 8th, I found the patient still complaining of much pain and still vomiting at intervals, but otherwise better, wherefore I injected $\frac{1}{8}$ grain of morphine, which induced after a short time a few hours' sleep. Towards nightfall the patient began to complain of pain again, but more of a dull aching character, which was felt almost entirely to the left side, passing through to the back and shoulders. There was less tenderness on palpation, the abdomen was still tense, but no peritonitis was present; vomiting recurred, similar in character, but small in quantity. Towards Friday morning, the 9th, the character of the vomit changed, and it became more abundant in quantity. The vomit consisted of a dark green looking fluid which had a suggestion of "coffee grounds" about it.

At the operation we found wide-spread fat necrosis, especially in the upper part of Morison's pouch on the right side, an enormous enlargement of the pancreas, which was like a phlegmon, and a deep purple engorgement of the gall-bladder. Cholecystotomy was performed, and thick black bile drained from the tube for two weeks; two drains of rubber tissue were also passed down to the pancreas. The patient made a most excellent recovery.

So far as my own experience goes, the only other abdominal emergency in which there occurs a profound collapse, with instant lowering of the blood-pressure and a general depression of the circulation, is dependent upon the rupture of a tubal gestation. But in a number of cases of this condition which I have treated I have only once felt any slightest doubt as to the diagnosis, and that was in a case which occurred twenty years ago, at a time when the diagnosis of abdominal diseases could not be made with that confidence and accuracy which we possess to-day. The history in cases of ruptured tubal pregnancy is characteristic. The patient is generally between the ages of 20 and 40, and one menstrual period has been

missed. About two or three weeks after the time at which the period should have occurred (sometimes, though rarely, even later than this; in one of my cases over ten weeks after) there is a slight vaginal discharge of blood, and almost at the same time an attack of severe abdominal pain, followed very speedily by pallor, faintness, collapse, air-hunger, sighing, restlessness, and all the symptoms of great loss of blood. The pain is acute, but does not even remotely approach in intensity that which is present in the conditions I have already described. The patients, indeed, usually say that they feel as if "something had given way" or as if "something had burst" within the body. The abdomen becomes full, especially in its lower half, where a feeling of tumidity, of "doughiness," is often present; and occasionally one side is more tender than the other. Resistance to the examining hand is not present. The muscles, it is true, may be in some degrees tightened by reason of the sudden increase in the contents of the abdomen, but the stubborn and unchanging muscular rigidity of the other catastrophes is never present in this. In a few of my cases there has been, as it were, a miniature attack of this kind before the formidable and final seizure has come; such are due, no doubt, to little leakings from a tiny rent, whose edges are presently torn widely asunder to give vent to the profuse bleeding which is taking place. It is, I think, quite impossible for any one now to mistake this clinical picture for any other; the correct diagnosis should always be easily possible.

The crises that develop in the course of cholelithiasis are exceedingly few. In more than two thousand gallstone cases I have only twice met with a sudden rupture of the gall-bladder, only thrice with acute phlegmonous

cholecystitis, and only once with acute gangrene with perforation of a common bile-duct, which was completely occluded by a large stone. The attacks of hepatic colic, especially those which are due to the temporary impaction of a calculus in the cystic duct, are terrific in severity, but they are not lethal; the agony is almost unendurable while it lasts, and the very extremity of endurance is reached, but the danger to life is quite inconsiderable. The acute cholecystitis which results will almost without exception subside in the course of a few days, so that a deliberate operation can then be undertaken with every circumstance of care. That which chiefly distinguishes a patient suffering the torture of colic, whether hepatic, renal, or intestinal, from one in whom the perforation of a hollow viscus has occurred, is his ceaseless agitation and unrest. The former patient tosses and throws himself about, writhes on the floor or the bed, doubles and twists himself in the constant effort to get ease; the latter at the moment of the catastrophe seems to be struck motionless, and for hours may be hardly able to breathe or stir. However acute the torment of hepatic colic, there does not seem to be any rigidity of the abdomen except in the immediate region of the gall-bladder. All other parts are supple and free from any tenderness. A rigor, or a brief shudder, with only a trivial increase of temperature, is seen not infrequently in cases of incipient cholecystitis. When perforation takes place the temperature always falls. In all my hospital experience I have only known one case of hepatic colic sent in as a case of perforated gastric ulcer, and in that case there was also a subacute pancreatitis, for when an operation was undertaken some days later recent evidences of fat necrosis were to be seen.

Whenever the surgeon is called to see a patient who is

believed to be suffering from an acute abdominal catastrophe he must bear in mind the possibility of the mimicry of this condition by a lesion above the diaphragm, an acute pneumonia, an acute basal pleurisy, or an acute pericarditis. In all these diseases in their earliest stage there may be severe pain, and some rigidity of the abdomen, more especially in the upper parts, and the resemblance to the conditions in an acute abdominal disease may be very close. In thoracic diseases the respirations are quickened out of all proportion to the rapidity of the pulse rate. If the respirations are more frequent than one-third of the pulse rate, a pulmonary lesion should always be suspected. In thoracic diseases there is almost always some elevation of temperature; in abdominal catastrophes there may be a normal or subnormal temperature. In the acute abdominal conditions already described the rigidity of the abdominal muscles is of the most extreme degree; in the thoracic conditions there may be stiffness, which is superficial and readily overcome; there is little or no tenderness, and often much relief from a degree of pressure, which if the abdomen were affected would be quite unbearable.

These are the chief among the various and most serious forms of calamity that occur in connexion with diseases of the abdominal viscera. Of all such it is true to say that they should rarely be allowed to occur. We are now able to recognize with rapidly increasing accuracy the correct interpretation of many symptoms formerly ascribed to "functional" causes. We are quickly being brought to realize that those recurring symptoms formerly supposed to indicate some vice in the action, some change in the secretion, or some disorder in the sensation of an abdominal organ, are in reality due to a perceptible alteration in

its structure, and that though medical treatment and continued watchful care may allay for a longer or a shorter time the symptoms which such organic diseases arouse, surgical treatment alone is capable of giving complete and lasting relief. And so it would appear certain that by efficient treatment of the chronic disorder the acute emergency for which it is surely responsible will be forestalled. Yet still the need remains, not only that we should learn to evade the catastrophe whenever possible, but also that we should recognize with fullest accuracy all those manifestations which swiftly develop when once the crisis has occurred. We must free ourselves from the tyranny of the text-book, which still chiefly deals with terminal events, and make certain that we know the essential difference between the signs and symptoms of the primary catastrophe and those of the various complications which finally develop. We must have a conception of abdominal diseases which is radically wrong if we do not realize that the exigencies which spring up so quickly and prove so serious are each one of them a very heavy rebuke both to our power of early diagnosis and to the resources of medical and dietetic treatment.

CONCLUSIONS

What, then, are the conclusions of the whole matter that we are entitled to draw? They are, I think, as follows:

1. The catastrophes which occur within the abdomen are not, strictly speaking, "acute"; they are, on the contrary, usually the result of the abrupt transition from a quiescent to an acute phase in a disorder of long standing.

2. An acute emergency can, therefore, be prevented by a timely recognition of the value and the significance of

the early symptoms, so often ignored or misunderstood, of the chronic malady in which it is the final development.

3. The occurrence of a sudden attack of intolerable agony in the abdomen, associated with tense rigidity of all the abdominal muscles, indicates that there is an acute lesion which needs immediate surgical attention. These two signs, and these alone, are an urgent warrant and compulsion to us to treat the case at once by operation.

4. A different diagnosis is generally possible if strict attention be paid to the details of the anamnesis, and if the firm abdominal wall be searched for a tender area of supreme resistance.

5. The perforation of a hollow viscus is indicated by the rigid immobility of the patient. Colic causes ceaseless unrest.

6. Shock is not a symptom of perforation, for in the early hours after this disaster has occurred the pulse is very little altered in volume or in rate.

7. In all cases of abdominal pain, especially in children, the use of aperients should be avoided.

REFERENCE.

- ¹ *Archives of Pediatrics*, September, 1909.

THE GIFTS OF SURGERY TO MEDICINE

The annual address in surgery delivered before the British Medical Association:

MR. PRESIDENT, LADIES, AND GENTLEMEN: The choice of the title for the address which I have the high honour to deliver must not lightly be held to indicate that I admit any difference between the essentials of medicine and surgery. The two sciences or arts are not in the remotest particular antagonistic; rather is it true to say that they are indeed one and indivisible, and that the separation between the two aspects which are presented to us is due to the limitations of the human intellect alone. It has been too long the custom for surgery to be divorced from medicine, for the problems of mind and of hand to be considered as distinct from one another. Happily, owing to the work which has been done in recent years, opportunities have abundantly been afforded for demonstrating the power of surgical research to enlarge the scope and to enrich the knowledge of many of the problems of internal medicine. By a study of what I have ventured to call the "pathology of the living" a very profound change has by degrees crept over our knowledge of almost every form of chronic abdominal disorder.

POST-MORTEM ROOM STATISTICS

In the earlier years of the nineteenth century an acquaintance with the morbid processes attacking internal organs was based upon two sources of information only—upon an inquiry into the details of the clinical history of

any disease as it developed, waned, or progressed, and upon the examination of the parts involved after the death of the sufferer.

I have endeavoured to show, on more than one occasion, how impossible it is to measure the sufferings of patients during their lives, or to assess their chances of death from any disease, by a consideration of the statistics gathered from the post-mortem room experience. People do not die in hospital from the chronic diseases from which they suffer during life. It is, so far as the surgical side is concerned, the acute terminal infections, malignant disease in all its forms, especially those lending themselves to surgical consideration, and the accidents of civil life, that supply the bulk of the material upon which the pathologist makes his observations. The statistics of Brinton and Welch, for example, two of the very ablest men ever engaged in medical work, upon gastric ulcer—statistics that meet one at every turn of the page in the literature of this subject—are, in my view, almost without value. For the observations were not made entirely by themselves alone, but by a number of observers of differing capacity working in distant places under diverse conditions. There could be, therefore, no common denominator; there was nothing by which the values of recorded figures could be made equal. And it would be futile to suppose that the patients who suffer from duodenal or gastric ulcer during life are adequately represented, in point of number, by those who die from these conditions in the wards of a hospital, or by those in whose bodies the traces of old, and perhaps quite inconspicuous, scarring or ulceration are discovered. We shall not, I hope, hear much in the future of post-mortem statistics as the guides or dictators of our opinions as to the maladies of the living.

THE SURGEON'S POSSIBILITIES OF DIAGNOSIS IN THE
LIVING

When the great gift of America to humanity—the discovery of the anæsthetic power of ether—was brought to the aid of the operator, vast possibilities were at once apparent in the range of the surgeon's work. But the dread of infection—indeed, the certainty of infection—held his hand for more than a generation, till the work of the greatest man our profession has ever produced, Lister, made the dream of the surgeon come true, made it possible for him with safety to carry through many procedures which before had been impossible. More than this, the chance was given to undertake the treatment of diseases which had formerly run their hasty or lingering course unchecked. Little by little our scope then widened. Acute conditions were at first attacked, perforations of the hollow viscera, gangrene of the appendix, hæmorrhages from the bursting of a tubal gestation, and so forth. By degrees the impression grew that such acute catastrophes were but final stages, terminal events in the history of diseases whose presence and course were betrayed by symptoms which were clear and often characteristic. When these conditions were approached surgically in their earlier and more quiescent periods the results of operations were at first not very satisfactory. Crude methods and imperfect technique left legacies of trouble behind them. The mortality was high, and remote results were rarely ideal.

It is interesting now to recall the clumsy manifestations which attended such operations as cholecystostomy or gastro-enterostomy in the days of their infancy. Owing to the labours of Senn and of Murphy simpler methods began to find a place. The bone-plates and the button

showed how little was really necessary to secure firm and permanent union between well-clad peritoneal surfaces. Though these instruments are now discarded entirely, to all of us the lessons learnt from them were most important and most necessary. But for them we should never have realised as we do to-day how speedily and how simply those manipulations can be carried through with precision which before had occupied two or three hours and had involved the separate introduction of 200 or 300 stitches. In surgery complexity of procedure indicates defect in method. The search in all our work is for the simple way. In surgery, as in other arts, simplicity is the supreme virtue. Our unceasing efforts in technique are to discover what may safely be left out.

THE ASSOCIATION OF ABDOMINAL DISEASES POINTING TO A COMMON CAUSE

As we began to recognize, almost unconsciously, the ease and sufficiency of the simple mode, the mortality from all operations fell rapidly. So it became a safe and customary procedure not only to deal with the particular lesion which had demanded attention but also to investigate the conditions of adjacent organs. And there surprising developments awaited the inquirer and rewarded his eager search. Conditions other than those which needed immediate attention were found to exist with no little frequency. In diseases of the stomach or duodenum the gall-bladder was found not seldom implicated also; in diseases of the latter, as of the former, the vermiform appendix seemed often to play the part of an infecting agent. And so by slow degrees the conviction was borne in upon us that these diseases I have named did not stand in rigid isolation, one separate entirely from the other, but that

their association was so frequent as to indicate the strong probability of some underlying primary cause. Infection, it was soon asserted, whether carried by the blood-stream, by the lymphatics, or ascending, as Bond has shown with great clearness, along the mucous canals, was the prime evil. Differences of opinion were soon declared, and still continue, as to the source of the infection. To many of us the quiescent inflammatory lesions of the appendix seem the most potent and the most persistent of all. Arbuthnot Lane, as I shall presently state more fully, holds firmly to the belief that the infections for the diseases I have named, as of many others, have their origin in the intestine, large or small. And his views are sustained by him with quiet and characteristic courage, and with a record of results that compel attention even from the most sceptical.

A DEBT OF SURGERY

To the surgical assault we made upon our patients for the purposes of this study of the "pathology of the living" there was one serious objection. After all abdominal operations some pain was felt. Not very much in the ordinary appendix cases, a little more perhaps in the gastric cases, and certainly more in the patients who had submitted to operations upon the biliary tract. The pain was rarely very severe, but it called often for the administration of a small dose of morphine, and it was certainly enough to constitute a blemish upon our artistry. Further than this, it was noticed that after an operation involving a handling of the parietal peritoneum, even so slight a manipulation as the separation and ligation of a hernial sac, the patient complained of flatulence, which, in the more severe cases of abdominal exploration and handling, was severe and most distressing. It had long ap-

peared quite certain to me that the condition described by the patient as "flatulence," the "gas pains" of the American surgeon, had really little or nothing to do with gaseous distension of the intestines. There was a feeling of "fullness" to the patient; but often no recognisable inflation of the intestines when an examination was made, nor was any real relief obtained by the expulsion of gas. Flatulence, I felt convinced, was the name given to a condition which depended upon trauma, or the rough handling of the parts engaged in the operation. Happily we are now able to make certain that any operative procedure in the abdomen can be carried out thoroughly without the infliction upon the patient of any intolerable pain and without his being caused to suffer severe flatulent distress afterwards.

ANOCI-ASSOCIATION

Crile has enunciated the principle of "anoci-association." He has shown that in the condition recognised as "shock" definite and demonstrable changes occur in the cells of the brain, which have discharged all the energy they had stored. This exhausting discharge of nervous energy is due to that excitation which is caused by the infliction of numberless injuries, each of them small, or to the infliction of one overwhelming impression. When an operation is performed under ether anæsthesia, the operator may delude himself into the belief that because his patient lies unconscious, and apparently unresponsive to any hurt, therefore no damage to his nerve centres is possible. But ether anæsthesia does not put all the brain to sleep; the larger part, and by far the more important part, is awake and staring, ready to be acted upon, and to be injured, just as easily as if the patient were awake. The fact that some operators produce little constitutional dis-

turbance, little shock, by the performance of an operation which at the hands of another causes very serious collapse, is not due to differences in the patient, in the anæsthetist, in the method, or in anything else but the surgeon himself. There are surgeons who operate upon the "canine" principle of savage attack, and the biting and the tearing of tissues are terrible to witness. These are they who operate with one eye upon the clock, and who judge of the beauty of any procedure by the fewness of the minutes which it has taken to complete. There are other surgeons who believe in the "light hand," who use the utmost gentleness, and who deal lovingly with every tissue that they touch. The former type of operator is described by Crile as "carnivorous"; the latter type is nowhere better exhibited than in his own work. The scalpel is, indeed, an instrument of most precious use—in some hands a royal sceptre; in others but a rude mattock. The perfect surgeon must have the "heart of a lion and the hand of a lady"; never the claws of a lion and the heart of a sheep.

The brain, then, under ether anæsthesia is in great part wide awake, appreciative of stimuli, and in part responsive to them. During any surgical operation, Crile assures us, there is, in reply to every incision, every pull of the retractors, indeed to every physical contact, a change in the pulse, the respiration, and the blood-pressure. Every surgeon conversant with abdominal work knows how a rough handling will cause tension in the muscles and deepen the patient's breathing, making loud and stridulous the expiratory effort, as though the victim were groaning in his agony. No general anæsthetic, it is clear, can shelter the brain from the assault committed upon it by the injuries inflicted during an operation. Crile has therefore suggested that by means of local anæsthetics—

novocaine for the skin, quinine and urea for the parietal peritoneum—a barrier can be erected around the area to be operated upon, so that no nerve impulses can be conveyed from the territory so isolated. The field of operation, that is to say, may be temporarily disconnected from the brain, not only at the time of operation, but for periods of one to five days subsequently. The operation then is conducted in an area which, for the time being, does not belong to the patient, which he cannot reach by any impulse directed towards it, and which can be dealt with as the surgeon wishes without the patient having any power of receiving impressions from it.¹

But this is not all. Shock may be produced not only by physical violence, but also by psychical disturbances, by emotional excitement, by the receipt, for example, of good or bad news or by fear, the suspense and the trials of some great ordeal. By many patients their submission to an operation is viewed with dread and apprehension. In order that the best results should follow upon our work it is necessary that every consideration should be shown to a patient, and every proper regard to his wishes; every encouragement should be offered, and the impression forced upon him that all those engaged in the operation or his after-treatment are working strenuously to the one end—his assured and rapid recovery. The fears which hover round the last hour before an operation are greatly modified by the administration of a small dose of morphine with scopolamine. A happy frame of mind is thereby induced, and very little nitrous oxide gas is required to put the patient soundly to sleep. The memory of the conveyance of the patient to the operation theatre and of the administration of the anæsthetic is often abolished by

¹ *The Lancet*, July 5, 1913, p. 7.

these measures. This is, in brief, the method of Crile, which I have used for many months, and which has added a pleasure to my work that is really immeasurable. To the great discoveries of Morton and of Lister this of Crile seems to be the fitting completion.

Several interesting side issues have developed as this procedure has become more widely practised. The most striking of all improved results is seen in the treatment of exophthalmic goitre. In England we see little of this disease, and very few operations appear to be necessary. In America, where the days are more strenuous and the rush of life more eager, operations are more often and more urgently needed. After such operations it was no uncommon thing to find that the patient suffered profoundly from "shock," and the heart beat so rapidly that it often seemed to be galloping to death. After an operation conducted by Crile's method the emotional activities of the patient are undisturbed, and within a few days his whole appearance and condition undergo a striking change for the better. "Aseptic wound fever" is almost certainly due to psychical factors.

EARLY SYMPTOMS AND LATE SIGNS

Equipped with these new powers, due to the three discoveries of ether,¹ of antisepsis, and of anoci-association, the surgeon has been empowered to conduct his investigations into the conditions of disease in an entirely novel manner. Half a century ago a patient who was suffering from any form of abdominal disorder could not do more than describe his symptoms in detail to his medical attendant. He could not lend his body to inquiry, and no

¹ I say nothing of chloroform, for I dislike and fear it intensely and use it hardly at all.

investigation of the parts concerned in his disorder could be conducted until after death. Death might occur from the final stages of this same disease, or more often from some intercurrent and independent malady. It was difficult then for the pathologist conducting an examination of the body to make the symptoms and the signs tally, for at this stage they had probably ceased to correspond one to another. The final ruin of an abbey tells us nothing of the domestic habits of the monks who found shelter within its once unbroken walls. The ultimate devastation in a lesion of the stomach, such as is seen on the necropsy table, tells us nothing of any value of those early wanderings from the normal condition which the same parts had once displayed. Terminal events may seem to have no connexion, or at best a very remote one, with the early changes of which they are the outcome. All the knowledge our forefathers possessed of the power of organic changes to cause clinical symptoms depended upon an inquiry into those changes when they had reached the last stage in their career. This last stage might be disastrous, as in the case of a chronic ulcer of the stomach which had led to cancer; or it might be inconspicuous, as in the case of a duodenal ulcer which had healed, as such ulcers sometimes will, without leaving any scar, or only such as the pathologist in his haste may overlook. So all was confusion. Two incompatible things were considered side by side—early symptoms and late signs. When we consider the crushing disadvantages under which our forefathers worked it is amazing to find how much they did, and with what accuracy they had solved many problems. The most conspicuous example of this extraordinary insight into abdominal diseases is, I think, afforded by the work of Brinton, whose books on "Diseases

of the Stomach" and on "Ulcer of the Stomach" for wide observation, profound and cogent reasoning, and beauty of language have never been challenged by those of any other writers. But with the new methods to which I have referred the study of the pathology of the living became possible. Symptoms recited at the moment could be ascribed to the lesion disclosed by the operation in the precise stage of its existence in which it was capable of arousing those symptoms. The history of abdominal surgery in the last ten years is the tale of the lessons that were learnt.

The most considerable revolution has occurred in connexion with our inquiry into the condition of "dyspepsia." To any who have no acquaintance with their works I can hardly imagine a greater intellectual delight than to read what Brinton, Johnson, Sir Thomas Watson, and other early fathers have written upon the subject of dyspepsia. With perfect accuracy of observation in many instances, with supreme mastery of English in almost all, they tell the story of many of the forms of dyspepsia. But none of them realised, as we by degrees have come to learn, that dyspepsia is so often a manifestation not of a nervous or functional disorder, but of a real organic change. The story of how this all came about may bear retelling.

In the early days of gastric surgery operations were undertaken either for the relief of patients afflicted with carcinoma, after the methods laid down by the great pioneer and master, Billroth; or for the treatment of cases of pyloric obstruction by the operation of gastro-enterostomy, suggested in a whisper by Billroth's assistant, Nicoladoni. Of cancer I have at this moment nothing to say. In cases of pyloric obstruction the operation gave results which were quite amazing in their character and rapidity.

Patients, emaciated almost to the last degree, unable to take more than the most meagre of meals, afflicted with copious vomiting at intervals of only a few days, became in two or three weeks happy mortals, with keen relish for food, which gave no unease, and which was retained without difficulty. Many patients underwent a veritable resurrection; one of my patients weighed 51 lbs. when operated upon and a few years later weighed 131½ lbs., and in several instances I have known the weight to be doubled.

“GASTRIC ULCER” IN THE RIGHT ILIAC FOSSA

So marvellous were these results that the eager activity of surgeons led them to employ the same method in other cases of “gastric ulcer.” Patients who for years had suffered the misery or the martyrdom of indigestion readily submitted to any operation offering a prospect of relief. But it soon became apparent that the results were not so brilliant in the later as in the earlier cases, and the dreadful mistake was widely made of accepting the diagnosis of “gastric ulcer” as positive in all patients who presented the symptoms which the text-books of medicine had told us were pathognomonic of the disease. Patients who suffered from pain, vomiting, and hæmatemesis were held to be the victims of “gastric ulcer,” and for gastric ulcer the approved surgical remedy was gastro-enterostomy. Little by little the truth dawned upon us that “gastric ulcer” was a perilous diagnosis to make. For, with whatever confidence the existence of this lesion was predicted, disappointment and dismay followed fast upon the investigation of the parts. The stomach in these cases often showed no trace of that hard white scar which we knew must indicate the site of an ulcer of old

standing. For a long while we were at a loss to know what the cause of the symptoms might be, when all the stomach walls and the duodenum appeared healthy. The scope of inquiry in such patients was therefore widened, and the discovery made which excited the deepest disbelief in the minds of many and which still meets with incredulity—the discovery that in the majority of cases which come to an operation a “gastric ulcer” has its place in parts other than the stomach.

There is now no longer any doubt in my own mind that the commonest site of a “gastric ulcer” is in the right iliac fossa. That is to say, that in the majority of cases in which the most erudite teaching of the most astute German physicians would justify or compel a diagnosis of ulcer, the patient is suffering from a lesion elsewhere, and more often than not from a lesion in the appendix. The appendix may present a variety of conditions, but they are all alike in one particular—they are all obstructive in character. Infection and obstruction together, or apart, as Sir Bertrand Dawson has well said, make all the ills from which a patient derives abdominal trouble. In the appendix both may be at work at the same moment; indeed, one follows inevitably upon the other. In my experience there is no appendicitis without obstruction. In these cases of mimicry of gastric ulcer is the stomach, then, quite healthy? In my earlier and less complete observations I often thought it was. Now I feel sure that there is, I think I may say always, such a change in the appearance of the organ as will enable the most absolute prediction to be made that the appendix is diseased. These changes are: a vivid injection, a deep congestion of the pyloric portion of the stomach over a distance of two or three inches at least; a great, irregular, eager activity of

contraction, the muscles of the part appearing to writhe in angry contortions; and thirdly, an enlargement of the subpyloric group of glands. The explanation of these changes is, I think, now clear; of their existence there is no longer any doubt. The present position of our opinion is accordingly this, that in many of the cases of "gastric ulcer," the symptoms of which are pain, flatulence, acidity, heartburn, vomiting, and hæmatemesis, the lesion primarily responsible for such symptoms does not lie in the stomach. The lesion is one in which infection and obstruction are in league to do harm, and its most frequent location is in the appendix.

The evidence seems to be increasing, and is, indeed, already abundant, in favour of the view that these distant infections, whether in the appendix or elsewhere, which often produce the gross lesions just described in the stomach, may be the precursors and the excitants of a chronic ulcer of the stomach. The experimental work of Turck, Bolton, and Wilkie has shown how ulceration of the gastric mucosa may be set up by infecting agents, and may be perpetuated by the inability of the stomach completely to empty itself in the normal time. To infection, stasis is added and often also an increased acidity, or at least an acrimony of the gastric juice. Gastric ulcer, then, would appear to be almost always a secondary disorder; the primary fault lies not in the stomach, but elsewhere, its expression is manifest in the stomach because of the particular series of incidents which occur therein. This much is certain—that when cases of gastric ulcer come to the operation table the evidence of other and apparently older lesions is rarely wanting.

CHRONIC ULCER AND CARCINOMA

Among the most notable of the gifts of surgery to medicine is the proof that in a large proportion of cases the onset of cancer of the stomach is not a new and unaccountable thing, but is, on the contrary, a tardy development upon an earlier condition which for years had clamoured for recognition. It appears to me that the work of the Mayo Clinic has offered irrefragable proof of this assertion.

I am, of course, well aware that all cases of cancer of the stomach, unhappily, do not come to the surgeon. No one but the surgeon can do any good to patients so afflicted. Yet there is a strange timidity of approach to the surgeon which is unaccountable, and far too often the favourable period in the history of a case is allowed to slip away before any recognition of the real condition is attempted. It is true, then, and must be admitted, that when the surgeon speaks of the work which passes under his hand he is not speaking of the whole. Nor is anyone else. Neither the physician nor the post-mortem investigator knows the whole range of cases; indeed, each sees far less nowadays than the surgeon. The view of the latter, therefore, if not all-embracing, is doubtless wider than that of anyone else. The experience of the surgeon shows—and here geographical considerations seem to matter little—that, roughly, two out of three of all patients who come for relief from a condition of carcinoma of the stomach give a history of inveterate and recurring dyspepsia over a stretch of many months or years. No one knows so well as the surgeon, for he made and repeats daily the discoveries, that such a history does not mean that there is a chronic ulcer of the stomach, healing and

breaking down afresh, during all that time. But though we are grown chary of making a diagnosis of "gastric ulcer" with that ease and certitude which formerly attached to the physicians of all countries, we can and do make an accurate diagnosis in a large proportion of the cases, if only those patients are allowed to be suffering from "gastric ulcer" who can hardly be supposed to be the victims of any other organic lesion. The surgeon who walks by sight and not by faith knows that a gastric ulcer is a real thing, though so many imposters have claimed his attention. In the majority of the cases of gastric carcinoma the history given of earlier attacks makes it almost certain that these were due to a veritable ulcer of the stomach. There may be, I fully admit, errors in this estimate; but making all the allowances that our operative experience warns us to be necessary, there can be, I think, no doubt at all that a genuine chronic gastric ulcer has been the cause of that dyspepsia of which recurring attacks are noted. In one of these attacks, perhaps after an interval of months or years of freedom, something different is noticed. The attack is heralded in the old way; at first no difference between it and the others may be observed. But by degrees it is realised that something worse is occurring. The symptoms, which in earlier attacks were so easily amenable to careful treatment, to rest, to sparing diet, and so forth, have now become more severe and incoercible. Relief does not come from the measures which before have been so instantly successful. Moreover, weight is more rapidly lost, anæmia may develop, and anorexia is most persistent and distressing. This is the occasion, all other and more favourable occasions having lapsed, when instant—it can hardly be called precocious—surgical treatment should be urged. The patient

has now arrived at middle life, or has passed it, and the diagnosis of cancer may tentatively be made and should be acted upon with alacrity. Surgical intervention for purposes of inquiry has hardly any mortality nowadays. If a cancer be found and a resection of the stomach is undertaken, the mortality will vary with the expertness of the hands which practise it. But whatever that mortality may be, it cannot attain the death-rate of inaction and of "expectant" or medical treatment, which is exactly 100 per cent. It was urged by Dr. W. L. Rodman many years ago that resection of the pyloric end of the stomach for the ulcers that singly or in clusters are found there was the most prudent mode of treatment. In his clinic at Rochester Dr. W. J. Mayo has for several years resected the stomach not only for chronic ulcers in the vicinity of the pylorus but also for those tumours which might be due to ulcer or might be due to cancer, for declared cancer and for those cancers which, though evidently not curable because of the enlargement of distal, secondary glands, or other visceral deposits, were yet removable. In his so safe hands resection has hardly any greater mortality than gastro-enterostomy. This procedure is unquestionless the ideal one. It has afforded, of course, a unique series of specimens for investigation. Dr. Wilson and Dr. MacCarty conclude from their examination of all the material so furnished that in 71 per cent. of these cases of cancer of the stomach the malignant process is engrafted upon a simple one, that cancer is really due to a secondary change which starts in the edge of an ulcer of long standing. My own material, far less in quantity, bears out their contention. It has been shown that in the base of these ulcers tending to cancer the mucosa has gone, leaving only scar tissue; in the over-

hanging border of the ulcers the mucosa is proliferating, and some epithelial cells, nipped off by scar tissue, are showing all the stages of aberrant proliferation with infiltration of the surrounding tissues and metastases in the lymphatic vessels of the stomach wall. The truth of these observations is hardly yet admitted by those whose inquiry has been based only upon specimens found in the post-mortem room or on the shelves of the museums—upon parts, that is, that have been long dead, and subjected, no doubt, to the many changes which death and swift decay bring in every cell. Upon the post-mortem table only the final dilapidated ruin of the disease is seen; in specimens removed during life the disease in its earlier stages can be scrutinised. The material upon which the pathologist has formerly worked has not been favourable to the discovery of the truth; the sources of eternal truth were poisoned.

It would be hard to decide among so many strong competitors as to the primacy of any piece of work given out by the Mayo Clinic. It is, however, safe to say that the real and permanent value of the contributions to this subject of cancer of the stomach, both from the technical and the pathological sides, can hardly be overstated.

DUODENAL ULCER

The infection which has its origin in the appendix or in the intestine wreaks other harm than that upon the stomach wall. Of duodenal ulcer and of cholelithiasis we have also learnt that they are usually secondary manifestations. Of duodenal ulcer I have so recently and so fully written that it is not necessary here to do more than record the fact that a full knowledge of its symptoms and course, and the power, unrivalled in any other abdominal dis-

orders, of making an accurate diagnosis are not the least important of the gifts of surgery to medicine. Of this disease almost nothing was learnt after enquiry from the dead alone, except of those late preventable disasters which come from its unchecked course. In the early days of our recognition of this condition we were assailed by a formidable array of post-mortem statistics which went to show the rarity of the disorder, and the absence or the inconstancy of any symptoms which could be attributed to it during the life of the patient. We now know the great frequency of the disease—every month I operate upon more cases than were formerly recognised in the post-mortem room of the largest hospitals in ten years—and the claim may truthfully be made that of all abdominal diseases none can be more certainly discovered by a scrutiny of the anamnesis alone.

THE ETIOLOGY OF GALL-STONES

Another and equally important reversal of opinion has occurred in connexion with cholelithiasis. It was formerly the accepted belief, and as fallacies die hard may still be the view of some, that in a large percentage of cases gall-stones were "innocent"; they declared their presence by no apparent sign, and their existence threatened no peril to the health or life of the patient.

The work of Lartigau upon the etiology of gall-stones is of the first importance. He showed that active organisms taken up by the portal stream from the intestine were passed through the liver, which acted as a "destructor." They emerged from it in the bile, lifeless. Some few, however, under special circumstances, made their escape, and remained active in the bile which flowed to the intestine. If the organisms which find their way into the gall-bladder

are violent in their activities an acute inflammatory condition, of a degree which varies with the intensity of the infection, is caused. There may be any gradation from an acute phlegmonous cholecystitis to a trivial and evanescent catarrhal condition of the mucosa. If the germs be in an attenuated condition the contractile power of the gall-bladder is competent to expel them, and no harm results. So far as experiment serves to show, a stone can only develop in the gall-bladder (and the gall-bladder is the factory wherein all stones are made) if, with a mitigated culture of micro-organism, there is some retardation of the outflow of bile. Sepsis and stasis must go together. The gall-bladder then puts forth its own efforts to protect itself, and secretes cholesterin, which being deposited upon the surface of the germs, clumped as they probably are, safely immures them. A gall-stone, then, consists of a deposit of cholesterin (alone, or with the addition of other salts) upon a nucleus of organisms which have intruded into the gall-bladder. Every gall-stone, as I have said before, is a tombstone erected to the evil memory of the germs that lie dead within it. The frequency with which gall-stones lie inert within the gall-bladder, causing no harm and arousing no symptoms, is so very small as to be quite negligible. It is certainly much less than 1 per cent. in all those cases which come for surgical treatment, and, though I admit that this estimate involves a possible fallacy, yet the truth cannot be known of all the cases in which gall-stones exist, for neither operative work, nor the examinations of the dead, nor the records of the "spas," reveal the whole matter.

THE INAUGURAL SYMPTOMS OF GALL-STONES

The error that has found a place in the minds of all medical men, and has been faithfully carried down from one generation of text-books to another—that in the majority of cases gall-stones cause no symptoms—has been forever dispelled by the work of the surgeon. In operating upon cases of advanced cholelithiasis a history of inveterate though perhaps trivial dyspepsia over a long period can almost always be obtained. In operating upon patients for the relief of other conditions—myoma of the uterus, ovarian or other pelvic conditions, appendicitis, or ulcer in the stomach or duodenum—a routine examination of the gall-bladder and kidneys should be made. Every now and again stones will be found in the gall-bladder, and far more rarely in the kidneys. In the case of the former a clear history of dyspeptic troubles can, in my experience, invariably be obtained. It is true that these symptoms are not those which are commonly recognised as being due to a gall-bladder condition, but the gift of surgery to medicine consists here in the true portrayal of those clinical manifestations which only an examination of the living could disclose. We now know that the earliest symptoms, the “inaugural symptoms,” of cholelithiasis are just as characteristic, just as certainly to be recognised, as those of the later sequels and avoidable complications. And more than this: the very little that was known of cholelithiasis in its clinical aspects has undergone a complete revision, with the result that we are often able to declare not only the presence of stones, but often the position of that which is causing the most serious trouble. The only circumstances under which symptoms are not at the moment aroused by stones which lie within

the gall-bladder exist when the cystic duct has become permanently closed and the walls of the gall-bladder, thick, and white, and hard, embrace firmly the stones that lie harmless within it. This is the "natural cure" of Rutherford Morison, a condition which develops only after months or years of symptoms, often of great severity. It is Nature's cholecystectomy, and though Nature may be an admirable physician, her skill as a surgeon is of the lowest order, and her work cumbersome, clumsy, and dangerous.

LESIONS OF THE PANCREAS

It is as an outcrop of the work of the surgeon on gall-stones that all our modern knowledge of the clinical aspects of chronic pancreatitis has sprung. The acute form of pancreatitis was first recognised and, with something nearly approaching to finality, described by one of the greatest of physicians—Dr. Fitz of Boston. But of chronic inflammation, of stone, of cysts, and of the mimeries of cysts nothing was heard or known till the surgeon came bearing these gifts in his hands.

We know well the great change that comes over all parts of the body after death; the face changes, wrinkles are smoothed away, the cheeks sink in, the eyes are lustreless, the orbits hollow. Other parts change equally, and among them the pancreas, perhaps, most of all. In a case of acute pancreatitis the gland, at the moment of operation, seems one massive phlegmon—tumid, doughy, and with no abrupt margin. After death it appears to be merely a bruised and blood-stained organ. So with the gland in a state of chronic inflammation. To the hand of the operator it may feel large and densely hard, and it may be responsible for the obstruction and a considerable dilatation of the common bile-duct. After death it seems

hardly altered from the normal, and certainly in earlier, less exact days would not have attracted close attention. The evidence of the operator and the pathologist was then incompatible, because neither seemed to recognise that their approach to the problem was from different points of view.

The question of chronic pancreatitis was first brought before the minds of surgeons by Riedel, who noticed that in many operations upon the biliary passages the pancreas was large, hard, and unduly firm. In three recorded cases he believed the patient to be suffering from carcinoma of the head of the gland, and he gave, accordingly, a hopeless prognosis. Two patients recovered, and remained perfectly well; the third patient died, and the examination of the pancreas showed no trace of malignancy, but the plain evidences of a chronic interstitial inflammation. Little knowledge, however, sprang from this observation, until Mayo Robson, with his then unrivalled experience of cholelithiasis, showed the frequency and the clinical importance of pancreatitis, and convinced us all of its powers of mimicry both of carcinoma and of the calculous form of common duct obstruction.

Its mimicry of carcinoma may be complete. Painlessly and progressively the patient may develop jaundice, which continues to deepen until the "black jaundice" of the older writers can be recognised. There is great loss of weight and prostration, hebetude and misery, though often the appetite is unimpaired. The liver enlarges and the gall-bladder distends to a degree which allows it to be easily seen and felt protruding below the rib margin. In accordance with the law of Courvoisier we assume that such a dilatation of the gall-bladder is due to causes other than stone. An examination of the stools might show a

complete absence of bile pigment, and this may seem the most conclusive evidence of carcinoma, for a chronic inflammation, however inveterate, rarely causes an absolutely impermeable block to the passage of bile.

CHOLECYSTENTEROSTOMY

With the history of a condition such as this, one could hardly fail to make a diagnosis of growth and predict a speedy ending to the case. But no one living is infallible in the differential diagnosis of obstructive jaundice. The diagnosis is always so difficult, and the chance of a life saved so important, that, however positive the evidence of malignancy may be, I advise operation in all cases. So far as immediate amendment is concerned, there is little to choose between the malignant and the benign cases. In both the patient begins to improve, the jaundice falls away slowly, sometimes very slowly, and weight is soon gained. The operation performed consists in joining the gall-bladder to the intestine, to the duodenum if easily available (it may be quite inaccessible, lying high and remote, when the liver is enlarged and the gall-bladder over-full), or to the stomach. It may be feared that when all the bile passes directly into the stomach, nausea, vomiting of bile, or loss of appetite results. Such fears are groundless. I have joined the gall-bladder to the stomach in more than 20 patients who have survived a year or more, and there is no suspicion of any special discomfort attaching to the operation. I have patients living still upon whom I operated four, six, and seven years ago in the confident belief that they suffered from carcinoma and would shortly be dead. It is impossible for the most astute clinician or the most subtle pathologist to discover by physical signs, from the anamnesis or from the chem-

ical examination of urine and fæces, whether a simple or cancerous disease is present. He may shrewdly guess, but a guess is a poor peg on which to hang a man's life. All cases of obstructive jaundice should be operated upon; the mortality of cholecystenterostomy now is trifling if we take into account the severity of the disease and the outlook. Apart altogether from the prolongation or saving of life, almost every patient will declare that the relief from the maddening torture of itching is worth every sacrifice.

Acute pancreatitis, so accurately described by Fitz, remained for long a desperate and often lethal disorder. The onset of the symptoms was so abrupt, their course so rapid, and the fatal event so precipitate that for many years surgeons were quite unable to realise the moment for swift intervention. When operation was undertaken it was generally upon the mistaken diagnosis of perforating ulcer of the stomach or duodenum. And it was not until Ramsey, in 1902, showed that the chief surgical indication here, as in the case of a phlegmon in the extremities, consisted in the relief of tension that success began to attend the surgeon's efforts. Now it is a matter of very little difficulty to make an accurate and timely diagnosis of acute pancreatitis, and the recovery of the patient can generally be assured. A tribute here may fittingly be paid to the work of Simon Flexner and Opie, who showed how apt an intense inflammation of the gland is to follow upon the infection of its duct by bile, by chemical irritants, or by infective agents. Acute pancreatitis is not seldom associated with cholelithiasis, bile which is obnoxious to the gland passing from the common duct to the canal of Wirsung when the orifice of the ampulla is blocked by a tiny stone.

Other diseases of the pancreas, cysts and calculi, have lent themselves also to accurate diagnosis and successful treatment by the surgeon. One of the very ablest and most original papers contributed to the literature of surgery in my time appeared in the *British Medical Journal* in 1892 (vol. ii, p. 1051). It was written by the great surgeon and my very good friend, who preceded me in the delivery of this annual address, the late Jordan Lloyd. He pointed out that, contrary to the generally received opinion, the fluid tumours appearing in the epigastrium after the receipt of an injury were not veritable cysts of the pancreas, but accumulations of fluid in the lesser sac of the peritoneum which had closed at the foramen of Winslow. Calculi are rarely found in the pancreatic ducts. Their presence has been recognised, and in a few cases the stones have been successfully removed, since the inauguration of surgical treatment by Pearce Gould in 1896.

THE SOURCE OF INFECTION IN THE ABDOMEN

Among the most interesting and possibly one of the rich gifts of surgery to medicine is the hypothesis that intestinal stasis, with the associated condition of absorption of toxins, is responsible for many of the diseases which attack not only the abdominal viscera, but even also parts remote therefrom. Perhaps no subject in medicine to-day has received more discussion, has been more bitterly assailed, more often attacked by derision rather than by argument, and more cheerfully supported than this. Its author, Arbuthnot Lane, is a man whose mind moves easily along new paths. Such a pioneer has often reached his destiny before other tardy travellers have set out upon the way. The pioneer in all branches of knowledge rarely himself reaches the truth—he is more apt to overreach, or

to be content to guess the road that lies ahead without beating it down with his own foot tread.

In contemporary surgical history many observers, as I have pointed out, have had their minds attracted to a firm belief in one thing—namely, that many of the diseases for which surgery is called upon to deal are not primary disorders, but are secondary; that they depend for their existence and extended development upon some common cause; and that this common excitant is an infection which expresses itself now in one way, now in another. The conditions I have already mentioned—ulcer of the stomach or duodenum and cholelithiasis—are, in the belief of all of us who do much work for their relief, really dependent upon an infection. For my own part I look upon the appendix as the most potent and the most frequent cause of offence. Arbuthnot Lane takes a wider view. He believes that the intestine itself is the factory in which the poisons are produced, which cause, or make more easily possible, not only the various conditions I have named, but also such diverse and distant conditions as “rheumatoid arthritis,” tuberculous disease of bones and joints, diseases of the breast, cystic and malignant, of the thyroid gland, and many other conditions. At first it was supposed that the large intestine was the malefactor, and some slender support was possibly derived for the hypothesis from the work of Metchnikoff and others. More recently the delayed drainage of the small intestine has been held more blameworthy. Various bands and kinks have been described in different parts of the alimentary canal, and these have been held responsible for the obstruction, behind which dilatation and stagnation occur. Controversy has raged around the question as to whether these veils and kinks were developmental in origin, inflam-

matory, or evolutionary; and very often the opinions of a writer are formed exclusively upon, or prejudiced by, the one out of many possible methods of examination to which he has devoted exclusive attention. The terminal ileal adhesion, for example, which is held by many to be the most powerful of all for evil, clearly owns at least two entirely different origins. The most common form of it, in my view, is that which depends upon inflammation of the appendix. But it is interesting to recall that in my book on "Retroperitoneal Hernia," published 14 years ago, I point out that the "physiological fusion" of Toldt occurs to excess in two parts of the small intestine, with the result that there occurs "an adhesion of the upper few inches of the jejunum, or the lower few inches of the ileum to the posterior abdominal wall." I point out there, moreover, a possibility which is constantly overlooked, that this physiological agglutination is not a process which ends abruptly at birth, but that it continues afterwards; it is possible, indeed probable, that it gradually advances during adult life. So far as the large intestine is concerned, my own experience points to the splenic flexure as the part where an arrest in the flow of contents is most prone to occur. Whether this is due to an exaggeration of the normal ligamentous attachments of the flexure, to its extreme fixity, or to the dragging effects of an overweighted and powerless transverse colon I cannot say. But there can be no doubt that obstruction of the most acute, as of the most chronic, kind may be solely dependent upon "kinking" of the large bowel at its splenic flexure, surrounded and held firm by membranous adhesions.

But these points, after all, are only incidental. The main question is concerned not with the exact means by which effects are produced, but rather with the existence

of the alleged effects. The fervid apostles of the new creed are a little prone to bewilder us with reasons for their immature observations. This is only to darken knowledge and to encumber their religion with dogma. We need not yet be greatly exercised over the terms of an explanation of how these effects come about, for in medicine explanation often lags far behind experience. The most exemplary instance of the effects of alimentary toxæmia occurs, perhaps, in the condition which may best be described as Lane's disease. The miserable chronic dyspeptic with sallow skin, dirty tongue, flaccid belly, offensive breath, dusky lips and nails, cold extremities, and constipation that is with some difficulty overcome, is restored to health with incredible rapidity when a short circuit is made between the ileum and the pelvic colon. The claims that Lane makes in respect of such patients must indubitably be admitted. I have never in these cases, nor, indeed, in any of "alimentary toxæmia," found it necessary to consider the question of a removal of the entire colon. As to the further claims which are made, I have not yet arrived at the point where I can admit them, but the hypothesis charms by its simplicity, and attracts by its magnitude, and I am travelling hopefully.

THE SUCCOUR OF THE INDIVIDUAL AND THE SERVICE OF THE CAUSE

Medicine in its quest of knowledge may rightly levy a tribute from every other science with which it comes into contact. Its doctrines and its practise are tested, may receive support, or be refuted, by work accomplished in other fields. Surgery in recent years has proved a powerful helpmeet not only in the elucidation of those problems of internal medicine to which I have briefly

referred, but also by reason of the light it has brought to bear upon the functions of many of the organs in the body. The experimental method, as a mode of enquiry, is not excelled in value by any other, and no experiments, I hold, can claim an equal rank with those which are a part of almost all surgical procedures. The chief glory of the surgeon comes from the dedication of his powers to the service of an individual; but there is a cause also to be served. In every operation something may be learnt, not only of those disorders which call urgently for relief, but of other associated, or it may be separate, conditions which chance at the same moment to be present. The researches so carried out upon a human patient are performed with a sterner sense of responsibility and with a graver ritual, and are impressed by more relevant influences than attach to any other form of enquiry. Their results are accordingly of far higher value. Clinical research, when sedulously conducted and illuminated by the disclosures made upon the operation table, affords the most accurate of all methods of investigation into the diseases by which man is attacked. The succour of an individual should mean also the taking of a step forward in the solution or the better understanding of the manifold and perplexing problems of disease.

THE SURGERY OF THE CHEST IN RELATION TO RETAINED PROJECTILES¹

WHAT is the fate of patients who have received wounds of the chest, and who harbour a projectile within the thoracic cavity? There are doubtless many hundreds, it has even been asserted that there are thousands, of men now in England in whose lungs a projectile is retained. At the present time the evidence as to the discomforts or dangers to which they are prone is conflicting. It is conflicting because it is incomplete. On the one hand we hear that some few men, the bearers of a foreign body that is lodged in the lung or in the mediastinum, suffer very little; are almost forgetful of the fact that they have been wounded; and continue their civil work, sometimes perhaps very arduous, without suffering any disability which might lessen their value in the labour market. On the other hand we find that pensioners come, in small numbers it is true, to the civil hospitals, making complaints of the distress they experience, and asking for the removal of the projectile which they believe to be the cause of their suffering. In these latter cases it is neither the physical properties of the retained projectile nor the presence of infection around it which are alone to blame. For, of all the forms of projectile, a shrapnell ball or a rifle bullet might be supposed to be the least harmful. Their surfaces are smooth, and except at the point of a rifle bullet no injury is likely to be caused by the chafing of the projectile against the tissues on movement. Yet patients with these forms of foreign body seem to complain as much as do those in whose chests a sharp, jagged piece of metal

¹ Reprinted from *The British Journal of Surgery*, Vol. VII, No. 28, 1920.

is lodged. Nor is the degree of infection alone responsible, as is seen from the record of a case where a sterile rifle bullet was found embedded in lung tissue. Except for the greater likelihood of post-operative troubles, such as suppuration of the wound, or empyema, there does not appear to be any conspicuous clinical distinction to be made between those cases in which the foreign bodies are infected and those in which the projectile is sterile. And it is interesting to note that, although the lung is admittedly as capable of defending itself against microbic attack as any part of the body, an active infection may be found upon a projectile removed after three years' lodgement in the parenchyma.

Nor does the position of the foreign body in the lung afford any constant clue as to the cause of the symptoms of which complaint is made. It is true that if the foreign body lies in, or in contact with, the heart, the anxiety of the patient as to his future is increased. But whether a missile is lodged in one part of the lung or another does not seem to be of importance, so far as the existence or the severity of the chief symptoms is concerned.

The frequency, therefore, with which symptoms are present in the case of those harbouring projectiles in the chest is uncertain. So far as an enquiry is concerned which cannot pretend to statistical accuracy, it appears to be certain that the great majority of men make some complaint of subjective phenomena. So long ago as 1916, Denéchau, in an enquiry into the condition of fifty patients whose wounds dated back many months, elicited a history in every case of subjective disorders. In the times of active warfare we were all naturally and properly suspicious of purely subjective complaints. Scepticism and incredulity were our defence against the blandishments

and the special pleading of many an "old soldier." But the similarity of the symptoms in a long series of cases, where collusion is impossible, makes it unlikely that malingering alone is responsible. Exaggeration there may be, but similarity or identity of invention in many patients, at long intervals of time, and widely separated geographically, is unlikely. And it was not long, in my experience, before patients who had been discharged from the army returned to hospital still complaining of their symptoms, and were willing, even eager, to submit to operation for their relief. So that if we discount fully the element of exaggeration, we are still confronted by a considerable body of evidence which goes to show that a projectile retained in the chest is a source of discomfort, variable in intensity, duration, and frequency, and of serious anxiety.

In my early experience I refrained from operating upon many patients, partly from ignorance of several matters concerned with intrathoracic surgery, and partly in the hope that delay in operating would allow of the firm encapsulation of the projectile, and the gradual recovery of the lung to a normal condition, or to a condition so nearly approaching the normal as to encourage the patient to return happily to full work. My advice to patients not to submit to operation was not always well received; and often I was urged to consider the removal of the projectile, as the patient was prepared to take the risk, though I had spoken of it in terms which now I realize were unduly grave.

In endeavouring to decide upon the principles which should govern us in the advice we give as to the removal of projectiles from the chest, we have to consider, on the one hand, the pathological conditions caused by the entrance of the projectile, the severity of the symptoms

aroused, and the prospects of increasing or diminishing discomfort, disability, or danger from the continued lodgement of the foreign body or from the changes aroused at its rude entrance; and, on the other hand, the severity of the operation necessary for the removal of the missile, the mortality, the post-operative discomforts, and the results as expressed in the altered conditions in the chest, and in the consecutive changes in those symptoms for which the patient first sought relief.

Among the projectiles found in the chest cavity, fragments of shell are the commonest. They are usually of small size, rarely more than an inch in length; they have rough and pitted surfaces, jagged edges, and sharp points. In a small proportion of cases fragments of clothing are carried in with the metal, and are found lying with it in the chest. In most instances there is only one piece of metal. Machine-gun or rifle bullets are found, and shrapnel balls. On one occasion in a series of cases a shrapnel ball was loose in the pleural cavity, in which it could be seen to roll about freely. It is very rare to find a large piece of metal in the chest; the probability is that all patients into whose chests such a foreign body penetrates, die as the early result of their injury.

I propose to consider the subject in the following order:

- A. *Pathological changes caused by projectiles within the chest.*
- B. *Symptoms to which they give rise.*
- C. *Operations for the removal of projectiles.*—General principles. Indications for operation. Operations: (1) Method of Petit de la Villéon; (2) Marion's method; (3) Duval's method; (4) Operations upon the root of the lung; (5) Operations upon the mediastinum.

D. After-history, and results of operations.

E. List of cases treated by operation.

A. PATHOLOGICAL CHANGES CAUSED BY PROJECTILES
WITHIN THE CHEST

1. **Wound of Entry.**—As a rule, the wound made by the projectile on entering the chest has healed. In the majority of the cases I have seen, the wound is in the chest wall (it may be in the neck or in the abdomen), sometimes on the side where the projectile has lodged, sometimes on the other side, a portion of the opposite pleural cavity and the mediastinum having been traversed before the missile comes to rest. It is very remarkable to find that the mediastinum with all its contents may be pierced by a bullet or a fragment of shell, and yet the parts apparently suffer not the slightest injury. The supple and elastic vessels seem to yield place to the swiftly-moving metal; they certainly escape damage in a manner that sometimes appears incredible. In a few instances the bullet has passed through the arm into the chest; and in one case of mine some fragments of the humerus had been carried into the lung. The rib at the point of entry may be fractured, and minute fragments and splinters of the bone be swept inwards to the pleural cavity and the lung; a similar lesion may occur in the scapula or the sternum. It is the rule to find only one wound of entry, but, as in other parts of the body, the superficial lesions may be multiple, many fragments of splintered metal entering the chest wall, one or more of them passing through the parietes to lodge in the lung tissue.

The same conditions in respect of the missiles and their effects upon the soft parts are found in the chest as in the tissues of the limbs. The damage inflicted depends upon

the size and shape of the projectile, its physical properties in respect of roughness and sharp edges, and its velocity. A rifle bullet discharged at a distance of 1500 yards, when its flight has become steady, may pass through the chest, cleaving its way, and leave behind very little evidence of trauma. A small fragment of coarse metal of ugly shape and lower velocity may bruise and tear and crush anything that lies in its path.

Wounds of the chest are often found in association with wounds elsewhere: in the abdomen, extremities, or head. Not only is the immediate problem of appropriate treatment affected thereby, but also the duration of convalescence and the quality of the ultimate recovery.

2. The Path of the Projectile.—So far as the soft parts are concerned, the lesions at once produced, and the conditions remaining after healing, are, as I have said, not different from those seen elsewhere. In the lung itself the course taken by a piece of metal can often be felt as a thick cord or strand when the lung is grasped in the hand. It is interesting that, in most instances, the foreign body is found near the surface of the lung; rarely in the middle of a lobe. It would seem that the central lung tissue itself offers very little resistance to the passage of a fragment of metal, which is brought to rest by the increased resistance it meets at the surface of a lobe. The projectile itself may be found at the very surface of the lung, embedded in adhesions of great thickness and density. In some instances it is not easy to say whether it has lain actually within the substance of the lung, or in masses of lymph deposited on the visceral pleura.

Two or three times, in separating the lung from the chest wall as gently as possible, I have felt the foreign body drop into my hand. The surface of the lung, when

examined, merely showed a shallow pit with a rough and shaggy wall. In other instances the metal is frankly in the lung tissue, which has to be incised in order to release the foreign body. The lung may then show signs of "hepatization," being thick, hard, and red. Or in rare instances the metal may be surrounded by a very thick yellow fibrous capsule, within which are the remains of a small collection of dried pus.

In one case of mine the tissue cut through resembled exactly the structure and consistence of a calcareous mesenteric gland, and for a moment I was inclined to think that the condition with which I was dealing was tuberculous. But as I cut deeper into the dense tissues I felt the metal against the knife, and a small fragment of shell-casing was released. Complete encapsulation of any foreign body is extremely rare. It is not often that a piece of clothing is found with the metal; when so found it is dark, deeply blood-stained, often offensive, and always infected. In two cases bronchiectasis was present, caused, no doubt, by the pressure of a fragment of metal of rather large size upon a large bronchus. In both cases expectoration before operation was profuse, and sometimes foetid; in both there was local collapse of the lung, and in both the condition was seen on *x*-ray examination.

3. Condition of the Pleural Surfaces.—This varies within very wide limits. I have often been struck by the apparent discrepancy between the pathological conditions discovered in the chest at the time of operation, and the evidence of such conditions afforded by the ordinary methods of clinical examination. It is evident that percussion and auscultation, even by the most expert physician, reveal only the coarser defects, and do not always discover even them. What appear to the surgeon to be gross

changes may be quite unrecognizable on clinical investigation.

Adhesions of the two pleural surfaces are almost always present. They may be of the slightest and flimsiest texture, breaking down at the gentlest touch, and scattered thinly over a limited area. They may be of considerable density, and restricted to the line of flight of the foreign body. A thick anchorage of adhesions is then found, and the rest of the pleura may have few adhesions or none. In other instances the two pleural surfaces may have become so intimately adherent that it is possible to separate them only by the exercise of the greatest force short of roughness. Indeed, in some few instances I have been quite powerless to separate adhesions, and have had to divide them with knife and scissors; even then their severance has been most difficult. In some instances the lymph poured out has become organized into the densest and heaviest felt-like material, which I have been able to dissect away in large sheets, and to keep as a specimen. Where adhesions are so very massive, they may isolate a small or large collection of fluid, old blood-clots, desiccated pus, or serum. Dense adhesions may be limited, only lying in the path of the projectile, as I have just stated; or they may cover the whole of one lobe, the other lobe or lobes being free; or virtually the whole of the pleural surfaces may be involved. The lobes of the lung may adhere to each other. The lung may adhere along the inner side to the mediastinum or to the pericardium. On the left side, especially, it may be difficult to say whether a foreign body which moves with the heart is in the edge of the lung, or on, or in, the pericardium; for the parts adhere strongly and are not anatomically distinguishable one from another; a mass of fibrous tissue binds them all together. In several in-

stances I have found very strong adhesions of the lung to the diaphragm, and the costodiaphragmatic angle has been filled with the organized remains of old blood-clot or of a pleural effusion. The immobility of the corresponding half of the diaphragm, as seen by *x*-ray examination, is easily understood in such cases.

4. **Infectivity of Projectiles.**—It was not always thought proper to examine the projectile bacteriologically; this was done only in those cases where the metal was lifted directly out of its bed with sterile forceps, and held while a smear was taken from it. In all, eighteen projectiles were examined. In eleven there was infection by *Staphylococcus aureus*, streptococci, pneumococci, or coliform bacilli. In seven the foreign body was sterile.

B. SYMPTOMS PRESENT IN CASES WHERE A FOREIGN BODY IS RETAINED IN THE CHEST

1. **Pain.**—This is present in the affected side of the chest. It is very variously described as “soreness,” “pricking,” “stabbing,” “burning.” It is fairly constant, but is increased when any exertion, work or play, is undertaken. More than one patient has told me that he felt then as though the side of the chest were being “held in a clutch,” and that the pain was insupportable and brought with it a sense of acute anxiety and distress. The amount or the quality of the pain suffered does not often appear to have borne any very close relationship to the size of the projectile, to the extent or position of the wound or wounds of entry or exit, to the presence of operation wounds (indicating that an effort has been made to deal with the projectile, or with the injured lung), to a former empyema, to the restrictions in the movement of the diaphragm as discovered by *x*-ray, or to the observed physical signs. It is

certain that the pain is no worse in those cases where very extensive and extremely dense adhesions are present. In several of my cases the pleural cavity was quite obliterated, and the cohesion of the pleural surfaces was with the utmost difficulty undone. Yet patients so afflicted made no unusual complaint of pain.

Grey Turner has observed that pain and tenderness are especially noticeable in cases where a localized area of adhesions is found in the track of the missile—where, that is to say, a part only of the lung is firmly anchored to the pleura, the rest being free to move. A general diffuse adhesion, he says, between the pleural surfaces is not attended with pain, and, indeed, may be a means of preventing it. These observations agree with my own.

In my earlier cases I was a little at a loss to account for the pain of which so grievous complaints were sometimes made, and I was almost persuaded that the knowledge of the patient that a projectile was retained in the lung, together with a possible reluctance to be considered fit for duty in the line, might be held largely responsible for the manifold complaints. But this view was soon found to be untenable when pensioners, who were no longer faced with the possibilities of further service, who indeed had something to lose by being laid aside from work more remunerative than ever before, came to the hospital seeking relief. In them there was no need to estimate and to discount the coefficient of exaggeration.

By degrees it became certain that pain in all such cases was a real thing. In a large number of patients who have missiles retained anywhere in the chest there is a considerable degree of apprehension as to their future, a far greater degree, in my experience, than is found in men who have pieces of metal lodged elsewhere. I know no reason for

this, but the fact is beyond doubt. In the years 1915 and 1916 I saw seven patients who did not appear to me to be suffering sufficiently to make it worth their while to submit to operation; all were dissatisfied with my advice to have nothing done, and most of them came back finally for operation.

2. **Dyspnœa.**—This varies greatly in different cases. It may be felt only on severe or protracted exertion; it may be slight even then. Or it may be an almost constant symptom, present when the patient is in repose, greatly augmented when he walks hurriedly, and especially on going upstairs or on climbing a hill with an eager pedestrian. There are times when pain and dyspnœa together produce a crisis of exhaustion, and the patient almost collapses in an agony of distress. I have twice seen patients in this condition when walking near the hospital. The dyspnœa on repose and the effort dyspnœa, in all probability, are both due to embarrassment of the lung crippled by adhesions, or to the massive remnants of an old hæmothorax, or to the shrinkage of the side of the chest and the mediastinal displacement and collapse of the lung which follow an empyema. There is not always a correspondence between the degree of distress and the amount of physical incapacity or deformity of the chest.

3. **Cough.**—This symptom is frequent as a rule, indeed, in some degree constant; though there are intervals in which it may be in abeyance, especially if the patient is kept in bed, or is bedridden by another lesion. Its presence is due not so much to the metal in the chest, as to such associated conditions as sinuses leading down to the pleural cavity or into the lung; to infection around the foreign body, causing local hepatization of the lung, or abscess; or to bronchiectasis or emphysema.

When an external sinus leads into the lung, its temporary closure may coincide with a period in which a teasing cough is accompanied by the copious expectoration of pus.

In a few cases *hæmoptysis* occurs. It is not often severe, but may be repeated on several occasions. It appears especially apt to follow on severe exertion. The first case in which I saw it occurred in a man wounded in September, 1914; a large fragment of shell-casing was retained in the lower lobe of the right lung. The wound healed, and in April, 1915, he was returned as fit for duty. He was given bayonet practice, and a sharp hæmorrhage occurred at once; a like experience followed on two occasions within a few days, and he then consulted the regimental medical officer.

I have seen three cases in which pain, dyspnoea, cough, purulent expectoration, and hæmoptysis have been present and have led to a diagnosis of pulmonary tuberculosis. Similar cases are recorded by Delmas and Fiolla. In one of my cases an *x*-ray diagnosis of a piece of metal retained in the lung was made, and an operation performed. No foreign body was found. The patient was subsequently stated to be suffering from phthisis.

The expectoration is sometimes abundant, frothy, purulent, and offensive. It appears, as a rule, within a week or two of the infliction of the injury, and it is rarely relieved by any treatment other than removal of the foreign body; after that it disappears at once.

4. **Proneness to Chill.**—On making inquiry into the clinical history of patients in whose lung a foreign body is retained, I have been struck by their frequent reference to attacks of "colds" or "chills." In these attacks, which last only a few days, the patient feels cold, shivers, has "goose flesh," feels miserable, and keeps huddled over a

fire. The dyspnoea and cough are a little worse, slight hæmoptysis may occur, and exertion is avoided. The temperature is raised for two or perhaps three evenings to 101° or 102°. The little attack soon passes off, and the patient feels himself again. These recurrent waves of infection—for that is what they are—show that the lung is not always tolerant of the presence of a septic foreign body.

5. **Palpitation.**—A number of patients have complained of severe palpitation, and of pain over the heart, as well as dyspnoea upon exertion; and several of them felt reluctant to lie upon the affected side. Irregularity of the pulse has never been noted, nor intermission.

In a very few cases there have been complaints of *digestive discomforts*, pain and flatulence after food, eructation chiefly due to air-swallowing, and constipation. In the worst of the cases there were many adhesions of the lung to the diaphragm.

C. OPERATIONS FOR THE REMOVAL OF PROJECTILES FROM THE CHEST

GENERAL PRINCIPLES AND DETAILS

The subject of thoracic surgery is one which, before the war, had been made difficult by the cumbersome methods employed. The fear of collapse of the lung when pneumothorax occurred was present in the minds of most surgeons, and was a powerful deterrent. The dread of pneumothorax was in truth the great inhibitory influence hindering the development of thoracic surgery. In the belief that it was necessary to prevent this, Sauerbruch and others in Germany, and Willy Meyer in New York, had devised and employed positive-pressure apparatus for

anæsthesia, and negative-pressure chambers in which the trunk of the patient and the operation team were stationed during the whole of the procedures conducted upon an opened thorax.

There was, however, abundant evidence to show that the fear of pneumothorax was greatly exaggerated. For many years past I have been accustomed, in performing operations upon the kidney for stone or for removal of that organ, to begin by excising the last rib in order to obtain more room, and in order also to prevent undue dragging upon the pedicle of the kidney. In, possibly, a dozen of such cases I have wounded the pleura and have heard the air enter freely into the chest. No disability or distress followed, and I looked upon the misadventure as rather a flaw in the artistry of the operation than a matter of surgical importance, a rebuke to my skill rather than a risk to the patient. Similarly, in operating upon recurrent local growths in cases of carcinoma of the breast, I have removed portions of the chest wall and, by mishap or deliberate intention, have wounded the pleura. Again no harm followed. It is well known that Bazy, of Paris, had spoken of the safety of open operations on the chest for years before the war; and had derided the supposed difficulties or dangers following the free entry of air into the pleura, provided always that there was no myocardial disease.

All these experiences and opinions have been abundantly confirmed by the knowledge we now have of chest surgery in the late stages of gunshot wounds. The entry of air into the cavity of the pleura has produced one effect only, a temporary quiescence or cessation of the respirations. Before opening the pleura we have taken pains to obtain a deep anæsthesia. Air is allowed to enter the

pleura slowly through an incision which, small at first, is subsequently freely enlarged, so as to allow of the easy entry of the hand into the chest cavity. The lung at once collapses, but the degree of collapse is, as a rule, slight compared with our expectations. It is not the degree of collapse seen in the post-mortem room. Such as it is, it is entirely to the advantage of the surgeon: it allows his manipulation to be more freely conducted within the chest; it enables him to reach all parts of the lung more easily; and it permits of the withdrawal of every part of the lung except the hilum from its ordinary position up to the anterior wound, and even outside the chest wall. I can imagine only one serious risk in the making of an open pneumothorax, and that is the wounding of the opposite pleura and the production of a double pneumothorax. That has never occurred in any of my cases, and in operations upon the lung is, I suppose, an impossible catastrophe.

If, however, the œsophagus were being in part excised, the danger would be a real one and need to be kept in mind. Emboldened by my experience in these cases of gunshot wound of the chest, and on the urgent demand of a patient, I recently excised a growth including 3 in. of the œsophagus. The growth lay below the arch of the aorta, to which, and to the posterior surface of the left auricle, it was firmly adherent. I excised the 7th left rib and divided the 6th, 5th, 4th, and 3rd ribs posteriorly, and, introducing Balfour's abdominal retractor, spread the ribs apart very widely. I laid the pleural cavity open freely and obtained a wonderful view of the heart, aorta, great vessels arising from it, trachea, œsophagus, and lung. The actual operation for removal was then made very easy; but remembering that the relations of the œsophagus in that region are

more intimate with the right pleura than with the left, the most scrupulous care was taken to avoid any opening of the opposite pleural cavity.

The Separation of the Pleural Adhesions.—The number, density, and strength of the adhesions found in the pleural cavity vary within the widest limits. They may be few, thin, and light, separating at the gentle touch of the finger; or they may be of the utmost density. I have several times had to dissect off from the surface of the lung thick masses of lymph, as solid as the felt of which a flat-foot pad is made. In such a case it is interesting to see the lung expanding little by little as it is freed from the dense adhesion which has clearly been compressing it.

In my earlier cases I felt that the indication for operation was the presence of the foreign body in the lung, and that the removal of that foreign body was the sole purpose of the operation to be performed. By degrees I came to believe that the removal of the projectile was only a part, and perhaps not always the most important part, of the operation. The adhesions encountered were so considerable in many instances that I became persuaded their presence alone would account for most of the disabilities of which the patient complained, and that their separation or removal would alone give relief to all distress. But realizing the frequency of infection present on the foreign body and the occasional presence of fragments of clothing which were always very offensive, I concluded that the purpose of the operation was a dual one, and that there was perhaps little to choose between the relative importance of the two intentions.

The separation of dense adhesions following perhaps upon a hæmothorax or upon an empyema is by no means free from serious consequences, especially if the foreign

body, which at last is reached and removed, is infected. In five of my cases empyema followed such a procedure: in all the foreign body was infected, in all there was hæmorrhage into the pleural cavity after the operation, and aspiration of this was in the first place necessary. The lesson to be learnt from this experience is that, in all cases requiring the removal of dense adhesions, the greatest care should be taken to secure perfect hæmostasis before the chest is closed. We have only a slight experience of draining such cases for one or two days, but such as it is it suggests that, where oozing cannot be completely checked at the time of operation, drainage gives safety and comfort. The continuance of the tube for longer than, say, thirty-six hours is probably harmful. Our general practice has been firmly and continually opposed to drainage wherever possible.

The dual intention of the operation is shown also by a consideration of those cases in which the projectile has passed completely through the thorax, or has passed through the pleural cavity and lies embedded in the chest wall. In such cases a high degree of respiratory embarrassment, due to pleural adhesions the result of an old hæmothorax, may be present. The opening of the chest cavity to free the lung from the thick membranes which cripple its action is then certainly desirable, though no foreign body require to be removed.

Anæsthesia.—The question of the anæsthetic to be used required, of course, very anxious consideration. We considered first the possibility of performing all the operations under local infiltrative anæsthesia, or under the paravertebral regional anæsthesia which I have seen used so successfully by Pauchet, of Amiens. Chloroform here, as elsewhere, I refused to sanction. The obvious dangers

are great, and its remote dangers in all cases not yet sufficiently realized. For years I have abandoned its use, and I saw no reason to try it in cases of this kind.

Ether has proved so satisfactory in all my work that I determined, if possible, to retain it here also, with or without gas, and oxygen-ether is universally applicable. Dr. Adamson has acted as anæsthetist at every operation, and she has kindly written the following brief account of her method and experience:

Method of Anæsthesia for Intrathoracic Operations.—

The method of obtaining a satisfactory anæsthesia for intrathoracic operations involved very little difficulty after the first three or four cases. The first cases were frankly experimental from the point of view both of the depth of anæsthesia required and of the means by which this might be brought about. The method has now been stereotyped in its essential points, and only calls for variations to meet minor differences in individual patients: the patients have all been young men from 19 to 34 years, in sound condition resulting from military training, and immediately before operation have been free from any infection giving rise to a high temperature. Many of them have required a large amount of anæsthetic.

The anæsthetic used for all the cases has been ether, administered through a Hewitt's wide-bore apparatus. This has been chosen for the following reasons: the ether has acted to a certain extent as a respiratory stimulant in cases which have had to carry on their whole respiratory function with one lung only; and for the convenience of the operator the depth of the anæsthesia has needed to be so great that chloroform administered to such a degree would have been extremely dangerous.

Having chosen ether as the more suitable anæsthetic, and considering it unwise to give any chloroform at all, it is obviously impossible, with this class of patient, to induce a satisfactory anæsthesia by the open method. The closed inhaler has been used throughout the series of cases. A positive-pressure apparatus was not used, as the surgeon wished for a collapsed lung.

In the earlier cases nitrous oxide gas was used to begin the induction, but has been discontinued because of a tendency to persistent cyanosis which appeared in some of the patients who were already the subjects of varying degrees of dyspnœa.

Before coming to the theatre the patients are given a preliminary hypodermic injection of morphine gr. $\frac{1}{6}$, scopolamine gr. $\frac{1}{150}$, and atropine gr. $\frac{1}{100}$, half an hour before the induction of general anæsthesia. This preliminary injection overcomes the agitation some of the patients show at the prospect of what is to them an alarming operation, and it also overcomes any trouble from excessive salivary or bronchial secretions.

Induction is begun with the Hewitt's apparatus without the bag, the proportion of ether being increased from nothing to the full strength possible. When this point is reached, and when the patient is breathing easily, the bag is fixed to the apparatus and used until the completion of the operation. For most patients the anæsthesia produced by this method alone is insufficient, and then the strength of ether vapour is increased by placing the bag in a bowl of hot water and also by surrounding the ether container with a swab wrung out of hot water. With this added help it has practically always been possible to obtain the required depth of anæsthesia, however powerful

and resistant the patient, provided this has been carried out before the pleural cavity is opened.

From the outset, anæsthesia is pushed to a considerable depth, allowing of complete muscular relaxation, and for a few minutes before the pleural cavity is opened the end of a flexible rubber tube connected with an oxygen cylinder is introduced under the edge of the face-piece of the inhaler and a gentle stream of oxygen allowed to pass along it. The face-piece is then kept slightly tilted to prevent over-distention of the bag with oxygen, but it is not removed periodically to give the patient a breath of fresh air as is usual when employing a closed inhaler for other operations.

At the time of the incision of the pleura the patient is deeply anæsthetized, breathing evenly and slowly, and his colour is bright red from the inhalation of an excess of oxygen. Directly the pleural cavity is opened, the lung, if free from adhesions, collapses, and the patient stops breathing. The period of apnœa varies from a few seconds to one or two minutes. The pulse remains regular, and usually unchanged in rate. In a few cases the rate has been increased by ten to twenty beats a minute for a few minutes and has then returned to its previous rate. The patient's colour has remained bright red.

Breathing recommences at about the previous rate, but the range of respiration is extremely shallow, and remains so until the end of the operation. For this reason it is essential that the opening of the pleural cavity shall be delayed until a satisfactory deep anæsthesia is obtained, as it has been found quite impossible to repair the omission later. The stream of oxygen is continued during the whole operation, and may need to be slightly increased for a short time after the resumption of respiration following the period of apnœa. The anæsthesia produced in this

way is sufficient to allow of the necessary manipulation of the lung and freeing of adhesions, the delivery of the lung through the wound to allow of thorough examination, and the stitching of any bleeding wound in the lung or its root. In cases which have involved manipulation of the heart there has been a temporary weakening of the pulse corresponding to any definite pressure on the heart. There has been no irregularity or missing of heart-beats noticed from this cause.

At the end of the operation the patient's colour is usually bright red, the respirations are still shallow and regular, and the pulse is of the quality that it was at the beginning. In most cases the administration of oxygen has been stopped directly the pleural cavity has been closed, and the patient has remained comfortable and of good colour on his return to bed. In a few cases the respirations have been too shallow to maintain a satisfactory oxygenation of the blood, and the patient has become markedly cyanosed and his pulse has begun to fail. This unsatisfactory condition has been remedied by administering small quantities of oxygen at intervals, whenever the patient's colour becomes in the least blue.

The only real difficulty in connection with the anæsthesia for intrathoracic operations is in obtaining a sufficient depth in the patients who require a large amount of anæsthetic to produce even unconsciousness. If the patient is insufficiently anæsthetized he is the subject of a most troublesome cough and straining each time an attempt is made to touch the lung. This greatly hampers the operation, and, owing to the shallow respiration and consequent small amount of anæsthetic inhaled when the pleural cavity is opened, it is practically impossible to deepen the anæsthesia at this stage.

On this account it should be emphasized that it is essential to secure a complete anæsthesia without cyanosis before the pleural cavity is opened, even if it leads to apparent delay in the operation.

The Use of x-Rays During Operation.—The performance of operations for the removal of foreign bodies, in all parts of the body, under the *x*-rays has been almost universally practised in France, where special operation tables have been devised, and where the radiosopic “bonnet” has been perfected. Comparatively little use has been made in the British Army of such methods. Various criticisms of an *a priori* kind have been brought against the French methods. It is said that the operator does not know where his instrument is going when it is pushed directly through the tissues of the limb or the chest, from the surface to the foreign body; that vessels or nerves may be encountered unwittingly and seriously damaged, with grave consequences; that the foreign body, even when reached, may not be easily grasped; and that the forcible and rough withdrawal of a foreign body, perhaps heavily infected, through sound tissues may be the cause of an acute recrudescence of sepsis in the wound. It is said that such operations are “groping in the dark,” and that a method is “unsurgical” which does not allow the operator to see what he is doing and where he is going. I confess that I feel a certain sympathy with all these objections; but they are, I now realize, quite invalid. The success, not of a few cases but of many thousands, has shown, I think indisputably, that the screen methods are, on the whole, and in properly chosen cases, safer than the open methods, and that their after-consequences are at least as tranquil. To the criticism that the operations are “blind,” the expert French surgeon replies that, on the contrary, under the

screen he sees exactly what he is doing, and that, when the foreign body has been accurately localized, he knows precisely what structure he may meet, and what structure he must avoid. And he will point to a very long series of cases to show that the fear of infection of the track along which the metal is withdrawn is excessively small. It is admitted, of course, that the methods have not a universal application. There are regions, like the heart or the hilum of the lung, that must always be approached by the open method. And there are projectiles so large that they cannot be withdrawn from the chest in the narrow space between two ribs. The work needs a special brief education; but the fact that the technique is by no means especially difficult is shown by its wide adoption by the army surgeons in France, and by the success which has attended it in all hands.

Whatever operation is practised upon the chest, the most accurate localization of the foreign body by *x*-rays is desirable; and the condition of the lung, the presence of pleural adhesions, and the range of movement in the diaphragm, should all be investigated. My colleague, Dr. H. B. Scargill, who has conducted all the radiological examinations in my cases, has kindly written the following brief note.

RADIOLOGICAL EXAMINATION.—This resolves itself into three parts:

1. *The Localization of the Foreign Body Should be as Accurate as Possible.*—It is advisable to mark the position of the foreign body on both anterior and posterior surfaces, and to indicate the distance of the foreign body from each.

The radiograph should always be taken from the surface nearer to the foreign body. The depth from the sur-

face can be ascertained by any of the usual methods. It is advisable to make observations from the anterior and posterior surfaces as a means of checking the result obtained.

2. *The Screen Examination of the Chest.*—If the metal moves downwards on deep inspiration, it must be in the lung, or embedded in the diaphragm.

If in the root of the lung the movement is downward, but is very slight indeed.

If the movement is upward on inspiration, the metal is either (a) in the chest wall, or (b) in a portion of the lung which is firmly adherent to the chest wall and can only move with the chest wall.

3. *The Examination for Adhesions of the Lung and Chest Wall.*—In the lower part of the chest, the movement of the arch of the diaphragm on the affected side is most important as an indication of the degree of expansion of the lung.

Around a part of the lung which is adherent to the chest wall there is generally patchy opacity to be seen, due to thickening of the pleura. In some cases the lung and pleura may appear quite translucent, and yet at operation there may be found very firm adhesions.

Adhesions can only be seen as opacities when there is thickening of the pleura of long standing.

INDICATIONS FOR OPERATION

So far as our present knowledge goes, the indications for operation seem to be:

1. *The Continued Presence of Subjective Symptoms.*—A full account of these, as seen in my own cases, has been already given. In all the cases I have dealt with by operation the complaints have been real, and the distress, in the

patient's opinion, has been ample warrant for his submission to an operation, the perils of which I did nothing to belittle. It must be admitted that in many patients a degree of apprehension with regard to their condition exists, and that consequently their subjective phenomena may lack nothing in descriptive detail. But an increasing experience has shown that the *x*-ray disclosures and the conditions found at operation often account for the presence of symptoms which had been ascribed to "functional" causes. The presence of thick masses of adhesions, which revealed little or no evidence on auscultation or percussion—especially adhesions to the diaphragm—will account for many legitimate complaints of pain in the mediastinal regions, or in the abdomen. It is not so much the mere presence of a foreign body in the lung that should be considered, but rather the various changes in the lung and in the pleura which result from the original injury, and which are chiefly the cause of symptoms and chiefly in need of relief.

2. *The Conditions of the Foreign Body and of the Lung Surrounding It.*—The foreign body induces certain changes in the parts of the lung in its immediate neighbourhood. These are described elsewhere. A complete investment of the foreign body by a fibrous covering is rare. Only once have I seen a piece of metal so closely covered on all sides as to be isolated from lung tissue and, so far as could be judged, incapable of inflicting further injury on the parenchyma. Conditions which are those of perfect and permanent tolerance of a foreign body are, therefore, extremely rare. Around the foreign body the physical conditions of the lung, however altered, are rendered more, rather than less, likely to be made active by the presence of an irritating or infected piece of metal or of clothing. If we take

into account the character of the foreign bodies retained, the physical properties of the tissue in which they are held, the incessant movement of the chest, the high degree of physiological activity present in the lung, and the number and size of the vessels in the chest and in the lung tissue, it is probably, as a rule, wiser to advise removal of the foreign body than to sanction its retention.

3. *The Conditions of the Pleural Cavity.*—In many cases that I have operated upon pleural adhesions were present in a degree that alone would cause a restriction of the activities of the lung. In such cases the measurements of the chest on the affected side are smaller; dullness may be present in some degree; and there is deficient entry of air into the chest. The sinking in of the chest wall, the collapse of the lung, and the pulling over of the whole mediastinum, are results of the pleural injury and the pathological conditions subsequently developed, and are causes of the respiratory and other difficulties of which an account is given elsewhere.

It is important to know to what extent these conditions can be relieved by operation. Speaking broadly, two types of operations are performed in such cases—the method of Petit de la Villéon, and the open method. In the former, nothing is done to alter the physical conditions within the chest cavity other than the removal of the foreign body. In the latter, all adhesions are separated, masses of lymph dissected off the lung and the diaphragm, and a considerable attempt made to cause a return of the conditions to the normal. How far such efforts are successful is, with the evidence at my disposal, a matter of doubt. If there has been an empyema before the operation, I think the conditions in my own cases have not been improved. This may possibly be due to a too early operation in which

infection has been freshly aroused, here as elsewhere, by precocious interference. If adhesions have been extensive and dense, their removal has certainly given increased freedom to the action of the lung. The records of my cases show that benefit has almost always resulted in such cases. Improvement does not occur in the same degree or so rapidly if no operation is done; for in patients whom I have kept under observation for months before operation, the change in the condition of the chest on examination, clinically or by *x*-rays, and the improvement in their subjective disturbances, has been either absent or exceedingly small. Open operation may therefore be said to be justified by its results.

METHODS OF OPERATION

The methods which have been practised for the removal of foreign bodies from the chest will be considered in the following order: (1) *Method of Petit de la Villéon*; (2) *Method of Marion*; (3) *The open method of Duval*; (4) *Operations upon the hilum of the lung*; (5) *Operations upon the mediastinum*.

1. **Method of Dr. Petit de la Villéon.**—The operation consists in the introduction, through a very small incision made between two ribs, of a special pair of forceps, with a blunt end and long parallel blades on the one side of the hinge, and short “crocodile-jaw” blades on the other. The position of the foreign body is very accurately determined by the *x*-ray. The operation is performed under the *x*-ray and with the aid of the screen. A preliminary injection of morphine is given and a light general anæsthesia induced. Petit de la Villéon uses chloroform. The forceps are introduced from the axillary side, the incision to admit them being made along the upper border of the rib, so as to

avoid vessels, and are guided by the image on the screen and directed towards the known position of the foreign body. The progress of the instrument is slow and gentle, and continues until the image of the tip of the forceps and of the foreign body coincide. If the entry has been expertly made the contact will then be felt; the metal is grasped by the wide opening of the "crocodile-jaw" blades, and is slowly and steadily withdrawn. Nothing remains but to close the skin wound by a single stitch. The penetration of a blunt forceps into the lung tissue does no damage. It ruptures no vessels; it does no injury to the delicate tissues of the lung; it seems to cause a separation of the tissues rather than a destruction of them. The experience of recent wounds of the lungs in this war has shown how very tolerant of injury they are, and how few are the symptoms produced by the slighter degrees of trauma. It is not then surprising to hear that a blunt instrument may be gently pushed through the lung substance without giving rise to any real danger. The withdrawal of a foreign body might be attended by more serious injury, especially if there were many sharp points and rough surfaces; these, however, do not inflict much injury, if any, if the jaws of the forceps grasp and include the foreign body in their embrace. Such damage as is caused would be enhanced in severity if the metal chanced to be infected by one or more organisms, which we know will remain potentially active in the lung for years. But suppositions and fear must yield to experience; and this has given abundant proof, in the hands of all, that the risks of injury are almost negligible. The mortality has been found to be extremely small, far less than by any other operation practised. The post-operative course is so smooth and devoid of incident as to excite the frank as-

tonishment of all who see the method practised for the first time. The functional recovery is said to be at least as good as that which follows the open operations; and is obtained at less risk and less cost in respect of suffering and duration of convalescence.

There are certain contra-indications to the method:

(a) *Proximity of the Foreign Body to the Hilum of the Lung.*—One of the few fatalities in the large series of cases operated upon by Petit de la Villéon occurred as the result of hæmorrhage after extraction of a piece of metal from the hilum. He, and every other surgeon, now agrees that for all retained projectiles in this position an open operation is necessary. It is imperative that the work to be done should be carried out under open inspection, and that steps should be taken to avoid laceration of the large and numerous vessels in the root of the lung, and to arrest such hæmorrhage as occurs either by suture or, as Petit de la Villéon prefers, by packing with gauze for two or three days.

(b) *Proximity of the Foreign Body to the Heart.*—In one of his cases reported in *Bull. et Mém. Soc. de Chir. de Paris*, 1918, p. 577, Petit de la Villéon describes the projectile as "appearing to be included in the wall of the left ventricle of the heart." It was extracted by his method, the forceps passing through the entire thickness of the lower lobe of the left lung. In another case some fibres of heart muscle were found on the missile after removal. In his most skilful hands the method does not appear to have presented unusual difficulties or serious dangers; but it is nevertheless one to be condemned. In all cases where the projectile is adherent to the surface of the heart, or in which the lung is so adherent to the pericardium, and this membrane to the heart, that it is impossible to say how

close the connection between the missile and the heart may be, the open operation alone should be practised.

(c) *The Size of the Projectile.*—The great majority of the foreign bodies lodged in the parenchyma of the lung are of so small a size as to allow of their easy extraction between the ribs. If the projectile is large, a piece of rib may be resected, or raised, and the remainder of the operation conducted in the usual manner. But even then the damage done to the lung by the forcible dragging through its tissues of a large solid body must be taken seriously into account. For large projectiles the open operation is either the only possible method, or the safer.

(d) *Suppuration Round the Projectile.*—This can generally be determined by the radiologist. When it is evident that a small abscess surrounds the foreign body, or that it is encased in a hard sclerotic mass, it is unwise to attempt the removal by this method. It is impossible to say whether the pus which lies on all sides of the missile is heavily infected or no. But it is well to take no risks. The removal of the foreign body in all such cases should be done under full inspection, so that an adequate cleansing of the infected cavity may be secured.

(e) *The Presence of Other Foreign Bodies than that Shown on the Screen.*—It is not often that pieces of clothing are found with the projectiles in the parenchyma of the lung. I know no explanation for this: but it is, in my experience, far less frequent to find débris of clothing in the lung than in the limbs, when pieces of metal are being removed. The danger of leaving behind a piece of cloth is therefore very slight, and the subsequent clinical history of a large number of cases shows that the risk is one that need hardly be considered. Petit de la Villéon believes that in many cases he removes not only the foreign body but its cap-

sule, and any other foreign body included in it. Such an experience must, I am sure, be exceedingly infrequent.

The essential circumstance for the successful extraction of the projectile by this method is its *mobility with the lung*. This is indicated by the *x-ray*; the shadow of the foreign body should move downwards concomitantly with the diaphragm. The exception is in the case of foreign bodies in the apex of the lung, where the range of movement is slight or absent. This freedom of motion indicates that the metal is not embedded in a mass of dense adhesions outside the lung, extrication from which would involve gross and heavy-handed measures. The benignity of the operation is remarkable. It is rare for a patient to be incapable of discharge from hospital in eight or ten days.

It has often been asserted that the method is a "blind" one; that the surgeon is "groping in the dark"; and that it is easy to lose one's way and to be compelled to pierce the lung in several directions until contact with the metallic foreign body is made. All these things depend upon the surgeon. To render it not a "blind" but an open method—a "clairvoyant method"—it is necessary for the operator to become practised in screen examinations, and to make himself an adept in the removal of projectiles from the limbs. As Petit de la Villéon says, an apprenticeship is necessary. This is hardly an objection, or if it is, it has a wide application. The method has on many occasions been controlled in this way: the small external incision has been made, the lung pierced, the forceps left *in situ*, and the chest opened to remove a foreign body whose fibrous casing has been dense, or whose situation in the diaphragm has made withdrawal difficult. An inspection of the lung has shown only a slight bruise at the point of

entry of the forceps, and "not a drop" of blood has been seen to issue from the path made in the lung.

There are times when a little air escapes into the pleural cavity by the side of the forceps. This is of no account. We know by long experience how little is the harm done by a pneumothorax so caused, as, for example, in operation on the kidney when the last rib is removed. Robineau, indeed, holds the opinion that it may even make the operation easier. He finds also that when the method is practised as an open operation, in the circumstances just mentioned, the movement of the forceps within the lung is always free, causes no hæmorrhage, never lacerates the lung, but allows it to slip forwards and backwards along the forceps with great ease.

The most alarming consequence which has followed upon this method is hæmoptysis. In some degree this occurs in the majority of cases; in serious degree, very seldom. Margins records one case in which the hæmorrhage was extremely serious though not fatal.

An occasional rise of temperature occurs; and a localized patch of consolidation may be found. In one case P. Duval lost a patient from double pneumonia. A serous effusion of slight degree into the pleural cavity is not infrequent. The evidences of it usually disappear within four or five days.

2. **Marion's Method.**—This consists in resection of one rib in front, usually the 4th or 5th. When the pleura is exposed and the lung is visible underneath, a curved Reverdin needle is passed through the pleura into the lung, out through the pleura again, and the stitch tied. A series of such stitches fix the lung firmly to the parietal pleura. When such fixation is thought to be complete, the pleura and lung together are incised. Air does not enter the

pleural cavity; that is to say, no pneumothorax develops. From the incised lung air and blood escape. A finger is pushed into the wound, and the foreign body felt and extracted with the finger; or a Kocher's forceps, or other instrument, is passed into the lung until the foreign body is felt, seized, and then extracted. Marion then passes a strip of gauze into the wound in the lung and allows this to remain for a few days. The parietal wound is closed round the gauze.

I can see little advantage in this method. The fear of pneumothorax is an exaggerated fear. The one reason for its adoption may be this, that in cases of infected foreign bodies the risk of conveyance of the infection is limited to the small track through the lung and to the parietal wound: it does not affect the cavity of the pleura.

The objection has been brought against the method that it creates a solid mass of adhesions fixing the lung to the parietal pleura. That is true; but some degree of adhesion of the lung no doubt occurs to every parietal wound in the ordinary open operation, especially when the pleural coaptation has been imperfect, as it often is. Some surgeons, R. Oliver, of Lyon, for example, speak enthusiastically of this method. (*Lyon Chir.*, 1918, xv, 351.)

3. **The Open Operation of Duval.**—The operation I have performed in my cases—a slight modification of Duval's—is the following: An incision is made exactly in the line of a rib (Fig. 9), following its curve, from the edge of the sternum outwards, for about 5 inches. As a rule the 4th rib is chosen. If the projectile is in the apex of the lung the 3rd rib may guide the line of incision; if the projectile is at the lower part of the chest the 5th rib is selected. The room given for the introduction of the hand is greater, the lower the incision is made. The in-

cision cuts through the skin, subcutaneous tissue, and pectoralis fascia, and exposes the fibres of the pectoralis major muscle. A pair of forceps is pushed through the fibres of the muscle until it touches the rib; the blades are opened and the muscle is split, and the separation is widely made from end to end of the original incision. The pectoralis minor is then exposed, and may be split in the same manner, or cut away until the outer surface of the rib is seen. All vessels which bleed, and there are many, are carefully ligatured, for a very dry wound is essential.

The rib and costal cartilage are now well exposed. Through the periosteum two incisions are made close to the upper and lower edges of the rib, and from them the periosteum is stripped upwards and downwards and from the posterior surface. The periosteum which lies between the two incisions is not separated from the rib, but remains attached to it through all the stages of the operation.

As soon as the periosteum is freed from the posterior surface for half an inch, the periosteal elevator of Doyen is slipped round the rib, and pushed backwards towards the axilla and forwards to and along the costal cartilage, until a length of about 5 inches is cleared. Here and there a little help may be needed with the knife or scissors to make the way easy for the instrument. The costal cartilage is now divided by two incisions meeting at a point (Fig. 10); this allows the divided ends to dovetail together when the operation is nearing completion. When the cartilage is divided, a gauze strip is passed underneath the rib, which is lifted gently upwards and outwards (Fig. 11).

In young patients the elasticity and suppleness of the rib are remarkable. It is quite easy to raise the bone out of the way throughout the operation and then to replace it. The third rib does not lift so easily as the lower ribs, being

shorter and therefore more resistant. In four cases (three of the 3rd rib) the bone has fractured as the result of the drag made on it. In three cases it was replaced and united firmly. When the rib is elevated, the periosteum is seen as a thickening of the pleura exposed in the wound.

Through periosteum and pleura a small incision is made, with the result that, in the absence of adhesions, air slowly enters the pleural cavity, and the lung begins to collapse. It is, I think, important to allow of the slow development of the pneumothorax; a sudden collapse of the lung might cause a little respiratory embarrassment. If air enters very slowly, the regular breathing is hardly disturbed for more than a few seconds or a minute, and the operation can proceed as tranquilly, so far as anæsthesia is concerned, as if it involved one of the extremities. Le Fort is, I believe, alone in saying that an immediate wide opening of the pleura is safer than the practice of making a small incision and allowing air to enter slowly. The incision in the pleura is then lengthened, always along the line of the periosteum, until there is room for the hand to pass through it. The rib-spreader is then introduced (Figs. 11 and 12). Tuffier's pattern is the most easily worked, and is very helpful. Separation of the ribs above and below that which has been elevated is always easy enough. I have never found it necessary to remove or elevate another rib, or to divide another costal cartilage to allow of more space being obtained by further displacement of the ribs.

An inspection of the chest is now made, and note is taken of any adhesions that may be found. The adhesions vary to a great extent; they may be few and of the lightest texture, breaking down with the gentlest handling; they may be almost universal, requiring a firm effort to separate

them; they may be of the utmost density, $\frac{1}{4}$ inch in thickness, so firm and strong that a separation with the finger alone is quite impossible. I have several times had to cut away, with the scissors, plates of lymph as thick as felt before I could liberate the compressed lung. As such adhesions are removed, the lung is seen to expand. It has been my practice always to separate every adhesion as the first part of the intrapleural stage of the operation.

I have felt, rightly or wrongly, that the restriction of the free expansion of the lung by adhesions was to be considered as perhaps the most essential point of the operation. The separation of adhesions, except those of the toughest sort, is best carried out by the procedure of "gauze stripping" which is adopted in the separation of a hernial sac. On separating adhesions, cavities containing old blood-clot may be found. On one occasion such a cavity contained not less than a pint and a half of old blood-stained fluid of the colour and consistency of thick cocoa. On two occasions I have found the remains of an empyema which had not been opened. These conditions could not be discovered unless the adhesions were methodically and habitually separated. The adhesions bleed freely, but the hæmorrhage is very easily and rapidly checked by the pressure of hot moist swabs, one or two being left in the cavity while the operation proceeds. I have sometimes felt the projectile drop into my hand as the adhesions were being separated; the foreign bodies lay not so much in the lung tissue as in adhesions binding the two pleural surfaces together.

When the lung is freed the projectile may be sought. It is easier to find a metallic foreign body in the lung than in any other part of the body. When the organ is gently grasped in the fingers a local hardness is felt at once. The

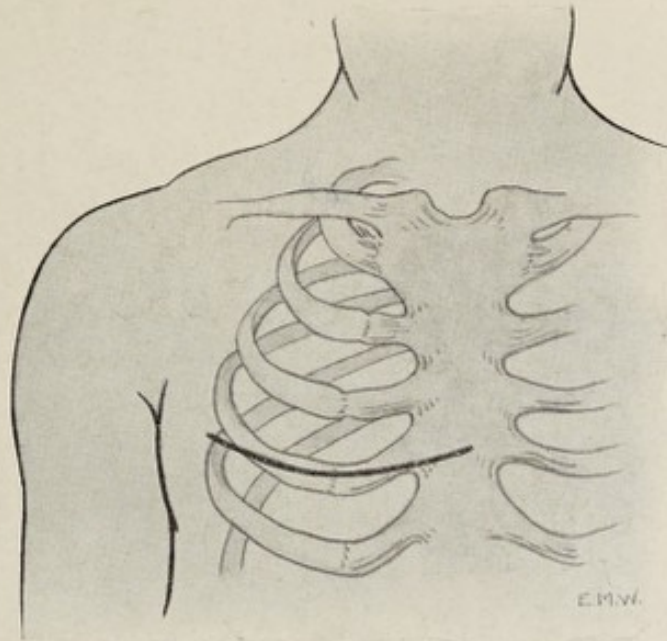


Fig. 9.—The skin incision follows the line of the fourth rib.

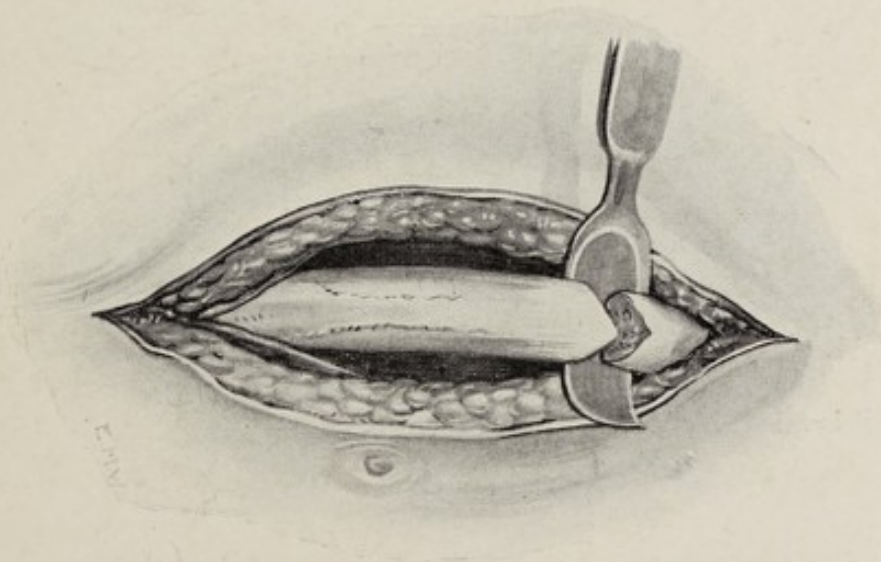


Fig. 10.—Division of the costal cartilage.

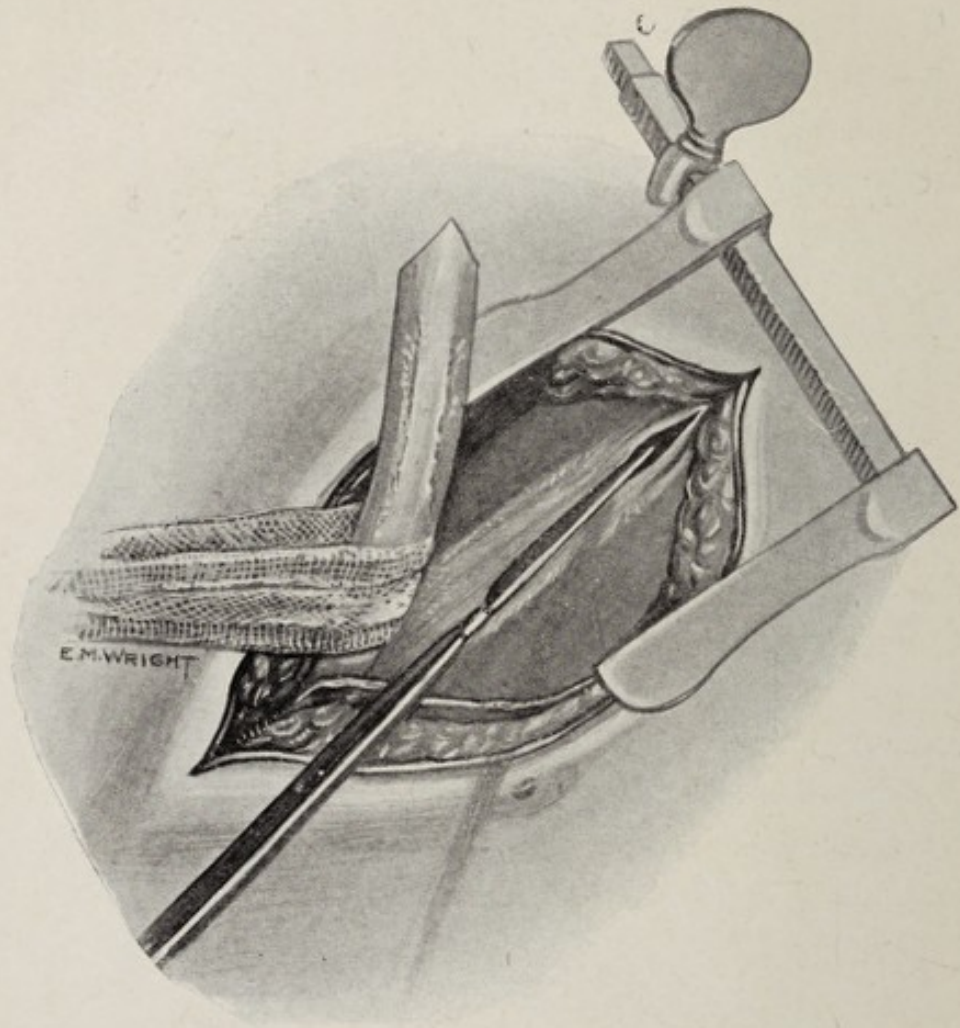


Fig. 11.—Tuffier's rib-retractor introduced separates third from fifth rib widely. Incision of periosteum and pleura. The rib is lifted out of the way; as a rule it is raised higher than is here shown.

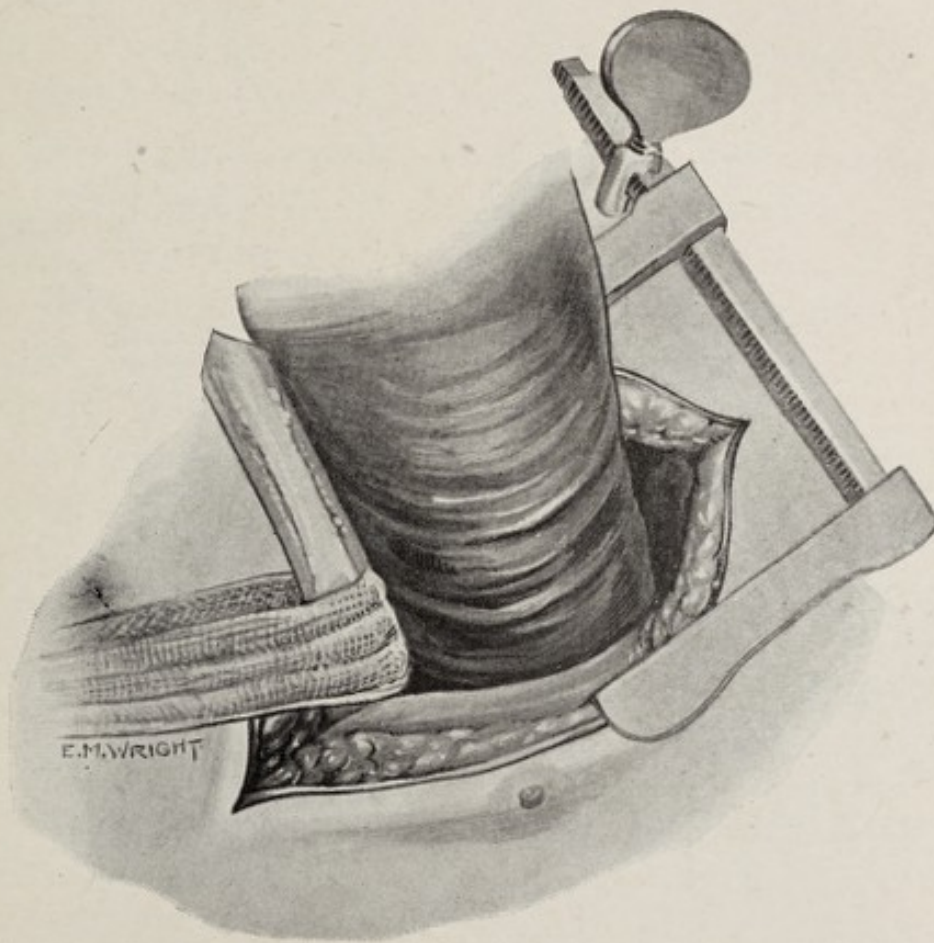


Fig. 12.—The hand introduced into the pleura to separate adhesions, etc.



Fig. 13.—The lung brought out on to the surface of the chest.

part of the lung which holds the metal is then brought to the surface. It is astonishing to find with what ease the posterior part of the lung, for example, can be brought forward to the wound, and held there while the foreign body is extracted. The mobility of the lung, and the ease of handling it, are very remarkable. The lung may be grasped with the hand, or held lightly in the specially devised lung forceps of Duval (Fig. 13), the grasp of which is firm and delicate. When the lung containing the projectile has been lifted forward, the depth of the missile from the surface is gauged, and steps are taken to remove the metal. A pair of blunt forceps may be pushed through the lung substance until they impinge on the bullet, the blades are opened, and the body is grasped and gently disentangled from the lung. Or an incision may be made through the lung directly down to the body (Fig. 14), which is laid bare and removed. The wound in the lung is now touched with pure carbolic acid, and closed by catgut sutures which closely approximate the pleural edges.

The condition of the lung around the retained metal varies. Sometimes a small abscess cavity is discovered, the pus being dried and hard; sometimes a hard fibrous mass encases the metal; sometimes there is a dark-red area of hepatization; quite often there is no appreciable change in the density or appearance of the lung tissue.

Throughout all the manipulations the lung is handled with extreme gentleness. The light hand and the tender caress are as necessary in this branch of surgery as in all abdominal operations, and equally repay the surgeon in the quick and quiet recovery of his patients. The heavier the handling of the lung, the greater appears to be the subsequent respiratory distress from which the patient suffers.

The wound in it being closed, the lung is allowed to

drop back into the chest, and pains are taken to see that all the fluid is removed. Bleeding must be checked by pressure, for the exudation of even four or five ounces on the day following operation is enough to cause distress. The retractor is now removed, and steps are taken to close the pleural wound. I have rarely been able to close the pleura with that perfect coaptation of the surfaces that is so easily obtainable in the peritoneum. The apposition is often very difficult, especially at the inner end of the wound, and the stitch may cut through if any special tension is put upon it (Fig. 15). Help may be obtained by passing one strong suture round the ribs above and below, and dragging them closely together.

In early operations I wiped the lung wound over with ether and left a little ether in the chest cavity. It rapidly evaporated, and at the completion of the operation I aspirated the chest, drew the ether vapour away, and allowed the lung to expand at once. This is neither necessary nor prudent, for the collapse of the lung helps hæmorrhage, and the air left in the pleura is very rapidly absorbed.

The rib is now replaced: a stout catgut suture passed through the costal cartilage holds the ends in apposition, and this is helped very much by the dovetail incision which was made to divide the cartilage (Fig. 16). Over the rib the pectoralis minor muscle is sutured, and the fibres of the pectoralis major are brought together by three or four stitches. The pectoralis fascia is carefully sutured in all its length, and finally the skin is closed by a continuous suture (Fig. 17). As a rule no drainage is used; but in two cases in which the bleeding was free I put a small drain in posteriorly for twenty-four hours, and I think the patient's comfort was increased thereby.

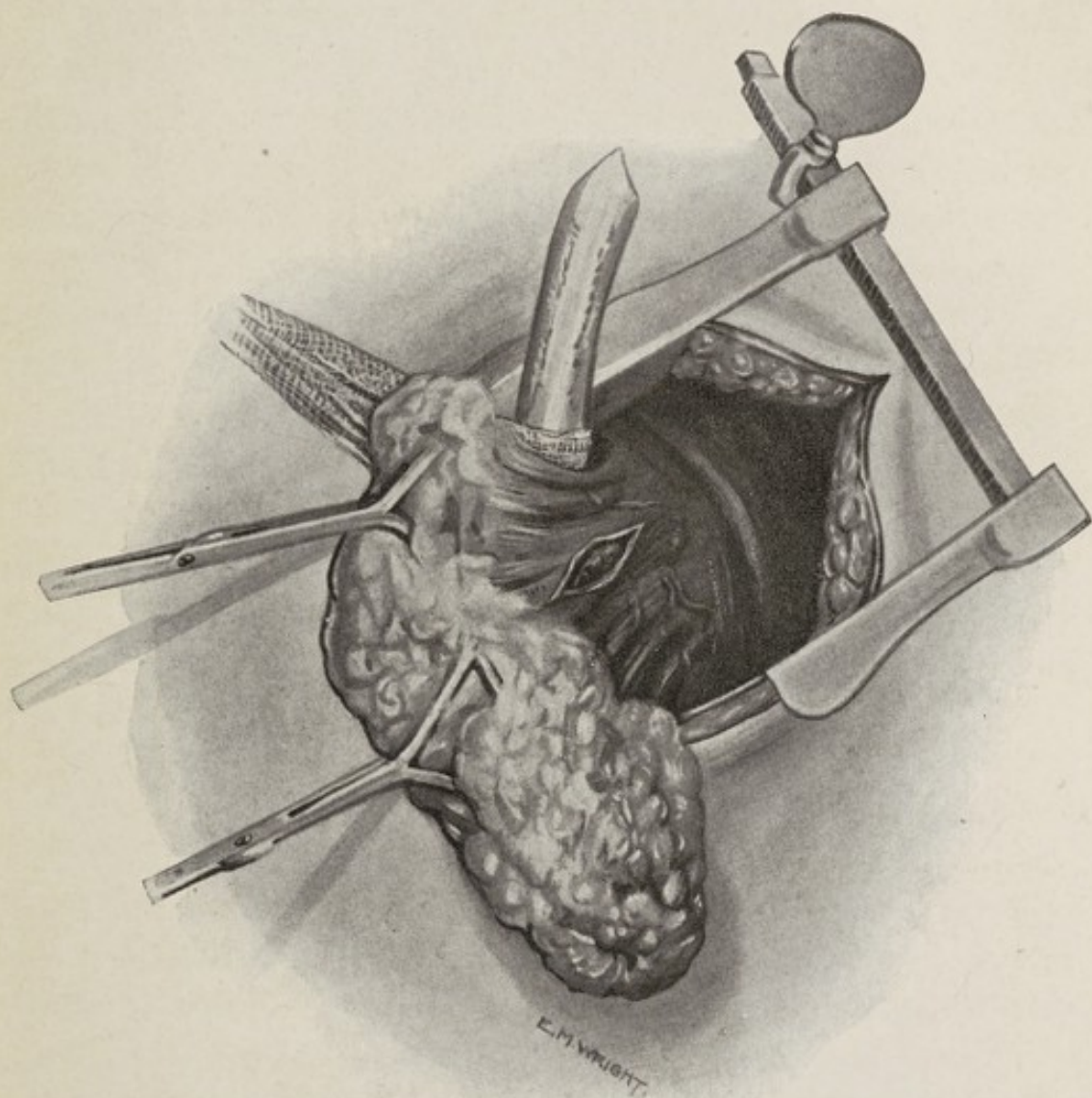


Fig. 14.—Position of a foreign body indicated, with the incision into the lung to expose it.

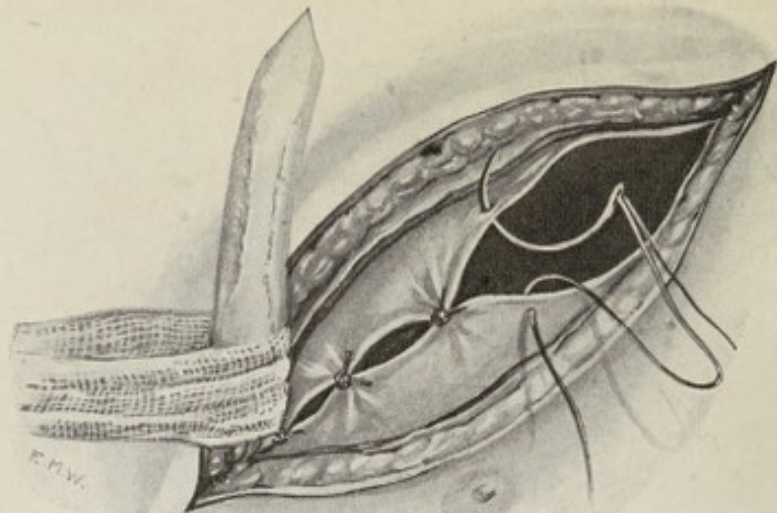


Fig. 15.—Suture of the pleura.

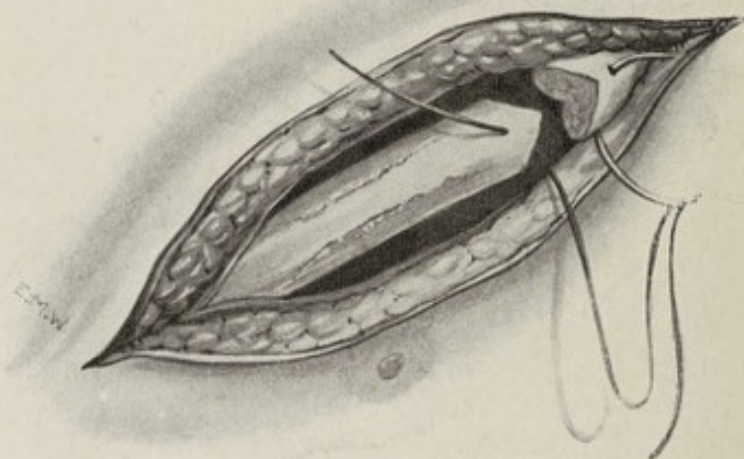


Fig. 16.—The rib replaced and the costal cartilage sutured.

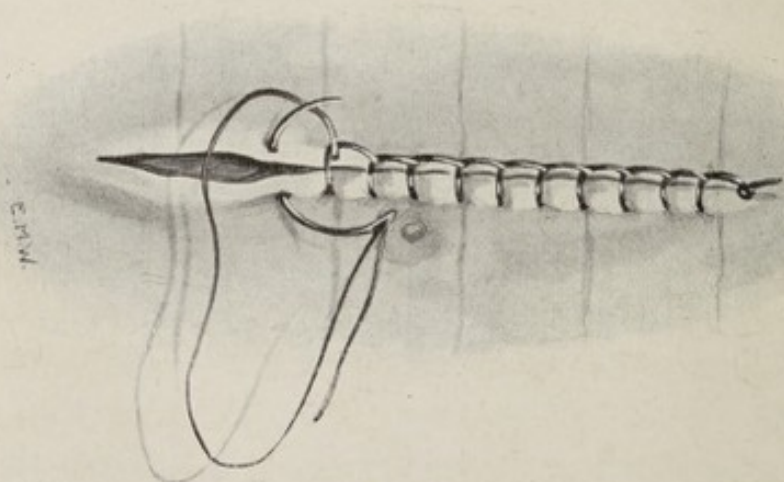


Fig. 17.—Closure of the skin wound by continuous catgut or horsehair suture.
The scratches made on the skin ensure accurate apposition of wound edges.

It is impossible to displace the hilum towards the surface, and all the rather difficult and often tedious manipulations have to be carried out inside the chest.

When the projectile is on, or in, the heart muscle, it is convenient to put in one or two sutures above and below, or to the sides, so as to hold the heart steady while an incision is made. On one occasion only I have found an isolated dried hard mass of calcareous material in the lung, which was possibly a cured local tuberculosis. On four occasions fragments of clothing have been found lying with the projectile.

AFTER-COURSE.—As a rule the after-course is simple. The following complications may be seen:

Hæmoptysis.—This has occurred 7 times in 49 cases. As a rule it is of the slightest, and causes no concern; once only have I seen a degree of hæmorrhage which could be assessed at 3 or 4 ounces, occurring in the first twenty-four hours.

Respiratory Distress.—This occurs rarely. It has only been noticed in cases where a multitude of severe adhesions had to be separated, and the lung rather heavily handled. In 12 cases an effusion of blood or serum has been discovered on the third or fourth day, and aspiration has given a relief that was striking in proportion to the amount of fluid removed.

Emphysema.—Surgical emphysema has developed in several cases, especially those in which a poor apposition of pleural surfaces was obtained. It has twice spread over the neck and face. It has always rapidly disappeared, and has never been a matter of distress.

Infection of the Wound, or of the Pleural Cavity. Empyema.—In 10 cases empyema had been present before operation. There were, as I have said, 12 cases in which

effusion of blood occurred into the pleural cavity after operation; of these, 5 developed empyema. In every such case the foreign body was infected. In the remaining 7 cases aspiration was performed, and the chest condition rapidly cleared up; in 6 of these cases the foreign body was sterile, and in 1 infected. The infection which occurs is undoubtedly the result of contamination of the wound at the time of operation, for, with one exception, where pneumonia occurred, the organisms recovered from the wound discharges or cultivated from the opened empyema were identical with those found on the projectile. These organisms are coliform bacilli, streptococci, and staphylococci.

An examination of the metal fragments removed shows that a prolific growth of organisms can be cultivated from them years after the infliction of the wound. The question as to the wisdom of freeing adhesions in all directions in the presence of an infected body will be referred to later.

4. **Operations Upon the Root of the Lung.**—The root of the lung is that part of the pedicle of the lung at the region where the pleura is reflected on to it. The measurements of the root are from above downwards about 30 mm., and from before backwards about 15 to 18 mm. The surface marking *in front* is the 3rd costal cartilage and the adjacent intercostal spaces on each side; and, behind, the inner end of the 5th rib and the adjacent intercostal spaces on each side. In the root of the lung lie the bronchi, pulmonary artery and veins, bronchial artery and veins, lymphatic glands and vessels, and nerves. The glands are numerous. The pedicle enters the lung at a vertical notch, the hilum, about 45 to 50 mm. long and 25 mm. broad.

The special considerations in connection with opera-

tions upon the root of the lung are, chiefly, the extreme vascularity of the part, its fixity, and its physical properties.

The number of vessels is great and their size formidable. A wound of the root of the lung should be inflicted with extreme caution, for if a vessel is wounded it is exceedingly difficult to arrest the hæmorrhage. It is almost impossible to secure the vessel and to ligature it in the ordinary manner. If a suture is passed round the vessel, it is likely that other vessels will be wounded by it. For this reason many of the French surgeons advise the plugging of the wound with gauze, which is left in position for two or three days.

One of my two fatal cases died from hæmorrhage. The projectile was embedded in the root of the lung. After its gentle removal there was free hæmorrhage, which appeared to be arrested by the sutures I passed for this purpose. The patient died in a few hours, and the pleura was found filled with blood. The error in technique was grievous, and the warning for similar cases did not go unheeded.

The fixity of the root makes all operations upon it far more difficult than those which engage other parts of the lung. It is really surprising to find with what ease all parts of the lung can be brought forward to the wound made by the elevation of the 4th or 5th rib, incised, and carefully sutured. The root of the lung is almost immobile. The operator must go down to it; he cannot bring the parts nearer to him. All the steps of the operation can, and should be, visible to the surgeon; nothing need be done in the dark; but the remoteness and the immobility render all manipulations much more difficult than they are elsewhere. All technical procedures at the root of the

lung are made easier if the parts near the hilum are fixed by the special light forceps of Duval. They not only withdraw the lung from the path of the surgeon, but give a stable field in which to work.

The physical properties of the root of the lung make it exceedingly difficult to distinguish a bronchus from a piece of metal. I have been deceived more than once. When, for purposes of comparison, I have examined the hilum in cases where it was known that no foreign body was lodged there, I have realized how exact was the mimicry of a projectile by the hard, rounded, but irregular condition of a bronchus.

Notwithstanding these several points, there is no need to modify the ordinary open procedure which I have described. Some surgeons have preferred the flap operation, which, as Le Fort has shown, is especially applicable in some operations involving the mediastinum. That more room is thereby gained is indisputable; but more room is never needed, for all requisite manipulations are possible through the ordinary incision. The flap method is certainly a little more formidable; inflicts a greater damage on the chest; and implies a more protracted convalescence, and perhaps a weaker chest wall in days to come.

Le Fort himself (*Bull. et Mém. Soc. de Chir.*, 1917, p. 1142) obtains adequate room by making an intercostal incision, dividing the costal cartilages above and below, and displacing them upwards and downwards by strong retractors. An approach to the hilum from behind is advised by Petit de la Villéon (*Bull. et Mém. Soc. de Chir.*, 1918, p. 976), who describes an area bounded on the inner side by the spine, on the outer by the border of the scapula, above by the 5th rib, and below by the 8th rib, as that in which the shadow of the root of the lung falls. If a piece

of metal is seen in this area, and is gauged to be at a depth of from 6 to 13 cm. from the posterior surface, it lies in the root of the lung. His operation is practised in three stages:

Stage 1.—Performed in a strong red-orange light. The patient lies prone. The omovertebral space is opened, and resection of the necessary ribs (6th, 7th, and 8th) is performed; the resection is made as wide as possible to give free access. The pleura is opened.

Stage 2.—Performed under *x*-ray, with screen examination. A long pair of forceps is passed through the visceral pleura and the lung to the hilum. Guided by the image on the screen, the forceps seizes the foreign body, grasps it, and is held steady.

Stage 3.—In daylight. The forceps is withdrawn with the projectile. Into the wound made by the forceps the surgeon plunges his left index-finger; this he gradually withdraws, packing gauze in long strips into the cavity it occupied. The wound in the parietes is closed. The packing remains for forty-eight hours, being loosened first by hydrogen peroxide. It is thought that the free pneumothorax aids in hæmostasis. Sixteen cases are recorded, with 16 recoveries. In none was there any hæmorrhage.

The method of Petit de la Villéon has obtained a degree of success denied to all other procedures. It requires a special installation of light and *x*-ray, and an apprenticeship on the part of the operator in the extraction of foreign bodies under screen examination. Its success depends upon details; but its success is no detail. Probably a combination of the anterior operation with a screen examination at the time of searching within the hilum for the projectile would be an improvement upon the original method. And no small part of the success of the opera-

tions performed by Petit de la Villéon depend upon his fully-trained capacity for details and for dainty operations of this type.

5. Operations Upon the Mediastinum:

Access to the mediastinum may be obtained either by the operations already described, in which one rib alone is elevated or removed, or by methods specially devised to give ample access. Of these special methods the following may be briefly described.

1. *The costal flap with external hinge of Delorme, modified by Le Fort* (whose description I give):

This flap is cut widely and regularly by dividing the costal cartilages and the intercostal spaces at equal distance from the bordering ribs (so as to permit the repair of the wall); it is then raised, guarded against fracture of the ribs either by simple elevation if the flap can be extended very far outward, as is the case with the lower ribs, or by causing a greenstick fracture by strong but cautious pressure, as can be done in the majority of patients up to and even above thirty years of age.

This procedure provides the most light, permitting complete exploration of the entire thoracic cavity, from the clavicles as far as the diaphragm, and from the sternum to the vertebral column and the ribs behind. It facilitates all manipulations, the introduction of both hands and instruments into the interior of the thorax, and the direct inspection of the entire cavity. Very recently I succeeded without difficulty in obtaining hæmostasis of the wounded azygos major vein behind the diaphragm, by means of an anterior flap.

2. *Le Fort's method of intercostal incision associated with division of the supra- or subjacent costal cartilages:*

As in the case of the flap with an external hinge of

Delorme, the procedure causes no mutilation of the thorax. The repair of the wall is easier and can be made even more accurately than after the Delorme flap, and the operation is perhaps even more free from danger. The procedure permits the breach in the chest wall to be made more or less extensive according to the necessities of the case. A simple incision of one intercostal space permits separating the ribs by about 6 cm.; division of the cartilage above or below permits of a separation of 8 cm.; division of both cartilages together gives an opening of about 12 cm., and the supplementary division of another cartilage enables one to enlarge the separation to 19 cm. It is very advantageous always to make the incision in an intercostal space slightly below the level of the foreign body which is to be extracted. This way of proceeding has a twofold advantage: on the one hand, the avenue of access supplied by the incision of an intercostal cartilage is so much the larger the lower the intercostal space; on the other hand, the intercostal incision combined with incision of the costal cartilages above can be very easily transformed into a costal flap by simple section of a higher intercostal space.

3. *The sternocleidocostal flap method, suggested by Duval:*

This operation provides free access to the cervico-mediastinal "cross-roads," to the arch of the aorta, the origin of the carotids, the brachiocephalic trunks and the subclavian veins, the internal portion of the apex of the lung, and the entire half of the superior mediastinum, without sacrificing the clavicles, without opening the sternocostoclavicular articulations, without damaging any organ, vessel, nerve, or important muscle. It consists in turning upward and outward a flap which comprises the clavicle, the first rib, and the upper outer segment of the sternal manubrium where these bones are inserted.

4. *Median division of the sternum, pericardium, and diaphragm—Duval's method:*

This provides free access to the heart, and is recommended for certain operations upon the right heart. Sometimes it may be desirable to add to the flap with an external hinge a small sternal flap with an internal hinge, etc.

The detail of these procedures does not really make much difference. The indispensable requirements are to provide all the necessary light for the operative intervention by means of a large gap, which can be further enlarged should an unexpected necessity arise; and to avoid all permanent mutilations, so as to permit an essential repair of the thoracic wall after the completion of the operation.

The relative advantages and difficulties of these several methods have been briefly indicated in the description of each. For the removal of small projectiles lying free in the lung which has no serious adhesions to the chest wall, the method of Petit de la Villéon is the easiest, safest, and least disturbing.

For all foreign bodies in the hilum, or in the mediastinum, or in the heart, an open operation is necessary. For many of these the operation in which one rib is elevated and resected is generally adequate. If it is necessary to have more ample space and a better view, the operations of Delorme, Le Fort, or Duval will be performed. The operation of Petit de la Villéon, in which the hilum is approached from behind, appears to be attended with great success, but, so far as I can learn, has been practised only by him.

D. AFTER-HISTORY AND RESULTS OF OPERATION

To my regret it has not been possible to make such comparison as I consider necessary between the conditions of the patients before operation and afterwards, especially months afterwards. The men upon whom I have operated are scattered about the country from Aberdeen to Cornwall; most of them are back at work, and it has been quite impracticable to get them to come for a medical and radiological examination. In most of the cases I have therefore to rely upon the patients' testimony. It is not certain that this is always as satisfactory as it might be; for more than half the men make some bitter reference to the dealings of the Pensions Ministry with them; of reductions which they consider untimely, or unfair, in the weekly pension. Some of the letters seem to express a fear that a too favourable report may result in a pension, already meagre, being further reduced; but the evidence is the best accessible. I have accordingly written to all patients, and their answers are given in the appended case reports.

As a class, these reports contrast in a very striking manner with those which I received almost at the same time from some of the patients upon whom, in recent years, I performed partial gastrectomy for gastric ulcer or gastric cancer. In the pleural cases it is comparatively rare to find the patient saying that he is entirely free from trouble. There is not infrequent reference to breathlessness on exertion, or to a little pain. There is rarely any mention of cough, and none of hæmoptysis. These two conditions are certainly relieved by the removal of the foreign body; but the functional troubles persist in some degree.

Does the persistence of some of these symptoms depend upon the operation performed? Is it, for example, a wise procedure to separate all adhesions binding the lung to the chest wall? In the presence of numerous and strong adhesions there does not appear to be necessarily any pain, nor any shortness of breath except on exertion. It is true that the lung then acts imperfectly, that it shows evidence of collapse in greater or less degree. My hope was that the free and open operation which I have customarily performed, together with the fearless separation of all adhesions, might do something to restore the lung to its full free function. And in some cases this hope has certainly been fulfilled. It is a very striking phenomenon to witness the gradual expansion of the lung when thick adhesions are separated, or tough heavy membranes stripped from its surface. The lung grows bigger and fuller under one's eyes, and it is evident that there has been compression as well as a willing collapse on the part of the lung. But in some cases the results that have followed have been below my expectations. As some of the late reports show, there is evidence still of restricted capacity for breathing, of effort dyspnoea, and of some pain. And the physical examination shows also that in some cases a degree of collapse is still present. The most certain test of a lung's free activity is perhaps afforded by an inspection of the range of movement of the diaphragm watched on the *x*-ray screen. In several patients there has been witnessed an increasing range, as function was restored. In a few of our patients the mobility of the diaphragm did not visibly increase.

The condition of the elevated rib is in all cases quite satisfactory. Sound union has occurred; and the chest wall may be said to be as strong and firm as ever.

SUMMARY

The following is an epitome of my experience: 49 cases have been treated by operation; 2 cases have died, one from hæmorrhage following the removal of a projectile from the root of the lung, and one from sepsis after the removal of an infected foreign body and a piece of clothing.

The late history has been obtained in 43 cases. The results may be described as *Good, Fair, Bad*.

1. *Good Results*.—These patients are, they say, in perfect health, and are able to do heavy work. Of these there are 24, equal to 55.8 per cent.

2. *Fair Results*.—Some of these patients are better than before operation, but still have some shortness of breath, or unusual respiratory trouble when having a cold, or in bad weather. Some are a little better since the operation. Of these there are 14, or 32.5 per cent.

3. *Bad Results*.—Two patients died; 3 are unable to do any work, or have serious respiratory trouble, shortness of breath, cough, etc.

The position of the foreign body in the 49 cases was as follows:

	Left lung.	Right lung.
In upper lobe.....	4	4
In middle lobe.....	—	1
In lower lobe.....	10	13
In root.....	5	2
	—	—
	19	20
In and adherent to pericardium.....		4
In heart muscle.....		1
In diaphragm.....		1
In pleural cavity (loose).....		1
In body of vertebra.....		1
Not mentioned.....		1
‡ Present (lung gritty and probably tuberculous).....		1
		—
		10

All but 5 were operated on by the ordinary anterior method. The 5 operated on by direct attack from behind show 4 with good ultimate results, 1 with fair result.

Eighteen of the foreign bodies were examined bacteriologically; 11 were infected with *Staphylococcus aureus*, or *Streptococcus brevis* in equal numbers, or by these organisms together with coliform bacilli; 7 were sterile.

Empyema after operation developed in 5 cases, and in each of these, when the foreign body was examined, it was found to be infected. In 12 cases blood collected after operation in sufficient quantity to require aspiration. In all these the adhesions were dense, and were widely separated. These 12 include the 5 reported above, which subsequently developed empyema. Of the 7 which did not suppurate, only once was the foreign body examined, and it was sterile.

In 10 cases the original injury had been followed by empyema. The only effect this had at the time of removing the foreign body was that adhesions were found to be very dense and extensive. Three cases were reported as having had hæmothorax at the time of the original injury; at the operation for removing the foreign body, adhesions were dense; in two of these three cases an exceedingly thick blanket-like membrane had to be removed by scissors to allow the expansion of the lung.

“THE MOST GENTLE PROFESSION”¹

Delivered at the Annual Prize Distribution to the Nursing Staff of the Leeds General Infirmary, January 21, 1921.

THE memory of unpleasing things is very tenacious. A century ago an operation was attended by a variety of circumstances calculated to arouse dismay and keen anxiety in every heart; and to-day the very word “operation” sends a shudder through many of those who learn that it is to be their early destiny. And this dread continues, though you and I know that an operation is an act of gentlest mercy, guided and determined by the utmost skill, inspired and controlled at every stage by compassion for the sufferer. To the word “nurse” a similar obloquy still attaches. Even now the word conjures up in some minds the picture of a bibulous and crapulous hag, unversed in the simplest rudiments of her art and indifferent and insensible to the needs of others. Her picture has been drawn by many hands; it was coarsely exaggerated, no doubt, even in Dickens’ day, but the recollection of it is still fresh in many minds, though you and I know that the nurse of to-day is one of the most gracious and most competent of women, and that the profession of nursing now attracts the best type of womanhood that this country can produce.

DIFFICULTIES ENCOUNTERED IN PRIVATE NURSING

But those of you who leave this hospital to go out into the world to nurse must not be surprised if you find that you are not welcomed with that open, eager

¹ Reprinted from “The Hospital,” January 29, 1921.

enthusiasm to which your training and your experience will fully entitle you. In your hospital life you are the despots, most merciful despots it is true, of all your patients, who conform with no word of denial or contumacy to all that is demanded of them or imposed upon them. They accept without question the discipline of the hospital and the beneficent rule of its officers. Of your work in private much will have to be done in the homes of your patients. Happily the day is almost past when an operation of any magnitude has to be performed in the unsuitable surroundings of a private house, with all the makeshifts and dangers inseparable from such work. But the convalescence of surgical cases and the whole course of a grave medical illness will be passed in a private house to whose rules and customs you will be expected to conform, in which, however great your competence and however congenial your society, you are an intruder. You will be compelled, looking only to your patient's welfare, to intervene between him and his friends, often running counter to their wishes and their normal practice as you shelter him from their well-meant but harmful attentions. It will be one of your many testing times, when you will require all the gifts, all the tact, and all the accomplishments that your natural aptitude, or your long training, have conferred upon you.

LEARN TO USE KNOWLEDGE JUSTLY

How are you to fit yourself for such tasks, or to become competent to undertake with highest success all the manifold and arduous responsibilities that lie ahead of you? First, you will need knowledge. To gain it in an adequate degree you will require intellectual powers of no mean order and industry above the average. There

is much to be learnt of anatomy, of physiology, of medicine, and of surgery; of the principles which underlie the technical work you will daily practise. You will have to avoid the little knowledge which is dangerous by delving as deeply as you can into those things which apply most nearly to your own tasks. It is better to learn intimately the relevant matters than to have a smattering of many things that it is not within your strict province to know. But knowledge which is within the reach of everyone who truly seeks it will avail you little unless it leads you along the way to wisdom. Wisdom implies the timely and rightful application of knowledge. Knowledge may even be a pitfall or an encumbrance unless you learn to use it justly. To gain wisdom is of all tasks in life the most difficult, and it is certainly no less arduous in nursing than in many other of life's activities. You will be foiled and rebuffed and disheartened, not once but many times, as you toil earnestly after it, for the application of the truths you have learnt may be so diverse, the reactions so unexpected and perplexing, and the personal aspects of them so capricious, that you may think of wisdom as Fracastorius did of the beating of the heart—that it "is so difficult as only to be comprehended by God."

You will have duties, fewer than they formerly were, which may appear menial or degrading, and they will sometimes need to be carried out upon those who are the mere wreckage of humanity. But drudgery may be a blessed thing, and you may derive consolation from the remembrance of One who thought it no ill task to wash the feet of the humblest of people. And you will perhaps day after day, especially in your early years, be almost dead with fatigue, embittered by the disappointments of

a case that has gone wrong, or wounded by a rebuke that has escaped from the lips of someone as weary and disheartened as yourself. Yet all the time you must show your best side, for you cannot give real help to others if you seem careworn or dejected. You must learn to bring an air of pleasure to the pursuit of duty. And so by degrees you will learn that it is not only knowledge, or even wisdom, but also, and chiefly, character that counts. You will learn to deal faithfully, stubbornly, and with untiring zeal with all your difficulties, and the word "trouble" will vanish from your vocabulary. No patient can ever cause you "trouble" if you remember that what is a daily and perhaps monotonous event to you is the great event and perhaps the sternest trial of a lifetime to him. Your patient's needs are your opportunity.

THE NOBLEST FUNCTION OF MAN

You will soon divine the great secret that in many patients who are seriously ill the restraints which adult life impose upon us all, fall away. The qualities of childhood again emerge; there is a trustful dependence upon others; there is great need of sympathy and understanding; there may be a little petulance, a little fretfulness, a querulous demand for many things unsuitable. You may need great patience, infinite gentleness, unfailing forbearance, if you are to read your patient aright, and to serve him to the utmost of your capacity. Service is the noblest and happiest function of man. And to render the highest service you must attune yourself spiritually with your patients, so that you may read their hearts, discover their motives, divine their impulses, and lead them at last to realise that you stand loyally behind them, or beside them, to help them, not

over against them to thwart them. And at all times you must keep reticence. Many secrets that have perhaps been most jealously guarded will be disclosed to you, and many of the most sacred mysteries will be revealed. You will preserve an inviolable silence. For taciturnity is an ornament, and in silence there is security; if you repent once of your silence you will repent ten times of your speech. You will find help from the 39th Psalm, "I will take heed to my ways that I offend not in my tongue. I will keep my mouth as it were with a bridle." To chatter of those intimate things you learn under the seal of the confessional as you work is a degradation of your calling. Gossip tainted with slander is the last and meanest infirmity of empty minds.

THE NURSE'S OFFICE

Such are some of the qualities required by a nurse, and this then is the nurse's office. To be ready in all emergency, quick and competent in action, courteous in speech, considerate in thought; a comfort in hours of sorrow, an inspiration and encouragement in times of gloom; to give ease to many a weary body and solace to many a troubled heart; to lift with strong and gentle hands a heavy load of anguish from those who falter and stumble in despair. It is to be a beacon of hope, a rock of refuge, and a tower of strength.

If your attainments are these and your work of this high order, you are members of a profession than which none is gentler or nobler. Your watchwords become "service and self-surrender." You do not seek reward or selfish gain. Your work will be done in a professional spirit; it will be done, not in the most meager way for the utmost gain, but with all the energy and truth that

you can put into it. The true rewards of honest work are neither to be seen nor handled, they are not measured by a gold standard nor by any material result. They are not acclaimed by the applause of the crowd. They lie within you; in your own knowledge that you have done your best, that you have striven to reach your own standard of your highest powers. You will often, perhaps always, fail to reach your own ideal; but be comforted. Ideals are not for attainment, but for pursuit.

RECOGNITION OF EFFICIENCY

If you enter a profession and become adept and worthy members of it you should receive the proper recognition to which your work entitles you. The time is now ripe, in my opinion, for your acceptance by some academic body which shall control the training and direct the teaching of the nursing profession, and in due time confer authority by licence, or diploma, or degree, upon those who have attained the standard of efficiency that is considered adequate. Your work, whether regarded as an intellectual task or as a technical accomplishment demanding the exercise of fine craftsmanship, fully entitles the nursing profession to make such a demand as this. If such a recognition comes, then will follow a result I have long desired to see. There will be a grading of nurses by qualification as there is a grading of medical men. It is, I think, just as necessary that a sister in charge of a ward, a theatre sister, or a matron in a teaching hospital should bear evidence in her qualification of longer study and more careful training as it is in the case of the medical staff of a teaching hospital. Until some system of supervision of the training of all who may call themselves nurses and of the registration and qualifica-

tion by diploma or degree is introduced, the nursing profession will not be cleansed from those impurities which still unhappily attach to it.

THE HONOUR OF THE TRAINING SCHOOL

In Leeds you are fortunate in your school. The training through which you pass here is as long, as arduous, as strict as it is anywhere in the world. And the honour of your school is of the highest; it has been created, maintained, and increased by the great multitude of your predecessors. Remember that you all carry with you, wherever you go, the honour and good repute of your school. Every one among you can add to that store of honour or detract from it. Leeds will be judged by your work and by your demeanour. And when the time comes for you to lay your work aside the highest praise that can be given to you will be that you have worthily upheld the high traditions of your own school and the dignity of the most gentle profession.

