

**Anatomico-chirurgical observations on dislocations of the astragalus / by Thomas Turner.**

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ANATOMICO-CHIRURGICAL OBSERVATIONS

ON

DISLOCATIONS

OF

THE ASTRAGALUS.

BY THOMAS TURNER, ESQ., M.R.C.S.L.,

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Physiology, Clinical Surgery, &c. &c.*



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1843.



ANATOMICO-CHIRURGICAL OBSERVATIONS

DISLOCATIONS

OF THE BASTARD

THE ASTRAGALUS

BY THOMAS TURNER, ESQ., M.R.C.S.



## DISLOCATIONS OF THE ASTRAGALUS.

It could not for a moment have been imagined by the author of this paper, when he was requested to make to the members of the Provincial Medical and Surgical Association, assembled at Exeter, an oral communication of a singular case of Compound Luxation of the Astragalus, which had come under his observation and treatment, that so much interest would be excited by the remarks elicited on that occasion, as to induce the proposal that he should prepare a paper on the subject for publication in the next volume of their *Transactions*. The request, however, was complied with: the author, therefore, will endeavour to accomplish his task in the best manner his knowledge, research, and leisure will allow.

As dislocations of the astragalus are accidents of unfrequent occurrence, in comparison with many



others which happen to the human body, (Dupuytren never having, in his extensive practice, met with more than twelve cases,) it may appear to many that the author's time might have been more profitably employed, and his labour more fruitfully bestowed, in bringing before the profession a subject of more general interest, and of greater practical utility. But, in looking over the list of surgical accidents, there is not one more serious in its characters and in its consequences than dislocation of the astragalus; and there is not one in which we are so destitute of rules, to guide us in our practical proceedings. The author is not alone in this opinion; as the fact was confirmed by the remarks made by the distinguished President of the Association, and by many of its members, when they did him the honour to listen to his lecture.

On examining the manner in which the astragalus is connected with the tibia, fibula, os naviculare, and calcaneum, it appears almost impossible to conceive otherwise, than that dislocation of this bone *alone*, *i. e.*, without displacement of the other bones of the foot, or fracture of one or both malleolar processes, is as impossible as luxation of the ribs; and that to speak of its occurrence was to imagine, rather than to realize the fact, which was, we have reason to believe, the case with the ancients who wrote on dislocations of the ribs: but, although luxation of the astragalus *alone* is, comparatively speaking, an uncommon accident, yet we know that it does occur; therefore we shall, at all events, escape, in commenting upon it, the animadversions passed on the older surgeons, for writing elaborately



on accidents which, we presume, they never saw. In works of surgery of bygone days, we meet with some subjects detailed with the greatest care, confidence, and minuteness, which modern surgeons have almost altogether expunged from the catalogue of casualties: thus, whilst Heister, Petit, and Duverney, have written largely on, and discussed very fully, the subject of luxation of the ribs, most surgeons of the present day deny the possibility of such an accident; and for many reasons, the most cogent of which is, that the force necessary to produce luxation would more readily occasion fracture, and thus the violence communicated would be expended in the latter effect. There does not exist on record a well-authenticated instance of dislocation of a rib, either at its vertebral, or its sternal extremity, as the result of force: how comes it, then, that ancient surgical writers have so minutely described the nature of this accident—have even given its varieties, and the mode of treatment adapted to each of them? They never could, in reality, have seen a case; therefore must have mistaken fracture, or some other injury, for dislocation. But, whilst the older surgeons fell into one extreme, in detailing what they fancied *might* occur, and thus prepared their minds to meet the exigencies of the case, when it actually happened, we should be careful not to allow the infrequency of dislocation of the astragalus to induce an opposite error; for although it may fall to the lot of a few surgeons only to witness a case of this kind, yet the embarrassment experienced will be very great to those who do witness it, unless they are armed with



some authority that will help them to decide on the means applicable to each variety of this accident. But, however important, necessary, and useful, general principles are, they may require modification; therefore, much must still here, as in other cases, be left to the judgment of the practitioner. In the treatment of violent injuries, general (as the constitution and habits of the patient) as well as local circumstances must not be overlooked; since that line of practice which may be justifiable in one case, or even in the majority of cases, may not be admissible in all. It is an admitted fact, that general principles must now and then be modified; but still, if founded on truth, they never can altogether be departed from. In modern surgery, facts established by correct observation, and a better knowledge of anatomy, have taken the place of theory; whence, although the domain of surgery has been abridged, (so far as erroneous opinions gave to it the appearance of extension,) another step has been gained towards its scientific advancement. It is to the refutation of vague statements, and to the establishment of sound practical principles, that our attention must, in the present day, be directed; and it is with the hope of lending his humble assistance towards the accomplishment of the latter object, that the author presumes to offer some observations on the following queries, which involve very many important practical considerations:—

1. What are the anatomical relations of the astragalus, and in what manner do they influence the accidents to which this bone is liable?



2. By what powers or kind of forces are dislocations of the astragalus produced?
3. In what directions can the astragalus be luxated?
4. What forms of luxation are, and what are not reducible?
5. What are the obstacles to reduction in most cases? and, lastly,
6. Since reduction is impracticable, in almost all cases of dislocation of the astragalus, by what principles are we to be governed in the treatment of this accident?

In bringing these subjects before the members of this Association, and the profession at large, the author is anxious to assist in rescuing the surgeon from the painful dilemma in which he may be placed, for want of established rules to guide him in the arrangement and treatment of accidents occurring to the astragalus; respecting some of which, we are left, by our best surgical authorities, in no inconsiderable degree of doubt and difficulty.

#### ANATOMY, &c., OF THE ASTRAGALUS, AND ITS CONNEXIONS.

*Bones.*—The astragalus is the bone of the tarsus, on which the tibia rests: it therefore presents an articular surface above for the concavity of the tibia; and another, on its inner side, for the malleolar process of the same bone; whilst the fibula is applied to its outer surface, forming the malleolus externus, and at its under part, there are two articular facets for the calcaneum; thus, by means



of these two bones, the superincumbent weight of the body is transmitted to the ground. It is important to remark here, that the articular surfaces between the astragalus and the os calcis are in the same perpendicular line as those of the tibia and astragalus ; a point of consequence to attend to, as it explains, what we might *à priori* suppose, that the *shortening of the leg is the invariable effect of a complete removal of the latter bone*. Lastly, the astragalus presents, on its forepart, an articular convex facet for the os naviculare ; whence it has six cartilaginous surfaces, but is connected with only four bones—there being two surfaces for the tibia, one for the fibula, two for the os calcis, and one for the navicular bone. There are formed by these bones three articulations, the ankle joint, an articulation between the astragalus and os calcis, and one between the astragalus and navicular bone ; and it will be observed, that there are three synovial capsules, and that the greatest extent of the superficies of the bone is covered with smooth cartilages, by which the astragalus is rendered much more moveable than any other tarsal bone, and therefore much more liable to dislocation ; which accident would, indeed, be less frequent than it is, if it were not for the presence of strong ligaments (implanted into rough processes) which tie it firmly to contiguous bones. It is, perhaps, worthy of notice, that the synovial capsule of the ankle joint is, naturally, exceedingly loose and extensible, and contains more than the ordinary quantity of synovia ; whence the author presumes the astragalus may be partially luxated, without laceration of the capsule of the joint.



*Ligaments.*—The astragalus is joined to the tibia by the internal lateral, or deltoid ligament, which expands in its descent, and is inserted into the os calcis as well as into the astragalus. There is also an anterior ligament, which is attached, above, to the fore part of the tibia, and below to the astragalus. On the fibular side of the ankle joint is situated an anterior ligament, which passes from the fibula to the astragalus; and behind is the posterior ligament of the fibula, which is attached above to the malleolus externus, and below to the back part of the astragalus. Thus, four ligaments pass from the bones of the leg to the astragalus; but the remaining ligament of the ankle joint, (the external, middle, or perpendicular,) which goes from the fibula to the os calcis, must not be overlooked; for, as stated by Dr. Quain, “The astragalus being wedged in between the malleoli, and the lateral ligaments passing downwards from these to the os calcis, both lateral ligaments must contribute somewhat to retain the astragalus in its proper position with regard to the latter bone.” In complete dislocation forwards, the anterior ligament must give way; and should the lateral ligaments not yield at the same time, they must be thrown into a very tense state, and by thus firmly embracing the body of the astragalus, or by diminishing the space backwards, between it and the tibia, will increase the difficulty of reducing the bone, when luxated, to its natural situation. In dislocation forwards and inwards, the anterior, wholly or in part, and the internal lateral ligaments, must yield; and, in dislocation forwards and outwards, the anterior and fibular ligaments will be broken



through, unless, in the former case, the tibia, and in the latter, the fibula, be fractured at the same time that the astragalus is dislocated, which accompaniment sometimes does, and sometimes does not, exist. In dislocation backwards, when the bone is thrown between the tibia and tendo-achillis, all the ligaments will, in all probability, be lacerated: this, one might suppose, must be the rarest of all the forms of dislocation occurring to the astragalus, as the posterior tibio-fibular ligament deepens the articulating surface of the tibia and fibula, and must offer great resistance to injuries occurring to the foot; still, four cases of this accident have been recorded. Besides the ligaments connecting the astragalus with the tibia and fibula, there are others which tie it to the os calcis and navicular bone: between the two articulating surfaces in the os calcis, there is a very deep sulcus, which is occupied by a strong ligamentous structure passing from bone to bone, and constituting a firm bond of union between the astragalus and os calcis, independently of a posterior and an external lateral ligament. The astragalus is secured, in its connexion with the os naviculare, by means of a broad band of ligamentous fibre, which passes from the upper surface of the former to that of the latter bone; and, lastly, it should be mentioned, that in the sole of the foot there exists a dense ligament, called by Mr. Bransby Cooper the "sub-astragalar," which, although connected, more especially, with the os calcis and os naviculare, serves to strengthen the tarsal joints. Its texture is very firm, being fibro-cartilaginous; and, from possessing the physical properties of



elasticity and flexibility, it is of importance, in preventing mischief to the foot, from the less violent injuries to which this part of the body is exposed. In all the forms of complete dislocation which happen to the astragalus, the ligaments connecting it with the os calcis and navicular bone must be ruptured; the sub-astragalar excepted, which may, from its elasticity, escape laceration.

It is not necessary to advert to the comparative resistance offered by the various ligaments to the dislocations which occur, as the course which the bone takes is determined by the nature of the violence, and the direction which the wrench and muscular action give to the leg and foot; but the extent of laceration of ligaments and soft parts is a matter of no mean consideration in determining the propriety of removing the bone in complete dislocation, whether simple or compound. When the astragalus has been excised, the bones of the leg may still be held in connexion with the foot by a portion of the internal or deltoid ligament, which is attached below to the os calcis, as well as to the astragalus, and by the perpendicular fibular ligament: all the rest must be sacrificed; but the divided and lacerated remains of the other ligaments may form adhesions to the parts with which they are brought into immediate contact, and thus may prove a future auxiliary bond of union between the bones of the leg and the navicular and heel bones of the foot. Seeing how firmly the astragalus is tied to the bones of the leg, and to the os calcis and os naviculare, it seems almost impossible to conceive how any force could cause this bone to



be tilted out of its normal situation, in the manner we know it to be in its simple and compound dislocations. Of this accident so many cases have been recorded as to leave no doubt on this point; and I shall add another instance, which has recently come under my own observation and treatment, at the Manchester Royal Infirmary; and which, from the direction in which the bone was thrown, is, so far as my knowledge and reading extend, without a parallel.

MUSCLES CONNECTED WITH THE FOOT, AND  
IMPLICATED IN ITS DISLOCATIONS.

Above the bones and joints of the instep is situated the extensor brevis digitorum communis muscle, which arises (partly fleshy and partly tendinous), from the os calcis, and terminates in four slender tendons, which pass inwards to the great and three adjoining toes. This muscle is not materially implicated in dislocations, except in the circumstance of its tendons being displaced, if not ruptured, in luxation directly forwards, and forwards and inwards; and in that of drawing, in some measure, the toes outwards, and the metatarsal bones triflingly backwards, when the astragalus is removed.

Superimposed on the former muscle, and running in their thecæ to the four lesser toes, are the tendons of the extensor longus; which, when the astragalus is dislocated forwards and outwards, will be either ruptured, or separated, so as to girt the bone; and in excision of the astragalus, this common extensor of the smaller toes will assist the



former muscle in drawing the second and third toes, the cuneiform, and navicular bones, a little backwards.

The tendon of the tibialis anticus runs to its destination on the inner part of the foot. In dislocation forwards, the bone will, in all probability, separate this tendon from that of the extensor proprius pollicis, which is situated between that of the tibialis anticus and the tendons of the long extensors of the toes; the astragalus would thus be girt by these structures, and fixed in its new situation. Behind the articular surface of the tibia there is an oblique groove, along which the tendon of the flexor longus pollicis passes; this groove is bounded on the inner side by a rough process of bone, which gives attachment to a strong posterior ligament. The flexor longus pollicis, the flexor longus digitorum communis, and tibialis posticus, run to their respective destinations, behind the inner ankle, and alongside the inner surface of the astragalus; but the first of these muscles only can be said to have an attachment to it, and this is merely by the implantation of some of its tendinous fibres into it, in common with the navicular and three cuneiform bones.

The peroneus longus and peroneus brevis, which pass behind the malleolus externus, are not in contact with the astragalus; but they, and the other muscles of the foot and toes, will have the course of their tendons so diverted, when the astragalus is luxated, as to encroach on the astragalar space, and thereby form one of the impediments to reduction; and the peronei will powerfully aid the muscles,



which send their tendons behind the malleolus internus, in pulling the foot towards the tibia and fibula, when the astragalus is completely dislocated or extracted, and thus tend to obliterate the space originally occupied by this bone: but this effect is considerably promoted by the gastrocnemii which are inserted into the protuberance of the heel.

ON THE MOTIONS OF THE ASTRAGALUS, AND THE OPERATION OF FORCES IN THE PRODUCTION OF ITS DISLOCATIONS.

If we examine the mechanism of the ankle joint, it will be seen, that although the united tibia and fibula form the concavity for the os astragalus, and thus produce a mortise-like articulation, the fibula bears no part in transmitting the superincumbent weight of the body. The under surface of the inferior extremity of the shin-bone rests vertically on the astragalus, and the astragalus on the os calcis; thus, the arch of the former bone receives the weight, and transmits the same, through the medium of the calcaneum, to the ground. The os calcis constitutes the posterior abutment of the plantar arch; the head of the metatarsal bone of the great toe forms the anterior and inner; and the cuboid, and the whole range of the metatarsal bone of the little toe, and its phalanges, form the resting point of the outer edge of the foot. Mr. Dodd (in the *Cyclopædia of Anatomy*, vol. 2, page 257) satisfactorily explains the advantage of this arrangement of the outer side of the foot. He is of opinion, that it is to a certain extent required, in consequence of the construction of the toes, these



being weaker and shorter, as well as their metatarsal bones, as they are further removed from the great toe : as their strength, therefore, diminishes, the corresponding part of the arch is shortened and flattened, and consequently less strain is thrown upon them, until, at the base of the little toe, the arch of the foot is obliterated, and what weight is resting here comes at once upon the ground. The astragalus is susceptible of movements on the leg, and on the heel, and navicular bones of the tarsus ; but the motions at the ankle are mainly limited to backwards or extension, and forwards or flexion. When the foot is forcibly extended on the leg, the astragalus is brought into close proximity with the posterior edge of the tibia and tibio-fibular ligament ; the convex articular summit of the astragalus is brought forwards, and the anterior ligament is stretched upon it. When the foot is powerfully flexed on the leg, it is prevented from passing beyond certain limits, by the anterior edge of the shin-bone coming into contact with the neck of the astragalus ; and in this case, the posterior and the middle fibulo-tarsal ligaments (improperly called perpendicular) are rendered so tense, that a little additional flexion would tear them, together with the posterior fibres of the deltoid or internal lateral ligament. It is obvious, however, that too great a degree of extension and flexion of the joint is prevented, not so much by yielding and lacerable textures, as by the approach of bone to bone ; to overcome which, would require a considerable force. Lateral movements of the foot upon the leg do not exist, in any appreciable degree, in the living



subject, when the binding structures possess their natural retaining property. The motion of the astragalus on the os calcis is of a gliding kind, forwards and backwards, and from side to side: the first of these happens when the foot presses the ground, and the second when the pressure is taken off; and it is probable that this last effect is much assisted by the elastic property of the sub-astragalar ligament. The movements between the astragalus and os naviculare are, mainly, those of turning the sole of the foot inwards and outwards; the former results from the action of the muscles which run behind the malleolus internus, and the latter by those which pass behind the malleolus externus; and in these movements the articulation between the os calcis and os cuboides participates; whence, dislocation of the astragalus from its scaphoid cavity is likely to occur, if this joint be violently wrenched by a sudden inversion or eversion of the foot. When the ankle is extended in the greatest possible degree, fully one half of the upper articular surface of the astragalus is exposed; a violent impulse now given to the os calcis would be immediately and directly communicated to the astragalus, and thus the ligaments may be torn, and the bone dislocated forwards; and if we examine the obliquity in direction inwards and forwards, which a force applied to the heel would produce, we can easily imagine why the astragalus may be ejected from its situation forwards and inwards on the navicular bone, more readily than forwards and outwards on the os cuboides.

Violent extension of the foot is, in most instances,



the cause of dislocation forwards. In one case given by Baron Dupuytren, dislocation forwards occurred in consequence of jumping from the top of a coach, and the patient pitching on his heel with all his weight. Other cases are recorded of dislocation forwards, forwards and inwards, and forwards and outwards, in persons falling from heights, and pitching on the heel, or sole, or side of the foot. Doubtless, in some of these cases the main concussion is received on the calcaneum, which is thrown by the foot into sudden extension, and the astragalus is thrust by the heel bone from its situation at the ankle. When the foot is fully flexed upon the leg, and a force applied to the superior part of the tuberosity of the os calcis, and to the under surface of the fore part of the foot, the astragalus might be thrown backwards, an effect much favoured by the extreme depression which the heel would experience, the greater distance at which the astragalus would be separated from the tibia, and consequently the increase of space gained backwards for the escape of the bone. The mode in which dislocation backwards may, in this way, occur, is well illustrated in the case of Mr. Goss, of Bristol, where, it would appear, the foot became forcibly flexed; in which occurrence, as already remarked by Mr. Phillips, the axis of the tibia becomes oblique in relation to the articular surface of the astragalus, in front of which the shin-bone is precipitated, in obedience to the impulsion which it receives from the weight of the body. This fact is equally confirmed by what occurred in the second case given by the same author. Here the patient, whilst running very



rapidly after a cricket ball, caught his foot in a gutter which was unobserved, on the further side of which the toes rested, while the heel was jammed directly into it, and in this state he fell forwards. The effect in this instance, as in the last, would be that of powerful flexion of the ankle joint. If the foot be forcibly inverted, the astragalus might be dislocated forwards and outwards, or directly outwards; and if everted, the luxation might be forwards and inwards, or directly inwards. We may thus theorize with respect to the manner in which direct and indirect luxations happen, from the operation of *direct* forces and actions; but we cannot so easily determine and estimate the manner in which *indirect* action and forces operate, not merely in tilting the astragalus from its natural locality, but in altering its relation or axis, by inverting, everting, or retroverting the bone.

In calculating and reasoning on the causes which produce dislocation, we must not confine our inquiry to the mere effects of a direct force applied, nor to the influence of direct muscular action. It must be admitted, that in some cases mere violence will lacerate the ligaments, and other connecting textures, and produce dislocation. The author presumes, however, that this is a very unfrequent occurrence: but if violence be continued, with a favourable coincidence of muscular contraction, dislocation may take place; but this accident is most frequently due to the irregular spasmodic action of muscles, which must be liable to modification from a variety of causes, especially from the position of the joint at the time the injury was



received, and the manner in which the muscles may thereby be affected. These remarks will, I presume, help us to an explanation of the causes of direct dislocations of the astragalus forwards, backwards, outwards, and inwards; but they do not throw sufficient light on the subject to enable us to account for the deviation in axis, or position, which the astragalus experiences in many cases of luxation of this bone.

However difficult it may be for us to form a conjecture, yet it is quite certain that the astragalus *alone* may be dislocated. This accident was known to Duverney, who details a case where this bone was pushed with so much violence (as the result of strong compression) that it became detached from the other bones, and pierced the flesh of the foot, causing thereby an insulated compound dislocation. Portal alludes to this accident as a very singular one; and it would seem, that when he published his *Anatomie Médicale*, a similar case had not occurred in his practice. According to Dr. Morris's statistics of dislocations in the Pennsylvania Hospital, only one case occurred in ninety-four instances of luxation; but the author thinks that the proportion is more likely to be 1 in 500 cases. Dr. M. does not state in what direction the bone was dislocated, or the treatment adopted; but it is recorded that the patient died in consequence of the injury. There is scarcely a displacement of any joint of the body, the mechanism of which, or of the cause or causes which produce it, may not be more or less satisfactorily explained. With respect, however, to dislocation of the astragalus *alone*, either



with fracture of one or of both bones of the leg, or what is more remarkable, without any fracture at all, ingenuity cannot clearly explain the *modus operandi* of the different species of violence, which are mentioned by writers, as having given rise to this accident. If they be analyzed and closely examined in their mechanical bearing, they appear hardly sufficient to explain the effect, except in those cases where there is a breaking up of all the binding textures of the bone. At all events, if we can conceive how dislocation occurs when the tibia and fibula are fractured, and there is more or less laceration of the ligaments which unite the os calcis and os naviculare with contiguous bones, thereby loosening their connexions, it is almost inconceivable how the astragalus can be dislocated *alone*, without fracture of the bones of the leg, or either of them, and without displacement or loosening of the tarsal bones; yet such has been the case in several instances.

Mr. Phillips prefaces the detail of his very interesting cases of dislocation of the astragalus backwards (to which we shall presently advert) with some remarks on the difficulty of conceiving the *modus operandi* of force, or of forces, by which luxation of the astragalus is effected. In his cases the astragalus was dislocated backwards, the dislocation being complete and simple, with scarcely any disturbance of the relative position of the other bones. Mr. Phillips expresses his astonishment at such an occurrence, and illustrates the difficulty with which this displacement is accomplished, by showing that we cannot, by any force applied to



the foot, bring about a similar result. He says, "If we take a leg, and place the foot (in a wooden shoe) in a vice, screw it there, so that no motion shall be permitted, and then apply any quantity of pressure backwards or forwards; once arrived at the natural limits of these movements, the pressure still continued, we shall experience a powerful resistance; this, however, may be overcome, and a very loud crackling noise will be produced upon the articulation, which has been the subject of experiment; if the pressure has been forward, by which the leg will have been flexed upon the foot, we shall find the posterior fibres of the lateral ligaments ruptured, but no displacement of the astragalus; and we shall obtain the same result if we make the leg the fixed point, and then forcibly extend the foot upon it." Mr. Phillips supposes that such a degree of violence should produce luxation of the foot backwards or forwards; but we shall always find that all our attempts in this way to produce dislocation will be in vain. Admitting that we could (but the author doubts the possibility of it) effect luxation at the ankle joint, this circumstance will serve in no way to explain the insulation or isolated detachment of the astragalus. The violence necessary to dislocate the tibia and fibula from the astragalus, in other words, to produce complete dislocation at the ankle joint, must be much greater, even in the dead body, than that employed in Mr. Phillips's experiment; and much greater still in the living subject, where muscular resistance enhances the difficulty in a considerable degree. During the horrors of the French revolution, amongst other heinous cruelties



practiced on the victims of revolutionary fury, attempts were made to tear them limb from limb ; but with all the force that could be exerted by animal and mechanical power, disarticulation could not be effected ; the knife, therefore, was had recourse to for the accomplishment of this diabolical object. We cannot, by any experiment, illustrate or imitate the mechanism of dislocation. Anatomy informs us of the projections and irregularities in the articular boundaries and surfaces ; whence we infer the greater ease with which dislocation may happen in one direction than in another. Anatomy teaches us the greater strength of the ligaments, and of the other binding textures in connexion with one articulation, than with another ; whence we infer different degrees of liability to dislocation, according to degrees in these respects. Almost without exception, the more moveable an articulation is, the fewer its connecting structures ; the reverse of which we might expect to be the case, if we were not to bear in mind that great strength is incompatible with great extent of motion ; whence, to give this last advantage to the shoulder, strength is sacrificed, and additional liability to accident incurred. According to statistical reports, dislocation of the humerus from the scapula is a more frequent accident than dislocations of all the joints of the body taken collectively ; and it is not difficult to believe this statement, if we examine the anatomy of the shoulder joint, and also the circumstances on which its great extent of motion depends. Finally, in reference to the mechanism of dislocation, there are powers concerned in its production



which we cannot always adequately appreciate ; and it must be borne in mind, that in all experiments we employ direct brute force on dead matter ; whereas, in the living subject, forces may be, and are frequently, indirect in their operation ; whence results are modified, and these will be still more modified by the active influence of muscles, which may, almost always, be regarded as the agents of dislocation.

ON THE DIRECTIONS IN WHICH THE ASTRAGALUS  
HAS BEEN DISLOCATED.

According to recorded and communicated cases of dislocations of the astragalus, this bone is susceptible of being displaced :—

Forwards,  
Forwards and inwards,  
Forwards and outwards,  
Upwards and outwards,  
Outwards,  
Inwards,  
Backwards, and  
Outwards, downwards, and backwards.

It will be useful, as a preparatory step to detailing the different cases which the author has collected from published works, through the kindness of his professional friends, and from other sources, to inquire into the

RELATIVE ANATOMY OF DISLOCATIONS, AS PRODUCING THE SIGNS,  
AND INFLUENCING THE RESULTS OF THESE ACCIDENTS.

The study of the abnormal conditions of the astragalus, *as the result of force*, will not only teach us the signs of the different forms, directions, and



kinds of luxation, to which this bone is liable, but it will enable us to understand the mechanical difficulties which the contact of irregular processes and concavities opposes to its reduction.

The author of this paper will employ the term *form* as applicable to dislocation, in being incomplete or partial, or complete : the term *course* refers to the direct or indirect ejection of the bone from its articular surfaces ; the latter implying a change in the position or axis of the astragalus, in being everted, inverted, retroverted, or turned upon itself : and the term *kind* is adopted in reference to the simple, compound, or complicated nature of the accident.

When the astragalus is *partially luxated forwards*, the inner hook-like process, bounding the posterior or outer articulatory process for the calcaneum, is received into a hollow between the two articulating processes of the latter bone ; and the posterior surface of the astragalus is brought into contact with the anterior, instead of the posterior facet of the os calcis. In this way the navicular facet of the astragalus juts forward, and above the anterior range of the tarsal bones, and rests upon the scaphoid bone ; there is a considerable vacuity at the inner part of the foot behind the astragalar cavity of the navicular bone, and below the malleolus internus. The tibia and fibula will, in all probability, be carried forwards so as to increase the distance between the tibia and tendo achillis, thus lengthening the heel, whilst the foot and toes are turned inwards ; or the tibia and fibula may remain partially supported by the posterior part of the astragalus, and thus be prevented from descending on the os calcis, as they do in complete luxation.



*In partial dislocation forwards and inwards*, the relative position of parts does not very materially differ from that which happens in luxation directly forwards.

*In partial dislocation forwards and outwards*, the hook-like process of the astragalus presses against the rough root of the anterior, or inner articular surface of the calcaneum, the anterior facet lying over the cuboid bone; and in this, as in the other instances forwards, and forwards and inwards, there is a remarkable hollow at the inner part of the foot, and the bones of the leg are thrown forwards or backwards; the heel is accordingly lengthened or shortened, and the foot and toes are inverted.

*In partial dislocations upwards and outwards*, the progress of the bone forwards is arrested by the posterior surface of the os astragalus coming into contact with the cavity of the scaphoid bone; the bone rests partially, but principally, on the os naviculare, and a small part may be brought to bear on the os calcis. The bone is very prominent and much raised in the instep, so as to be readily mistaken for complete luxation: but here, as in all cases, the distinction is easy, if we examine the calcaneum and the position of the bones of the leg; indeed, the author is of opinion, that if this diagnostic distinction be neglected, and the prominence of the bone taken as the ground of judgment, we may often confound the incomplete with the complete form of this accident; a circumstance, he is inclined to think, of not unfrequent occurrence.

*In partial dislocation outwards*, the inner hook-



like process at the under part of the astragalus is received into the hollow between the two articular surfaces of the os calcis ; the astragalus projects on the outer part of the foot ; the fibula may or may not be fractured ; the vacuity at the inner and hinder part of the foot will be greater than in dislocations forwards ; and the foot is inverted.

In *partial dislocation inwards*, the outer hook-like process of the posterior articular surface of the under part of the astragalus, is received into the inner part of the rough depression between the calcaneal articulating facets. The astragalus will project at the inner side, and there will be a void at the upper and outer part of the foot. In these lateral luxations the foot will be turned either outwards or inwards, but more frequently inwards, and the heel is raised.

In *partial dislocation backwards*, the inner pointed process of the astragalus passes into the depression which is situated behind the acute summit of the posterior edge of the posterior articular facet of the os calcis, and between it and the elevated ridge at the upper part of the tuberosity of the heel. The bones of the leg may be carried a little forwards, or backwards, according to the state of the ligaments ; the length of the heel will be accordingly increased or diminished ; and in the latter case, a vacant place will be seen at the fore part of the ankle joint. In these cases, it is to be presumed that the heel will be but triflingly raised, and the foot but slightly inverted.

In *complete and direct luxation forwards*, the bone is tilted out, so as to rest partly on the navicular,



and partly on the two outer cuneiform bones. The exceeding prominence of the bone on the instep is an unequivocal feature of this accident; the tibia and fibula are drawn towards the hollow in the os calcis, vacated by the astragalus; and the fibula is received upon its outer side. But, as the measurement of the tibia, from before to behind, is scarcely more than one half that of the astragalus, it cannot occupy the whole of the cavity, therefore the heel is lengthened; and as the leverage is increased, the tuberosity of the os calcis is much drawn upwards. The new articular surfaces for the tibia are formed by the hollow facet of the os naviculare before, (into which the fore part of the under edge of the shin bone is accurately fitted,) and the anterior part of the hollow of the calcaneum below. The base of the new concavity is partly bony and partly ligamentous, bone being wanting between the os naviculare and os calcis, at the interior and inner part of the base of the foot. The anterior edge of the tibia is received into the hollow of the scaphoid bone; the inner malleolar process is situated between the tuber of the os naviculare and the jutting edge of the anterior and inner part of the os calcis; the prominence of the inner malleolus is thus rendered less salient and conspicuous, and its lowest point assists in forming the arch of the plantar region of the foot, all which circumstances are accurately delineated in the plate.\* The malleolus externus rests on the outer side of the os calcis, therefore is lower and less prominent than when in natural contact with the astragalus.

*In complete and direct dislocation forwards, for-*

\* *Vide* plate i.



*wards and inwards, forwards and outwards, upwards and outwards, outwards, inwards, backwards and outwards, downwards and backwards*, there will be, of course, differences induced, arising from difference of locality with respect to the luxated bone. The signs, therefore, of these accidents will of necessity vary; but in all *complete* dislocations, whether simple or compound, direct or indirect, there will be no deviation from what is stated to happen with respect to the tibia and fibula; namely, that the foot will be approximated to them by the action of muscles; that the tibia will occupy a part of the hollow which has been vacated by the astragalus, and that the leg will accordingly be shortened one inch or more, correspondingly to the depth of the bone which has been dislodged from the ankle joint.

In *partial, as well as in complete luxations*, the astragalus may be normal in position, or it may undergo a *change of axis with respect to its articular surfaces*. It is easy to conceive, that it is not a matter of indifference whether the one or the other of these conditions exists, as it regards the successful issue of attempts at replacement. In the most promising cases, the latter of these states of the bone would offer an almost insuperable barrier to reduction. Dupuytren alludes to it as a most formidable association with luxation of the astragalus; and that in almost all the cases in which he found it expedient to extirpate, malposition or altered axis rendered nugatory all attempts to reduce the bone to its natural situation. In partial dislocation, where the bones of the leg are fractured, and the ligaments torn, so as to give increased space



and more power and command over the parts, inversion, or eversion, or even the turning over upon itself of the astragalus, might not be an insuperable obstacle; but in complete dislocation, whether simple, or compound, or complicated, with fracture or not, and especially in the second case, reduction is, the author thinks, almost impracticable. Luxations of the astragalus, partial as well as complete, direct and indirect, may be *simple*, or *compound*, or *complicated*. Incomplete dislocation is rarely compound; and, what we might not *à priori* expect, even complete dislocation is more frequently simple than compound. The truth of Sir Astley Cooper's observation, "A simple dislocation of the astragalus sometimes, though rarely, occurs; a compound dislocation is still more rare," is not, however, fully confirmed in the collection of cases in this paper; for it will be seen, that the average of simple to compound is not much, if at all, in favour of the former; but we shall find, that the proportions are not the same in all the localities in which dislocation occurs; the reason of which, is to be inferred from an examination of the

SUPERIMPOSED TEXTURES IN THE DIFFERENT ASPECTS OF  
THE FOOT AND ANKLE.

It is a matter of great importance, in connexion with the different dislocations, to inquire into the nature of structures in the sites of these accidents; for, although the superjacent laminated textures, over the ligaments, are much the same in all of them, yet they vary in density and property, in such a way as to be capable of modifying results.



Thus, in dislocations forwards, the astragalus may be partially, indeed wholly, thrust from between the bones of the leg and calcaneum, without breaking through the skin and tissues below it; although we know, from observation and recorded cases, that (with few exceptions only) the pressure of the bone, in its abnormal situation, will cause, sooner or later, the integuments to give way, and the astragalus to protrude. In one of Baron Dupuytren's cases, where the bone was luxated forwards, the dislocation was simple, and remained so; and in cases, given by Baron Boyer and others, of luxation forwards and inwards, the bone did not break through the skin; and where the anterior range of the tarsal bones has been separated from the astragalus and os calcis, by the fall of heavy weights on the forepart of the foot, the dislocation has been of a simple kind. The cause of the resistance offered by the soft parts may be attributed to the yielding nature of the skin on the dorsal aspect of the foot, and to the strength and elasticity of the loose sub-cutaneous reticular web. The sub-cellular fascia, although strong, is nearly inelastic; this, therefore, together with the tendons and their thecæ, may be ruptured; but the more elastic textures which lie above them at the instep, and to which we have just adverted, will sometimes remain in a state of integrity, tightly stretched over the projecting bone.

Dislocations inwards and outwards are, most frequently, of a simple kind, as the strength and tensesness of the sub-cutaneous textures are such as will prevent the bone from being at once driven through



them : thus, in almost all the cases which the author has met with of dislocation inwards, the accident was simple ; but, in most of them, the astragalus sloughed, and the bone was either partially or wholly excised. In Mr. Lawrence's valuable "Lectures on Surgery," allusion is made to a case of dislocation inwards, where the astragalus sloughed out. It is to be observed, in explanation of this fact, that about the inner malleolar region, the cellular tissue is more scanty and less lax than it is at and about the outer ankle ; whence, in one case of dislocation outwards, which occurred to Mr. James, of Croydon, the bone remained in its new situation, without making its way to the surface ; but there is not a single instance on record, of luxation inwards, where this result manifested itself.

Dislocation backwards is always simple, and always remains so, according to the examples of this accident which have been published ; and when we examine the soft structures, and their anatomical relations to other parts, which occupy the space between the posterior boundary of the joint and the tendo achillis, this fact admits of ready explanation. It cannot fail to strike the reader of the cases of dislocation backwards, that in no one instance was the luxation compound ; nor did the bone ulcerate its way to the surface, but it quietly rested in its new locality : it is, therefore, interesting to enquire into the reason of this circumstance. Posteriorly to the joint is situate the tibio-fibular ligament, which may or may not be torn ; behind the ligament is the deep fascia of the heel, which is regarded as continuous with



the fascia profunda of the leg; connected with this structure is a good deal of lax cellular and fatty texture; behind which is the tendo achillis, covered with another fascia, and which is united by the sub-cutaneous cellular texture with the skin of the heel: lastly, the skin in this region is thicker and stronger than in any other part about the ankle joint, whence, it offers a considerable obstacle to the protrusion of the bone; and it must not be overlooked, that the interval between the posterior part of the tibia and the tendo achillis is sufficiently spacious to give occupancy to the dislocated bone, without much removal of the tendon of the heel, and without direct pressure on the integuments of this region. In one instance, it is stated by Mr. Phillips, "that the tendo achillis was pressed by the astragalus, so as to form an angle of forty degrees, and where at one point the bone had reached so near to the surface that vesication was produced directly over it;" but still the astragalus did not slough or become exposed. Mr. Smith, surgeon to the Leeds Infirmary, has kindly favoured me with the result of his experience on this subject. He states, "that he has seen several cases of dislocation backwards, but in no instance has he known the bone to slough, or any attempt to be made by nature to throw off the dislocated bone, as in those cases where the astragalus has been luxated in the anterior aspect of the foot." He also states, that his colleague, Mr. Teale, has had a case illustrative of the same important fact.

The extreme rarity, too, of dislocation of the ankle backwards is a proof of the resistance which



the textures of the posterior part of the joint offer against displacement. The author has never seen a case, and no example of this accident is given in works on surgery, except in one instance presently to be alluded to. Mr. A. Adams, who has written a valuable article on "Abnormal Conditions of the Ankle Joint," in the *Cyclopædia of Anatomy*, (a work most ably conducted by Dr. Todd, of King's College,) is of opinion, that dislocation of the bones of the leg backwards, whether complete or incomplete, is an accident of rare occurrence. Boyer, in his valuable work on surgery, gives no case of it from his own practice, and observes, that no author, in his knowledge, has done so. Sir A. Cooper says, that he has seen the tibia dislocated forwards, inwards, and outwards, but never backwards; and Baron Dupuytren states that he never met with this accident. The sole case on record is published by Professor Colles of Dublin, and it is the only one that ever occurred in his extensive practice; and here the dislocation was merely partial. In this case the tibia seemed thrown partially backwards from the articular pulley of the astragalus; the fibula was unbroken, and was also carried backwards with the tibia; the foot (measured from the instep upon its dorsum) was longer than that of the opposite side; the heel was shorter and less pointed; the space in front of the tendo achillis (near to the os calcis,) was partially filled up; and a hard swelling occupied the lower and back part of the tibia, which was evidently formed by a quantity of callus, which had cemented together the fragments of a fracture of the lowest part of the tibia; and the leg was



shorter than the opposite limb. The man did not apply to Stevens's Hospital until the bones were united in their new and faulty position, therefore Professor Colles knew nothing of the history of the case, but conjectures, from appearances, that it was one of dislocation of the tibia and fibula backwards. Mr. Syme, in his very useful work, *The Principles of Surgery*, when speaking of dislocation of the astragalus, gives it as his opinion, that this accident does not admit of reduction, and that the bone must be removed. He adds, "if an opening has not been caused by the accident in the first instance, one ought to be made without delay, in order to anticipate and prevent the violent inflammation which will otherwise occur, as the precursor of sloughing or ulceration, by which the loose astragalus must make its escape." As a general rule, in *complete* dislocations, the author believes the opinion of this excellent surgeon to be quite correct; but he would venture to state, that luxation backwards is an exception to the universal adoption of this line of practice.

#### EXAMPLES OF DISLOCATIONS.

Having now completed his anatomico-physiological views of the normal conditions of the astragalus, and of the causes which produce, and the signs which denote, its abnormal changes as the result of force; the author will next endeavour to illustrate these subjects by a detail of some of the most interesting and instructive points connected with published and unpublished cases of these accidents.



In giving examples of dislocations of the astragalus, the author will relate his cases according to the following arrangement, which will comprehend all the forms, directions, and kinds of luxation which have occurred in practice, and will facilitate the institution of comparative views as to the forms, directions, and kinds of dislocation which have happened in the different regions of the foot :—

1. Partial, direct, and simple.
2. ———, ———, and compound.
3. ———, ———, simple, and complicated.
4. ———, ———, compound, and complicated.
5. ———, indirect, and simple.
6. ———, ———, and compound.
7. ———, ———, simple, and complicated.
8. ———, ———, compound, and complicated.
9. Complete, direct, and simple.
10. ———, ———, and compound.
11. ———, ———, simple, and complicated.
12. ———, ———, compound, and complicated.
13. ———, indirect, and simple.
14. ———, ———, and compound.
15. ———, ———, simple, and complicated.
16. ———, ———, compound, and complicated.

#### I. DISLOCATIONS FORWARDS.

CASE 1.—*Partial, Direct, and Simple.*—A case of partial dislocation of the astragalus occurred in a gentleman in this neighbourhood, who was attended by the late Mr. Thorpe, surgeon to the Manchester Royal Infirmary, where a portion of the bone was removed, and there now remains a very useful foot ; indeed, the patient walks with scarcely any degree of lameness.



CASE 2.—*Partial, Direct, and Compound*.—Dr. Wallis, of the Bristol Infirmary, has kindly communicated to the author the result of a case of this kind, which came under the care of Mr. Lowe, surgeon to the Infirmary, where the head of the bone was removed, and the remainder reduced, and the case did well.

CASE 3.—*Partial, Direct, and Compound*.—Mr. Smith, of the Leeds Infirmary, has favoured the author with the following case, with others of great interest:—

Isaac Brierley, aged 22, was admitted an in-patient April 7th, 1826, for an injured ankle, caused by a fall of earth whilst he was at work in a pit. It happened on the 7th of February. The part was very much inflamed when the patient was admitted, and a small wound was discovered near the ankle. In about three months (suspecting the astragalus to be displaced) the opening was enlarged, and a small portion of the bone removed; but in a short time afterwards the wound degenerated, and sloughed to a considerable extent, but having soon nearly healed, he was made out-patient.

August 5th, admitted again.

October 11th, wound entirely healed; but the ankle joint is quite stiff and painful on setting the foot to the ground.

CASE 4.—*Partial, Direct, and Complicated*.—In the *Lancet* for February 3d, 1827, under the head “Guy’s Hospital Report,” there is given a disputed case of dislocation of astragalus forwards. Without pretending, of course, to decide the question between the contending parties, (two such eminent men as



the late Sir A. Cooper and Mr. Key,) the author thinks it may be instructive to detail the case, as it shows, at all events, that a doubt may be entertained with respect to the existence and non-existence of this accident.

“There is at this time, in Cornelius ward, a case on which some difference of opinion exists as to its nature. Sir Astley Cooper considers it to be a ‘well-marked instance’ of a comparatively rare accident—partial dislocation of the astragalus. The patient is a young man, and was admitted under the care of Mr. Key, a few weeks since, in consequence of having received severe injury to the right leg. The accident occurred from the man having fallen from a height of six yards to the ground, and alighting on his feet. There was so much tumefaction immediately following the injury, that when the patient was admitted, and for some time after, it was certainly difficult to ascertain the precise nature of the injury done; crepitus was indistinctly felt at a short distance above the ankle, and in front of the joint was a considerable hard swelling. In the course of a few days, after the application of leeches, discutient lotions, and the observance of rest, the general swelling had so far subsided as to admit of a more accurate examination being made. It was now apparent, upon handling the limb, that the tibia was fractured at a short distance above the joint, and the fibula also broken at about two inches higher up the limb. The malleolus externus and malleolus internus were found to maintain their relative situation; but in front of the ankle joint there was a bony projection, equal in magni-



tude and much resembling in figure the forepart of the astragalus. Various and forcible attempts were made to reduce this swelling, but without effect; and the case was therefore simply treated in reference to the fractures. There is nothing material to remark on the progress of the case, only that the fractured bones became united in about the usual space of time, and at the period of making this report they appear to be firmly consolidated; but the tumour on the instep remains, and hence a question arises as to its nature. We have before said that the malleoli preserved their relative situations—such is the case now. The foot (if we except the swelling on the instep) is not deformed; there is the customary lateral motion, flexion, and also extension, but more especially the former is made with some difficulty. Sir Astley Cooper's opinion of the case is, that the bone projecting at the instep is the astragalus; which bone, he says, is thrown forward, whilst, at the same time, the lower portion of the tibia has receded. Mr. Key, on the other hand, considers that the swelling is occasioned by a fracture, with consequent displacement of the lower portion of the tibia, *i. e.*, its articulating portion, which has advanced; whilst, at the same time, the malleolus internus is left entire, and in its natural situation."

The author cannot find any subsequent report of this case; the probability is, therefore, that its nature remained undecided up to the period of the patient's discharge from the hospital.

CASE 5.—*Complete, Direct, and Simple.*—In the first volume of the *Medico-Chirurgical Journal*



there is a case given of dislocation of the astragalus forwards, which occurred under Baron Dupuytren. On examining the limb, there was found on the fore part of the foot a hard prominent tumour, which proved to be an irreducible luxation of the astragalus; the bone was cut away, and the patient recovered with ankylosis of the bones.

CASE 6.—*Complete, Direct, and Simple.*—I am indebted to Mr. Gaskell, late resident medical officer of the Manchester Royal Infirmary, and now medical superintendent to the County Lunatic Asylum, for the following case in which reduction was accomplished.

The accident above-mentioned occurred in a middle-aged man, who sustained the injury by a fall from a considerable height. The astragalus was dislocated forwards, and lay under the integuments and tendons of the dorsum of the foot. The dislocation was apparently perfect, many of the projecting points and surfaces of the astragalus being perceptible through the skin. The bone was reduced after persevering for some time in drawing down and flexing the foot, and also in making pressure upon the astragalus. It passed into its place suddenly, and with an audible snap; a bandage was applied, and the limb placed upon a splint; neither pain, swelling, nor other signs of inflammation occurred, and in three weeks the patient was able, with the use of a stick, to walk across the ward, and ultimately recovered the perfect use of his limb.

CASE 7.—*Complete, Direct, and Compound.*—The case of Thomas Toms, communicated by Mr.



Green to the late Sir A. Cooper, presents a perfect illustration of compound dislocation forwards : here the head of the astragalus, which was torn from the articular surface of the os naviculare, protruded through the divided integuments ; here all attempts at reduction failed, notwithstanding there was a free division of the skin. The difficulty seemed to arise in the capsule of the joint, and in consequence of the bone being tightly held by the tendons of muscles. In this case, the extraction of the astragalus was had recourse to at the recommendation of Sir A. Cooper, and in from three to four months (notwithstanding a good deal of constitutional disturbance, from the formation of abscesses and other causes) the patient was capable of performing, to a considerable degree, the flexion of the foot on the leg, but could not extend it. He was discharged from the hospital in less than four months after admission, and soon after resumed his business as a bricklayer.

CASE 8.—For the following case of this accident I am likewise indebted to the kindness of Mr. Gaskell :—

Thomas Santer, aged forty-four, fell through several trap doors in a cotton factory, and alighted on the edge of a large tub. The integuments, anteriorly to the ankle joint were extensively lacerated, the astragalus had passed through the wound and remained attached to the limb by a mere shred of membrane, which extended from the dislocated bone to the external lateral ligament. The limb was amputated, and the patient ultimately recovered.



CASE 9.—*Complete, Direct, Simple, and Complicated*.—Baron Dupuytren mentions a case where dislocation of the astragalus forwards was complicated with fracture of the tibia and fibula, and where the reduction was accomplished.

CASE 10.—Baron Boyer relates in his *Traité des Maladies Chirurgicales* the case which occurred to Monsieur Aubray, Chirurgien en chef at the Hotel de Dieu, de Caen, of a patient who suffered from luxation of the foot, combined with fracture of the fibula, and where it was likewise discovered, subsequently, that the astragalus was both fractured and dislocated. The surgeon removed the astragalus, which was followed by a free discharge of matter, and the case terminated favourably in ankylosis of the foot.

CASE 11.—Mr. Beever, late house surgeon of the Manchester Royal Infirmary, has kindly furnished the author with the following case, illustrative of the advantage afforded to attempts at reduction, when additional space is gained by fracture, associated with dislocation of the astragalus:—

Josiah Barlow, of middle age, robust in health and appearance, but said to be intemperate in habits, whilst following his employment as a brick-setter, fell from a considerable height, and alighted upon the right foot. The violence of his fall seems to have been received entirely upon the os calcis, and caused a comminuted fracture of that bone, and tilted the head of the astragalus upon the navicular bone, without producing any apparent injury to the soft parts. The reduction of the dislocation was effected without difficulty by exten-



sion and rotation of the foot. There was some consecutive fever with much local inflammation, requiring the application of leeches, and his recovery was protracted by the tedious exfoliation of two or three small fragments of the fractured bone; but ultimately he quitted the hospital with a slight halt only in his walk.

## II. DISLOCATIONS FORWARDS AND INWARDS.

CASE 12.—*Complete, Direct, and Simple*.—It is recorded in Sir Astley Cooper's valuable work, that the first case he ever saw was one of this kind, and the limb was amputated; the bone was thrown forwards and inwards, on the os naviculare. It was on the occasion of seeing this limb on the table of the dissecting room, that Sir Astley exclaimed, "surely that limb might have been saved."

CASE 13.—Baron Boyer has published a similar case to the above, where reduction was impracticable. Nothing, however, was done; and although the deformity continued, there was no lameness.

CASE 14.—*Complete, Direct, Simple, and Complicated*.—The following case is given by Sir Astley Cooper:—On the 24th of July, 1820, Mr. Downes had the misfortune to dislocate the astragalus, by falling from his horse. Mr. West, surgeon at Hammersmith, who was called to the patient, made an attempt to reduce the dislocation, which he could not effect. The patient was largely bled, and the limb placed in splints; Goulard's lotion was applied and an anodyne given. The patient felt great pain, and a sense of pressure against the skin and liga-



ments, on the evening of the accident. On the following day (the 25th) Mr. Ireland, who had visited Mr. Downes the evening before, called upon Sir A. Cooper, and requested him to accompany him to see the patient, and to meet Mr. West. When Sir A. C. examined the limb, he found the astragalus dislocated forwards and inwards, and the fibula appeared to be broken a little above the joint; Sir A. C. made an attempt to reduce it, but found the bone immoveably fixed in its new situation, projecting, so as to make the nature of the case perfectly clear, and bearing so strongly against the skin that a slight incision would have exposed it. Sir A. Cooper's first impression was, that he ought to dissect away the astragalus; but aware of the resources of nature in accommodating parts under luxations, and in restoring the limb to usefulness, he observed to Mr. West and to Mr. Ireland, that he would not operate, and that, perhaps, the skin might give way, and the bone become exposed, when he would be justified in removing it. The astragalus gradually became dislodged, the ligament sloughing or ulcerating. In September the patient was able to be removed to London. On October 5th, 1820, Sir A. Cooper again saw him, and finding the astragalus very loose, removed it with forceps, dividing only some slight ligamentous adhesions. The bleeding was trifling, and was suppressed by the application of lint alone. In October, 1821, he had a slight motion at the ankle, which has been slowly increasing.

CASE 15.—*Complete, Indirect, and Simple.*—Baron Boyer gives the following case:—



A man, aged 36, fell from his horse, and was dragged by the animal, at full gallop, with one foot in the stirrup. The astragalus was turned inwards upon the tibia, and the head of the bone was carried forwards; the Baron attempted to reduce the bone, but without success; therefore, he abandoned it to nature, to wait the event. He considered this step preferable to the practice of excising the skin and ligaments, because, even if he did so, the luxation of the bone was such as to render reduction impossible. The patient went on well until about the eighteenth day, when the skin reddened, and subsequently sloughed, and exposed the head of the astragalus. It seemed that the ankle joint was seriously involved, consecutively, in the mischief, therefore it was considered prudent to amputate the limb, and the patient recovered.

### III. DISLOCATIONS FORWARDS AND OUTWARDS.

CASE 16.—*Partial, Direct, and Simple.*—Through Mr. Milner, M.R.C.S., the author has learnt that a partial dislocation of the astragalus occurred in the practice of Mr. Taylor, Oldfield Lane, and the bone was reduced.

CASE 17.—*Complete, Direct, and Compound.*—A case of dislocation of the astragalus has been communicated by Mr. Milner, where the bone was completely luxated, and where partial reduction was effected by means of force used with a pair of forceps. In this case there was permanent inflexibility of the foot, and the heel was elevated three inches from the ground.



CASE 18.—A third case, communicated by Mr. Milner, is one of complete and compound dislocation forwards, and a little outwards, without fracture. Reduction was impossible; the bone, therefore, was cut away, and the patient did well.

CASE 19.—The fourth case communicated by Mr. Milner is the one which the author visited, in consequence of the solicitation of a friend of the patient. He found that the bone had been excised by Mr. Taylor, for an irreducible dislocation of the astragalus. The accident occurred at Haslingden, in this county, in consequence of a fall from a height, and the weight of the body coming on the os calcis. The patient was a very unfavourable subject for any accident or operation. He died from phlegmono-erysipelatous inflammation, which commenced about the foot, and extended up the leg and thigh, although the case was judiciously managed by incisions, &c.

Through the kindness of Mr. Milner the author has obtained information as to the cases of dislocation of the astragalus that have come under the notice of Mr. Taylor, of Oldfield Lane, and he thinks it right to subjoin Mr. Milner's letter on this subject:—

“Dear Sir,—I beg to acknowledge the receipt of your note of the 23rd instant, respecting dislocations of the astragalus. The case of compound dislocation of the astragalus we saw together proved fatal the day after. The symptoms varied little from those you saw. The inflammation gradually increased in the leg and thigh; and had there been excessive suppuration, the inflammation must necessarily have subsided, and the symptoms consequent upon the extensive injury to the joint and soft parts would, in some degree, have been ameliorated, and the patient might have rallied. This case was not inspected.



“ Mr. Taylor has favoured me with the following answers to your questions :—He has met with four cases of dislocated astragalus; all of them were forwards, and rather outwards. In the *first case*, there was a partial dislocation of the bone, which he reduced, and kept in apposition during the reparative process. The case went on progressively, without any deep suppuration, or, indeed, any bad symptoms; and the use of the joint was, in a great measure, restored. I presume in this case there must have been a fracture of the fibula, though Mr. Taylor said not. It occurred many years ago. In the *second case*, there was a complete dislocation of the bone, which Mr. T. partially reduced by the aid of a pair of forceps. This case went on favourably, without any bad symptoms, and no suppuration ensued. There was a contraction, of course, leaving the heel permanently three inches from the ground; and, necessarily, a permanent inflexibility of the joint. In the *third case*, there was a compound and complete dislocation of the bone, without any fracture of the fibula. The bone was removed, and the patient gradually got better. In this case the constitutional symptoms ran high, and the inflammation and suppuration were rather extensive, and several collections of matter took place in and above the ankle. The man is able to walk tolerably well, though a certain degree of stiffness remains in the joint; but not so much as you might suppose would result from such a case. This patient came under our care in the spring of this year, and he now resides at Rhodes, near Middleton; his name is Partington. The above three cases were favourable subjects, being strong constitutioned young men. The *fourth* and last case is the one you saw with me.

“ In conclusion, I have given you as many particulars of the above cases as I could gather from Mr. Taylor, and remember myself, at present. The two last cases I attended, in some measure, myself. I have misplaced the other astragalus, but will endeavour to find it, and call upon you in the course of a few days.

“ Yours, very respectfully,

“ December 26th, 1842.”

“ R. MILNER.

These cases, coming from the source they do, are invaluable, as showing the impracticability of reducing complete *isolated* dislocation of the astragalus, by any experience united with the greatest



degree of force that can be exerted ; for it is well known that Mr. Taylor has been able by force, used with unsparing and untiring hands, to accomplish what most surgeons durst not attempt ; yet complete and isolated luxation of the astragalus is an accident which defied all his efforts at reduction.

In the two cases of complete dislocation Mr. Taylor excised the bone. The first of these occurred in February, 1841. It happened to a healthy man residing at Rhodes, near Middleton, in this county ; and was produced by jumping from a wall, in the dark, on an irregular surface of ground. The patient was immediately removed home, and on the following morning taken to the "Whitworth doctor," who found the astragalus dislocated, without fracture of any of the bones of the leg ; attempts were made to reduce the bone, by extension and counter extension, kept up for half-an-hour by seven athletic men, but all to no purpose ; upon which, amputation of the limb was recommended. The patient, however, was unwilling to submit to this proposal, therefore was sent to Mr. Taylor, of Oldfield Lane, who also tried reduction, but in vain ; and finding this to be the case, the astragalus was excised. The case did well, and on the 1st of January, 1843, the author had an opportunity of seeing the patient, and of witnessing the satisfactory state of his limb, which, although one inch shorter than the opposite, is capable of performing tolerably free motion.

The author was requested, by a friend of the patient, to visit the fourth and last of these cases on the 13th of December, 1842. He found him



as stated in his report. The unexpected occurrence of being called to a case of dislocation of the astragalus, under the care of Mr. Taylor, was most opportune for enabling the author to obtain some information from Mr. T. (who is well known to have very extensive experience in dislocations and fractures,) as to the results of cases of this kind that had come under his observation; he was, therefore, induced to elicit from him, through Mr. Milner, the important information communicated in Mr. M's. letter, and in the detail of cases which came under his notice and treatment.

For the following case the author is indebted to Mr. Smith, of the Leeds Infirmary:—

CASE 20.—*Complete, Direct, Simple, and Complicated*.—John Hewick, aged 25, was admitted into the Leeds Infirmary for a supposed dislocation of the ankle joint, with fracture of the fibula.

October 25th, 1825. The bones were reduced in the usual way, and a cataplasm applied. In a short time a large slough formed below the ankle, which separating, it was discovered that the astragalus had been displaced; the articulating surface, by which it was joined to the os naviculare, being turned outwards, and exposed.

November 22nd. The astragalus, having separated, was removed; cataplasm continued.

27th. Wound dressed, and placed in a fracture box. Made out-patient January 13th.

CASE 21.—*Complete, Direct, Simple, and Complicated*.—Monsieur Velpeau gives the following case:—

A merchant, while leaping out of his carriage,



fell upon his left foot, and dislocated the astragalus forwards and outwards. There was also a fracture and wound of the integuments at the same time. The astragalus was removed; but an emphysematous tumefaction of the whole limb came on, accompanied with alarming nervous symptoms, and ended in the death of the patient the fourth day after the accident.

CASE 22.—*Complete, Indirect, and Simple.*—A man, 47 years of age, a German by birth, and of a healthy constitution, fell down a flight of stairs. The patient immediately felt a severe pain in the left ankle, which, on examination, was found to be deformed, and its motion exceedingly painful. On the next morning he was taken to M. Dupuytren's consultation, and the case is thus reported:—"Foot turned inwards; immediately below the situation of the malleolus internus, (which cannot be felt,) there is a deep depression; external malleolus very prominent; and below, and in front of it, there is another projection, which feels unequal and angular; skin at this part much stretched, severely contused, and slightly excoriated. The foot cannot be moved in any direction; most severe pain when the gentlest attempt is made; swelling not very considerable. The foot appears somewhat shorter than the other, and it is carried a little backwards; no disturbance of the bones of the leg can be detected." The case was immediately pronounced to be one of dislocation of the astragalus, forwards and outwards on the calcaneum. Reduction was attempted, but without success; the limb was, therefore, permanently deformed.



CASE 23.—The author has the permission of Mr. Smith, of Leeds, to publish the following :—

James Bracewell, aged 27, a prisoner in the Wakefield House of Correction, was admitted an in-patient, August 3rd, 1830, under Mr. Smith. About three o'clock the previous afternoon, when employed in his usual occupation of treading the wheel, one of the steps being broken, his foot slipped, and was caught by the wheel ; after which he was unable to stand. Mr. Dunn, the surgeon to the prison, after attempting for more than two hours to reduce the bone, failed, and then ordered him to be sent to the Infirmary. He has been unable to rest during the night from pain. The astragalus forms a projecting tumor over that portion of the os calcis which articulates with the os cuboides ; the sole of the foot is turned inwards ; its outer edge, when he stands, rests upon the ground ; two prominences, which appear to be the two external angles of the astragalus, point distinctly under the skin. Reduction was attempted with the pullies, the bandage being fixed on the calf of the leg, the leg being bent to relax the flexor muscles. A silk handkerchief was fixed round the heel and over the instep, and gradual and powerful extension was kept up for near ten minutes, Mr. S. pressing on the prominent part of the bone with his hand, and attempting by these means to reduce the bone, but every effort proved ineffectual. Mr. S. hoped, that by allowing the parts to remain in their present state, the integuments would slough and the displaced bone come away, and that an articulation would be formed



between the os calcis and the tibia, Mr. S. having had three previous cases which terminated successfully in this manner. A large poultice was applied, and the limb ordered to be kept in the bent position. Sol. cath. ℥j. ter. die.

6th. The integuments over the tumour beginning to slough, the patient has had no rest on account of severe pain.

9th. Much easier.

15th. Slough increasing.

September 1st. Slough still increasing; considerable constitutional irritation. The patient has lost flesh, and is become very weak.

11th. Sloughing process ceased. An abscess has formed on the inner side of the foot, discharging pus profusely. The patient shows no improvement in his health. It seems the astragalus has not been sufficiently detached from its connexions to cause its acting as a foreign body in the wound; attempting its removal at present would, probably, be a much more serious remedy than amputation.

22nd. The discharge from the inner side of the foot nearly ceased. Poultices discontinued, and soft dressings applied: much less pain. The patient's health improving.

23rd. Limb ordered to be put in splints, as for fracture, gradual pressure being maintained on the inner side of the foot, with the hopes of bringing it nearer to its natural position.

28th. Being necessary to make a counter opening for the abscess, which continued to suppurate, the splints have been removed, and poultices applied.

October 1st. Another slough has appeared an-



terior to the former ; an articulating surface of bone presents, which appears to be that part of the astragalus in connexion with the os schaphoides. Poultices continued.

15th. Granulations springing up from the bone, and the sore healing. Continue poultice.

19th. Surface of bone entirely covered by the granulations, which bleed freely when disturbed by the probe. Discontinue poultice, and apply soft dressings and bandage. Appetite poor ; feels weak and languid. R. infus. rosæ c sulph. quiniæ ʒj. ter. die.

22d. Sores healing ; limb to be put up in splints as before.

November 1st. Foot easy, and sores healing ; health gradually improved.

December 1st. Sores quite healed.

20th. The patient not being able to bear any weight on the injured foot, and the bone apparently not at all likely to be cast off, at a consultation with Messrs. Chorley, Hey, and Smith, it was determined to remove it by operation, and to have recourse to amputation as a last resource, should the attempt at its removal fail.

23rd. (*Operation.*) Mr. Smith commenced by making a crucial incision above the projecting portion of the astragalus ; and dissected down the flaps on all sides. For the purpose of obtaining a better purchase, an attempt was made to bore a gimblet into the substance of the bone, but its extreme softness prevented this being of any service ; on removing the gimblet it bled profusely. The progress of the operation was now considerably



impeded, owing to the strong connexions which had been formed between the astragalus and contiguous bones, it being firmly ankylosed to them. It was with great difficulty that Mr. Smith was enabled, by chisels and levers, to remove the bone from its connexions: this, however, was effected, and the foot was brought into its natural position with ease. On examining the bone it was found to be completely inverted by the accident, for instead of the two projecting points being, as was supposed, the external angles of the bone, they proved to be the *posterior*; that portion which overlaps the posterior articulation with the os calcis internally, and the *anterior projection* formed by the internal edge of that surface which articulates with the os schaphoides. This may appear strange, but it is proved by the situation of the perforation made with the gimblet; for if the bone had not been inverted, how could the perforation be made, during the operation, on the under surface of the bone where it articulates with the calcis? But the fact of the inversion of this bone is further confirmed by one related by Dupuytren in 1819; who on cutting down upon the astragalus, in a case of this kind, found that he could not remove it so readily as he expected, nor could he replace it; and it was not till after a tedious operation that he succeeded in taking it away. The difficulty arose from the upper surface of the bone being turned downwards, and what was naturally the lower part of it took hold of the tibia in the manner of a fork. (*Annuaire Medico-Chirurgical des Hopitaux de Paris*, 1819, p. 28.) The bleeding was trifling, no vessels being



tied. The flaps of the wound were brought together and secured by adhesive plaster, over which, soft dressings and a wet calico bandage were applied.

25th. The dressings were removed this morning, wound tolerably healthy, though no adhesions have taken place, and the lips looks livid and flabby. Discontinue dressings; applied cataplasma lini.

January 4th, 1831. Healthy granulations, and wound rapidly healing; discontinue poultice, apply soft dressings, and bandage in such a manner as to keep the foot, as much as possible, in its natural position.

9th. Chasm entirely filled up; the granulations having risen above the edges. The wound to be dressed with lint and strips of adhesive plaister.

18th. Sore continues to heal, can now bear considerable pressure on the foot, but the mere application of the bandage is not sufficient to bring it to the natural position; a shoe is to be worn, hollowed out opposite the wound, and straps fixed from the knee to the outside of the toe and heel, to keep up a more effectual pressure outwards than can be done by bandage alone. Health has considerably improved since the operation; is allowed to get up during the day, but from the contraction of the muscles, owing to the limb being so long in the bent position, he cannot put his foot to the ground. The linim terebinth to be applied twice a day to the contracted parts.

February 12th. Foot nearly brought to its natural position, and admits of slight motion at the ankle joint; the man has almost regained the complete use of his knee. A boot, with a double sole,



ordered so that with its assistance he will be able to walk very comfortably.

18th. The ankle of the injured foot is about an inch nearer the ground than the other. The high-heeled boot answers very well. Discharged cured.

December 7th, 1831. Mr. S. received a letter from the patient, in which he says, "My leg is a great deal better; it is sufficiently strong that I can walk about home with the help of my stick." The man would have come over to Mr. S. to see him, but was afraid of being again sent to the House of Correction.

Since this account was written, Mr. Smith paid the patient's coach hire from Barnsley to Leeds, in order to have an opportunity to take a cast of the leg: he could then walk with a slight limp, and there was very tolerable motion in the joint.

The author has given this case in full, as it is a very instructive one, and shows the difficulties with which we have to contend, and the line of practice to be pursued, in dislocations with altered axis of the bone. Mr. Smith has obligingly sent the author the extracted astragalus, and casts of Bracewell's foot, before and after the operation.

The author is indebted to Mr. Gaskell, of Lancaster, for the particulars of the following case, which occurred at the Manchester Royal Infirmary, during the house surgery of Mr. Golland:—

CASE 24.—*Complete, Indirect, Compound, and Complicated.*—Mr. Gaskell writes:—"The most important case which has come under my observation is one of compound dislocation of the astragalus, in which the bone was removed by Mr. Golland,



and the patient recovered the use of the limb. I have no note of the manner in which this accident occurred. The wound of the integuments was considerable, extending across the anterior and outer side of the ankle; the external malleolus was broken off the shaft of the fibula; the astragalus was split into two portions, the external and smaller portion had escaped, and the other piece remained between the tibia and os calcis; but although still remaining in the socket, it was displaced from its original position, and the connections with the os calcis, &c., were broken. This portion was removed, as well as the external malleolus; the edges of the wound carefully brought together, and the limb placed in a splint. No untoward symptoms arose, and in four or five months he was able to walk tolerably well.

Mr. Banner has kindly sent an account of an interesting case which occurred in his practice:—

CASE 25.—*Complete, Indirect, Compound, and Complicated.*—W. J., aged 63, was admitted into the Liverpool Northern Hospital, with compound dislocation of the astragalus of the right leg, and compound fracture of the fibula. The patient had led a very irregular life, *having been a hard drinker*, and his general appearance indicated an intemperate man: his employment is that of a labourer about the docks, and at the time of his admission he was under the influence of drink. He had fallen into the hold of a vessel, but could not give any distinct account of the accident, but thought he had alighted on his feet and then fell; and at the bottom of the ship's hold were several small boxes



bound with iron, with which he came in contact. There was a small angular wound about one and a half inch above the external malleolus, as also another in front of the external malleolus extending three inches from its point towards the front of the foot; through this latter wound, which is uneven and lacerated, the astragalus has been forced, and is resting over the mouth of the wound in front of the external malleolus, and which is only just large enough to admit of its exit. The only connexion the astragalus has with the foot is through the tibio-tarsal ligament; and so forcibly has it been driven from its situation that the upper surface of the bone (or that on which the tibia rests) is turned inwards, and the surface which was connected to the *os calcis* has become most external, so that it presents the following appearance:—The inferior portion of the bone lies in front of the wound, showing its two articulating surfaces for the *os calcis* with the deep groove, from which the interosseous ligament has been torn; the larger and deeper articulating surface is nearly in front of the external malleolus, whilst the smaller one is still more in front of the bend of the foot, the deep groove being in the longitudinal direction; the articulating surface of the navicular bone is pointing across the foot towards the great toe, thus the surface for the end of the tibia is turned inwards, and held only by the tibio-tarsal ligament. The bone is easily raised, and exposes the wound through which it has passed. There is a compound fracture of the fibula immediately opposite the upper wound. In consequence of the patient's age and previous intemperate habits,



and in consideration of his occupation, we determined to amputate the limb. The man left the hospital in seven weeks quite well.

#### IV. DISLOCATIONS UPWARDS AND OUTWARDS.

CASE 26.—*Complete and Compound*.—A highly interesting and instructive case, and the only one of this kind on record, is given in the 2nd volume of the *London Medical Gazette*, extracted from the case book of Dr. Wells, of Columbia:—

Dr. G. W. S., aged 30 years, of an active constitution and sanguineo-nervous temperament, was, in the early part of his convalescence from fever, taking a short ride in an open carriage, when his horses became frightened and ran off. In attempting imprudently to extricate himself, by leaping from the vehicle, he struck upon his left foot, and dislocated the os astragalus from its junction with the schaphoides upwards and slightly outwards.

Several medical gentlemen of the vicinity were called to his assistance, who made violent efforts to reduce the bone, but without effect. This was followed by fever, swelling, inflammation of the joint, and ulceration of the soft part, so as to expose the astragalus, which shortly afterwards became carious. This accident confined him to his room several months longer. He came to Columbia, (a distance of 150 miles,) in six months after the injury of his ankle, when he had but imperfectly recovered his general health. The ankle was considerably swollen, occasionally painful, and admitted of little or no motion; the foot was



turned inward, and was partially extended. A circular ulcer, about three-fourths of an inch in diameter, exposed the head of the astragalus in a carious state. He walked on crutches, and could bear very little weight on the lame foot. Towards the close of the seventh month, having taken much more exercise than usual, he was attacked with violent inflammation throughout the tarsus, accompanied with great swelling, excruciating pain in the part, and high fever.

Bleeding, general and local, and the most rigid antiphlogistic course, were followed up for several days, notwithstanding which an extensive suppuration took place, and the matter was discharged by punctures with the lancet on both sides of the joint. On examination with the probe it was ascertained that the astragalus had become carious at different parts.

It was now a question whether the leg should be amputated or the diseased bone removed, one or the other of these operations being deemed necessary to save life; and as there did not appear to be any other bone besides the astragalus affected, the latter was determined upon, and done on the 18th of August, in the presence of several medical gentlemen.

An incision was made, commencing at the edge of the original ulcer, near the tendon of the common extensor of the toes, and carried obliquely backward and downward, a little past the lower head of the fibula, and the astragalus was carefully detached from its connexions. There was very little difficulty in the operation, no vessel divided



requiring the ligature, consequently very little blood was lost.

The astragalus, when extracted, left a frightful wound, the foot seeming to be nearly separated from the leg.

A hollow splint was adjusted to the inside of the foot and leg, so as to preserve the limb perfectly steady and in a proper position, the foot being kept at a right angle with the leg. Simple dressings were applied to the wound, and an anodyne administered.

At the end of September the wound was healed, and the swelling of the parts had subsided. Twelve months after the operation this gentleman walked without the least difficulty, and the ankle was perfectly sound. The leg was shortened about an inch, and the deficiency supplied by a thick heel upon the shoe.

#### V. DISLOCATIONS INWARDS.

CASE 27.—*Complete, Direct, and Compound.*—It is recorded that Monsieur Ferrand, surgeon to the Hotel Dieu de Paris, had extracted, with success, the astragalus, which was dislocated in an officer, and who was in the habit of carrying the bone in his pocket, and showing it as a proof of the severe injury he had received.

CASE 28.—Monsieur Lacemonier communicated to the *Société Royale de Médecine* a case of dislocation of the astragalus, which occurred in August, 1790, caused by a violent twist of the foot, which produced a complete compound dislocation of that bone from the tibia, fibula, calcaneum, and os



naviculare, inwards, below the malleolus internus, and between the tendons of the tibialis posticus and long flexor of the great toe, which had been partially lacerated, and was in a state of gangrene.

The astragalus was of a black colour, and the wound discharging a foetid sero-purulent matter. The leg and foot were much swollen, and the patient laboured under slow fever. Considering the astragalus as a foreign body, M. Lacemonier thought it proper to extract it, which operation was followed by considerable amelioration of symptoms. Matter, however, subsequently formed about the outer ankle and above the foot, requiring counter openings; but from this time the patient continued to improve, and in fine had a useful foot, notwithstanding the loss of the astragalus and of the tendons of the peroneus longus and flexor longus pollicis muscles.

CASE 29.—*Complete, Direct, Compound, and Complicated.*—Mr. Bransby Cooper has related an interesting case, under his care, of most extensive fracture of the lower ends of the tibia and fibula, with compound dislocation of the astragalus inwards. The accident occurred to Mr. —, near Aylesbury; and Mr. Ceeley, an eminent practitioner of that town, reduced the dislocation, applied a long splint along the outer side of the limb, and, in conformity with the patient's desire, brought him up to town to his own residence. When Mr. Cooper and Mr. Ceeley examined the limb together, on the patient's arrival at his own house, a part of the astragalus was still projecting through the wound, and confined a portion of skin so tightly under it, that Mr. C.



considered it advisable to remove the piece of bone. By this means the skin was immediately liberated, and the foot readily placed in its natural position. The case was proceeding favourably up to the time of its being published in the second edition of the late Sir A. Cooper's valuable work, edited by Mr. Bransby Cooper.

CASE 30.—*Complete, Direct, Compound, and Complicated.*—In the *New York Hospital Report* for 1827 there is a case given by Dr. Stephens of dislocation inwards :—

A stout lad fell from a height of 50 feet, and received a compound luxation of the astragalus inwards. He was immediately conveyed to the Hospital above-mentioned, and put under the care of Dr. Stevens, who endeavoured to reduce the bone to its proper place ; but, failing in this, he tried to pull out the bone, which was also impracticable. Extension was made ; and as the bone could not be reduced to its proper site, it was extracted, by dividing the ligaments that held it, with the scalpel, though not without considerable suffering to the patient. Upon minute examination of the bone, the processes to which the ligamentum inter fibulam et astragalum posterius, and ligamentum fibulæ anterieus are attached, were found broken off. The limb was laid flexed on its outer side on a splint and pillow, and the wound dressed with lint and roller. We need not detail the after treatment, which appears to have been judicious. There was ultimately some flexibility of the ankle joint, with little deficiency in the length of the limb.

CASE 31.—*Complete, Indirect, Compound, and Complicated.*—Mr. Sawyer has published, in the



first volume of the *Gazette*, a case of dislocation of the astragalus inwards, accompanied with fracture of the tibia and fibula:—

William Wright, aged 42, of a thin, spare, and bad habit of body, sallow complexion, lax fibre, &c., when thatching a corn stack in September, 1825, fell from a height of 40 feet, perpendicularly, and his left leg and foot sustained the injury. He was immediately conveyed home, a distance of nearly two miles, when Mr. Sawyer saw him. Upon examination of the parts injured, the malleolus internus was found fractured obliquely, the fibula was also fractured a little above the joint, and the astragalus was situated at the inner part of the foot, below the internal malleolus, wedged between it and the os naviculare, forming a prominent projection under the skin, and turned upside down, so that there was a complete luxation of the astragalus, with fracture of the lower ends of the tibia and fibula. The usual means of reducing the astragalus were adopted, without effect. The part was much swollen, with great extravasation. Inflammation took place, extending to the thigh, and was so severe as to threaten gangrene. In a few days sloughing took place, with a great discharge of pus, exposing the surface of the astragalus. This bone becoming loose, it was taken out with the forceps. The removal of it occasioned a little hæmorrhage. The granulations which had formed at the side of the wound were slightly scarified, and pressed downwards, which assisted materially in filling up the gap. Adhesion immediately took place, and the granulations at first grew rapidly. Afterwards, however, they became weak, and it was, therefore, some time before



the external wound completely healed ; no exfoliation whatever took place. On examining the astragalus, the articulating surfaces of the under part were found to have been broken off, as well as the navicular process of the anterior and posterior convex surfaces of the fossa. It is, therefore, more than probable (and the strength of joint led Mr. Sawyer to believe) that ossification must have taken place to some extent, connecting the under surface of the astragalus with the navicular process, making up the deficiency caused by the loss of the upper part of the bone. The man has a little flexion of the ankle, can walk without the aid of a stick, and had worked at country work above a year when the case was published. The leg is the same length as the other.

I am indebted to Mr. Wickham, surgeon to the Winchester Infirmary, for having my attention directed to the following case, related by Mr. Burnett, but in which Mr. Wickham was consulted. It has been published in the 19th volume of the *Medical Gazette* :—

CASE 32.—Colonel G., an active man, of a spare habit of body, and upwards of 60 years of age, was fox-hunting on the 23rd of February, and had made a leap, when suddenly he found himself unable to follow, in consequence of his right foot being displaced; his usual habit was to ride in his stirrup, the foot resting on its outer side. When Mr. Burnett first saw him, the boot had been removed, which, from the force of the injury, had given way, the bones protruding through it. The foot was dislocated inwards, at right angles with the leg; and two bones were plainly to be seen pro-



jecting out of a wound, which was about three inches in length, extending across the outer ankle. Mr. B. carefully examined the situation and shape of these bones: the upper one, the os naviculare, had projected its cuneiform surface outwards and inwards in an oblique direction; and the other bone was the astragalus, which had forsaken its natural cavity, was driven forwards and outwards, and presenting that surface which in its natural position would be in contact with the os calcis. Mr. B. steadily kept pressure as firmly as he could for nearly a quarter of an hour upon the prominent os naviculare, in the direction of the joint, to which he was directed by the end of the tibia, which was plainly to be seen beneath the astragalus. At the expiration of this time he had the satisfaction to see the bones slip into their proper places, and the foot resume its natural character. The end of the fibula was not fractured. Having placed the limb in proper splints, Mr. Burnett conducted the patient home, where he was met by his family surgeon, Mr. Wickham, of Winchester, in whose able hands Mr. B. had every satisfaction of knowing it would be watched with an active and intelligent eye. The case has done remarkably well, and in a letter which Mr. B. received from Mr. Wickham, he is told, "I am able to inform you that Colonel G.'s case has been brought to the most satisfactory termination. The wound is healed, the motion of the joint is perfect, and the swelling of the part is nearly reduced. Weakness, which time only can remove, and the occasional puffiness from use, are the only remaining effects of the injury. You are aware that the progress of the case has scarcely been



interrupted, and that inflammatory symptoms only once occurred during the period of his confinement; these were ushered in by a rigor and succeeding heat; they occurred about three weeks after the accident, and only lasted a few hours. At present he is able to walk with crutches without the least inconvenience, and the limb supports, occasionally, its share of the weight of the body. As to the motion of the joint, it can not only be performed by myself, but the patient can freely bend and extend the foot."

Appended to the relation of this case are some useful reflections on the nature of this very severe accident. Much credit is due to Mr. Burnett for his management of the case, which is to be regarded as one of dislocation of the astragalus and os naviculare, whence more easily reduced than isolated luxation of the astragalus is proved to be.

#### VI. DISLOCATIONS OUTWARDS.

CASE 33.—*Complete, Direct, and Compound.*—Amongst other interesting cases given by Baron Boyer is mentioned one of compound dislocation of the astragalus outwards. The surgeon in this case, in spite of the opinion of his two colleagues, who were favourable to amputation of the limb, decided on excising the bone at the eighth day after the accident occurred, and in about fourteen weeks the patient was able to walk with the assistance of a crutch.

CASE 34.—*Complete, Direct, and Compound.*—Monsieur Mauduyt communicated a case to the *Société Royale de Médecine*, of a military man, of the age of 30, who was severely wounded in the



foot, in consequence of leaping from the top of a wall. The shock was considerable, and caused a compound dislocation of the astragalus outwards. The surgeon who was called to the patient, believing that it was not possible to reduce the bone, detached it, by dividing the ligaments and other structures by which it was held. The cure was lengthened and difficult; but after about 18 months the patient could walk slowly by means of a cane.

CASE 35.—*Complete, Direct, and Compound.*—A case is recorded in Mr. B. Cooper's edition, of a Mr. Miles, who met with compound dislocation of the astragalus outwards, without fracture of the fibula or tibia. Here the reduction could not be accomplished; and Mr. Callaway, in consultation with Sir A. Cooper, decided on the removal of the astragalus, which was done by Mr. C. This case was followed by great constitutional irritation, of which the patient died on the 11th day. On examining the limb after death, a large abscess was found underneath the metatarsal bones, and a prodigious quantity of matter had burrowed up the leg under the gastrocnemii, nearly as far as the knee.

CASE 36.—A very similar case to that of Mr Callaway's occurred at the Hopital St. Louis, Paris, under the care of Monsieur Richerand. A man, aged 46, met with the accident of compound dislocation of the astragalus outwards, the bone resting on the upper part of the cuboid bone. The medical attendants immediately tried to reduce the bone, but unsuccessfully. On the following morning, M. Richerand again attempted reduction, but his endeavours were equally ineffectual; therefore extirpation of the bone was decided upon and immediately



performed. The case went on well whilst in the hospital, but the patient's wife was anxious for his removal home, which was granted, and it was reported that the patient died eight days after his discharge from under Monsieur Richerand's care.

CASE 37.—*Complete, Direct, Simple, and Complicated*.—Sir A. Cooper mentions a case of dislocation outward. Being sent for into the country to visit a patient, the surgeon, Mr. James, of Croydon, whom Sir A. Cooper met there, requested him to see a gentleman who had a dislocation of the foot, which had happened several weeks before, but had not proceeded to Mr. James's satisfaction. Upon examination, Sir A. Cooper found the astragalus dislocated outwards, and the tibia broken obliquely at the inner malleolus; every attempt at reduction was made which Mr. James, who is an extremely well-informed man, could adopt; five persons kept up a continued extension when the accident first happened, but without effect; the patient was taken home, and several persons were employed in extending the foot, and it was thought, after a time, with some success; but the reduction could not, by all their efforts, be rendered complete, as the astragalus still remained upon the upper and outer part of the foot. The extension could not be carried further; the integuments sloughed from that which had been already made, and the wound was a long time in healing. The limb now deviates much from its natural shape; the toes are turned inwards and pointed downwards; there is some little motion at the ankle, and only a slight degree of it between the projecting and raised astragalus and the other bones of the tarsus.



The following case of dislocated astragalus is furnished by Mr. Smith, of Leeds :—

CASE 38.—*Complete, Indirect, and Simple.*—September 3rd, 1821. During my absence a few days in the country, James Fawcett, aged 66, was admitted into the Leeds Infirmary. He had been driving his cart quietly on the road, when two or three young men, who were also driving carts, whipped their horses into a gallop in order to pass him, when he was thrown out, and one of the carts passed over his ankle. There was a considerable degree of swelling of the limb, and the case was supposed to be a fractured fibula. A poultice was applied and the limb placed in a bent position. Mr. Smith saw the limb on the 7th, when there was a projecting part of the bone in the situation of the head of the fibula, and a little lower another portion of bone; these were covered by the common integuments much upon the stretch; the bones were firm and immoveable, and it was evident that the covering of integuments would slough away shortly. At this period I looked upon the case as being one of fractured fibula, and the inferior projecting point of the bone I suspected to be the os cuboides forced from its proper situation.

September 15th. The integuments had sloughed and the two points of bone were projecting, but a small slip of integument had remained, dividing them into two; this had sloughed also, and it was now distinctly seen that these two points which projected were portions of the same bone. Mr. Smith immediately suspected it to be the astragalus which was dislocated; and upon comparing it with one of these bones, the upper portion was found



to be the outer surface of the bone which articulates with the tibia, and the lower portion was found to be the head of the astragalus which articulates with the scaphoid bone.

September 18th. The patient complains of pain in the head and shoulders ; bowels constipated.

19th. The bowels have been freely moved, and he has experienced great relief.

21st. The circumference of the wound rather increased.

October 6th. Mr. Smith proposed to his colleagues the removal of the dislocated bone, which was immediately assented to, and the man was taken into the operation room. Mr. S. anticipated great difficulty in removing the bone, but was agreeably surprised to find that after passing the scalpel round to detach it from the integuments, it was removed by a single push of a sharp chisel ; a very deep chasm was exposed, which bled very freely, but ceased immediately after removing the tourniquet. The sides of the cavity were covered with dressings of lint and ung. ceræ, and a poultice over all.

7th. The patient has passed a good night, and the wound looks healthy.

10th. Continues to go on well ; the poultice to be discontinued.

27th. The cavity is much diminished, but there is a slight inflammation.

30th. Much better.

November 27th. Was ordered to walk about the ward a little.

20th. The wound is nearly healed ; he has a slight motion in the joint : was made out-patient.

December 4th. He came to the Infirmary in a



cart, got wet, and was shook a good deal in returning home.

17th. Mr. Greenwood was sent for to Hunslett to see him. He had been taken ill in consequence of exposure to wet and cold in returning from the Infirmary; an abscess had formed in the inner ankle, which Mr. G. opened. The original wound had a foul appearance, and a thin sanious fetid discharge flowed from it; a poultice was ordered, and he was again made an in-patient. At this period an erysipelatous inflammation pervaded the whole limb, and a probe, passed in at the opening made at the inner ankle, came out at the original wound at the outer ankle.

December 23rd. He is much better; wounds now look healthy and are nearly healed; swelling much abated. He was again made an out-patient, and has since continued to improve gradually; he can walk tolerably without the assistance of a stick, but he still uses a crutch and stick. There is a very fair motion of the tibia upon the os calcis, and he thinks the limb is about half an inch shorter.

#### VII. DISLOCATIONS BACKWARDS.

In the 14th volume of the *Medical Gazette* there are given two interesting cases of this accident by Mr. Phillips:—

CASE 39.—*Complete, Direct and Simple.*—A gentleman (Mr. G.), aged about 35, was driving himself and two ladies in a phæton, when the horse became unmanageable, and the reins broke. Mr. G. threw himself from the carriage, with the hope of succeeding in stopping the horse, and alighted upon



his feet, but immediately fell forward to the ground. He was brought home, and in about two hours from the occurrence of the accident Mr. P. was requested, by the patient's medical attendant to consult with him on the case.

The kind of injury which had occurred was immediately apparent, by the projection which was presented just above the os calcis, and the absence of any other very apparent change in the relative position of the other bones.

The tendo achillis was pressed backwards by the displaced astragalus, so as to describe an angle of about 40 degrees ; and at one point it had reached so near the surface, that vesication of the skin was produced directly over it. Upon careful examination there could be no doubt about the nature of the accident. That the projection of the tendo achillis was produced by the astragalus was quite certain, for there was no fracture of the tibia or the fibula. The tibia was slightly displaced forwards upon the foot, and the os calcis retained its natural position.

Before the reduction was attempted, the patient was bled to twenty ounces, and nauseated by tartar emetic, the effect of which was maintained for an hour, during which time the efforts to reduce the bone were uniformly sustained.

The point to which the endeavours were directed was first, to produce the greatest possible quantity of flexion of the foot upon the leg ; at the same time, by means of pulleys, removing those organs as far as possible the one from the other, and, by means of pressure upon the astragalus, endeavouring to restore it to its natural situation.



These efforts were unsuccessful, and therefore only one of two modes of proceeding remained for selection, viz., to leave things in their then state, merely combating any untoward symptoms which might be developed, or to extract the astragalus. Mr. Phillips having in his recollection, among others, a case which occurred in the practice of Dupuytren, in which the astragalus was displaced forwards, and the long and painful operation which occurred in extracting it, the long convalescence which followed, and the permanent lameness which was the consequence, declined to accede to this proposition. Leeches in large numbers were applied to the seat of the injury, the bowels were carefully regulated, and no bad symptoms occurred; an artificial articulation was formed between the bones of the leg and the os calcis; little inconvenience was occasioned by the astragalus, and when Mr. P. last heard of the patient he walked nearly upright.

CASE 40.—*Complete, Direct, and Simple.*—The second case upon which Mr. Phillips was consulted was in a gentleman, aged 32, who was occupied in playing cricket; and while fielding and running very rapidly after the ball, his foot became fixed in a gutter, which was in his course, and unobserved. The toe rested upon the further side of this gutter, while the heel was jammed directly into it, which caused the patient to fall forwards. It was found, on raising him, that he was unable to rest upon the injured leg, and it was evident to the bystanders that a displacement had occurred. Mr. Phillips was not summoned till the following day, before which time some inconsiderable attempts at



reduction had been made. The leg presented an appearance very similar to that which Mr. P. has described in the former case, except that there was more ecchymosis about the external malleolus. The patient was bled to sixteen ounces, and twenty leeches had been applied to the injured part. In this case there was, when Mr. P. saw it, considerable tumefaction; he declined, therefore, to make any further attempts at reduction, or to have recourse to a removal of the displaced bone.

This accident occurred in August. The first week in November the patient was able, with the aid of a stick, to walk a short distance; and on the first of January scarcely any lameness remained. Considerable extent of motion was produced in the new articulation, and the only inconvenience of which the patient complains is the necessity which has been imposed upon him of wearing a shoe, the hinder leather of which shall not reach so far as to come in contact with the projecting astragalus.

There are appended to these cases some valuable physiological and practical remarks on newly-formed joints in unreduced luxations, and on the difficulties which are met with in reducing dislocations of the astragalus.

CASE 41.—*Complete, Direct, and Simple*.—Mr. Lizarz mentions a case in his useful and well-illustrated work on surgery, where the astragalus was driven backwards behind the tibia, between it and the os calcis, in which all attempts at reduction were unavailing; but the case did well, and a useful limb remained.

CASE 42.—*Complete, Direct, and Simple*.—Baron Boyer gives a case of this accident, the history of



which illustrates the fact that dislocation backwards, owing to the space being so considerable between the posterior part of the tibia and tendo achillis, may be overlooked, a mistake scarcely likely to happen in dislocation in any other direction. A young man fell from a height and pitched on his feet, but more particularly on the right foot. The surgeon who was called to the patient treated the case as a violent sprain.

Baron Boyer saw the case a month after the accident, and discovered it to be dislocation backwards. No attempt was made at reduction, and the patient recovered with ankylosis.

CASE 43.—*Complete, Indirect, and Simple*.—Mr. Liston met with an instance of displacement of the astragalus backwards. A heavy young man, in a state of utter intoxication, fell backwards down a stair, and in the fall the foot became entangled in the railing. The astragalus was found lying betwixt the back of the tibia and the tendo achillis; its upper articulating surface facing forwards, the lower in contact with the tendon. All attempts to reduce the bone proved fruitless; violent inflammatory action followed, but was reduced by active measures, and the limb ultimately became very useful; in fact, though not till after many months, little lameness or shortening was perceptible.

CASE 44.—*Complete, Indirect, Simple, and Complicated*.—The only instance on record where this dislocation was reduced is given in the *Lancet* for July 6, 1839, where a case is reported which occurred at University College Hospital, of dislocation backwards, conjoined with fracture of the fibula.

J. S., aged 22, was admitted June 22nd. He



states, that whilst getting out of a carriage his foot slipped between the step and the wheel; and as the vehicle was going on at the same time, the spokes of the wheel struck the foot against the step and produced the accident. The foot was but slightly displaced, though a little swelled; an imperfect motion existed in the ankle joint; a hard tumour was felt between the tendo achillis and the inner malleolus, which was also fractured, and the irregularity of the broken surface of the lower fragment could be felt under the skin. A hollow, in which the finger could be passed as far as the first joint, existed below and in front of the outer malleolus. The great toe was flexed, and could not be extended by any moderate degree of force. The leg was placed on the thigh, and the foot on the leg; extension was then made from the heel and instep, and counter-extension from the leg, the foot being at the same time turned inwards, when pressure was made to force the hard substance on the tendo achillis forwards. The pressure being kept up for ten minutes, the tumour was felt to disappear, and a snap was heard. All the deformity of the foot, except the slight swelling, had disappeared. The limb was then placed upon one of Mr. Liston's splints, with the foot bent inwards as much as possible.

July 1st. Doing very well.

#### VIII. DISLOCATION OUTWARDS, DOWNWARDS, AND BACKWARDS.

CASE 45.—*Complete, Indirect, and Compound.*—  
The author cannot find on record any case of this



form of dislocation; he, therefore, presumes that the one which he is about to detail is without a parallel:—

Charles Butterworth, aged 32, a stout healthy-looking man, was brought to the Manchester Infirmary on the 11th of February, 1841, in consequence of a wound of the foot. It so happened that the author was at the Infirmary when the patient was brought in; he, therefore, proceeded at once to inquire into the nature of the case. The patient was an engineer on the Manchester and Leeds Railway line; and whilst at work, the fly-wheel of the engine caught his knee, and as the foot was fixed against the bed plate, the leg, it was supposed, was turned violently inwards, whilst the foot was pushed in the opposite direction, which caused the astragalus to be dislocated, and the bone to appear through the skin and stocking of the left foot. On minute examination, we discovered an oblique wound, about one and a-half inch in length, on the outer side, and behind the malleolus externus, from which the astragalus (tilted round so as to present its tibio-fibular articulating surface to the wound) was protruded. The dislocation was outwards, downwards, and backwards; and singular to remark, the tibia and fibula had escaped fracture. The most persevering attempts were made in the presence, and with the assistance, of my colleagues (Mr. Thorpe, Mr. Wilson, and Mr. Jordan) to reduce the bone, but they were quite unavailing; it was, therefore, decided upon, in consultation, that the author should dissect out the astragalus, which he did without very much difficulty. The



wound was dressed, and the patient carried to bed, where the limb was put up in appropriate apparatus, with foot-board, &c.

It is not necessary to detail the daily reports of this case; it will be sufficient to say, that the patient had a good deal of constitutional irritation; that extensive collections of matter formed about the foot and leg, owing to an attack of phlegmono-erysipelatos inflammation; but although the progress of the case was slow, yet the patient began steadily to improve, so that on the 23rd of June it was reported that the patient's general health continued good, that the wounds in the limb were nearly healed, that there was but little swelling, and that the patient could stand and walk.

The patient remained under treatment at the Infirmary about seven months. After his discharge two small spiculæ of bone exfoliated, since which he has been perfectly well, and has resumed his employment as engineer at the Manchester and Leeds Railway, where the accident occurred.

To the attention which was paid to this case by Mr. Furnival, the house surgeon, and Mr. Smith, it is impossible to award too much credit; indeed, the author does not hesitate to say, that its successful issue was much promoted by the care which they gave to its after management.

These are all the cases of dislocation of the astragalus which the author has, after much labour, been able to collect; a summary of which, in the form of a table, may be useful, for the purpose of comparing the relative frequency of the various forms, courses, and kinds of dislocation, in the different regions of the foot.



S.

<i>n, Course, and Kind of Dislocation.</i>	<i>Outwards.</i>	<i>Backwards.</i>	<i>Outwards, Downwards, and Backwards.</i>	<i>Total.</i>
al, Direct, and Simple Dislocations .....	.....	.....	.....	2
al, Direct, and Compound Dislocations ..	.....	.....	.....	2
al, Direct, Simple, and Complicated .....	.....	.....	.....	1
ete, Direct, & Simple Dislocations .....	.....	Case 39, 40, 41, 42.	.....	8
ete, Direct, & Compound Dislocations ..	Case 33, 34, 35, 36.	.....	.....	12
ete, Direct, Simple and Complicated .....	{ Case 37. Frac. of tibia.	.....	.....	7
ete, Direct, Compound, and Complicated ..	.....	.....	.....	2
ete, Indirect, & Simple Dislocations .....	Case 38.	Case 43.	.....	5
ete, Indirect, & Compound Dislocations ..	.....	.....	Case 45.	1
ete, Indirect, Simple and Complicated .....	.....	{ Case 44. Frac. of tibia.	.....	1
ete, Indirect, Compound, and Complicated ..	.....	.....	.....	4
Total in each Region	6	6	1	45

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## REMARKS ON TABLE I.

The transverse lines in this table show the total number of each form, course, and kind ; and the vertical denote the number of luxations in each region of the foot. It will be observed that there are—

## OF SIMPLE CASES :

Partial .....	3	{ Without fracture .....	2	} 3
		{ With fracture .....	1	
Complete .....	21	{ Without fracture .....	13	} 21
		{ With fracture .....	8	

## OF COMPOUND CASES :

Partial .....	2	{ Without fracture .....	2	} 2
		{ With fracture .....	0	
Complete .....	19	{ Without fracture .....	13	} 19
		{ With fracture .....	5	
		{ With dislocation of the ankle	1	

Thus, there is no great disparity in numbers between the simple and compound cases.

In a former part of this paper, the author alluded to a statement of Sir Astley Cooper, in reference to the number of simple exceeding that of compound cases of dislocation of the astragalus ; in which opinion the author was then fully disposed to coincide ; but having been favoured, since that announcement was sent to press, with many fresh cases, which have swelled the list of compound luxations, the proportion of simple is so much diminished as to lead him to doubt the accuracy of Sir Astley Cooper's statement. With a view to correct statistics, the author has made diligent search for published as well as unpublished cases, and he now feels warranted in asserting that the number he has been able to bring together is sufficient to justify the inference that the proportion of compound to simple examples of luxation of the astragalus is barely, if at all, in favour of the latter.



In the table it will be seen that dislocations on the anterior aspect of the foot are more numerous than all the rest put together ; there being 25 on the anterior, six on the inner, seven on the outer, and seven on the posterior region of the foot.

In addition to those on the dorsal aspect which have been given, the author has received accounts of others which have occurred in the practice of his colleagues at the Manchester Royal Infirmary. Since the former part of this paper was sent to press, Mr. Thorpe has communicated a case of partial and irreducible luxation forwards, in which Mr. Ainsworth, himself, and Mr. Jordan, were consulted. The bone projected a good deal, but did not materially interrupt the movements of the foot. As this case had been of some standing, there was nothing to justify renewed attempts at reduction ; and it would have been hazarding too much to have excised the prominent portion of the bone ; the consultants, therefore, thought it the most prudent course not to interfere.

Since the cases have been printed, the author has met with a very interesting instance of luxation forwards and inwards, which occurred at the Middlesex Hospital, under the care of Mr. Arnott and Mr. Shaw, where the bone was extracted with complete success.

Within the last few days, Mr. Smith, of Leeds, has favoured the author with another case of compound dislocation forwards, in which the bone was nearly detached from all its connexions, together with an extensive lacerated wound of the calf of the leg, which, with other injuries about the ankle, induced Mr. Smith to amputate the limb, and the patient recovered. Mr. S. has kindly sent the



author the foot for examination, the appearances of which are as follow:—The astragalus is luxated forwards and slightly outwards, the bias outwards being probably consecutive from the forcible inversion of the foot. The tibial articular surface presents itself forwards and upwards, and the facets for the malleolar processes of the tibia and fibula are fully exposed. The integuments are freely lacerated in front, but the outer inferior malleolar edge of the bone is tensely girt by them and the subjacent textures. It is evident that the bone is completely detached from the tibia, fibula, and calcaneum, but not from the os naviculare; and but for this circumstance, and the integuments giving way, it is very probable that the astragalus would have had its axis completely reversed from its natural position. It is obvious that there is a greater tendency to an ejection of the astragalus from its connexions with the tibia, fibula, and the tarsal bones, outwards, than either inwards or backwards. The dislocations forwards and outwards are more numerous than those forwards and inwards; and those directly, or having a bias outwards, are more frequent than those directly, or having a bias inwards. There are, perhaps, reasons of an anatomical nature for this difference. The fibula is tied very firmly to the astragalus, as well as to the os calcis, by the external lateral ligaments; and so tenacious is the insertion of the anterior and posterior fibular ligaments into the astragalus, that in some of the removed astragali the author has found the bone broken at the point of attachment of these ligaments; the same thing was noticed in Dr. Stevens's and in Mr. Sawyer's cases; and it is probable, that the portion



of the astragalus which remained in the joint, lived and granulated, and caused the limb, in both cases, not to be so much shortened, as it usually is when the astragalus is wholly disengaged from the joint. In the case in which the author excised the astragalus, a small portion of the bone was broken off, and it is probable that some small spiculæ, which exfoliated in the progress of cure, were fragments of the broken astragalus. Dislocations outwards would not be so frequent (owing to the strength of the ligaments), if the position of the tibia with respect to the astragalus were not such as to cause a greater degree of pressure on the inner than on the outer part of the foot. The pressure, directed from above downwards, bears more particularly on the internal part of the superior surface of the astragalus, whence it has a tendency to thrust this bone outwards. This same circumstance determines the greater frequency of dislocation of the ankle inwards; the axis of the under articular surface of the tibia on the astragalus, being slightly oblique from above downwards, and from without inwards; therefore, the tibia has a tendency to push the astragalus outwards, to cause a rupture of the internal lateral or deltoid ligament, and to become dislocated inwards, displacing, thus, the foot outwards. This result would be favoured by any cause producing at the same time a spasmodic action of the muscles, which send their tendons behind the malleolus internus, and which would occasion a sudden inversion of the foot. In this case, as a conjoint effect, the astragalus might be violently thrust outwards, with a change of axis, as in Partington's and other cases; thus, we should



have dislocation of the astragalus outwards, complicated with that of the tibia inwards.

*Dislocation complicated with Fracture.*—Some of the examples recorded were accompanied with fracture of one or both bones of the leg; and in one instance, with fracture of the os calcis. A complication of this kind might impress us with a belief, that the accident would thereby be rendered more formidable in its characters; but this apprehension has not been confirmed by the results of cases in which this accompaniment occurred. So far as reduction is concerned, fracture of the bone of the leg or of the os calcis must offer facilities, proofs of which are given in cases 44, 9, and 11.

When dislocation is conjoined to fracture it is more frequently simple than compound, in the proportion, in our cases, of 9 to 5; the reason of this is explicable on the division of force, the force being divided between the two effects. On the side of the bones a moiety might produce a simple, whereas the total force, if concentrated in the bones, would produce compound fracture. In the same way, the violence being divided between the fracturing of the bone or bones, and the dislocation, would have the effect of causing the latter to be less in degree, and the soft parts to sustain less injury. This reasoning, which applies to luxations of the astragalus, is remarkably corroborated in compound dislocations of the ankle joint; which accident is admitted by the best authorities to be, generally speaking, less terrible and severe with than without fracture; provided the solution of continuity in the bone or bones be of a simple kind.

The late Mr. Hey, of Leeds (with the mention of



whose name can be associated only one feeling in the minds of every British surgeon), gave it as his opinion (forty years ago), that the loss of the limb is rarely necessary in a compound luxation of the tibia, which is not attended with any other injury except a fracture of the fibula ; and this, he thought, must of course take place whenever such a luxation occurs, unless the astragalus is also dislocated. Mr. Hey states, that he once saw a case of this kind, and mentions that a similar instance came under the notice of Mr. Gooch ; in both cases the bones were irreducible, and it was judged to be absolutely necessary to amputate the limb.

*Dislocation complicated with Luxation of the Ankle Joint.*—There is one case (32) recorded in this report of compound dislocation of the astragalus, combined with that of the ankle. This accident is a most formidable one, and might, *primâ faciê*, be supposed to demand immediate amputation ; but although few surgeons would be disposed to animadvert upon the adoption of this practice, yet success has attended the removal of the astragalus, and the subsequent replacement of the bones of the leg. In English surgery, cases of this kind have been published ; and Baron Boyer mentions some examples of this accident where the astragalus was extracted, and the cases did well ; and he considers the advantage of removing the bone to consist, not merely in facilitating the reduction of the bones of the leg to their proper position with respect to the foot, but in preventing the high degree of inflammatory action, and its consequences, which would be likely to ensue in case the bone was allowed to remain in its abnormal situation.











## SUMMARY OF TREATMENT IN CASES.

Cases of partial reduction .....	2	{ Compound .....	1	{ Simple and complicated .....	0
		{ Complicated .....	1	{ Compound and complicated ...	1
Cases of complete reduction .....	6	{ Simple .....	3		
		{ Compound .....	0		
		{ Complicated .....	3	{ Simple and complicated .....	2
				{ Compound and complicated ...	1
Cases where the astragalus was allowed to remain in its new situation .....	10	{ Simple .....	8		
		{ Compound .....	0		
		{ Complicated .....	2	{ Simple and complicated .....	2
				{ Compound and complicated ...	0
Cases of partial excision .....	6	{ Simple .....	1		
		{ Compound .....	2		
		{ Complicated .....	3	{ Simple and complicated .....	0
				{ Compound and complicated ...	3
Cases of complete excision .....	18	{ Simple .....	2		
		{ Compound .....	11		
		{ Complicated .....	5	{ Simple and complicated .....	3
				{ Compound and complicated ...	2
Cases of amputation .....	4	{ Simple .....	2		
		{ Compound .....	1		
		{ Complicated .....	1	{ Simple and complicated .....	0
				{ Compound and complicated ...	1
Total .....	46				



## SUMMARY OF RESULTS.

No.			
2	Partial reduction .....	Permanent inflexibility .....	1
		Tolerable motion .....	1
6	Complete reduction .....	All did well, with tolerable, and in some with perfect, motion .....	6
		Anchylosis .....	1
		Deformity and impaired motion .....	2
10	Bone allowed to remain in its new locality .....	Imperfect motion .....	1
		Result not published .....	1
		Useful foot .....	5
		Deformity and permanent lameness .....	1
6	Partial excision .....	Deformity, with a tolerable foot .....	6
		Anchylosis .....	1
		Useful foot .....	3
18	Complete excision .....	Anchylosis .....	1
		Useful foot .....	13
		Death .....	4
	In 10 the operation was immediate .....		
	— 1 on the 2nd day .....	Simple cases .....	3
	— 1 on the 11th day .....	Simple and complicated .....	3
	— 1 after four weeks .....	Compound cases .....	10
	— 1 after 33 days .....	Compound and complicated .....	2
	— 1 after 10 weeks .....		
	— 2 after 14 weeks .....		
	— 1 after seven months .....		
4	Amputation .....	Recovery .....	3
		Not recorded .....	1



## REMARKS ON TABLE II.

In this table the author has given, in a convenient form, the treatment and results under which heads he has arranged his cases, with a view to illustration. The treatment is comprehended under the following divisions :—

- 1 Partial reduction.
- 2 Complete reduction
- 3 Left to nature in its new situation.
- 4 Partial excision.
- 5 Complete excision.
- 6 Amputation.

*Partial reduction* is shown by the results to be (as we might, *à priori*, suppose) less favourable than *complete reduction*. In dislocations backwards, the sequel of *allowing the bone to remain in its new situation* has been most satisfactory ; but not so in dislocations in the other directions. *Partial excision* left a useful foot in three out of six cases ; in the remaining three there were deformity, lameness, and ankylosis. The results of *complete extirpation* of the astragalus have been very encouraging, when we consider the desperate character of the accident which demands this formidable mode of procedure. In 13 cases out of 18, a very useful limb remained ; in one only was there true ankylosis, and death occurred in four cases. In no simple case was there a fatal result ; it is, therefore, to be presumed, that death happened rather from the conjoint injuries which the soft parts sustained by the violence which produced the compound, and compound and



complicated luxation of the bone, or by the force used in attempts at reduction, or both united, than from the operation itself; and there is a weighty argument in support of this opinion, in the fact, that the cause of death in the four examples was diffuse cellular inflammation, extensive suppuration, sloughing, &c., the latter being the sequel of the former; and as affording additional evidence of this truth, it may be mentioned, that in three out of the four cases the accident was *compound* and *uncomplicated*; therefore cases where there was no division of the effects of force, but a direct concentration of it on the joints and surrounding textures. That the degree of injury which the soft circumjacent tissues receive, has a material effect in influencing the result, is further demonstrated by the fact, that dislocations in the anterior and posterior aspects of the foot, do much better than lateral luxations, as they are not usually accompanied with so much laceration of the ligaments, tendons, fasciæ, and skin, in the former as in the latter localities.

#### PRINCIPLES OF TREATMENT IN DISLOCATIONS OF THE ASTRAGALUS.

##### REDUCTION.

As a general principle, the surgery of dislocations consists in the replacement of the bone in its natural situation. This rule admits of very few exceptions; certain forms and kinds of luxation of the astragalus do, however, constitute some of them. It is a very material point, connected with the partial bearing of our present enquiry, to premise, that



we ought carefully to distinguish between practical and complete luxation, *i. e.*, between a case where the bone has been incompletely, and that where it has been wholly thrust from its articular connexions. Incomplete dislocation can rarely occur in the articular or ball and socket joints, but may often happen in the irregular and ginglymoid articulations; and it is, therefore, easily understood, why, on this account, the astragalus is liable to this accident.

We have spoken of reduction under the two heads, partial and complete. The partial reduction of a complete dislocation must, one would suppose, be as difficult to effect as complete reduction, as the pre-requisite conditions for the former are the same as those of the latter: in one instance only has this been done, and the result was not very encouraging; and it is quite certain that if the bone can be partially reduced, the unreduceable portion, in case the dislocation be compound, should be excised, to prevent the foot from becoming permanently fixed by the mechanical obstacle which the projecting bone opposes to the movements of the ankle. To partially reduce a dislocated bone is, *in ipso facto*, to put the limb in the condition of partial luxation, the treatment of which involves the questions of reducibility and irreducibility, to the consideration of which subjects we shall now devote our full attention.

If the astragalus be partially dislocated, and not twisted round, as it often is when the dislocation is complete, there is reason to hope that reduction may be accomplished; because if the bone retains,



in part, its position between the tibia and os calcis, the main obstacle to success, namely, the forcible traction of the one bone to the other, will not occur; this obstacle to reduction, which exists in all cases of complete luxation of the bone, in whatever direction the astragalus may be ejected from its articular surfaces, is not brought about by the action of the gastrocnemii alone, but by all the muscles which pass from the leg to the foot, behind the malleoli; and therefore, although we should gain a point in bending the leg upon the knee, by which we relax the gastrocnemius externus and plantaris, we cannot annihilate the action of the soleus, the paronei, tibialis posticus, and flexor muscles of the toes, in the same way; as the foot is in this accident often fixed, and cannot be extended, so as to enable us to put these muscles in a state of relaxation. In cases where the astragalus is changed in its position, the bone is always very firmly locked in its new situation. It is recorded that in three or four instances in which M. Dupuytren extirpated the astragalus, he found the bone fairly turned over upon itself, and the same has been noticed by the author and by other surgeons. This eminent surgeon, (Baron D.,) reasoning upon this fact, states "that we cannot be much surprised that the reduction of dislocation of the astragalus is so difficult, or even altogether impracticable; but even when this bone has not become reversed, we shall find that the configuration of its articulating surfaces, and of the os calcis, suggests a very obvious explanation of the danger of their forcible disjunction, and separation."



He continues: "The posterior part of the astragalus forms a claw-like process, which, when carried forwards, rests between the two articulating prominences of the upper surface of the os calcis, where, indeed, it is so confined that it can scarcely be moved. Any attempt, therefore, to force it back into its normal situation, has often the effect rather of pressing the point of the process against the spongy substance of the os calcis, than of lifting it out of the groove in which it has become lodged." These remarks, however, do not apply to complete but to *partial* luxation forwards, as the author has endeavoured to show in a former part of this paper; he ventures, therefore, to correct this error, having satisfied himself, by anatomical examination, that the remark is erroneous as applied to *complete* luxation in any direction. In considering the subject of reducibility and irreducibility of the astragalus, when completely luxated, we must always remember that the bones of the leg are actively and forcibly drawn towards the os calcis, so as to obliterate the space normally occupied by the astragalus. This being admitted, the question of reduction involves, firstly, the possibility of separating the bones of the leg from the os calcis, to such an extent as will admit of the replacement of the dislocated bone. If the space gained by extension, counter-extension, and other manœuvring, be sufficient for this purpose, if the bone be not much detached from its connecting textures, and not inverted, everted, or turned upon itself in any considerable degree, it might be restored to its primitive situation; but the safety of returning it is the next and a very serious considera-



tion ; since, if the bone be so loose and detached as to be capable of being easily reduced, is it not likely that it will die from want of sufficient vascular connexions ; and shall we not thus put the patient in a more hazardous condition than if the astragalus had been excised or allowed to slough from its new situation ? A reference to cases will prove, that in many instances of dislocation forwards, inwards and outwards, simple as well as compound, that the bone sloughed where extraction was not performed ; but in the instances of luxation backwards, the bone scarcely seemed to act at all as an extraneous body, *i. e.*, it neither died nor did it excite any great amount of local or general disturbance ; this difference in the results of dislocation backwards, when compared with anterior and lateral dislocations, justifies a more decided negative to extirpation of the bone in the former case than in the latter instances. In irreducible simple dislocations forwards, inwards, or outwards, the author would not extract the bone in the first instance, but in most compound cases he would not hesitate to do so without a moment's delay. In revising the subject of reduction, it is obvious that the rigid and unyielding approximation of the leg to the foot, by the powerful action of muscles, is the most insuperable obstacle to the replacement of the luxated bone ; but although the main difficulty, it is not the only one : the bone may be girt by the capsule of the joint, and by tendons of muscles ; but these are, comparatively speaking, trifling impediments in the way of reduction. It can easily be imagined that the girding effect of an opening in the synovial capsule,



only just large enough to give exit to the astragalus, would be one impediment to reduction ; that the circumstances of the bone being embraced by the fibres of the torn ligament, by separated and displaced tendons, and by the edges of a small integumental opening, would all and severally oppose replacement ; but they would not prove insuperable obstacles, as the opening in each may be extended. It is said that Desault's practice, in one case of dislocation of the head of the bone from the navicular cavity, was to divide the integuments and ligaments, and that he then reduced the luxation with facility ; but it is to be remarked here, that this case was one of dislocation of the tarsal joint, between the astragalus and os naviculare, and not of the former bone from the tibia and calcaneum. The distinction is most important. But it is also stated, that in a case where the astragalus was disarticulated from the calcaneum, as well as from the os naviculare, and turned upon itself, Desault effected reduction with ease. It is to be remarked here, that the dislocation was simple, and probably, therefore, partial ; or if not, the bones must have been so far rendered moveable, by the laceration of their ligaments, as to admit of being separated from each other to such an extent as to permit the replacement of the bone ; indeed, it is impossible to suppose otherwise, as it is said that he returned the bone " by pressure with his fingers."

But, since the tracting influence of muscles seems to be the most unmanageable obstacle, the question may here be put, would tenotomy, or the division of the tendons passing behind the ankle



to the foot, be justifiable as a means of annihilating the action of these muscles on the foot? This question was put to the author by Mr. Crosse, of Norwich, at the Exeter meeting, and on reflection he thinks it is one well deserving attention. It is quite certain that the division of the tendons which pass to the heel, and behind the malleoli, would have the effect of subduing the action of the muscles which draw the foot to the leg, and fix it there; but there are considerations connected with this practice: firstly, we must here revert to the observations which we made when speaking of reduction, namely, that the astragalus may be so far insulated from its soft attachments, from which the periosteum derives its vessels, as to render the death of the bone inevitable; in which case it would act as a foreign body, and more harm than good would result from its replacement. Secondly, if the tendons were cut through behind the ankles, they would be retracted in their thecæ so as to lose all attachment with the bones of the foot; the foot, therefore, would become a passive appendage to the leg, and would furnish no basis for it unless ankylosis (which is not the most favorable termination) took place, and the proper angle of the foot with the leg preserved. It is stated by the late Mr. Wilson, in his "Lectures on the Bones," that in a case of displacement of the peroneus longus and brevis, from rupture of the ligament which confines them behind the malleolus externus, he recommended (in consequence of severe suffering) a removal of part of the tendon of the peroneus longus, which was followed by shrinking and con-



traction of the muscle *to the full extent*, consequently its use was lost ; but this objection to tenotomy would not be valid if the tendon of the gastrocnemii alone were divided ; and as this operation, which is easily performed, might give us a great controul over muscular action, its adoption may I think be seriously entertained, provided the bone be not so far extruded as to cause its death : this objection would, however, have no weight in partial dislocation, therefore the suggestion in this case is feasible, and might be adopted with some chance of success. Tenotomy may thus be regarded as a means of facilitating reduction, and in this point of view the practice is justifiable. As an auxiliary measure, the late Sir A. Cooper gave tartrate of antimony in full nauseating doses, for the purpose of weakening the resistance of muscles ; and in full plethoric patients blood-letting may be coujoined as a useful adjuvant. Matters being thus far prepared, the next object is to place the patient in a recumbent position, to bend the thigh upon the trunk, and the leg upon the thigh ; continued extension and counter extension of the leg and foot are then to be kept up by means of pulleys, until sufficient space is gained for the return of the astragalus. When the dislocation is partial, reduction may be effected : so, also, when there is fracture of the leg, fracture of the os calcis, or dissevering of the bones of the tarsus without or with fracture. Baron Dupuytren, seeing the difficulties to contend with, asks the question, "how comes it, in some cases of this dislocation, the reduction is accomplished with the greatest ease ?" His answer is



ready "in supposing that all the connecting ligaments have been torn and detached, so that a much freer motion than is common is permitted between the bones of the leg and tarsus;" and this, doubtless, has been the fact in almost all reported cases of reduction of *complete* luxation of the astragalus.

*In complete compound dislocations of the astragalus alone, without fracture or solution of continuity and connexion in the bones and joints of the tarsus, all attempts at reduction are not only hopeless but prejudicial; and although we may be justified in hazarding the chance of allowing the bone to continue in its new situation, where the luxation is simple, extirpation ought always to be performed when the accident is of a compound kind.* The author's colleague, Mr. Ainsworth, senior surgeon to the Manchester Royal Infirmary, and who has been connected with this institution more than thirty years, never saw a complete case reduced; neither has Mr. Thorpe, who has been surgeon to the same institution upwards of twenty years. Mr. Wilson, in company with the late Mr. Ransome, witnessed reduction in one instance. The Messrs. Hey of Leeds, Mr. Smith, who has had more experience in this accident than almost any provincial or London surgeon, and Mr. Teale, surgeons to the Leeds Infirmary, never saw a case reduced; and the author cannot learn of any reduction having been accomplished in the Liverpool, Bristol, or any other provincial hospital. But the discouragement does not arise from the non-success of the practice alone, but from the mischief which often results



from torturing attempts at reduction. In more than one instance the dislocation has been made to pass from a simple to a compound form. Sir A. Cooper acknowledges, that in one of the cases which he witnessed, sloughing of the integuments was brought about by the continued extension and force used to reduce the bone; and the author has recently seen a case of diffuse cellular inflammation, extensive suppuration, fascial sloughing, and death, which arose, in all probability, from the pressure of the bandages and apparatus employed in reiterated violent efforts to reduce an irreducible dislocation.

It is remarkable that, in the face of all these arguments, reduction has been said to be accomplished "with facility." In these cases, we may rest assured, there must have been a considerable laceration of the ligaments, or severing of the joints, displacement of the bones, or two or more of these effects combined; for it is not in the nature of possibilities for reduction to be effected without the means of gaining sufficient space for the re-introduction of the bone. If the astragalus be completely luxated, whether in a simple or compound way, and there is no derangement in the position of other parts about the joint, save the approximation of the tibia and fibula to the os calcis, which, I contend, is the invariable attendant on *complete* luxation, the bone is almost immoveably fixed in its new situation, and reduction is almost impossible; and, again, when the bone is reversed in position, or thrown out of its natural axis, replacement is absolutely impracticable. The table shows us, that out of 45 cases there were six reductions;



of these, one was partial, direct, and simple, where, therefore, the normal space for the astragalus was not obliterated; another case was complete, direct, and simple; a third case was complete, direct, compound, and complicated, with dislocation of the ankle; two cases were simple and complicated with fracture; one of the tibia, another of the tibia and fibula; and in a sixth case, the dislocation was united with fracture of the os calcis, which was comminuted in such a way as to destroy the vitality of some of its fragments, they having exfoliated during the progress of cure. One of these cases only (namely the second) can be said to militate against the author's conviction, that the astragalus when completely dislocated and alone, *i. e.*, without fracture, disjoined tarsal bones, or dislocation of the ankle, is an irreducible dislocation, and that all attempts at accomplishing reduction are worse than useless; that to the violence used we may attribute much of the mischief which arises from diffuse cellular inflammation, from immediate gangrene, induced in the parts by the direct pressure which has been applied, and other destructive consequences, which increase, in a very marked degree, the dangers of the accident. The successful case referred to was communicated to the author by Mr. Gaskell, a surgeon on whom he can fully rely for correct information, and for the exercise of sound and discriminating judgment; but he can conceive a mistake to be made in discriminating between partial and complete dislocation, unless attention be paid to the only infallible criterion, namely, the obliteration of the tibio-calcaneal space by the traction of the foot on the



leg. It is obvious that this was overlooked by the celebrated Dupuytren, when he said, that the impediment to the reduction of complete dislocation is the fixed implantation of the posterior hook-like process of the astragalus in the irregular concavity between the articular surfaces of the os calcis ; for it will be readily seen, that if the unciform process of the astragalus be thus situated, the bone cannot have been wholly ejected from the tibio calcaneal space ; it follows, therefore, that the tibia is prevented from descending, and that the dislocation is not complete. The author is very anxious to call attention to this point, as it may lead to a more accurate classification of the accidents which occur to this bone. Still, however, here the case was simple. No case of isolated compound dislocation is recorded ; we presume, therefore, that no such case has ever occurred. We are, consequently, quite safe in deducing, from this fact, the principle, that although reduction in complete simple isolated luxation of the astragalus is possible, it having been exemplified in 1 case in 16, (there being in our report 45 cases, 16 of which are simple dislocation,) yet there is no example of the reduction of complete compound isolated luxation, although 15 cases of this accident have been communicated. Three single, and complicated with fractures, making one in seven recorded cases ; and one compound and complicated, with dislocation of the ankle joint, are not such as would render replacement impossible ; because, in fracture of the tibia and fibula, the purchase of the muscles, passing from the leg to the foot, behind the malleoli, is impaired,



and space is given, or can be obtained, by the mobility of the malleolar processes; and in dislocation of the astragalus, conjoined to that of the bones of the foot, there is implied considerable rupture of ligaments and other binding textures; therefore, not only space but ease in manipulation must result from it.

These facts point out the urgency of establishing principles of treatment in the different kinds of luxation of the astragalus, and of leaving the subject no longer in doubt. It may be considered presumptuous in the author to attempt this arduous undertaking, but if he can do no more than show that the inquiry is open to, and demands investigation, he will rest satisfied with the hope that more experienced men may enter the arena of this important and interesting practical inquiry.

#### THE PRACTICE OF ALLOWING THE ASTRAGALUS TO REMAIN IN ITS NEW SITUATION.

If the astragalus cannot be reduced, the inquiry which next obtrudes itself upon us is, whether the dislocated bone ought to be permitted to remain in its abnormal situation, with the hope that, should it not die, nature will in time accommodate herself to its presence, and experience therefrom no great degree of inconvenience; and that, should it die, whether ulceration will ensue and the bone be cast off by nature? means? The question is one which demands deliberate consideration. We have seen, in the detail of cases, that in all the dislocations backwards (one excepted) the cases were left to nature, and did well; the conclusion, therefore,



at which we may safely arrive is, that in this kind of luxation we are not to interfere, except by making reasonable efforts, at reduction; for the case ought not to be abandoned without hope, as Mr. Liston succeeded, on one occasion, in reducing the bone. The author stated that in one instance of luxation of the astragalus from the os naviculare, the bone was allowed to remain in its new situation; and although the movements of the foot were for some time restrained, yet ultimately they became free. This is encouraging in reference to this form of accident, and may be applied to confirm the belief, that if the astragalus be partially and simply luxated either forwards, outwards, or inwards, and is irreducible, we should not interfere, but leave the case to the resources of nature. But what is to be done in case the dislocation is *complete, although simple*? Mr. Syme, Baron Larrey, and some other surgeons, advocate removal of the bone. Boyer and others seem by their practice to be opposed to this opinion. The author will examine the arguments which may be brought forwards on both sides of the question. It may be argued, on the side of removal of the luxated astragalus, that the presence of the bone cannot fail to create a great amount of local irritation and inflammation, which will endanger the limb, if not the life of the patient, by bringing on diffuse cellular inflammation, suppuration, sloughing, involving the tendons, ~~and~~ their thecæ and synovial lining, which will form a route for the extension of mischief to the ankle and leg; and that if the bone should die, these results are certain. It is very true that in almost every instance the above



anticipations with respect to the limb have been realized ; but still death did not occur in any case, and a tolerably useful limb has been the result in the majority of examples in which the bone was left, until, by the sloughing process, it became so loosened from its connexions as to admit of easy extraction. The arguments which may be adduced against excision are, that as the bone does not necessarily die, it may not act as a foreign body, and excite inflammation, and its sequelæ ; and that should it die and slough, it will be extricated by a natural process. This is true, at least probably so ; but the result anticipated in this last proposition is by no means a sequitur. If the vitality of the bone be destroyed, it must create a greater degree of inflammation, suppuration, ulceration, and sloughing, in the contiguous living textures, than if the bone were to continue to live ; and the disturbance of the system and constitutional irritation would be proportionate. This, therefore, in theory, cannot be a safe state of matters, either for life or limb ; but if we go to the facts of the case, as evidenced by results, our theory is not valid or confirmed by the test of experience. It may be argued, too, that to make an incision down upon the bone and to extract it, is objectionable, as it converts a simple into a compound dislocation, and thereby the case is rendered infinitely more hazardous. Experience has not fully realized this apprehension, still the argument is not without its weight in the scale of probable consequences. The author thinks that the following is the safe line of practice :—In partial cases, whether simple or simple and compli-



cated, should attempts at reduction fail, there must be no operative interference. In partial and compound, or compound and complicated, (reduction failing,) excision, if practicable, of the protruded portion of bone should be performed. This proceeding gives great facilities to the proper adaptation of the parts; but leaving this out of the question, by neglecting partial excision we incur one of two risks: firstly, the exposed or prominent part of the bone may die, and the patient have to undergo the tedious and trying processes of inflammation, suppuration, and exfoliation, and the death of one part of the bone may endanger the vitality or disease of the remainder, and ultimately involve the ankle joint (as in one of M. Boyer's cases), and demand, as a last resource, amputation, as the means which alone could give to the patient a chance of life; and if the extruded portion of bone should not be excised, and continue to live, its presence would so far restrain the action of the ankle as to produce permanent contraction of the heel, permanent inflexibility, and permanent lameness, as in one of our recorded cases. It is, however, to be remembered that this practice does not apply to *partial* and *simple* dislocation of the astragalus in *any* direction; for the justifiability of operation in partial luxation, when there is no external wound having a direct communication with the displaced bone, is very questionable. The practical proceeding in complete and simple, or simple and complicated dislocation, will be determined by the position of the bone: if its protrusion be direct, in reference to its axis, and cannot be



reduced by moderate efforts, the case ought to be left to nature, because, although the chances are against its remaining passive, it will be well to wait the event; and should the skin inflame, and other matters predicate the tendency to ulcerate through, it will be better to save the patient this source of irritation, by an incision over the site of the astragalus, and leave the extrication of the bone to the efforts of nature, or at all events until it is so loose as to be easily extracted. The grounds of this practice are, to take off tension, to abridge the process of ulceration, and to put the parts in such a position as will remove pressure from the adjacent textures.

#### PARTIAL EXCISION.

In some of the cases which we have recorded, it will be perceived that the astragalus was partially removed; and in others, the bone being fractured as well as dislocated, one or more of the fragments escaped, or were extracted through the wound. Mr. Lowe partially excised the astragalus, *i. e.*, removed the projecting portion of bone, in partial luxation, and reduced the remainder, and the case did well; and in contradistinction to this practice there is an instance given where the prominent portion of bone was allowed to remain, and the result was permanent inflexibility of the foot.

In Mr. Ceeley's case, a part of the bone was excised by Mr. Bransby Cooper, which gave facility to the adaptation of the remaining portion.

Dr. Stevens's case gives us an example of fracture of the astragalus, combined with dislocation, where



a portion of the bone remained in the joint, and where a tolerable useful, but stiffish limb followed, with little deficiency in length.

In Mr. Sawyer's patient, the articulating surfaces for the os calcis were broken off from the upper part of the bone, and never came away ; the result was that the patient had a little motion at the ankle, and the affected limb was of the same length as the sound one.

The author has been favoured with the following case by Mr. Gaskell :—

Peter Roberts, a healthy middle-aged man, sustained an injury by falling into a well of considerable depth ; the astragalus was split into three or four portions, one of which had escaped through the wound of the integuments. About two months after the accident, a second portion of the astragalus, which had for some time previously lost its vitality, was withdrawn from the wound, and about the same time the surgeon had to contend with one or two attacks of hæmorrhage from the posterior tibial artery. The case remained in the hospital four or five months, and Mr. Gaskell afterwards attended him at home, where he remained a patient either four or five months, at the end of which time the wound had healed, and the thickening and swelling of the parts had considerably abated. The patient could not, for a considerable time after the healing of the sore, bear the whole weight of the body on the limb. He suffered much from constitutional irritation, and was greatly reduced in bodily strength. In about two years after the accident



this man called upon Mr. Gaskell, who found, on examining the limb, that a slight degree of rigidity and thickening remained. The patient could, however, walk well, and he was able to use the limb at his work (that of an excavator) with as much efficiency as before the accident. In this case about one-third of the astragalus came away.

It is the author's opinion, that in the majority of cases of dislocation of the astragalus, there is an accompanying fracture of the bone. He has examined the astragali removed by Mr. Taylor and Mr. Smith, and found them all more or less fractured, as was also the case in his own patient; but whether the bone is broken, as a conjoint effect of the dislocation, or in the operation of removing it, is a question not easily answered. In some instances this occurrence (fracture) may be a favourable coincidence, in others a decided evil and disadvantage. It may prove favourable, provided the fragment left in the joint retains its articular connexions with the os calcis, as it probably did in Dr. Stevens's, and most certainly did in Mr. Sawyer's case, as it may continue to live, and prevent the limb from shortening so much as it ordinarily does when the astragalus is wholly removed; but it may be productive of the evil of inducing true ankylosis by throwing out osseous juice, which may cement the tibia to the os calcis, and thus impede the movements of the ankle; and should the fragment die, the cure, to say the least, would be protracted, and the danger of the case materially augmented.



## COMPLETE EXCISION OF THE ASTRAGALUS.

It is no longer problematical, as to the expediency and safety of extracting the astragalus in certain cases of dislocation of this bone; for in addition to the eighteen examples given in the table, there are others mentioned in the progress of our inquiry; and it will be remembered that the operation was successfully performed by Fabricius de Hilden, by Larrey, and by the late Mr. Trye, of Gloucester, and doubtless by many others, whose cases have not been made known to the profession through the medium of the medical press.

The testimony of our most distinguished British surgeons, and of those on the continent, is in favour of excision. Baron Larcy, who had not seen many cases of luxation of the astragalus, has given it as his opinion, that it is an accident which requires extraction of the bone; and Baron Boyer, who has written most ably on the subject of dislocations, says, "that if the astragalus has almost escaped through the wound in the integuments, and the ligaments much torn, the wisest course to adopt is to extract the bone, since in this case the astragalus must be considered as a foreign body; therefore, if it could be returned to its natural situation, it would not be likely to unite with the other bones of the foot, and, therefore, its presence there would be a source of serious consequence." It is an opinion to which every surgeon must subscribe, that if the astragalus were completely luxated and severed from all or most of its connecting textures, the best practice would be to extirpate the bone; but it is



important to determine in what instances it is particularly demanded. Our table will show the cases in which the operation of extracting the bone, either immediately or consecutively, was adopted, and it gives the results. In 18 cases, 13 recovered with useful limbs, one with ankylosis, and in four cases death ensued.

Few surgeons would, perhaps, be so bold as to propose immediate removal of the astragalus, without making, in the first instance, some attempts to replace the bone; and very few patients would be disposed to submit to the operation without a previous trial at reduction; but the author is of opinion, that in some kinds of luxation all attempts to reduce the bone should be abandoned, not only because experience has proved that they will be ineffective, but because the violence done in the extension and counter extension of the foot and leg will do positive mischief. It is not necessary to do more than to refer the reader to our remarks on the treatment of partial irreducible dislocation, to show that cases of this kind are not such as demand excision of the bone, and we have anticipated any observations which might here be introduced as to the treatment of complete simple, or simple and complicated luxations. Complete excision may be called for, sooner or later, in the progress of the case, or its performance may be immediate. Simple cases may be followed by the death of the bone, subsequent ulceration, and sloughing, consequent upon which it may be required to excise the bone from its ligamentous and cellular connexions. The author has ventured an opinion that nature ought to be



aided in the ulcerative process of the skin and subjacent fascial textures by incision, and that the surgeon's subsequent aid is useful in extirpating the bone. When simple and complete dislocation is indirect, *i. e.*, attended with altered axis of the bone, it is fair to presume that the astragalus has been so far severed from all its connexions as to die infallibly, in which case, the author would propose immediate incision over the bone, with a view to remove tension and to expedite its escape ; but it might not be proper to proceed to the immediate excision of the astragalus. But in isolated compound dislocations no attempt should be made to reduce, but extirpation immediately had recourse to ; and especially, and beyond all controversy, if the bone be inverted, everted, or turned upon itself ; for if this practice be not followed, the patient will, to say the least, remain a cripple for life, with his foot miserably distorted, or will incur imminent peril from inflammation, suppuration, and gangrene of the foot and leg, and probably loss of limb or life ; whereas, by the removal of the astragalus, he may recover with a useful foot, and be exposed to little comparative danger.

It being admitted that all complete, compound, and isolated dislocations of the astragalus require extirpation of the bone, a difference of opinion may arise amongst surgeons as to the period when the astragalus should be removed ; some advocating deferred, others, immediate excision. The author conjectures, that the advocates for postponing the operation, would argue, that immediate removal would cause a communication between the joint and



surface ; but that, if deferred, a chance would be given of sealing up, by granulation and adhesion, the deeper seated parts about the joint before the bone was extricated. It is true that the astragalus has been excised or extracted at different periods after the accident and in some at very remote periods, as seen in the table ; and yet the cases did well, without a fatal exception ; but many of them were simple dislocations, which became compound by ulceration and sloughing ; and where, therefore, the injury to soft textures was less severe than what happens in the rending and bruising accompaniments of compound dislocation. The sudden laceration and contusion of the integumental structures must heighten, in a considerable degree, the danger of the case. It was stated in another part of this paper, that the causes of death in all the fatal cases was diffuse cellular inflammation, extensive supuration, and sloughing, induced, no doubt, more by the injury which the skin and sub-cutaneous tissues sustained, as the conjoint effect of the luxation, than from the operation required for the extraction of the bone. When the astragalus is dislocated forwards, inwards, or outwards, and is compound, it can hardly be doubted but that the bone will perish ; therefore, *if reducible*, the replacement would be tantamount to the introduction of an extraneous body into the synovial capsule, and the consequence of such an intrusion on this sensible and morbidly disposed membrane may be readily foreseen.

It may be summarily stated, that in simple, direct, and complete luxation, the author advocates the



practice of allowing the bone to remain in its new situation, without any operation, until it manifests a tendency to ulcerate the skin, in which case he would make an incision over the bone to relieve tension and pressure ; and that when the bone is so far detached from the circumjacent textures by the natural process of separation, he would remove it. In simple, indirect, and complete luxation, he would anticipate, as a matter of certainty, that the bone would die and require dislodgment ; to take off tension and pressure from the angles of the displaced bone, he would at once make an incision over it, but not remove the bone, wishing to benefit by the probability that the exposure of the cavity of the joint may have an injurious effect. In complete compound luxation, whether direct or indirect, or complicated, with fracture or with dislocation of the ankle joint, he would immediately proceed to the removal of the astragalus, from believing that the limb will be put in a better condition for the reparative process of the joint, by the abstraction of the processes of inflammation, suppuration, ulceration, and sloughing (processes necessary to the disengagement of the astragalus by natural efforts) ; for if these be saved, nature will be able to direct, undividedly, her sanatory operations to the interior or deeper seated parts ; whereas, if her powers are divided between the extrication of the astragalus from its abnormal situation, and the reparation of the joint, they might be insufficient for the purposes required, and the limb or life fall a sacrifice.

May not the danger of compound fracture and dislocation over the simple forms of these accidents



depend, in some measure, on this division of reparative action, thereby the diminution of amount of natural efforts in each separate part? We know that a compound fracture or dislocation is divested of much of its formidableness, if the external wound can at once be healed by adhesion; nature often acts with great discrimination in concentrating her main energies to the repair of the greater evil, before she attempts much for the lesser; thus, if two injuries happen to the body at the same time, the one a simple the other a compound fracture, it generally follows that the compound will unite before the simple, the latter remaining for some time in a passive state; and if two injuries, equal in degree, occur in the body at the same time, nature's attempts to repair (being divided) will be tardy, if not altogether abortive.

The following very interesting cases will illustrate these facts:—

1. Communicated by Mr. Furnival, late house surgeon to the Infirmary.

A man, aged 18, was admitted December 2, 1840, under Mr. Fawdington, with *simple* fracture of the right humerus, and *compound* fracture of the ulna and radius of the same arm, with severe contusions of soft parts. Reduction effected in both.

January 15, 1841. Wound in fore arm almost healed, and sufficient union of the ulna and radius for the hand to be sustained without support. *No union in the humerus.*

February 10. Wound quite healed, radius and ulna firmly united; humerus still flexible at the point of fracture.



April 5. Fore arm quite consolidated and restored, humerus not yet quite firm. The patient feels a want of confidence in it.

Mr. Furnival has kindly given other cases illustrative of the same principle.

The following case communicated by the author's nephew, Mr. William Smith, late house surgeon, shows that in compound dislocation, combined with simple fracture, the former will get well before the latter:—

A youth, aged 12, had compound dislocation of the elbow joint, complicated with fracture of the head of the radius, and in the same arm there was simple fracture of the ulna, about its middle. Dislocation was reduced and fractures set. The wound at the elbow granulated and healed, and the motion of the joint was nearly restored before the fracture of the ulna seemed disposed to unite; eventually, however, reparation of both injuries was effected.

2. Numerous cases might be adduced to show the abortive efforts of nature, when two severe injuries exist in the same individual. The author has witnessed a melancholy instance of this very recently, in an accident occurring from machinery to both upper extremities, and which proved fatal, without scarcely any reparative effort, in about three weeks from the receipt of the injury.

The operation of excising the bone may be very easy, and free from danger when the bone has been almost wholly separated from its connecting ligaments and other textures; but in other cases its attachments may be so firm, and the space in which we have to dissect so much encroached upon by



displaced tendons, and the posterior tibial artery so denuded of its protecting coverings, as to render the operation of extirpating the bone not only exceedingly difficult, but without great care exceedingly dangerous ; this latter circumstance, however, is the main source of danger, as the artery is much exposed, and in some instances it has ulcerated or sloughed, and gave issue to alarming hæmorrhage.

In Mr. Arnott's and Mr. Shaw's case at the Middlesex Hospital, an interesting and detailed account of which is given in the *Medical Gazette* for July 15, 1837, the utmost difficulty was experienced in the excising of the bone, so much so, that Mr. Shaw, under whose care the patient fell, in consequence of Mr. Arnott's absence from town, was obliged to remove it piece-meal. The case, however, did remarkably well ; the proper bearings of the foot to the leg were preserved, the sole of the former came fairly to the ground ; there was motion at the ankle, and apparently the right foot would prove as useful as the left for the purposes of support and progression.

The after treatment of the operation consists in placing the leg and foot in close apposition, with due attention to the proper angle of the one with the other ; and in this position they are to be kept by splints and apparatus with foot board. Great caution is necessary to keep the tibia well applied to the os calcis, for if the former were to become displaced much backwards, there would be no union, and no joint, and the foot would become a loose and useless appendage to the bones of the leg. In almost every case the length of the affected



limb is diminished about one inch, a defect which may be easily compensated for by the use of a high-heeled shoe.

#### AMPUTATION.

In our report we have recorded some cases in which the limb was amputated in consequence of other severe injuries being associated with dislocation of the astragalus. This mode of proceeding urges upon us the subject of primary and subsequent amputation, subjects of great moment, and upon which the opinions of surgeons are, in some respects, at variance. The question of amputation in dislocations of the astragalus is one which, *a priori*, we should consider as often called for; but, miraculous as it appears to be, it is nevertheless true, that it need seldom be seriously entertained.

There appear to the author to exist anomalies in reference to injuries about the foot and ankle: first, in the fact of very many severe injuries of these parts, to wit, compound dislocations of the ankle-joint, and compound fractures implicating the joint, simple dislocations of the astragalus, complicated with dislocations and fractures of the tibia and fibula, compound luxations of the astragalus and other bones of the tarsus, with dislocations of the ankle, and sometimes fractures to boot, doing well, when the primary shock sustained is followed by the secondary shock of a severe operation. In the first of these instances, for example, by the sawing off of the extremities of the tibia and fibula, of which numerous successful cases are recorded; and in the other cases, more or less operative practices, as excision of bones, expo-



sure of joints, &c., and yet many of them do well. Comparatively speaking, how few is the number of deaths in these cases compared with the number of escapes from it, and the well-doing of the individuals who have been the subjects of these accidents. The anomaly consists, further, in the fact of these terrible cases doing well, notwithstanding the injuries occur in the lower extremity, and at a part most distantly removed from the centre of circulation, whence, as is commonly supposed, at the minimum point of reparative power. That dread which surgeons entertain with respect to wounds of joints, and disarticulation of bones, seems almost to vanish from the mind when the ankle and foot are concerned, since the annals of surgery furnish us with more terrible operations and practices, undertaken about this region, than about any other part where similar textures exist; and next to the knee, the ankle is the most complex of all the articulations. Whence the reason of this? Is it that we are really too apprehensive of mischief from meddling with joints, and are thus deterred from risking so much as we might safely do? It is very true that a compound dislocation is a serious matter; but many cases do extremely well. The author, therefore, thinks that our experience, with respect to this accident at the ankle and foot, should reasonably give us confidence in the resources of nature, aided by surgical art, wherever this accident may occur, provided the soft parts have escaped such an amount of laceration and bruising as would endanger sloughing and mischief, and risk the life of the sufferer.



The author has advanced an opinion, that more danger is to be apprehended from injury to the soft than to that of the hard parts. A luxation or a fracture is, abstractedly, not to be considered as a dangerous accident; which opinion is confirmed by the results of simple fractures and simple dislocations; but if the soft parts are much lacerated or contused, or both, the case is increased in danger in a remarkable degree; and the author finds that Mr. Banner, of Liverpool, agrees with him in this opinion, since he states in his excellent "Report of Fracture" occurring at the Northern Hospital, "that the danger of these accidents is in the ratio of the injury done to soft parts by the violence which broke the bone;" to which we may add, by the action subsequently set up in the structures affected. The injuries which require the consideration of *immediate amputation* of the limb, in connexion with our present inquiry, are laceration and contusion of soft parts, united with simple, simple and complicated, compound, compound and complicated dislocations. The injury to the circumjacent textures ought to be extremely severe ere amputation should be had recourse to; but no general rule can be given to the surgeon, since much must depend on the age, constitution, and habits of the patient. If young, and in vigorous health, the case may, in a general way, be hazarded; but in a person past the meridian of life, of unsound constitution, and further impaired by debauchery and over stimulation, amputation would become a matter for serious deliberation. A person more advanced in years, healthy, and not prema-



turely aged by excess, would stand a better chance than the last patient; therefore, more may be risked in this than in the preceding instance. The truth of these practical deductions might be illustrated by numerous examples; but two will be sufficient:—

A youth, about 19 years of age, was admitted into the Manchester Royal Infirmary as the author's patient, for compound and comminuted fracture about the head and neck of the humerus, with laceration of the capsular ligament of the joint; and the soft parts were injured to such an extent that, in full consultation with his colleagues, it was considered most advisable to amputate at the shoulder joint. The proposal was, however, resisted (fortunately, as matters turned out) by the patient and his friends; for although the progress of the case was slow (owing to the exfoliation of bone and other causes), and the cure protracted, yet he eventually recovered with ankylosis of the shoulder joint.

The above-mentioned shoulder case may be compared in character, but forms a striking contrast in result, with another that has recently come under the author's observation, at the same institution:—

A man, aged 42, but in constitution apparently upwards of 50, a window-cleaner, fell from a considerable height on a stone pavement. He was immediately sent to the hospital, when, on examination, it was found that he had sustained a very severe injury in the left shoulder. There was a compound and comminuted fracture of the head and anatomical neck of the humerus, a rupture of the capsular ligament of the joint, and an escape of the head of the bone to the inner side of the glenoid cavity



under the scapular extremity of the clavicle, with not much contusion of the soft parts, excepting at the point where the extremity of the shaft of the humerus had perforated the deltoid muscle and skin. In a consultation with his colleagues in this case, it was considered that, even if the age and constitution of the patient were propitious, the accident was an irreparable one; and as the head of the bone was insulated from all its articular connexions, a part of the shaft would die; and even if it lived, could by no means be brought into contact with bone, so as to form ankylosis. Amputation at the shoulder joint was proposed, but the patient would not consent, and he lingered six weeks without scarcely any effort in the system to repair the injury about the joint. After death it was discovered that the head of the bone lay under the coracoid process, that there was a transverse fracture through about two-thirds of the *anatomical* neck, when the course of the fracture was changed to a longitudinal direction, and separated the lesser tubercle of the humerus from the body of the bone. The greater tubercle was likewise detached and isolated in the wound, and not the slightest attempt at reparation could be discovered. In this case, age, united to a leuco-phlegmatic temperament, gave a different turn to the results of the accident, which was not more severe than in the preceding instance.

*Subsequent amputation* of the limb may be demanded at different periods after the accident: some days may elapse, when traumatic gangrene may manifest itself, either from the means used to



effect reduction (a cause which the author believes to be a common one, if not of gangrene, of phlegmonous or phlegmono-erysipelalous inflammation, from the havoc which it makes with the sub-cutaneous fascia, tendons, and cellular textures), or as the conjoint effect of the violence which produced the dislocation. Consecutive amputation is, further, a question of expediency, which may be entertained in case of deficient reparative powers, and in extensive suppuration, sloughing, &c., of reticular and other textures, which may induce tetanus, and a fatal issue.

It is a critical point to decide when amputation is demanded, or when it can most safely and most successfully be performed, after severe injuries have been inflicted on the body. For the basis of our decision we must look to the results of experience in military and general hospitals ; and reason on the immediate and consecutive circumstances connected with them. The first of these involve the effects produced in the individual, and the structure or structures implicated. The second have reference to the action set up in the mutilated part. The immediate attendant on almost every severe injury is a shock on the nervous system, indicated by great prostration of strength, and a suspension more or less of vital force, manifested by collapse, which is of variable duration, between six and 24 hours. In this stage of the injury the patient may sink, a consequence often witnessed in railway accidents. The question in this case is, ought the mutilated part (if it be an extremity) to be removed, notwithstanding the state of collapse, from which the



patient cannot be made to rally even with the free use of stimulants? The author's opportunity for observation has confirmed him in the opinion that amputation ought not in this case to be performed, unless there is an obvious cause for the sinking condition of the patient, as from hæmorrhage, and which an operation would put a stop to. It usually happens sooner or later, according to the constitution of the patient and the nature of the injury, that the period of collapse is followed by reaction, or return of strength and vital functions.

After every species of violence offered to the body, whether accidental or from operations, a certain degree of reaction is essential, the limits of which sanatory process are prescribed by the *vis medicatrix naturæ*; but owing to various circumstances connected with the health of the patient and the injury received, nature may be too active or not active enough in her reparative proceedings, in which case she will require to be controuled or assisted. If not successful in her efforts, it becomes a question whether the removal of the injured part would do good? The decision will hinge on the consideration, that although the patient may not have rallying powers sufficient to overcome the injury inflicted on the body (in form of lacerated wound, &c.), yet he may have enough to answer the demand made upon the constitution for the healing of a stump. There can be no question but that this (the reactive period) is the most favourable season for operation, and ought to be selected in preference to any other when an operation is rendered necessary. The third sequela of the



accident is the inflammatory period, which is indicated by constitutional irritation and fever; these symptoms are sympathetic of the injury, to repair which nature is making her first struggle in the form of reparative healthy inflammation, which draws in a temporary disturbance of the general system. This is not a season for operation; the surgeon, therefore, looks with anxious anticipation to the way in which this state of things will terminate. It may end in suppuration, which if limited may prove a prelude to recovery, but if extensive it may exhaust the powers of the patient and urge upon us again the question of amputation; respecting the propriety of which practice, the author's mind is fully confirmed from experience and observation in numbers of cases. Unhealthy and destructive, instead of healthy suppurative action, will sometimes follow in the form of diffuse cellular suppuration and sloughing, in which case the question of amputation will again obtrude itself on our attention. In the majority of cases these sequelæ of accident are dependent on constitutional causes, either direct or indirect; therefore, operation in the way of amputation will be a hazardous and inadmissible proceeding.

Gangrene of parts as the result of accident may be traumatic, or a mode in which inflammation terminates. The immediate death of a part from violence, as gun-shot wound of blood vessels, does not contra-indicate, but positively demands amputation. This practice has been confirmed by the united testimony of the best surgical authorities in military and civil surgery. Even in spreading



traumatic gangrene, amputation has been performed by Mr. Toogood of Bridgwater, and by Mr. Porter, of Dublin, with perfect success.

It will be seen, however, on examining the cases operated upon for irreducible luxation of the astragalus, that extensive suppuration and sloughing have taken place, and drawn in a train of general bad symptoms, which in some cases have proved fatal. The practice of free incisions, and supplying the strength of the patient, are the means most to be relied upon; but if unsuccessful, amputation may be called for, and has been successfully performed.

These rules appear to the author to be a correct summary of the principles which ought to guide us in our decision as to the propriety of amputation in the different stages of severe injury.

#### RESULTS OF DISLOCATIONS OF THE ASTRAGALUS.

The results of dislocations of the astragalus may be divided into primary and ultimate. The former of these refer to the circumstances which manifest themselves during the progress of the case; the latter to its issue or termination.

##### PRIMARY RESULTS.

In these are included the amount of local action and constitutional irritation necessary to the function of repair; which constitutes a period of very great importance, demanding the closest watching and attention. It may be salutary, or may go on to a destructive extent, and the result will be favourable or otherwise, according to the degree of inflammation which follows the injury. Con-



stitutional irritation is, as we have remarked, a necessary accompaniment of every violence inflicted on the body ; but to discriminate between salutary and morbid action, requires experience, and a perfect knowledge of the laws of health and of disease ; subjects well elucidated by Mr. Travers, to whose work the author refers the surgeon, with the assurance that he will be much benefited, and aided in his judgment and in his practice by its perusal.

It cannot fail to strike the attention of the reader of the cases which have been brought before him, that most of them have been attended, during their first period, with *diffuse cellular inflammation*, which in most instances has gone on to suppuration, and in some to extensive sloughing of parts ; still, however, the cases have, with few exceptions, done exceedingly well. But although this attendant is not uncommon on injuries done to the body, it is nevertheless a formidable one, and requires the promptest assistance.

“ Diffuse cellular inflammation ” is a disease well known, and very familiar to every medical practitioner. Dr. Duncan wrote ably on the subject under the above appellation ; but Dr. Thomson and Mr. Copland Hutchinson designated it “ phlegmonoid erysipelas.” It is a disease with which the practical and operating surgeon cannot make himself too well acquainted ; and as it is observed to be a very usual sequel of the accident which we are now treating, the author trusts that he may not be considered tedious in stating its general characters ; for a more detailed account of which he begs, however, to refer to Dr. Craigie’s highly valuable



work on "General and Pathological Anatomy." "Diffuse cellular inflammation" is a term used to indicate a spreading inflammation in cellular or reticular tissue, and employed in contradistinction to "phlegmon," in which disease the inflammation is circumscribed: and the difference between the two is not inaptly illustrated by Hunter, in comparing the effects of water on dry and moist paper. Although Hunter's explanation is, as Dr. Craigie observes, the statement of a physical, not a physiological phenomenon, it affords, nevertheless, no imperfect idea of the distinction between the limited and spreading nature of inflammation in the texture alluded to. On various occasions the author has spoken of the violence used to reduce the luxation, as a cause of phlegmonoid erysipelas; but he has likewise admitted, that it may result from the injury which the soft parts suffer, simultaneously, with the displacement of the astragalus.

It may terminate in mere serous infiltration, but it more usually ends in suppuration and sloughing, requiring free incisions and general supporting means, under which treatment the disease usually yields: but gangrene, to a great extent, will sometimes follow, and terminate fatally.

#### FINAL RESULTS.

The terminations of cases have been the following:—<sup>1<sup>st</sup></sup> in the formation of a new joint; <sup>2<sup>nd</sup></sup> in false and true ankylosis; <sup>3<sup>rd</sup></sup> in death; and which of these will happen, must depend, in a general way, on the nature and limits of the actions set up during the primary incidental period of the injury.



## NEW JOINT.

Although the presence of a portion or fragment of the astragalus in the ankle may not prevent the formation of a new joint, (as the resources of nature under accidents occurring to the limbs are often displayed in the most wonderful manner,) yet the author cannot doubt, but that a better chance is given to the formation of a useful articulation when the joint is free for the fair descent of the tibia and fibula, than when this effect is prevented by the interposition of bony fragments. This fact is most satisfactorily illustrated in plate 3, which refers to a case occurring under the author's colleague, Mr. Wilson, who has favoured him with the following letter, giving an account of the same:—

“Dear Turner,—I was early, in the course of my practice, led to contemplate the very serious nature of the simple complete dislocation of the astragalus. The preparation I send you, and the history of the case, will best illustrate my own ideas upon the subject. In the year 1829 I received a letter from Mr. Rogerson, of Garstang, in this county, stating that a young man, who had two years before received an injury to his ankle, which had entirely deprived him of the use of his foot, was desirous to be admitted into the Manchester Infirmary, for the purpose of undergoing amputation of the limb, provided no other means could be devised in order to rectify the effects of the accident.

“James Lamb, aged 31 (the person referred to), was admitted the 31st day of May, 1829. The right foot presented a very singular appearance: it was turned considerably inwards, so that when placed upon a level surface the only part which came in contact with the ground was the extreme outer side of the foot; the two points of contact being the outer edges of the os calcis and metatarsal bone, supporting the little toe; the patient could not bear the slightest weight to rest upon the foot. Upon the outer side of the dorsum there was a large projection: the lines of the tibia and fibula could be regularly traced; and there was



no evidence to show that these bones had of themselves suffered injury. The integuments covering the projection were uninflamed at this time; but on the slightest exertion, redness with heat immediately ensued, and several times slight sores had formed upon the shin. Considering the length of time which had elapsed since the accident, it was not thought right to make any attempts at reduction, and at the patient's earnest solicitation, with the consent of my colleagues, I amputated the leg, and the patient had a good recovery."

Mr. Wilson has, in his letter, also favoured the author with the particulars of a case where he excised the bone with perfect success, leaving a moveable and useful joint; as well as an account of a case where he, assisted by the late Mr. Ransome, brought about reduction, which the author presumes to be the same case as that given by Mr Gaskell; and he thus concludes his letter, with his opinion as to the practice to be recommended in dislocations of the astragalus:—

"In complete simple dislocations (attempts at reduction failing) the practice, I imagine, reduces itself to these two points: first, whether it is right to make an incision through the soft parts and extract the astragalus, suffering the tibia and fibula to form a bed upon the os calcis, thus bringing the case (but it must be remembered under more favourable circumstances) to the condition of a compound case; or, secondly, whether we shall take the chance (if I may so term it) of the parts, under proper treatment, undergoing that change which does frequently happen; so that the bones shall adapt themselves to their new relations; for myself, I strongly incline to the first measure, namely, extraction of the irreducible bone, *now* become a very *formidable foreign body*. It is very true inflammation may, and often does ensue; sloughing take place, and nature rid herself in many instances of the offending body, but usually after a good deal of constitutional irritation; but I believe the effects of an incision, for the extrication of the astra-



galus, through parts uninflamed is not likely to be attended by so much constitutional irritation as the effects of the same end accomplished by nature's more tedious process of sloughing. Your own case, which I had an opportunity of witnessing, affords abundant evidence of this fact. I rejoice that you have brought this subject fairly before the profession, as it must lead to much interesting discussion, to a knowledge of facts, and to a right line of practice, which can only result from the experience of many.

“ With much regard,

“ Believe me, dear Turner,

“ Your's truly,

“ W. I. WILSON.

“ *Mosley Street, February 6th, 1843.*”

The opinions entertained, and here expressed by Mr. Wilson, are in accordance with the author's, as given in the preceding parts of this paper; and the author believes that he is justified in stating, that they coincide with those of all his colleagues at the Royal Infirmary. But to revert to the particular subject now under consideration, viz., the impediments to the formation of a new joint by the interposition of fragments of bone between the tibia fibula and calcaneum, so well illustrated in plate 3, copied from Mr. Wilson's preparation; the author begs to mention, that it seems also to confirm his views as to the locality of the tibia when the astragalus has been completely dislocated or completely excised; and which, conformably to his opinion, were printed, and plate No 1, illustrative of it, struck off, before Mr. Wilson's preparation was known to him.

If the author's views of what happens be correct, we ought to find, firstly, that when the astragalus is completely removed from between the tibia and fibula above, and the os calcis below, the two



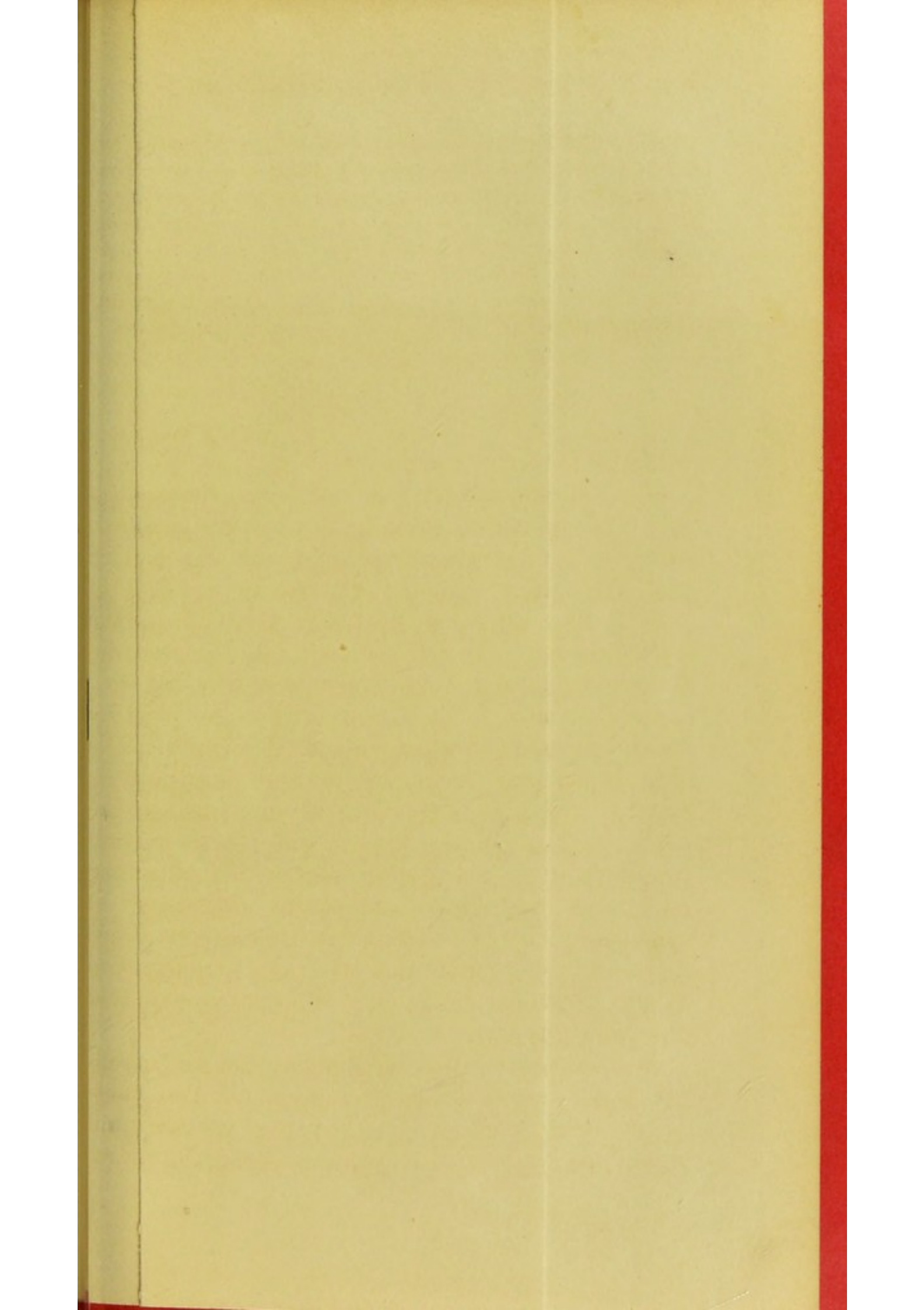
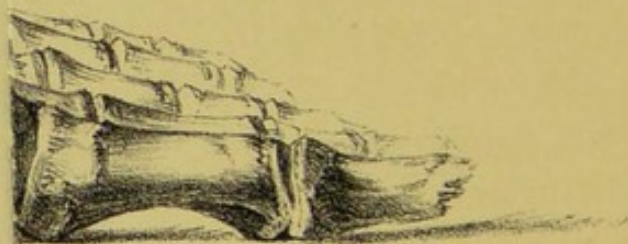




Plate 1.



Day & Hagbert's to the Queen.



former bones should be drawn towards the latter, as seen in plate 1; but, secondly, if the astragalus be partially displaced outwards and forwards, and fractured, and one or more of the fragments of the bone should remain interposed between the cup of the os naviculare and the anterior inferior edge of the tibia, that this bone would be still drawn downwards, or the foot upwards, but its articular surface would occupy the *posterior* astragalar facet of the os calcis, instead of the anterior; thus, the posterior edge of the tibia recedes, or is situated nearer the tuberosity of the heel than when the astragalus is wholly luxated or excised; and the heel in this case will be shortened instead of lengthened, as it appears to be when the hollow of the os calcis has been vacated by the astragalus, and gives occupancy to the tibia, which descends upon it.

If plate 3 be compared with plate 1, it will be noticed, that in the former instance, as in the latter, the malleolar process of the tibia is closely applied to the os calcis, but in the first case the bone is ankylosed with it. The apposition of the tibia to the os calcis is complete at the malleolus internus; but in the front view of the preparation, from which the engraving is taken, the position of the line of the under articulating surface is oblique from within outwards, the obliquity inclining outwards and upwards. This is caused by a portion of the fractured astragalus being interposed, and ankylosed to the tibia, fibula, and calcaneum. The fibula and outer edge of the under articulating surface of the tibia being thus mechanically prevented



from descending, it follows, as a matter of course, that the malleolar or inner part *alone* of the tibia or shin bone is brought into contact with the os calcis; that the partially dislocated and broken astragalus prevents the approximation of the outer part of the tibia and fibula to that bone; that the line of articulation between the leg and the foot, thus becoming oblique, the prominence of the inner malleolus is lessened, whilst that of the outer is increased; and the obliquity of the line of articulation being from within upwards and outwards, the shafts of the tibia and fibula are thrown in an oblique direction upwards and inwards, and the foot becomes strikingly inverted; most of which facts are shown in plate 3. This case is an instructive one in other points of view: it shows either that a disarticulated bone, *if fractured*, will pour out osseous juice so abundantly and extensively as to ankylose it, not only to the bones with which it is in contact, but to cement in one mass all the bones of the joint, namely, the tibia, fibula, astragalus, os calcis, and navicular bone; or, that the presence of a bone, not in its proper locality, acts by producing irritation and inflammation, which may set up disease in the joint, and be followed by abrasion of cartilage, by secretion from the surfaces of denuded bone, and ankylosis; whence the hazard of a portion of bone being allowed to remain, unless it preserves some of its articular facets undisturbed, as in Mr. Sawyer's and other cases?

When the displaced bone is allowed to remain in its new situation, there is, *cæteris paribus*, no more



impediment to the formation of a new joint than when the astragalus has been excised ; but in the former case there may be some risk of a mechanical hindrance to the motions of the foot, whereas in the latter it is quite sure that this cause cannot operate.

What really happens, then, when the astragalus has been wholly removed ?

Boyer says, that after the astragalus is extracted the tibia is approximated to the os calcis, and the soft parts around the articulation become relaxed. The enormous void which results from the extraction quickly diminishes, and the articular surfaces of the tibia, the fibula, and the calcaneum, become ankylosed ; thus, he says, the movements of the foot are abolished, and the member loses a part of its length, equal to the height of the astragalus.

M. Boyer came to this conclusion, no doubt, from having had an opportunity of dissecting the limb of a patient of Desault, on whom extraction had been performed, and where he found the tibia almost entirely ankylosed with the calcaneum ; but it does not follow that ankylosis is an inevitable consequence, and that the cure always takes place after this manner.

Richerand says, that the bones of the leg become permanently fixed by bone to the heel bone. Although the termination of the case may be in false or true ankylosis, yet in the majority of cases in which extraction has been performed these results did not follow. Mr. Smith, in a letter to the author with respect to the mode of termination of Bracewell's and Faucett's cases, writes, that each patient " had an excellent hinge joint of the tibia on the



os calcis," and numerous instances offering a similar result have been recorded: thus, in Mr. Phillip's first case, an artificial but moveable articulation seems to have been formed between the bones of the leg and the os calcis; and in the second case, an articulation, enjoying considerable extent of motion, was produced after the same manner.

We have opportunities in practice of seeing how the head of the bone, in an unreduced dislocation, will, by pressure on the surface of the bone on which it happens to rest, form for itself a new articulating surface, and in time acquire a considerable degree of motion. Sir A. Cooper has given, in his work on "Dislocations," two plates illustrative of this fact in unreduced dislocations of the hip; and the author has, in the Museum of the School of Medicine in this town, a preparation showing the same thing in dislocation of the shoulder joint. In these cases the socket is lined by a cartilagiform texture, (no doubt arising from a change effected by the pressure which the head of the bone exerts on the periosteum,) and, probably, a membrane composed of cellular texture, which performs the office of secreting a fluid, which, if not identical is equivalent in purpose to true synovia. The juxtaposition of surfaces in irreducible dislocation of the hip forwards or backwards, or in the shoulder forwards or backwards, does not form so intimate a co-aptation as that which exists in the ankle when the astragalus is removed; for here, the anterior edge of the tibia is received in the cup of the navicular bone, and the under cartilaginous surface of the tibia is brought into contact with tolerably



accurate apposition with the os calcis ; thus, a good and favourable adaptation of parts exists for the formation of a new joint. The pressure of the anterior edge of the tibia will readily cause a transition of its periosteum into cartilage or cartilagiform structure, and will enable it to move easily on the cup of the navicular bone ; and the pressure of the inferior articulating surface of the tibia will readily, we imagine, wear down or cause an absorption of the asperities between the anterior and posterior articulating facets of the os calcis, so as to form a surface on which the polished cartilage of the tibia will glide easily backwards and forwards in extension and flexion. In all these cases there is, for a long time, a stiffness or false ankylosis, induced by the indurated textures which connect the bones, and by the rigidity of tendons, from inaction and long immobility of muscles ; but by degrees these difficulties are in a great measure overcome, and the joint enjoys a fair extent of movement ; which, at all events, has been the result in many cases where extirpation of the astragalus has been performed.

In the last case detailed by the author, there rests on his mind no doubt but that the joint is formed between the tibia, os calcis, and os naviculare : the length of the heel being apparently increased, and the leg, from the knee to the sole of the foot, being shortened the depth of the astragalus, appear to him to be conclusive on this point ; and the certainty of it is borne out by what has happened in other cases.

The form of the foot (see plate 2) denotes, on



comparison, that the inner malleolus on the left is about one inch lower than that on the right side; that the expanse across the instep is less in the left than it is in the right foot; and that the left os calcis is raised an inch above the level of the right.

The admeasurements in the 45th case are:—

RIGHT LEG :

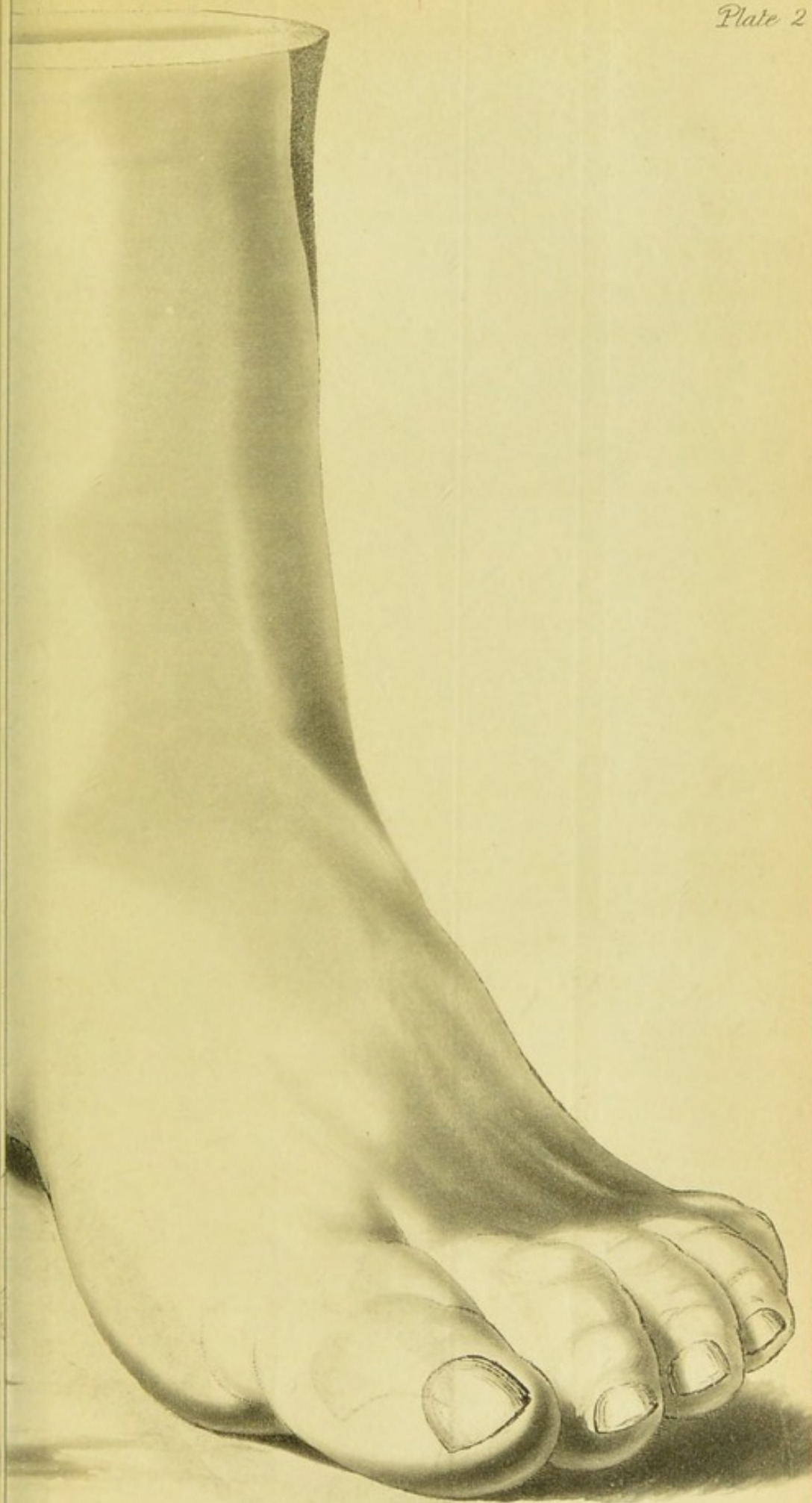
From inside of patella to ball of great toe .....	} 1 foot 8 inches.
From point of heel to ball of great toe .....	} $7\frac{1}{4}$ inches.
From inside of patella to point of heel .....	} 1 foot $7\frac{1}{2}$ inches.

LEFT LEG (THE INJURED ONE) :

From inside of patella to ball of great toe .....	} 1 foot 8 inches.
From point of heel to ball of great toe .....	} $7\frac{1}{4}$ inches.
From inside of patella to point of heel .....	} 1 foot $6\frac{1}{2}$ inches.

The issue of the case may, in some measure, be calculated upon by the sequel of the operation; if the inflammation be not considerable, and the suppurative process slight, we may augur favourably as to the degree of motion which the part will have when the cure is complete, because, in all probability, the cartilages will resist the ulcerative process, as we know they often will do, in the midst of extreme suppuration; but if the limb should suffer from phlegmono-erysipelatous inflammation, followed by extensive abscesses and sloughing, the cartilages are hardly likely to escape the havoc; and then a bony union of parts, and therefore a more tedious and protracted cure, may be the consequence.







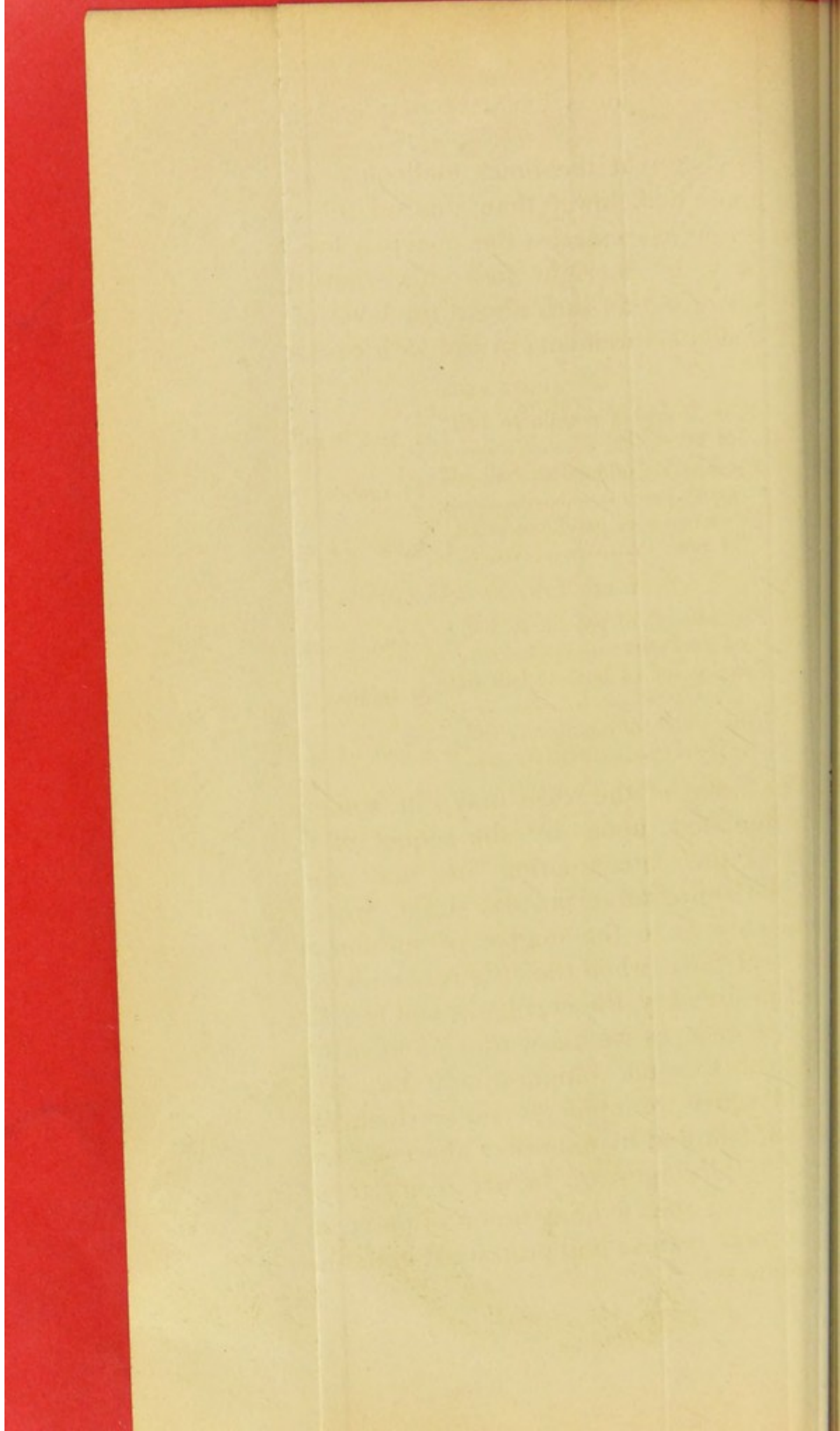
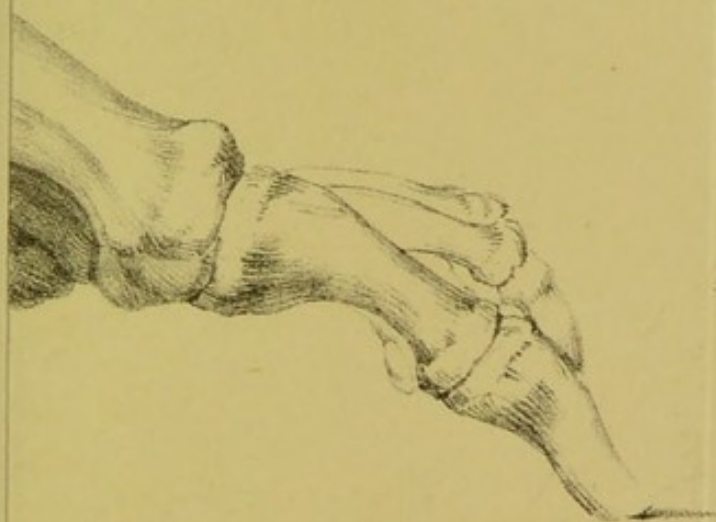


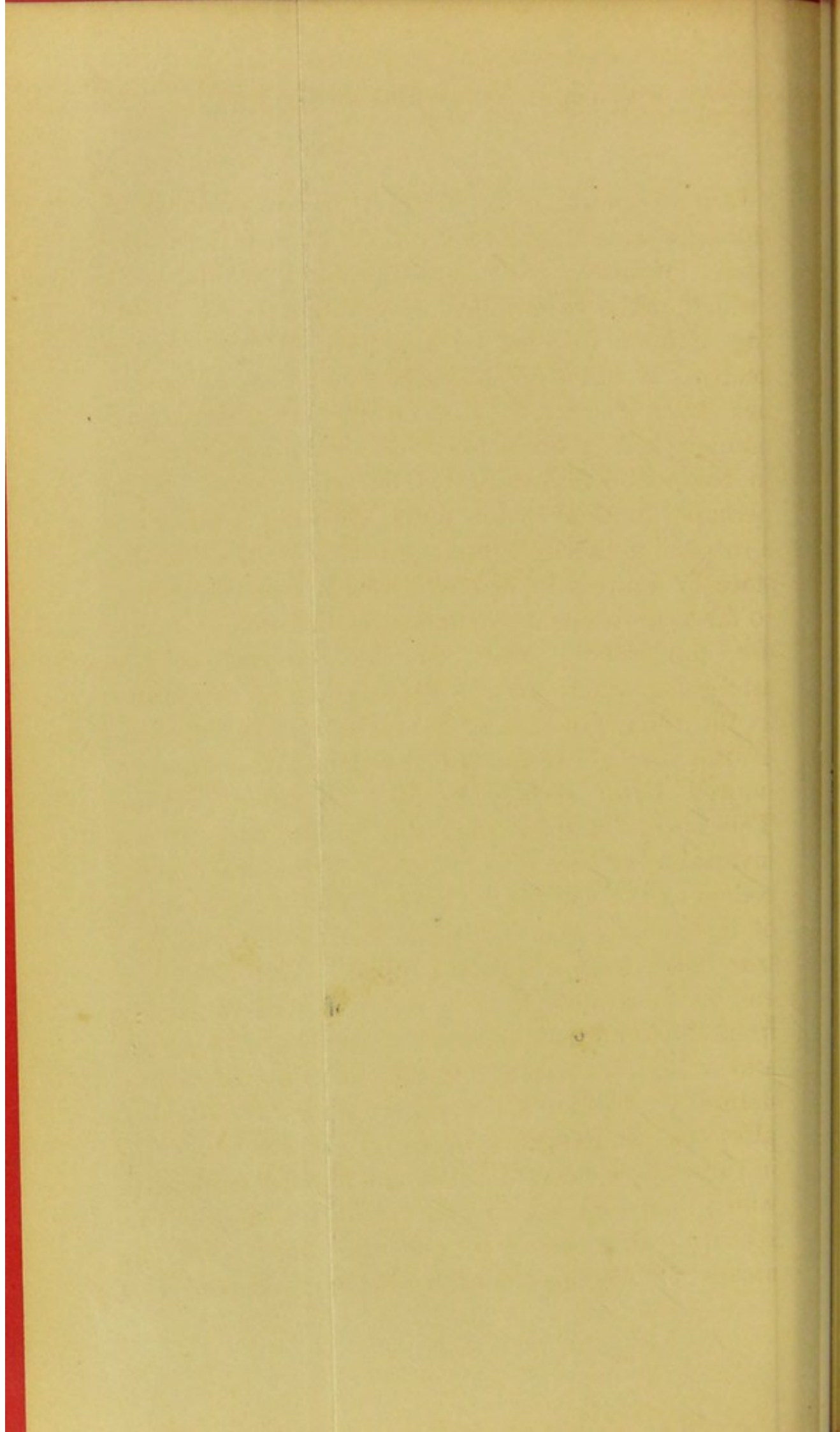


Plate 3.



David Hapbe 1847 to the Queen







## ANCHYLOSIS.

Another mode of termination of the removal of the astragalus from its natural situation is in ankylosis. Monsieur Boyer is of opinion that this result (which, taken in its fullest acceptation, is the soldering of bone to bone by a deposit of new osseous cement) is *inevitable* in cases where the astragalus has been extracted, and occurs after the same manner that it takes place on section of the tibia, in compound dislocation of the ankle joint. It is, perhaps, presuming too much to differ from such a surgical authority; but the author thinks that the state of matters in the two cases is very dissimilar, so far as provisional circumstances for such an event are concerned: since, on the removal of the astragalus, where there is no solution of continuity in the tibia, fibula, and os calcis, and no fragment of the astragalus left in the joint, there is no injured bony surface to take on ossific action. The author admits that this preliminary is not invariable or essential, but it is a presumed antecedent in the majority of cases; and in the absence of it, we may reasonably and fairly anticipate that true ankylosis will not happen. The case may end in false ankylosis, a state of matters arising from thickening of ligaments, rigidity of tendons, and other textures; but the soldering of bones, naturally distinct from each other, usually implies the pre-existence of caries, or fracture: for in these cases we shall have an injured surface, in which increased action of a reparative kind will be set up, callus secreted, and the bones will, by means of osseous effusion, become cemented, a



provision for which event is made on an extensive scale in cases of section of the tibia in dislocation of the ankle. Monsieur Boyer admits a distinction between false and true anchylosis, in attributing the former to the condition of the surrounding and connecting textures of the joint; and he admits, at the same time, that *true* anchylosis results sometimes from white swellings, wounds of joints, hydrops articuli, and from other diseases in which the articular cartilages are destroyed, and the bones brought into a carious condition, which state of matters the author believes to be almost if not essentially necessary. In those cases, if nature should come to the aid of art to arrest the progress of caries, morbid may be exchanged for healthy action; granulations will arise from the denuded articulating surfaces, the granulations of one surface will become united with those of the opposite, and by the deposit of phosphate of lime in them, they will constitute a medium for cementing the bones together, and thus producing *true* anchylosis.

There is reason to believe that false anchylosis does happen for a time, as the sequel of the removal of the astragalus, owing to the long immobility of the limb, the chronic action in the ligaments and adjoining textures, and rigidity of tendon and muscles from long disuse. But this disease is curable; whereas true anchylosis, which may be apprehended when extensive suppuration in the joint has followed the operation, is permanent or incurable, as nothing can unsoder the bones thus united by osseous matter, and nothing can give motion to a joint thus rendered immoveable.



Finally, *death* has been the result of the accident in four cases, and in all from the destructive effects of diffuse cellular suppuration and sloughing. It is remarkable, indeed, that more cases have not terminated fatally; and when we consider the locality and violence of the injury, it is very extraordinary that in no one instance has *tetanus* occurred as a result of dislocation of the astragalus.

## CONCLUSION.

The author fears that the length of his paper may bear the stamp of tediousness, and will amount to an unreasonable monopoly of the pages of this volume of the Society's *Transactions*; if so, he can but apologize, and hope for an excuse, on the ground of having wished to do justice to the numerous communications of his professional brethren, who have so kindly and liberally assisted him in the execution of his labours. When the author considers the prompt manner in which the applications to his professional friends have been responded to, he is fearful that it will appear invidious, in acknowledging and recording their acts of kindness, to make any distinction; but he feels assured that he will be readily excused for returning, in an especial manner, his thanks to Mr. Smith, of the Leeds Infirmary, when he states, that this gentleman has had his attention directed a good deal to dislocation of the astragalus, from the circumstance of his experience in this accident having been singularly great; and that it was his intention, had he not been anticipated by the author of this paper, to have prepared a short essay on the subject, which



project he kindly chose to abandon in the author's favour, and liberally handed over to him his cases, clinical observations, and his casts, to use as he thought proper. The author has spared no time or labour, compatible with the discharge of his public and private professional duties, in endeavouring to amass facts whereon to build the principles to be borne in mind, and to elucidate the practice to be adopted in dislocations of the astragalus : he would, therefore, fain indulge a hope, that his attempt, seconded as it has been by his professional friends, to inspire confidence in hospital and private surgeons, at a period of extreme emergency, will be acceptable to them ; and although he is aware that the execution of his paper has not been commensurate to the advantages which he has derived from the valuable communications of his surgical brethren, yet he trusts that he may have contributed some assistance towards the rendering of his and their services more decided, and more efficient, in the relief of suffering humanity.

FINIS.

WORCESTER :

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