ON DISLOCATION OF THE FOOT

WITH

VERSION AND TORSION OF THE ASTRAGALUS.

BY

RICHARD BARWELL, F.R.C.S.,
SENIOR SURGEON TO CHARING CROSS HOSPITAL.

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MANY instances of entire dislocation of the astragalus from its connections with the rest of the tarsus, and also from the bones of the leg have been recorded ; it is to be noticed that in these cases the bone is very rarely projected straight out of the socket, but receives a twist so that its axes lie, and its surfaces look, in quite abnormal directions. There is, however, another form of injury in which the astragalus is likewise twisted or turned over, but remains in the tibio-peroneal socket, the bone is *in situ*, but its axes and surfaces are misplaced, while its connection with the rest of the foot is sundered. This condition is extremely rare ; moreover most of the few instances on record are described in so cursory and indefinite a manner that it is often doubtful what kind of injury is in reality indicated, and it is generally quite impossible to gain any idea as to its distinctive symptoms. The case, which I have now the honour to report to the

Society, presented itself under circumstances which enabled me very clearly to note its clinical features; while the operative treatment employed afforded an opportunity, as perfect as a post-mortem dissection, of verifying my previous diagnosis. I would hope, therefore, that some minuteness of detail in description will not be considered tedious.

George F—, aged 28, a coachman, of apparently healthy constitution, was admitted under my care into Charing Cross Hospital on 15th November, 1881, having received an injury to the right ankle. The accident occurred through the breaking of an axle, the gig fell over on its right side, and he was thrown out. The horse ran away, and the man holding the bridle, was dragged for some distance along the ground. He does not think this latter circumstance caused the injury, but believes that the foot was hurt when the gig fell.

I saw him about an hour and a half after the accident. The foot was greatly inverted, the sole looking almost directly inward, its front somewhat turned in, the heel raised. The inner malleolus was much hidden; beneath it the skin was thrown into two ridges by three deep folds drawn in segments of concentric circles from a centre a little above the malleolus. The cutis of this part was so much compressed that the ridges felt hard, tight, and unyielding. The outer malleolus projected abnormally, the skin over it rather tightly drawn. About an inch in front of it and a little below its level was a rounded projection, which also somewhat stretched the skin. An inch and a half up the leg and in front of the fibula, was a small but deep wound, from which venous blood flowed pretty freely. The man was unable to move the foot in any direction, and suffered a good deal of pain.

On palpation the following additional particulars could be made out. Below and in front of the inner malleolus deep pressure revealed absence of the usual bony substratum, the finger sank into a hollow, bounded in front by the tuberosity of the scaphoid, which lay abnormally

near the malleolus. The rounded projection in front of the outer malleolus could readily be recognised as the head of the astragalus. A little way behind this was a ridge of bone, also evidently a part of the astragalus, it led from the head backward and a little upward, disappearing under the upper part of the malleolus, at the angle between it and the horizontal anterior edge of the tibia. This ridge was markedly convex *outward*. The extensor tendons, pressed together, ran in a bundle a little distance inside the rounded projection. The wound communicated with the injury. No fracture of bone could be detected. The foot, incapable of active movement was hardly amenable, unless much force had been used, to any passive motion.

From these data the diagnosis was not difficult up to a certain point; namely, it was clear that the other bones of the tarsus were displaced from the astragalus. At this point, however, the niceties of diagnosis really began, for the astragalus, though evidently not in normal position, was certainly not out of its proper place. I therefore expressed to my class this view deduced in the manner described at p. 47, that the astragalus was twisted in but was not dislodged from the tibio-peroneal socket. Nevertheless, it seemed right to attempt reduction; therefore chloroform was given and, assisted by Mr. Morgan, I endeavoured in all ways to replace the bones, even Cline's method, of placing the knee against the prominent malleolus and forcibly drawing the foot in the direction contrary to its abnormal posture, was used. No effect was produced save some temporary change in the position of the foot. I then, rather in deference to the opinions of my colleagues than because I expected any better result, divided the tendo Achillis and renewed my efforts at reduction, but with like negative result. I ordered a poroplastic splint to be moulded on the limb in its then position; the wound to be injected with a solution of carbolic acid, and the same material to be kept applied on a suitable pledget.

November 17th.—The man having consented to the course I proposed, ether was administered, and I made a semilunar incision from the middle of the lower end of the tibia to the tip of the outer malleolus; the middle of this cut ran over the displaced head of the astragalus. The flap was turned up and the bone fully exposed. It was a little turned on its perpendicular axis, for its long axis ran from behind forward and a little outward; its head lying some distance in front of the outer malleolus. It was twisted ninety degrees or a quarter of the circle on its antero-posterior axis, its trochlea looking outwards, was in contact with the articulating cartilage of the outer malleolus, its inner surface rested upon the horizontal joint-surface of the tibia; its lower surface, that for the calcaneum, was opposite the articular facet of the internal malleolus; its outer surface faced the calcaneum. I noted especially how closely the inner upper angle of the trochlea fitted into the entering angle formed by the lower articulating surface of the tibia and the outer malleolus. The bone was not at all displaced forwards; that is, it did not protrude abnormally from the socket. The extensor tendons and the anterior tibial artery were all to the inner side. I did not see the peroneus tertius; it can hardly have been pressed inwards, but it certainly was not divided with the knife.

Having verified these particulars, I seized the bone in lion forceps, and, turning it still further in the same direction, divided what ligamentous fibres restrained that movement; these were not many, some of the posterior and a few of the internal lateral ligaments only required the use of the knife. The calcaneo-astragaloid interosseous ligament had been torn through. The bone, therefore, came away with singular ease and the bleeding was trifling. I then passed my finger into the large cavity; there was not the slightest roughness; no chipping of bony edges nor, as far as I could make out, any detachment of cartilage. I also felt the extensor tendons gathered much together on the inner part of the cavity;

Torsion of the Astragalus (90°). (The bone should have been represented as being a little more abducted.)

they assumed their usual places when the foot was turned into its normal position. The anterior tibial artery was beating well.

The foot was placed on a T-splint and slung. The man passed a fairly comfortable night, expressing himself as much relieved by the operation. On the fourth day the temperature rose to 102.4° ; after dressing the wound and the action of a laxative it sank to 100.3° , and since that time remained normal, except on one night, when it rose to 100° .

The skin wound healed mostly by first intention, save a little part anteriorly which gave passage to a small amount of pus formed in some part of the deep cavity. Therefore on December 17th I made a counter opening in a more dependent part below the outer malleolus through the recent scar.

January 13th.—I found the union between the leg and foot affording good resistance. All wounds have been healed a week ago. Limb put in plaster of Paris. To get up.

24th.—Discharged nine and a half weeks from date of operation.

Several points present themselves for consideration in this and in the very few similar cases recorded. Firstly, as to name. Recent writers have endeavoured to avoid the confusions of an older terminology by naming luxations between the astragalus and leg bones "dislocation of the ankle-joint;" such as take place between the former bone and the rest of the tarsus "subastragaloid;" while the combination of these two injuries is termed "dislocations of the astragalus."¹ But the word dislocation can hardly be with propriety applied to the relations between the leg bones and astragalus which subsisted in this case. Such a term would certainly tend to mislead, as denoting dislodgment or extrusion of the astragalus from the

¹ Boyer, '*Traité des Maladies Chirurgicales*,' t. iv, p. 382, named these "double." The term "complete" is inadmissible, since it is already employed to mean the reverse of a partial dislocation—of a subluxation.

tibio-peroneal socket. I would propose to name these kinds of injury "Dislocations of the foot with version, and with torsion, of the astragalus."¹

For it must be remarked that the bone may be turned within the tibio-peroneal socket either horizontally so that its long axis looks across the joint and at right angles to its normal position: this I would call "version." Or it may turn over sideways upon its antero-posterior axis: this might be named "torsion."²

Of the former injury I find by a very diligent search in all the records to which I have access, seven cases,³ of which two are merely anatomical, being found in subjects examined for other causes. In all these cases save one the front of the bone was thrown inwards. In one case the head was broken off. In the four (inward version without fracture) the head presented below and sometimes also a little behind the inner malleolus; it appears to have a great tendency to become entangled between the tendon of the tibialis posticus and of the flexor longus digitorum muscles. In only one case did version occur outwards,⁴ the turn was only a quarter of the circle (45°), the head of the bone resting against and in front of the external malleolus. It is, indeed, evident that the lower position and greater length of that outer projection would prevent the head of the astragalus passing under it as it does on the inner side, therefore, the twist being checked, a mere partial version in this direction can occur.

Torsion would at first sight seem a more common injury, for Malgaigne reports no less than six cases;⁵ but on

¹ Malgaigne, 'Traité des Fractures et des Dislocations,' terms these "Luxations par Rotation sur place" and "Luxations par Renversement." Such words do not indicate the displacement at the tarsal joints of the astragalus.

² It would seem from the description of one case (Thierry) that the two twists may be combined.

³ An appendix added to this communication gives the pathological positions and other particulars of each case.

⁴ This was the analogue of a subluxation, and I cannot but think might have been reduced. (See Case 6 b, in Appendix.)

⁵ Malgaigne also gives a plate, without history of this form of injury. The

referring to the originals it becomes plain that these numbers must be very considerably corrected, indeed, almost entirely rejected.¹ Malgaigne has fallen into one error by quoting the same case twice over from two different sources. Of the five remaining all, except one, must be rejected, because in four of them the astragalus, though certainly twisted, was also displaced out of the tibio-peroneal socket. In the one valid case the bone lay with its posterior end beneath the tibia. These statements can be verified by reference to the appendix, in which I have quoted the description of each case separately.

It appears that the distinguished author was misled, partly by an imperfect acquaintance with English in his interpretation of very unskilfully worded descriptions; partly by haste in accepting such words as "turned" or "*mouvement de rotation*" as signifying the condition in question, without going further to ascertain whether change of place did or did not accompany change of position.

Nevertheless Malgaigne's plate from the *Musée Dupuytren* represents an astragalus slightly displaced forward and turned on its long axis one eighth of the circle; its inner trochlear edge resting on the horizontal articular facet of the tibia. Thus, although my case is the only one recorded in which the four sides have each assumed the position of another while the bone remained in its socket beneath the tibia, yet it is evident that such accidents may, indeed probably have, taken place, and therefore are worthy of careful study and intelligible description.

The light which my case throws upon the subject appears to render the mode in which these injuries occur comprehensible. Two factors appear to me indispensable:—First, that during the time that the foot is twisted it should be at a right angle to the leg; secondly, that there be a cer-

astragalus is represented as partially turned, the inner edge of the trochlea looking upwards.

¹ Correction seems the more necessary, since the writer of the article, "Dislocation," in the new edition of 'Cooper's Surgical Dictionary,' has in all faith accepted the account given by Malgaigne.

tain relationship of strength between the ligaments of the ankle and the calcaneo-astragaloid or interosseous ligament. When the gig my patient was driving fell over towards the right, the sole of his foot resting on its floor was made to face more and more inward until, no doubt, the external lateral and the outer parts of the interosseous ligaments were unusually tight. At that moment the outer border of the foot, then looking almost directly downward, came in contact with the ground, and thus was completed, by the impetus of a blow, what a more gradual force could not probably have effected. Had the foot been extended or flexed, as well as inverted, the astragalus could surely not have escaped dislocation backwards or forwards and outwards. Or had the interosseous ligament been weak in proportion to the lateral ligaments of the ankle, subastragaloid dislocation alone would undoubtedly have been produced. From this, too, we may infer that version results when the foot, while at right angles to the leg, is forcibly turned horizontally inwards (inverted), and is used as a lever wherewith to wrench round the astragalus in the intermalleolar mortice. Strength of the interosseous ligament is here also a necessary constituent.

My case, the only one I believe in which diagnosis has been arrived at from a study of the symptoms during life,¹ shows that certain signs which may be taken as pathognomonic can by care in examination be made out. Thus, since the astragalus was clearly absent from its normal place between the os calcis and the scaphoid, and since the head of the bone lay in front of the *outer* malleolus, the question as to the position of the body of the bone required solution. Now in all cases of dislocation of the astragalus, properly so called, the bone can be found somewhere about the foot or behind the bones of the leg, hence

¹ Malgaigne, and following him other writers besides those named in the text, describe the diagnosis of this condition as impossible. That opinion is, I believe, much too hasty; it appears to me that in the absence of any considerable swelling the diagnosis founded on anatomical knowledge can in most cases be made.

the conclusion that the bone was still in the socket was inevitable. But the abnormal position of the head showed that some change in its relations to the intermalleolar socket had taken place, that is to say, that the case was not merely a subastragaloid dislocation. The key to the problem was furnished by the bony ridge described in the history of the case as running back from near the head of the astragalus to the angle between the outer malleolus and the anterior edge of tibia. In a normal foot fully extended, the outer edge of the trochlea can be felt in precisely that situation: but when the position of the bone is so changed that its head lies in front of the outer malleolus, that edge of the pulley must also have moved away, therefore the ridge which I felt must evidently be some other part of the bone, and as there was no fracture, a twist of the astragalus must of necessity have occurred. The peculiar shape of that ridge, and the fact that it was convex *outward* instead of *upward* and forward, led me to conclude that the trochlea lay against the outer malleolus.

The diagnosis of version is, I should judge, still more easy; for, in all cases uncomplicated by fracture, the head of the bone could easily be felt; in one in front of, and a little below the outer malleolus; in five below, and a little behind the inner malleolus. In one case in which the head was broken off, the trochlea was visible through a wound under the inner malleolus.

Concerning treatment very few words are necessary. Any unreduced dislocation of the astragalus, save in the backward direction, very generally ends in sloughing of the integuments and wide-spread suppuration, unless the bone be removed. Of the six instances of "version" collected in the appendix, one is an old injury and does not seem to have been followed by suppuration, but the man must have been very lame. The cases of delay and hesitation all ended badly.

One case of "torsion," since it is an old injury, viz. that depicted by Malgaigne, does not appear to have been

productive of any acute troubles, but the displacement was only slight. Only one other case of veritable "torsion" (Case 4, p. 53, in Appendix) is on record; in that case the bone was almost entirely extruded from the tibio-peroneal socket and was excised. In my case it was impossible to replace the foot until the astragalus was removed.

A certain difference of opinion has existed as to whether it is better to excise at once or to wait until inflammation and suppuration have loosened the connections of the bone. Probably at the present day it is hardly worth while to refute this latter contention. My view is that in all cases of dislocation of the astragalus certain and sufficient, but not too persevering, attempts at reduction should be made. If they fail, the bone, unless it be luxated backward, should be at once excised.

Both version and torsion when complete, that is to say when the twist amounts to 90° , are irreducible. In the former case, excision is the best practice, though it is not so imperative as in the latter. When torsion is complete, the only choice lies between an utterly useless foot, excision of the astragalus, and amputation.

It is well known that excision of the astragalus leaves a very useful foot, as may be seen by the preparation on the table taken from Charing Cross Hospital Museum (a patient of Mr. Canton's), and by the way the subject of this paper, now in attendance, walks.

Postscript.—At the end of April, 1883, George F—, presented himself at the hospital walking with a barely perceptible limp. He said that if he had to go far his ankle got a little tired, but that this and occasional pain on change of weather were the only remains of the injury. He wore a shoe about one third of an inch thicker than that on the other foot.

APPENDIX.

Abstract of cases previously recorded.

VERSION.

1. *Laumonier* ('Journal de Fourcroy,' 1791, t. ii, p. 60). The head of the astragalus protruded under the inner malleolus, between the tendons of the tibialis posticus and flexor longus digitorum, the trochlea lying transversely in the socket and forcing apart the tibia and fibula. The bone excised with success ('Revue Med.-Chir.,' 1855, p. 207).

2. *Denonvilliers*.—The head was broken off and remained attached to the scaphoid, the body of the bone turned at a right angle; there was a wound eight centimètres (2½ inches) long, exposing the inner malleolus; below and a little behind which the trochlea was visible. "The projection of the tendo Achillis has disappeared, as also that of the heel, the whole foot seems to have moved bodily forwards, its inner border and lower surface are quite insensible, while the wound itself is extremely painful." On the second day exsection of body of bone; gangrenous inflammation; death on sixth day.

3. *Foucher* (a dissecting-room subject).—The astragalus had turned in its socket, the head had left the scaphoid and was under the inner malleolus, to which it was attached by firm fibrous adhesions, so that before dissection it was mistaken for an abnormally prolonged inner malleolus. Other changes were observed but the injury was evidently very old.

4. *Thierry*.—The head projected about midway between the internal malleolus and the tendo Achillis; the front part of the trochlea (*la gorge de la poulie astragalienne*)

lay just beneath the malleolus, while the posterior border of the bone was directed forwards and outwards, being placed between the calcaneum, cuboid, and scaphoid. "Thus the bone had turned on two axes; on its vertical, so as to place the head behind the inner malleolus, and also on its longitudinal, so that the trochlea became vertical and looked inward and forward; while the outer border lay below the inner above and the lower face looks towards the back part of the outer malleolus." Thierry temporised; sloughing occurred, through which the position above described was seen; excision; persistence of inflammation; amputation; recovery.¹

5. *Verebely* (of Pesth).—Vigorous man, æt. 29. Tibia uninjured; fibula fractured above the malleolus. Under the internal malleolus the skin was very tense; about an inch lower there was a hard and bony enlargement about half an inch in diameter. Reduction failed. At the end of the third week an abscess was widely opened and showed that the enlargement under the inner malleolus was the head of the astragalus turned round to that situation. After four months' treatment the man could with difficulty put the foot to the ground.

6. *Verebely*.—Man, æt. 45. The foot was at right angles with the leg, the sole looking somewhat inwards and upwards (*etwas nach innen und oben*). "Under the easily distinguishable outer malleolus and in front of it a bony projection half an inch in diameter may be plainly felt; this can be moved without much pain backwards and forwards independently of the other bones. Behind the navicular is a considerable hollow." Attempts at reduction failed ('Wiener Medizinische Wochenschrift,' 1869, Nos. 17 and 18).

This case, referred to in my text as the only one in which version had taken place outwards, is compared to a subluxation, and for anatomical reasons we must conclude it to have been reducible.

¹ All the above cases are in the 'Revue Medico-Chirurgicale,' 1845, p. 203, reported by Foucher.

TORSION.

1. *Boyer*.—Of very doubtful reality. The description may be given in his own words ('*Maladies Chirurgicales*,' vol. iii, p. 899). "Un homme de 36 ans d'une petite stature, mais fort et vigoureux, tombe de cheval; son pied reste dans l'étrier pendant que le cheval continue de galoper; l'astragale éprouve la double dislocation dont il est ici question." (Boyer is writing of what is now called dislocation of the astragalus). "Cet os était renversé sur le tibia, et sa tête, qui avait abandonné la cavité scaphoïde en sortant par la partie interne supérieure de la cavité de cet os, formait sous la peau une tumeur très remarquable." In eighteen days the skin over the head sloughed, and the limb was amputated. Boyer only says of the condition, "L'examen anatomique de la partie fit voir la double luxation de l'astragale et les surfaces articulaires de cet os cariées, ainsi que celles du tibia et du péronée." Surely if he had seen the bone within the tibio-peroneal socket he would have made some remark on so singular, and at that time unknown, a condition, nor would he have termed it double dislocation.

2. *Smith* of Leeds (Turner on 'Dislocations of the Astragalus,' p. 69).—Man, æt 66. "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 immovable." In a week the integuments had sloughed, "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 those 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." Eighteen days afterwards the bone was excised

and the man made a good recovery. It seems impossible to assume here that the bone was in the socket, since the trochlea or the outer surface presented at the wound. The description is very obscure.

3. The preparation which Malgaigne says Liston possessed is thus described ('Pathological Transactions,' vol. i, p. 45): "*Dislocation of the Astragalus* which had become separated from its connections with the os calcis and the bones of the leg, neither the tibia nor fibula having been fractured or separated from each other. The astragalus was so tilted on itself that the under surface looked towards the outer malleolus, being confined by the peronei tendons, which passed over its posterior aspect; the head was so tightly embraced by the annular ligament and tendons of the extensor longus digitorum as to render reduction impossible. An analogous case had come some time before under the notice of Mr. Liston in which, although the foot was put straight, it was impossible to reduce the bone—5th April, 1847." I confess myself unable to interpret this description—it is clear that the bone had turned, but the first sentence would point to real dislocation; to extrusion from the tibio-peroneal cavity.

4. *Dupuytren's* first case (according to Malgaigne) is to be found in the old Sydenham Society's publications, 1847. (Dupuytren 'On Injuries and Diseases of Bone,' translated by Le Gros Clark: also in Rognetta's 'Memoir on Extirpation of the Astragalus,' p. 29.) M. G—, æt. 50, coach-builder, jumped from a ladder and alighted on the heel. "The medical man first called in, found a large, hard, irregular, and irreducible prominence in front of the tibia and extending to the instep." "When consulted, Dupuytren at once was satisfied that this was the astragalus." Attempts at reduction being useless, an incision was made through the skin parallel to the axis of the foot, and the head and neck of the astragalus were immediately brought into view. These were seized, but efforts to remove the bone were vain; for the posterior part was grasped and held fast between the tibia and os calcis.

Surprised at this unexpected resistance we attentively sought for the cause and discovered not without extreme astonishment that the astragalus was turned round in such a way that its upper surface was directed downwards, its lower upwards, and that the hook-like process at its inferior and posterior part was fixed beneath the tibia so as to completely frustrate our efforts to extract it" (the patient ultimately did well).

From this description it is plain that the interosseous groove of the astragalus was caught against the anterior edge of the tibia, therefore, that nearly the whole of the bone was extruded from the socket.

Dupuytren's second case ('Leçons Orales,' vol. ii, p. 18, also quoted by Rognetta p. 31, and referred to by Malgaigne) "L'astragale avait éprouvé un mouvement de version tel que la face supérieure était en dehors et devenue externe, c'était elle qui se marquait sous la peau ainsi que la face externe qui était devenue supérieure . . . Sous la peau de la face dorsale du pied ou plutôt sous un cicatrice inégale ondulée, l'astragale saillant donnait en quelque sorte au membre la difformité d'un pied bot."

From this description it appears that the astragalus was extruded from its socket, and was not the sort of case which Malgaigne imagined and named a "rotation sur place," or the astragalus would not have been thrust forward on the dorsum of the foot. These cases are the only ones of Dupuytren's mentioned by Rognetta which bear the slightest resemblance to the injury in question; therefore, Malgaigne, in ascribing to the former surgeon three cases, has quoted one or the other twice over—for Rognetta's quotations are from the same sources that Malgaigne had previously named.

The figure in Malgaigne's atlas has no history attached—it is from Dupuytren's museum—it is an old injury, since ankylosis had taken place. The torsion is very slight, the outer angle of the trochlea rests against the inner surface of the tibia (barely 45°). The body of the bone is slightly misplaced forward.