REMARKS
ON
THE DIAGNOSIS,
AND ON
THE INVERSION OF THE FOOT,
IN
FRACTURE OF THE NECK
AND UPPER PART OF THE THIGH BONE.
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LECTURER ON SURGERY, ETC. ETC. ETC.

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THE observations which have been lately published by Sir Astley Cooper on fractures and on dislocations, and the discussions which they have given rise to, have had the effect of drawing the attention of the Profession more closely to a subject which has always been allowed to be attended with considerable difficulty ; and whilst they have established certain principles and modes of practice, highly beneficial to mankind, have also shewn that the subject is by no means exhausted, neither has it received all the elucidation of which it is at present susceptible.

The depth at which the head and neck of the femur are situated and the manner in which they are surrounded by the soft parts, render an examination of them sometimes difficult. The fact of displacement therefore, together with its particular nature, is often more satisfactorily ascertained by certain attendant and even distant signs, than by the closest investigation of the part itself, the immediate derangement of which cannot, at all times, be perceived, more particularly if the sufferer be large and fat.

The principal difficulty hitherto supposed to exist, is that of distinguishing between dislocation of the head, and fracture of the neck of the femur. This has been presumed to be overcome by certain signs diagnostic of each of these kinds of injury: but, as they are common to both, they require to be considered collectively, rather than separately, in order to enable the surgeon to arrive at a legitimate conclusion.

The dislocations hitherto demonstrated, which may be mistaken for fracture, are of two kinds:

1. Upwards and backwards, on the dorsum of the ilium.
2. Backwards, into the ischiatic notch.

In the first kind of dislocation, or upwards and

backwards, the head of the femur is removed from the acetabulum, drawn upwards, and turned backwards on the dorsum ilii. The trochanter must, consequently, be forwards, and nearer to the anterior superior spinous process of the ilium. The limb is necessarily shortened, from one inch and a half to two inches and a half. The knee is turned inwards, and a little advanced, and the great toe rests on the instep of the other foot. The head of the bone is firmly fixed in its new situation, the limb cannot be drawn outwards, or fully separated from the other, although it admits of motion inwards, when the head of the bone may be felt in most cases moving on the dorsum ilii. The trochanter major is less prominent, the hip will, consequently, be flatter, and its rotundity will be diminished. There will generally be a greater degree of distortion than is apparent in any other kind of injury.

In the second kind of dislocation, or backwards into the ischiatic notch*, the limb is from about half an inch to one inch shorter than the other, but generally not more than half an inch. The trochanter major is behind its usual place, but is still remaining nearly at right angles with the ilium, with a slight inclination towards the acetabulum. The head of the bone is so buried in the ischiatic notch that it cannot be distinctly felt, except in thin persons, and then only by rolling

* Sir A. Cooper on Dislocations, &c. page 66. 3d edition.

the thigh-bone forwards so far as the comparatively fixed state of the limb will allow. The knee and foot are turned inwards, but less than in the dislocation upwards, and the toe rests against the ball of the great toe of the other foot. When the patient is standing, the toe touches the ground, but the heel does not quite reach it. The knee is not so much advanced as in the dislocation upwards, but is still brought a little more forwards than the other, and is slightly bent. The limb is so fixed that flexion and rotation are, in a great degree, prevented.

There is a third kind of dislocation mentioned, but which has not been demonstrated. The dislocation is upwards, but, contrary to what takes place in the first species, the head of the bone is turned forwards, the trochanter backwards. When such an accident occurs, the knee and great toe must be very much turned outwards, the limb shortened from an inch and a half to two inches and a half, and fixed so as not to admit of rotation inwards. The head of the bone will be distinguishable on the dorsum of the ilium, the trochanter will be deeply buried, and turned backwards. The hip must be greatly flattened, constituting, altogether, a diagnosis not easily mistaken, whenever such a case occurs.

Dislocation may take place at any age, but it is a rare occurrence in old persons.

Fractures of the neck of the femur may be confounded with the dislocation of the os femoris upon the dorsum ilii, and with that into the ischiatic notch, as in both these luxations the limb is shorter. It is said to be distinguished from them by the eversion of the foot, and by the mobility of the limb in fracture. The eversion of the foot is, however, by no means a constant or diagnostic sign of this injury, and it is admitted by the best authorities, that the foot is sometimes inverted, although it is considered as an extremely rare occurrence. Even where the eversion does take place, some hours often elapse before it assumes its most decisive character, as the muscles require time to enable them to assume a determined contraction. The inversion of the foot, in fracture, was first noticed by Paré, and his remark was confirmed by Petit, but subsequently disputed by Louis, who considered it either as an error on the part of the author, or of his copier. Dessault, however, met with it so often, as to compute the frequency of its occurrence to be as one to four; an assertion which may be considered very extraordinary when compared with that of Boyer, who says, he never saw an instance of the kind in the very great number of fractures which came under his observation, and concludes his remarks with the following observation: "We are not acquainted with a sufficient number of instances, in which the foot turned inwards, to enable us to admit that this even happens

occasionally. We have never seen it, and it is difficult to conceive how it can take place. Time, further observation, and, above all, anatomical inspection, can alone furnish the solution of this problem.”*

I had always conceived, with others, and taught in my lectures, that when the foot was turned in, or neither in nor out, the fracture must have occurred in the cervix of the bone, near the head, so that the portion attached to the trochanter passed behind that remaining with the head of the bone, and, in this manner, caused the turning inwards of the great toe; or that the capsular ligament being torn, it passed backwards behind the acetabulum, giving rise to the same appearance. In either of these hypothetical cases, the inversion of the toe, or point of the foot, should not have continued after the limb had been restored to its proper length; a result which, in the cases I have actually seen, did not follow; proving, therefore, that the opinions entertained of the nature of these cases, were unfounded. The only dissection of an injury I am acquainted with, made previously to the one presently to be noticed, in which the toe turned inwards, is in the possession of Mr. Langstaff; but in that case the great toe was, in the first instance, everted, and subsequently turned inwards, when

* Boyer. *Traité des Maladies Chirurgicales*. Tome iii. p. 268. Paris, 1818.

the patient began to use the limb. The preparation shews the fracture to have been within the capsular ligament, close to the head of the bone, and gives a decided refutation to the opinion of the length of the broken portion attached to the trochanter being the cause of the inversion, inasmuch as this part has been removed by absorption. The point of the foot was everted whilst it retained its proper length, and only became inverted by a wise provision of nature to assist progression, after it had begun to be shortened. This circumstance receives great illustration in the person of Henry West, a boy from whom Mr. White, of the Westminster Hospital, removed the head, neck, and part of the trochanter of the left thigh-bone, in consequence of scrofulous disease of the hip-joint attended by abscess. He recovered after the removal of the bone. The thigh is three inches and a half shorter than the other, and the toes turn inwards, not only in walking, but when he lies on his back in a quiescent posture, or prepared for sleep.

In January, 1823, I visited a lady who, seven days previously, had slipped at the entrance of her house, and fallen on the left hip. She suffered great pain in the part, at the inside of the thigh, and in the course of the sciatic nerve. She was lying across her bed with the affected limb supported by a stool, the toe and foot being very much everted, and the heel resting below the angle of the opposite side. On placing her in the extended posi-

tion, the limb seemed little shorter than the other, was moveable in every direction as far as it could be tried, on account of the extreme pain it occasioned. The upper part of the thigh or hip was swelled, and a derangement of the trochanter could be distinguished, but the nature of it could not be distinctly ascertained ; a crepitus was not discoverable. The injury was declared to be a fracture exterior to the capsular ligament, but, after the first day of treatment, the great toe turned inwards, resting against the toe of the opposite side, and continued to do so for several weeks, giving rise to a great deal of annoyance on my part, and several subsequent examinations, from the fear of having misunderstood what appeared at first to be a well-marked case. This lady can now, after an interval of eighteen months, walk with the help of two sticks, the limb is little shortened, and the foot is in its natural position.

Sarah Gibson, aged 90, fell, on the 9th of January, from a high stool on which she was sitting, upon the left hip, and being a heavy woman suffered considerable injury. I saw her two days afterwards with Mr. Dillon of Judd Street, and found the marks of a considerable contusion having been sustained by the part, which was very painful and swelled. The limb was rather more than half an inch shorter than the other, and the great toe turned inwards, as in the preceding case, in a manner sufficiently marked, although not quite so

decidedly as in a case of dislocation. The limb was moveable in every direction, but these motions were attended by considerable pain, and it could be easily extended to the same length as the other. No crepitus could be distinguished. The patient died on the 22d February, forty-four days after the accident, and on dissection a fracture was discovered external to the capsular ligament. The little trochanter was broken off, and with it the attachment of the psoas and iliacus muscles. The head and neck of the femur were separated from the shaft by a diagonal fracture, extending from the upper and outer part of the trochanter major to the trochanter minor, so as to leave the insertions of the pyriformis, gemellus, obturator externus and internus, and quadratus, with the head and neck of the bone. The glutæus medius formed a bond of union at the upper part of the trochanter major, between the broken pieces, retaining them in contact. The capsular ligament was not injured, and no steps whatever appeared to have been commenced to repair the mischief which had been committed. The great age of this person, and the trifling nature of the accident giving rise to so serious a fracture external to the capsular ligament, deserve remark.

In the dead body and when muscular power is extinct, the toes turn outwards, from the weight of the foot and limb preponderating in that direction. If the living body be placed on the back,

in the extended position, but in a state of quiescence, the same thing takes place, the weight of the limb being greatly assisted by the rotators of the thigh outwards, viz. the pyriformis, the gemellus, the obturator internus and externus, and the quadratus. Any kind of fracture, admitting of displacement, which can happen within the insertion of these muscles, will have the effect of increasing this eversion, as it diminishes the resistance to the contractile power of these muscles, which, stimulated to action by the injury, readily overcomes that of their antagonists, and particularly of the tensor vaginæ femoris, the glutæus minimus, and part of the glutæus medius.

When the fracture has taken place in such a manner as to be external to the insertion of these rotators outwards, yet sufficiently within the insertion of the glutæus medius and minimus, so as not to deprive them of their due action (as in the case of Sarah Gibson), the toe will be turned inwards, and must always be so; or remain without any alteration of position, according to certain variations in the inclination of the fracture affecting the power of these muscles. The effect which the breaking off the little trochanter, together with the attachment of the psoas and iliacus muscles, had on the position of the limb, must have been rather to assist the inversion of the toe than otherwise, but whether it be an essential part of the accident is to be determined by future observation.

When the thigh is broken immediately below the little trochanter, the upper portion of bone is carried outwards and upwards, in a manner deserving of particular attention. The power of the rotators outwards being infinitely greater than that of the rotators inwards, which can now act, viz. the glutæus medius and minimus, the broken extremity of bone would be pointed directly outwards, if it were not modified by the action of the psoas and iliacus, partly assisted by the pectinalis, which cause it to take rather a diagonal direction upwards, or forwards and outwards, constituting then, in every case, a rising and displaced extremity of bone which is the first step towards the shortening of the limb ; a circumstance which has always been, although I conceive erroneously, attributed to the action of the long muscles inserted into the lower portion of the fractured bone. Those who have been conversant with amputation at the thigh at this part, will acknowledge the correctness of the remark, and do not forget, in placing the fractured limb in position, that if it be convenient to follow the movement caused by the psoas and iliacus, it is not less necessary to attend to that which has been effected by the rotators outwards.

When the thigh-bone is broken in any part below the little trochanter, the toes are turned outwards, provided the patient is placed in the extended position ; which arises principally from the weight of the limb, increased by that of the bed-

clothes, and from the different effect produced by muscular action in fracture, to what takes place when the bone is in a state of integrity. The slight degree of influence the tensor vaginae femoris can exert as a rotator inwards, is counteracted and invariably overcome. The long muscles and the adductor have lost the point d'appui and centre of motion afforded by the head of the femur, whilst the weight of the foot, at the extremity of the long lever of the leg remains, rather assist than retard, in the commencement of their action, the eversion of the fractured portion of the limb.

The inferences to be drawn from these observations, are,

1st. That whilst the eversion of the foot is characteristic of fracture, its absence does not indicate the non-existence of fracture.

2d. That the inversion of the foot is equally characteristic of fracture as of dislocation, and is only distinguishable, with reference to these two different states, by comparison, or a due estimate of the degree of inversion.

In the dislocation upwards and forwards, or on the dorsum ilii, the inversion of the foot is complete, the great toe is turned inwards, and rests on the instep of the opposite foot, being the first

or greatest degree of inversion. The limb is generally two inches shorter than the other.

In the dislocation backwards into the ischiatic notch, the inversion of the foot is decidedly marked, but is not so complete as in the preceding case. The knee and great toe turn in, the latter resting against the ball of the great toe of the opposite foot, and not admitting of rotation outwards. The limb is but little shortened, yet cannot be lengthened without great force.

In fracture the inversion of the foot is less complete, the great toe merely turns to the opposite one, and sometimes scarcely does this; the limb is but little shortened, is easily everted, readily moved in almost every direction, although not without pain, and is restored to its proper length on the application of a very moderate extension. This constitutes the third degree of inversion.

3d. That inversion of the foot does not take place in fracture within the capsular ligament, and that this symptom is rather diagnostic of a fracture through the trochanter major, a portion of it being continuous with the shaft of the bone.

The shortening of the limb, both in dislocations and fracture, is a subject which has not only met with great attention, but has given rise to considerable discussion. This appears to me to have

arisen, rather from a misunderstanding, than from any real difference of opinion ; from not distinguishing between the symptoms which may be called immediate, and those which are consecutive ; and from not considering the positive nature of the accident itself, which sometimes does not allow of any displacement of parts, although it will not admit of the accomplishment of their usual motions. Instances are recorded in which the patient walked several steps after the accident ; and Dr. Colles, in the 2d volume of the Dublin Hospital Reports, has given the dissection of three cases, in which no displacement could have taken place, as the fractures were incomplete. I have known a man walk several steps after a fall on the trochanter, then become incapable of moving the limb, although no retraction of it took place ; yet, on examination several weeks after, the deposition of bone behind the trochanter, uniting the parts, could be readily perceived. It is admitted, however, on all sides, that in relation to the retraction, as well as to the eversion of the limb, three or four hours must elapse before it assumes its most decisive character, and persons have not been wanting to assert that, in the first instance, the limb is rather elongated than shortened.

The shortening of the leg, in a recent case of fracture of the neck and upper part of the femur, that is, after the first twelve hours, will rarely exceed an inch and a half, and will seldom be found

to arrive at that, when due care is taken in the measurement of the part, by placing the patient on the back, and the two anterior superior spinous processes of the ilium on a line with each other. A diminution of the length of the limb to the extent of three or four inches, cannot, I presume, take place in a case of fracture within the capsular ligament, unless the ligament be torn through, and then only as the consequence of a long continued and unopposed action of the muscles, combined with the weight of the body on the limb. The obliquity of the pelvis, clearly demonstrated by Mr. Hunter in his lectures, forty years ago, as giving rise, in disease of the hip-joint, to a shortening of the limb, may augment the computation, if the admeasurement be not made from the anterior superior spinous process of the ilium.

The question of the greater or less shortening of the limb, with reference to the diagnosis of fracture within or without the capsular ligament, is one which does not easily admit of a satisfactory answer. By some it is asserted, that the fracture without the ligament is usually attended by a greater shortening of the limb, whilst the reverse is steadily maintained by others. This difference of opinion on an apparently mere matter of fact, would seem to imply great want of attention, but it really arises from the complicated nature of the subject; the greater or less diminution of the

length of the limb not depending, as the preceding case and dissection would show, on the circumstance of the fracture being within or without the capsular ligament, but on the precise nature of the fracture in either of these parts. If the solution of continuity of the cervix and its inverting membranes be not complete, as in some of the instances already referred to, a shortening of the limb may not take place. The same thing may occur if the bone be broken horizontally or diagonally, so that the upper portion prevents the rising of the lower ; or the shortening may only be perceived after a lapse of several days. If, on the contrary, the fracture be effected with great violence, the lower portion of bone may be driven above the upper, or the capsular ligament may be torn, and the bone pass through it ; in either of which cases, the shortening of the limb at the moment may be considerable.

If the fracture be external to the capsular ligament, but diagonally in the direction of the trochanters, the tendon of the *glutæus medius* retains, independently of the attachment of other parts, the separated portions of bone nearly in contact, and, being attached to each, prevents the material elevation of either, and there is scarcely any shortening of the limb. But if the fracture be effected with great violence, the solution of continuity being complete, and external to the capsular liga-

ment, although including as little as possible of the trochanters, there can hardly be a doubt that the diminution of the length of the limb may extend to, or even exceed two inches in the course of a few days, there being little obstacle to the muscles exerting an influence on the part nearly as powerful as in a case of dislocation upwards.

The greater or less extent of shortening of the limb, considered separately, cannot form a criterion by which the judgment can be guided as to the immediate seat of injury. As a general rule, however, founded on experience, although admitting of considerable exception, I would say, the shortening of the limb within the first forty-eight hours, is less when the fracture is external to the ligament; than when it is within it; from the circumstance of its being most frequently diagonally through the trochanter, as in the instances adduced.

A greater degree of pain, swelling, soreness, and contusion, would seem to indicate, in general, a fracture external to the ligament, rather than within it. A crepitus, or the sensation caused by the rubbing of the broken bones against each other, cannot always be distinguished, even when the limb has been drawn down to its proper length*. The change of position of the great trochanter in fracture, is frequently so trifling as

* M. Lisfranc, in a memoir published in August, 1823, on the use of the Stethoscope, says, "all difficulty vanishes before

not to be readily ascertained, and the alteration of its motion from its natural state, on rotating the knee inwards, is frequently unsatisfactory.

The mobility of the limb in fracture, and its immobility in dislocation, have, until lately, been considered diagnostic marks of these two kinds of injury. Mr. Todd mentions, however, in the 3rd volume of the Dublin Hospital Reports, that Mr. Cusack and himself had each a case of dislocation, in which the limb admitted of an extensive degree of motion; a fact which demands attention, as showing that the judgment must be formed from comparison. In a case of fracture, motion *can* be fully accomplished in every direction, although it is sometimes attended by great pain. In dislocation, motion cannot be given to the limb in every direction to the same extent, and least of all towards complete abduction. The shortened limb in dislocation cannot be restored to its proper length without the application of the force of several persons; in fracture it may be readily accomplished by the surgeon alone. In dislocation the limb once restored to its proper length, remains so; in fracture it is very soon retracted or shortened as much as before.

this instrument"; that "the crepitus is distinguished on the slightest movement of the limb, and sounds as strongly on the anterior part of the crista ilii as over the joint; it is very remarkable on the patella, and extends along the whole of the limb."