prevents the formation of viscid mucus, diminishes the swelling of enlarged bronchial glands, and initiates a reparative process, if such be yet possible, in the infiltrated connective tissue of the lungs. Although in its effect it somewhat resembles that of a warm, or rather of a Turkish bath, it is for many reasons preferable to the latter, even in the intervals between the asthmatic seizures, when alone there can be a question of substitution. To obtain, however, the full benefit it is capable of producing, pilocarpin should be used systematically. It should be injected at intervals, commensurate to the forces and to other circumstances of the patient, until the pathological changes in the lungs are perceptibly improved.

The anatomical changes in the lungs, however, being the result of a combination of causes—local irritation and a constitutional disposition—it is obvious that even this powerful remedy would fail of its effect, unless the diseased mucous membrane of the bronchi be guarded against the injuries, to which, from ignorance of the true etiological factors of asthma, it is continually exposed; just as no dyspepsia can be cured, unless there be the needful restrictions as to diet. What those etiological factors are, I shall mention as I proceed.

ON THE CHARACTERS AND MECHANISM OF THE MOST COMMON FORM OF COMMINUTED FRACTURE OF THE UPPER THIRD OF THE SHAFT OF THE FEMUR.*

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IN discussing this subject, I set aside the varieties of comminuted fracture of the trochanteric region of the femur, which occur as the result of the ordinary impacted extracapsular fracture of the neck of the bone, in which the fractures of the trochanters, and, if they occur, of the shaft, are direct consequences of the impaction of the neck, and are secondary to its fracture. Particular attention to this exclusion is essential; for I shall presently demonstrate that a fracture of the neck occurs in the injury I am discussing as a secondary lesion, and with characters quite different from the common fracture, yet very easily mistakable for it in the living.

The title of my paper excludes the simple fractures "through the trochanter major" of Cooper, the intratrochanteric fracture of Henequin, and "the simple fracture below the trochanter minor" of Cooper. I must also exclude gunshot fractures of the upper part of the femur.

I seek to establish the propositions that the most common form of comminuted fracture of the upper third of the femur is of a definite type; that the secondary fractures are due to a constant cause; and that a fracture involving the neck of the femur, external to the capsule, occurs as one of the secondary fractures or comminutions in the injury.

I am not acquainted with any, except the most superficial, allusions to the details of this injury in the standard treatises on fractures, nor do I know of any authority who offers any solution of the mechanical questions which its study suggests.

The first account of this fracture which I have been able to find is that given in the plate and accompanying text of Sandifort's *Museum Anatomicum* (plate 80, f. 1, 2, 3; Conf. sec. 4 and 288, page 207). Here is figured, with great exactness, a comminuted fracture of the upper third of the shaft of the femur, the comminutions occurring in the upper fragment, separated by fissures, which, wide below, extend upwards as narrowing clefts to the trochanters and neck. The text contains a description which, while it omits all mention of probable or known causes, puts the question of fracture of the neck beyond doubt. "Collum totum fuisse separatum a corpore ossis." A glance at the plate proves that the cause of comminution in this specimen was the intrusion of the lower fragment as a wedge into the upper. The pieces of the upper fragment are united around the lower, while the fissures extending to the neck and trochanters, widely separated below, become narrower as they pass to the base of the neck.

I come next, before examining a series of specimens, to the allusion of Malgaigne, in which he shows that he recognised some points in the detail of this injury; but which also shows, by its meagreness, that his acquaintance with it was most limited. He says, in describing fractures beneath the trochanters: "Quand la fracture est très-rapprochée du petit trochanter, elle est assez souvent comminutive, et combinée avec la

fracture extra-capsulaire." The context of this passage shows that he here separates this from ordinary fractures of the neck outside the capsule; for he devotes special chapters to that injury, and here is dealing with subtrochanteric fractures of the shaft. His statement that, when the fracture is "very close to the lesser trochanter, it is liable to comminution and to be combined with fracture of the neck", is certainly likely to mislead; for in most cases, as I shall show, the primary fracture in these injuries is rather remote from than near to the lesser trochanter. Anger, while he follows Malgaigne almost exactly in his description, furnishes, in his illustrations of subtrochanteric fractures, evidence which supports directly the views I take, both as to the essential characters of this comminuted fracture and of its relative frequency. Each of his three illustrations of comminuted subtrochanteric fracture agrees in character with the specimens I am about to submit, and with Sandifort's case, in the details of the direction of the primary fracture, in the direction of the secondary fissure, and in their extension into the cervical fracture.

1. The first of the specimens is a fracture of the upper third of the shaft of the femur, which shows distinct evidence that it had occurred some time, say a month, previously to the death of the individual from whom it was obtained. We know nothing of the life-history of the specimen. The bone has been broken most obliquely, the prime fracture extending through five inches of its length, from the middle of the anterior surface, immediately below the anterior intertrochanteric line, downward, outward, and backward to the outer side of the bone beyond the junction of the upper and centre thirds of the shaft. The lower fragment, after the prime fracture occurred, was driven into the structure of the upper, and, acting as a wedge, split it lengthwise. We can trace the secondary line of fracture upwards through the anterior face of the great trochanter to its summit, where, turning over the upper border, it passes to the depth of the digital fossa; from this it passes along and above the posterior intertrochanteric line and between the neck and lesser trochanter into the prime fracture. Thus the neck is completely detached with a small portion of the front of the shaft. But the cervical fracture has not undergone displacement. As the fracture turns over the summit of the great trochanter, a little wedge of bone is seen detached, squeezed out, as it were, by the pressure of the sides of the fracture on each other, an appearance clearly indicating that the fracturing force acted from below, as the fissures themselves indicate, for they are widest below. In this specimen I have to notice, lastly, and as most important for my purpose, that there remains a large piece of compact bone jammed in the gaping fissure, from which the secondary fractures spring. This is evidently the apex of the lower fragment, the apex of the wedge, in fact, broken off after it had split asunder the upper fragment. I have gone thus minutely into the details of this specimen, as its features are easily observed, and are of a kind which do not admit of any doubt. The remaining specimens will be seen to agree in their essential characters with it, while a reference to the plates of Sandifort and of Anger shows how closely the lines of their instances follow the same paths. This specimen belongs to Trinity College, being one of the collection of the late Professor Smith, but no record has been preserved with it.

2. The next specimen is contained in the museum of the Royal College of Surgeons, Ireland, for permission to exhibit which I am indebted to the Council of the College (Ea 569). In its details, it closely resembles that which I have just shown. The lines of its fracture are, both primary and secondary, similar. In addition, the neck has been more exactly severed from the shaft; for a fracture splits off the piece of the shaft connected to the lesser trochanter, which, in the previous specimen, retained its connection with the neck. The additional interest attaches to it, that we possess an account of the mode of occurrence of the injury. "It occurred in the infirmary of the Royal Hospital, Kilmainham, in a patient under the care of Surgeon-Major Carte. A pensioner aged 92, while reaching across a table, broke his thigh-bone. He had all the symptoms of fracture of the neck of the bone, and in about one month he died." In this short history, given in the catalogue of the museum, the important fact is clearly stated, that the injury was the result of indirect force, and that its clinical features were such as to lead to the diagnosis of extracapsular fracture: a diagnosis correct, no doubt, in part, but erroneous in so far as it implies that the fracture of the neck was of the ordinary variety. Indeed, the author of the description in the catalogue appears to have considered it to be of the ordinary variety; for he states: "Two distinct fractures were found; one of the upper third of the femur, in which there was no attempt at union, and appeared to be subsequent to an impacted fracture of the neck of the femur." My reading of the characters of the injury is the reverse of this. I see here, as in the last specimen, a primary fracture of the shaft, with secondary fracture of the upper fragment and an extracapsular fracture of the neck, all directly result-

* Read in the Section of Surgery at the Annual Meeting of the British Medical Association in Cork, August 1879.

ing from impaction, not of the neck into the trochanteric region, but of the lower fragment of the shaft into the upper. The record of a case I shall presently give shows how readily the error of diagnosis may be made in life, and how important it is to establish it.

3. My next specimen is from the collection of Trinity College. At first sight, this is a fracture of the upper third of the shaft of the femur, which chiefly attracts attention by its great obliquity and by the horrible deformity which characterises its union. The fragments cross each other at an angle of 130° ; and a firm callus unites them, the oblique point of each fragment projecting nearly two inches above and below. The upper fragment, however, shows that the lower has split it as in the two preceding specimens, and that the lines of secondary fracture are precisely the same as in the first; while the summit of the great trochanter has had a wedge-shaped piece pressed out by the compression of the sides of its fissures, exactly as in the first specimen. The primary fracture starts from the front of the bone more than an inch below the level of the previous specimen; and no impacted wedge is seen as in No. 1. Either it is concealed by callus, or more probably is absent, the lower fragment being impacted *en masse* rather than pointwise into the upper. The base of the digital fossa and the neck are traversed by a fracture which, though completely detaching the neck, has led to no displacement.

4 and 5. Ea 558 and Ea 589 of the College of Surgeons' collection exhibit similar features; only in these instances the injuries have been caused by forces which acted with greater effect than in the previous cases. The lower fragment in each has been so violently driven into and against the broken surface of the upper, that the secondary fractures have separated completely; the neck, carrying with it a splinter from the front of the shaft, has been set entirely free. In each, the same vertical fracture ascends through the great trochanter and splits it in two.

6. Ea 564 of the College of Surgeons' collection, mounted in spirit, shows similar characters; but the details are not as easily made out, in consequence of the soft parts covering the bone and in part concealing the upper fragment. To an eye familiar with these dry specimens, it is clear, however, that the fissures of the upper fragment are similar to those they present, and the result of the same kind of force.

7. Last of the series is this specimen from the Trinity College collection. It at once reminds one of Sandifort's plate. The union of the fracture is of old date and most complete; but we can readily see the lines of the primary fracture, as in all the preceding, oblique from above, and in front, downwards and outwards; the impaction of the lower into the upper; the splitting of the upper; and the lines of fracture, passing vertically through the great trochanter, then into the digital fossa and neck. This specimen alone shows a comminution of the lower fragment as well as of the upper. A long splinter has split off from the outside of the bone, extending nearly to the lower third of the shaft along its outside.

I have now given the details of the seven specimens of this injury before the meeting, and have merely to note that, with the exclusion of the forms of fracture I have noticed at starting—that is, of comminuted fractures directly secondary to fractures of the neck of the femur external to the capsule, and of gunshot comminuted fractures—they are the only examples of comminuted fracture of the upper third of the femur in our Dublin collections. The testimony of Anger's plates, drawn from the Paris museums, leads directly to the same conclusion as to this being the most common variety of comminuted fracture of the upper third of the femur. I have failed to find any exception to the rule of these specimens in such of the museums of London as I have been able to examine. There only remains for me to give the details of a case of injury of the femur which I have recently observed, which, I have no doubt, is an example of this fracture.

A strong healthy man, aged about 32, slipped in stepping from a loft piled with grain on to the rungs of a ladder which led through a trap to the floor below. Failing to grasp any support, as the piled grain offered no fixed point, he fell with his foot between the uppermost rungs of the ladder, and remained entangled. How long he hung in this position he could not tell, as he stated that he became unconscious almost as he fell. He was found, as far as we could learn, about an hour and a half after his fall, by his son, a boy of eleven years of age. The boy stated that he found his father hanging by his leg from the ladder, with his shoulders resting on the floor (the total height of the ladder was only about six feet, and the man was nearly six feet in height). After being found, he lay on an extemporised bed in the store for two nights and a day, suffering great pain, but unwilling to move or give up personal charge of the store, which was under his care. He was said to be a perfectly sober man, and to have been sober at the time of his fall. On admission to Sir P. Dun's Hospital on the day but one after his injury, I found him lying with the limb everted and shortened

an inch and three-quarters; while the thigh was greatly swollen, and distended to the knee by effusion. Traction at the foot reduced the shortening to less than an inch; but the pain of any further effort in this direction became intolerable. During reduction, the trochanter descended and rotated with the shaft of the bone, while a portion of its posterior margin appeared to be displaced backwards. An osseous tumour could be indistinctly made out in the inguinal region over the lesser trochanter; and, during the extension of the limb, crepitus could, though with difficulty, be elicited. I felt satisfied that I was dealing with an extracapsular fracture of the neck of the femur, which had become unimpacted by the complete splintering of the trochanteric region. So satisfied was I of the correctness of the diagnosis, that I wrote it in detail on the bed-card. The limb, being put up in a long splint, lay fairly well; but the patient was most intolerant of a perineal band. One point in the case struck me as most difficult to explain: the occurrence of an extracapsular fracture of the neck of the femur, with fractures of the trochanters, from a cause such as the history of the case indicated. At first, I inclined to the idea that the history was incorrect; that the man had fallen right on to his hip, but that he failed to recollect it. Only direct cross-examination of his son, some days after his admission, removed all doubt of the truth of his statement. When the swelling subsided somewhat in the thigh, after an interval of a fortnight, I detected for the first time a point of bone projecting slightly to the outside of the shaft of the femur, near the junction of the upper and middle third. This point was shaped and directed so as to leave no doubt that it was the apex of the upper fragment of a very oblique fracture of the shaft, oblique from above downwards and outwards. Viewed in connection with the series of specimens I have presented, and particularly with the second instance, in which we have a similar kind of injury and a similar error of diagnosis, I think this case valuable as helping to explain the mechanism of the injury.

I believe that this case and the specimens I have exhibited and quoted establish the fact that the commonest form of comminuted fracture of the upper third of the femur is of a definite type—namely, a primary fracture, oblique from above and in front downwards and outwards, so as to place the lowest point of the upper fragment on the outside of the bone about the junction of its upper and middle thirds, and secondary splittings of the upper fragment, which include a fracture of the neck external to the capsule; that these splittings result from the impaction of the lower fragment into or against the structure of the upper, and that the pieces of the upper fragment may undergo more or less complete dissection or may remain firmly connected; lastly, that the primary injury results from indirect violence, and it may be chiefly from muscular action; while the secondary fractures are caused by the impaction of the lower fragment into the upper, most likely by the action of the muscles of the thigh.

NOTE ON TINNITUS AURIUM.

By SAMUEL SEXTON, M.D., New York.

ALTHOUGH not a disease in itself, tinnitus aurium is frequently a most distressing symptom of some aural affections, and not unfrequently it is the only one of which the patient is cognisant.

Those ringing or buzzing sounds, synonymous with tinnitus aurium, which are heard in the head or ears under certain circumstances, arise usually from the busy circulation in the immediate neighbourhood of the auditory conductive apparatus; and, in addition to these, but heard more rarely, are also the motions of the heart, the respiratory act, the throbbing of the carotid arteries in their bony canals, and the friction of the ossicula themselves in some anomalous conditions. Moreover, the phenomena which arise from these causes are subject to an increase by the existence of aural hyperemia, chronic and acute inflammations of the ear, flushings affecting this region, probably due to vaso-motor influences, the excitement of alcohol, quinine, and anæsthetics, and straining at stool or labour.

When tinnitus, however, arises from these subsidiary causes, it is never permanent until certain pathological changes, to be presently mentioned, have occurred in the conductive apparatus.

I shall not include among the enumerated varieties of tinnitus aurium the phenomena of autophony, sounds arising from supposed contractions of the tensor tympani muscle, or from foreign bodies present in the external auditory meatus; although from these two latter causes the most distressing kind of tinnitus results.

Strictly, therefore, sounds of an intracranial origin, or those, in other words, impinging on the drum-head, or ossicles, from within, are concerned in tinnitus aurium. The circulation of the blood here referred to, especially when abnormally active, may set in motion waves of sound that can, under certain circumstances, be heard by the patient