

CHAPTER XXIX.

FRACTURES OF THE FEMUR.

Development of Femur.—The femur is formed from five centres of ossification: namely, one for the shaft, commencing at about the fifth week of foetal life; one for the lower end, including the condyles, commencing at the ninth month of foetal life; one for the head, commencing at the end of the first year after birth; one for the great trochanter, commencing during the fourth year; and one for the lesser trochanter, commencing between the thirteenth and fourteenth years. None of these epiphyses are joined to the shaft until after puberty, but consolidation is generally completed at the twentieth year. The order in which union occurs is the reverse of the order in which ossification commences, the lower epiphysis being the first to exhibit traces of ossification, and the last to unite.

FIG. 127.



Development of femur. (From Gray.)

Division of Fractures.—Of 236 fractures of the femur, not including gunshot, which have been recorded by me, 114 belong to the upper third, 86 to the middle third, and 36 to the lower third; or, if we confine our analysis to the shaft alone, 80 belong to the upper third, 80 to the middle, and 36 to the lower.

(I have personally examined many more cases of fracture of the femur than are enumerated above, but these include all which have been subjected to this species of analysis.)

Dr. Frederick E. Hyde, in his analysis of 322 cases, in Bellevue Hospital, states that 95 occurred in the upper third (including fractures of the neck); 169 in the middle third, and 38 in the lower third (including the condyles). In the 20 remaining cases the point of fracture is not stated.

To give a summary of these valuable tables more in detail, 61 belonged to the neck, of which 14 are stated in the records to be intracapsular, 17 extracapsular, and thirty undetermined. Thirty-four were in the upper third of the shaft; 169 in the middle third, and 31 in the lower; the exact point of fracture of the shaft being undetermined in 20; 7 fractures belonged to the condyles.¹

The femur constitutes, therefore, a striking exception to the rule which my observations have established, that in the case of the long

¹ Hyde, Analysis of 322 cases of Fracture of the Femur, at Bellevue Hospital, from 1865 to 1873, inclusive. Medical Record, 1875.

bones the lower third is most often the seat of fracture. The shaft of the femur is most often broken in the middle third, and generally near the upper end of this third; that is to say, above its middle.

§ 1. Neck of the Femur.

Eighty-four of the whole number recorded and analyzed by myself were fractures of the neck, either intra- or extracapsular. The youngest of these patients, excepting one case of supposed epiphyseal separation, was twenty-nine years, the oldest eighty-four; forty-five were males and thirty-nine females. Nearly all were simple. Forty-two were believed to be without the capsule, and thirty were believed to be within; the remainder were undetermined.

We have already given the number of fractures of the neck, both intra- and extracapsular, reported in Dr. Hyde's tables. Having reference to age, 19 years was the youngest, and 85 the oldest; 20 years and under presented two cases; from 20 years to 30, five cases; from 30 to 40, nine; from 40 to 50, eight; from 50 to 60, fourteen; from 60 to 70, fifteen; from 70 to 80, seven; from 80 to 90, one. Of the whole number, thirty-nine were males, and twenty-two females; none of the fractures were compound; fourteen are recorded as of the right leg; seventeen of the left; and thirty are undetermined. Fourteen were diagnosed as intracapsular, and seventeen as extracapsular, thirty being undetermined.

Surgeons have differed in their opinions as to the relative frequency of fractures of the neck of the femur within or without the capsule. This has arisen, no doubt, in part from the difficulty and probable inaccuracy of many of the diagnoses. Malgaigne, who has adopted a mode of deciding this question which, it must be conceded, is much less liable to error than simple clinical observation, namely, an examination of cabinet specimens, finds in four large collections sixty-one intracapsular fractures, and only forty-two extracapsular. So that, according to his observations, they stand in the proportion of about three to two; the intracapsular being the most common. On the contrary, Nélaton believes that extracapsular fractures are much the most common, and Bonnet, of Lyons, affirms that they constitute the immense majority. Bonnet made four dissections, and in each case he found the fracture extracapsular. This testimony, so far as it goes, is positive, but the number is not sufficient to establish anything more than a probability in favor of the greater frequency of extracapsular fractures.

Clinical observations are in this case too uncertain to be made available in so nice a question. Cabinet specimens may have been collected for a special purpose, and this is well known to have been the fact with the celebrated Dupuytren collection, the specimens in which constitute nearly one-third of the whole number referred to by Malgaigne. I allude to the effort which was made while the controversy was pending between Dupuytren and Sir Astley Cooper as to the probability of bony union in intracapsular fractures, to accumulate cabinet specimens of this fracture; and which effort extended itself, no doubt, both to London and Dublin, from which two latter sources Malgaigne has gathered the remainder of

his figures. In Dr. Mütter's collection, at Philadelphia, I think there are only three examples of intracapsular fracture, to seven extracapsular.

Dr. Reuben D. Mussey, of Cincinnati, has in his cabinet twelve examples of fractures of the neck of the femur without the capsule, and only ten within.

We ought, therefore, to regard the question of relative frequency as still undetermined. Nevertheless, it is my opinion that the extracapsular fracture is very much the most frequent.

(a) *Neck of the Femur, within the Capsule. (Intracapsular.)*

Causes.—In no other fractures do the predisposing causes play so important a part as in fractures of the neck of the femur, and this whether within or without the capsule; indeed, experience has shown that without the concurrence of those pathological changes which usually accompany old age, these fractures can scarcely occur.

Dr. Merkel considers the fragility of the neck, within the capsule, in old persons, due to the absorption of that process of the cortical substance which arises from about the level of the trochanter minor, and ends close under the head of the bone, at the anterior part of the neck; thus occupying the situation where the greatest pressure is made in the erect position. This process he calls the "calcar femorale." In newly born children it is absent; it appears when they begin to walk, attains its greatest development in middle age, and completely disappears in old persons.¹ Dr. Merkel says that no account has hitherto been given of this process; but this statement is scarcely correct, inasmuch as it has been both described and represented by various surgical and anatomical writers for a long time (see Fig. 131 of this volume). The fact of its absorption in advanced life is, however, an original observation.

Sir Astley Cooper thought that the majority of fractures of the neck after the fiftieth year were intracapsular; but Robert Smith has given us the ages of sixty persons having fractures of the neck of the femur, and the average age of thirty-two in whom the fractures were within the capsule, is sixty-two years, while the average age of twenty-eight in whom the fractures were extracapsular, is sixty-eight years. Malgaigne has referred to this testimony in proof of the inaccuracy of the opinion held by Sir Astley Cooper; but I trust it will not be regarded impertinent or hypercritical for us to inquire how Mr. Smith became possessed of the ages of all these persons from whom these specimens were obtained; for more than half of the whole number, that is, just thirty-two, have their ages set down in round decimals, such as 50, 60, 70, etc., and it would be easy to show, by the inevitable law of chances, that this could not possibly be a true statement. If Mr. Smith does not pretend to have given the ages with accuracy, but only to have arrived as near to the truth as his sources of information would permit, then I protest that these tables do not constitute proper evidence in relation to this point; and until better evidence is furnished I shall continue to think, with Sir Astley Cooper, that fractures within the capsule belong generally to an

¹ Merkel, Am. Journ. Med. Sci., Jan. 1874.

older class of subjects than fractures without the capsule. This opinion, confirmed by my own experience, does not, however, as Malgaigne seems to think, imply that fractures within the capsule may not occasionally occur in persons much younger than the average limit, namely, under fifty years.

Dr. Hyde's tables present two cases under 50 years, and twelve at or over 50. Of the two under 50 years, one was 48 years of age, and the other 39. Of course, the reader will make what allowance he shall think proper as to the accuracy of these diagnoses, inasmuch as such diagnoses are notoriously difficult, and often inaccurate.

It is also believed that intracapsular fractures are more frequent in women than in men. In Dr. Hyde's tables there are ten females and four males.

The position of the neck of the femur, and the great thickness of the muscular coverings, render its fracture from a direct blow a very rare circumstance; indeed, it can only happen as the result of gunshot accidents, or other similar penetrating injuries.

It is broken, therefore, usually by indirect blows, such as a fall upon the bottom of the foot, upon the knee, or upon the trochanter major; or by muscular action alone, as has sometimes happened with very old people, who, in walking across the floor, have tripped upon the carpet, breaking the bone in the effort to sustain themselves. We must not always infer, however, because the patient has tripped, that the bone was broken by muscular action; since it is quite as likely that the fall, consequent upon the tripping, has occasioned the fracture; and we ought in such cases to make a careful examination of the hip over the trochanter to ascertain whether it has been bruised, and to interrogate the patient as to the manner of the fall.

Riedinger¹ thought he had met with an *impacted* fracture of the neck caused by muscular action alone, in the case of a man 60 years old, who, falling upon the left side, received an injury upon his right side. That an impacted fracture should have been thus produced seems to me scarcely credible.

Rodet has attempted to show by a series of experiments made upon the dead subject, and by other observations, that the direction in which the force had acted will determine the situation and direction of the fracture. Thus he maintains that when the person has fallen upon the foot or knee, the fracture will be intracapsular and oblique; that if the front of the trochanter receives the blow, the fracture will be intracapsular also, but transverse; if the back of the trochanter is struck, the fracture will be partly intra- and partly extracapsular; and if the person falls directly upon the side, or receives the blow fairly upon the outer side of the trochanter, the fracture will be entirely without the capsule.²

Without intending to give my unqualified assent to these propositions so ingeniously maintained by Rodet, I am, nevertheless, prepared to admit their general accuracy; and especially has my experience led me to believe that falls upon the feet or knees in most cases produce intracapsular fractures, and that falls upon the outside of the hip, or upon the

¹ Riedinger, Cent für Chir., 1875, No. 32, p. 817.

² L'Expérience, March 14, 1844.

great trochanter, generally produce extracapsular fractures. There are, however, frequent exceptions to this latter proposition. Especially have I observed that in persons over fifty years of age, or somewhat advanced in life, a fall upon the trochanter has caused an intracapsular fracture. The following case, verified by an autopsy, is conclusive:

A man, 75 years of age, was received at Bellevue, March 24, 1875. He stated that on the same day he had slipped and fallen upon the sidewalk, striking with great force upon the trochanter. The house surgeon Dr. E. A. Lewis, examined the limb immediately on admission, and

FIG. 128.



Transverse intracapsular fracture.

FIG. 129.



Intracapsular fracture caused by a fall upon the trochanter.

diagnosed an intracapsular fracture. I saw him during the day and confirmed the diagnosis. He was feeble, but not suffering much, apparently, from shock or from pain. Food and stimulants were administered, but no surgical treatment was adopted. On the following morning he was found to be sinking, and he died before night. After death Drs. Dennis and Isham repeated the manual examination, and found the evidences of an intracapsular fracture very marked, including a slight crepitus and rotation of the trochanter upon a short axis. The accompanying woodcut, taken from the specimen now in the possession of Dr. Dennis, shows that the fracture was close to the head, and, of course, entirely intracapsular. It was not impacted, and no absorption of the neck had taken place.

Pathology.—I have already, when speaking of partial fractures, expressed my conviction of the possibility of a partial fracture, or a fissure of the neck of the femur, and I have referred to the case reported by Dr. J. B. S. Jackson, of Boston, as having determined this question beyond all possibility of a doubt; yet its occurrence must be regarded as an exceedingly rare, and, we may say, improbable event.

It is much more common to meet with examples of complete fractures of the neck both within and without the capsule, unaccompanied with a

rupture of either the periosteum or the reflected capsule.* Such was the fact in eight cases examined by Colles; in three of which, however, he believed the fracture not to have been complete, but Robert Smith thinks they were all of them examples of complete fracture.¹ Stanley has also related a case of complete separation of the bone unaccompanied with laceration or injury of either the periosteum or capsular ligament. This was in the person of a man aged sixty years, who had been knocked down in the street. On being admitted into St. Bartholomew's Hospital, shortly after the injury, he complained of pain in the hip, but there was neither shortening nor eversion of the limb, and its several motions could be executed with freedom and power. A fracture was not suspected; but five weeks after this he died of inflammation of the bowels. The dissection showed a fracture extending through the neck, accompanied with a slight bloody effusion, but no displacement of the fragments or laceration of the soft parts.²

In other examples the bone is not only broken, but displaced to such an extent that the capsule is completely torn in two. But in a large majority of cases both the capsule and the periosteum are only partially torn asunder.

The intracapsular fracture is generally somewhat oblique, and its direction is usually from above downwards, and from within outwards. Sometimes its direction is such as to include a portion of the head; occasionally it is quite transverse. Occasionally the intracapsular fracture is impacted. In one example of an old fracture I have seen the ends dovetailed upon each other, the fracture having a double obliquity, and not admitting of displacement.

There may occur also another species of impaction, the lower portion of the neck entering the cancellous structure of the head, while its upper portion rides upon the articular surface, a circumstance which is well illustrated by the annexed woodcut (Fig. 130), copied by Mr. Smith from a specimen in the Dupuytren Museum at Paris; or the impaction may occur without any degree of either upward or lateral displacement.

Separation of the Epiphysis.—Mr. Liston says: "Even in children separation of the head of the bone may, on good grounds, be supposed occasionally to take place;"³ by which we understand him to mean that a separation of the epiphysis which completes the head of the femur may occur. Mr. South relates a case in a boy ten years of age, who had fallen out of a first-floor window upon his left hip. The limb was slightly turned out, but scarcely at all shortened. The thigh could be readily moved in any direction without much pain, but on bending the limb and rotating it outwards, a very distinct dummy

FIG. 130.



Impacted intracapsular fracture. (Smith.)

¹ Colles, Dublin Hosp. Rep., vol. ii. p. 339.

² Stanley, Med.-Chir. Trans., vol. xiii.

³ Liston, Elements of Surgery, Phila. ed., 1837, p. 480.

sensation was frequently felt, apparently within the joint, as if one articular surface had slipped off another. This was regarded by Mr. South and Mr. Green as an example of epiphyseal separation, and he was placed upon a double-inclined plane, but he felt so little inconvenience from it that he several times left his bed and walked about. We have no information as to the result or as to the further progress of the case.¹ According to Erichsen, M. Stanley reported a case in a lad of 18 years.

A girl, *æ*t. 18, was brought before Dr. Parker, of New York, at his surgical clinic, Nov. 1850, who had been injured by a fall upon a curbstone, when eleven years old. The accident was followed by suppuration and a fistulous discharge, from which, however, she finally recovered, but with the foot everted, and a shortening of one inch and a half. "Flexion and rotation of the joint occasioned no inconvenience." Dr. Parker thought this circumstance alone sufficient to distinguish it from hip disease, in which ankylosis is the termination.²

At a meeting of the Kappa Lambda Society, held in New York, March 25, 1840, Dr. Post mentioned a case which he had seen in a girl sixteen years old, who, in taking a slight step with a child in her arms, made a false movement, and feeling something give way, she was obliged to lean against a wall. Dr. Post saw her the next day, when he found the affected limb one inch shorter than the opposite one, movable, the toes turned outwards, no swelling, some slight pain at the upper part of the thigh. The trochanter major moved with the shaft. There was also crepitus. From the age of the patient, and the slight amount of violence by which the injury was produced, Dr. Post thought a separation of the epiphysis of the head had taken place. The extending apparatus was applied, but the limb remained from a quarter to half an inch shorter than its fellow.³

Aug. 14, 1865, Andrew Leroy, *æ*t. 15, in attempting to escape from the House of Refuge, fell from the fourth story. On the following morning he was admitted into my wards, at Bellevue Hospital. I found his right thigh shortened three-quarters of an inch, and slightly abducted; toes everted. Placing him under the influence of chloroform, we detected a feeble crepitus in the vicinity of the joint. It was unlike the crepitus of broken bone. With fifteen pounds of extension we were able to overcome the shortening entirely, and to put the limb in position. This was maintained with Buck's apparatus. At the end of two weeks, however, it was ascertained to be shortened half an inch. Four more pounds were then added. At the close of my term of service I lost sight of the boy, and have not been able therefore to verify my diagnosis; but I believe it to have been a separation of the upper epiphysis.

Dr. H. Wardner, of Cairo, Ill., has reported a case of "intracapsular fracture of the neck of the femur" in a boy fourteen years of age.⁴ He does not state that he regarded it as epiphyseal, but his remarks lead us

¹ South, note to Chelius's Surgery, vol. i. p. 619.

² Parker, Amer. Med. Gazette, vol. i. p. 342, Nov. 30, 1850.

³ Post, New York Journ. Med., vol. iii. p. 190, July, 1840.

⁴ Wardner, a paper read before the Southern Illinois Med. Assoc. at Arena, Illinois, June, 1877.

to suppose that he did. The lad had hurt himself by jumping and alighting upon his feet, this being followed by a lameness in the hip-joint and some difficulty in walking. Twenty-four days later, on "attempting to get out of bed, one foot became entangled in the bedclothing, and this led him to exert forcibly the adductor muscles, when he suddenly cried out with pain, saying his hip had gone out of place, and he found himself unable to rise.

Dr. H. S. Smith, of Blandville, and Dr. Swett, being called, thought it a dislocation, and under chloroform attempted reduction, but unsuccessfully. Dr. Smith has since informed me by letter that he did not at that time detect crepitus. The day following Dr. Wardner was called, and in his report of the case he says the limb was shortened one or two inches, and was lying nearly parallel with the other limb, with the toes rotated.

Dr. W. detected a "dull crepitation," and, regarding it as a fracture, made extension, and maintained it for several weeks, or until the cure was effected, when "the injured limb was of the same length as the sound one, and no deformity of any kind was detected." By a letter, however, dated February 2, 1875, thirteen months after the accident, from Dr. Smith, I am informed that there was then a shortening of one inch, and that the published statement of Dr. — was derived from the father through Dr. Smith, and that he now found it to be incorrect.

Dr. Smith farther states, "The motions of the hip-joint are limited to about one-half the normal extent, the muscles, leg, etc., of that side of the pelvis are considerably shrunken, he walks a little lame, and complains of weakness of the limb." . . . "I think there can be no doubt that the neck of the femur was fractured."

It will be noticed that the first measurement was so indefinite that Dr. Wardner could only declare it "one or two inches" shortened; nor am I assured by Dr. Smith that the shortening observed by him was determined by measurement, although I presume it was.

Mr. Hutchinson¹ mentions three cases, and Spillman² refers to one observed by Sabatier, and another by Verduc.

Only one case has been established by an autopsy. The subject of this accident, who was 15 years old, had been run over by a wagon. The limb was shortened and everted. The patient was unable to move the limb. He died in a few hours. There was found in the autopsic examination, complete separation of the epiphysis, which was attached to the neck by a strip of periosteum two millimetres in breadth. The capsule was torn at its inner portion.³

Dr. Stetter⁴ has reported a case observed in a child 14 years old, and supposed by Professor Schönborn, of Königsberg, to be caused by muscular action. The lad having slipped, threw himself backwards to save himself, and fell on his left side. He experienced violent pain on the right side, and was unable to run. The right limb was found shortened three centimetres, and strongly everted. No crepitus could be

¹ Hutchinson, Med. Times and Gaz., 1866, p. 195.

² Spillman, Dic. Encyc. Art. Cuisse, p. 228.

³ Bullet. de la Société Anat., 1867, p. 283.

⁴ G. Stetter, Centralblatt für Chir., 1877, No. 36, S. 561.

detected, but there was swelling in the region of the right trochanter, and the motion of the limb produced by flexion caused intense pain.

Symptoms.—(We are speaking now only of true fractures, having as yet no means of determining absolutely the symptoms of epiphyseal separations.) Whether the limb will be shortened or not must depend upon whether the fragments are impacted, or have become displaced in the direction of the axis of the shaft of the femur. It is well established that in this fracture the broken ends frequently remain in contact for several hours or days, or until the gradual contraction of the muscles or the weight of the body upon the limb occasions a separation, and that consequently there is often at first no appreciable or actual shortening of the limb. To determine, however, its existence, it is not sufficient to lay the patient upon his back and place the limbs beside each other; we ought also to measure carefully with a tape-line from the pelvis to the leg or foot, and from various other points, until we have placed this question beyond a doubt.

If shortening occurs, it may vary from one-quarter of an inch to two inches, or even more; but this extreme shortening is not reached usually, except after the lapse of several weeks or months, when the ligaments have gradually given way under the weight of the body in walking, or not until the neck has undergone a partial or almost complete absorption.

Sir Astley Cooper has stated that a shortening to this degree may occur at once; but Boyer, Earle, and others, doubt the accuracy of this opinion, and Robert Smith declares that he does not think the capsule would admit of such an amount of immediate displacement, unless it were extensively torn, an occurrence which he thinks very rare indeed.

With this qualification, the opinion of Mr. Smith does not differ from that entertained by Sir Astley, who only admits its possibility as a rare event; in a large majority of cases the shortening does not at first exceed one inch. Of the methods of measurement, I shall speak hereafter, in connection with fractures of the shaft.

Crepitus, unlike shortening, is generally absent when the displacement of the fragments is complete; but under no circumstances is it easily developed. When the fragments remain in apposition, and the femur is rotated for the purpose of moving the broken surfaces upon each other, the small acetabular fragment, resting in a smooth cup-like socket, and holding upon the opposite fragment by denticulations or by the untorn periosteum, or capsule, glides about in obedience to the motions of this latter, and no crepitus can be produced. Nor is the difficulty rendered less by pressing firmly upon the trochanter, as some surgeons have recommended, since, while this pressure tends, no doubt, to fasten the upper fragment in the acetabulum, it tends much more to fasten the broken ends together, and thus defeats the purpose in view. When, on the other hand, the fragments have become completely separated, it is almost impossible to bring them again into contact. The limb may, perhaps, be easily brought down to the same length with the other, but it must by no means be inferred that, consequently, the broken ends are in apposition. It is almost certain, indeed, that in its progress downwards the trochanteric fragment has caught upon the acetabular fragment, and pushed its floating and broken extremity downwards before it. Under these circumstances, the discovery of a crepitus must be accidental, and

is scarcely to be looked for. Sometimes, however, we may recognize a sound not unlike crepitus, but less harsh, produced by the friction of the trochanteric fragment against the rim of the acetabulum or dorsum of the ilium.

One thing we ought never to forget, namely, that by extraordinary efforts to obtain a crepitus we may lacerate the capsule, or produce a displacement of the fragments which we never can remedy, and which, without such unwarrantable manipulation, might never have occurred.

Eversion of the foot is almost uniformly present in some degree, taking place immediately or more gradually, in proportion as the fragments become displaced, and the external rotators contract. The opposite condition, or an inversion of the foot, is occasionally present, and sometimes also the foot is neither turned in nor out, but the toes point directly forwards. In sixty cases of fracture of the neck seen by Cloquet the foot was never turned in, and Boyer never met with such an example in all of his immense experience; but Langstaff, Guthrie, Stanley, Cruveilhier, Bigelow, Conklin,¹ have each seen one example, and Robert Smith has seen two.² I have myself seen one.

The explanation of the fact that the foot is usually everted is not difficult. In the case of an intracapsular fracture it is probably due, first, to the relative friability of the laminated or cortical structure on the posterior aspect of the neck, in consequence of which this portion gives way more readily than the cortical structure on the anterior aspect; second, to the natural form and position of the foot and leg, which incline them to fall outwards by their own weight; and, third, to the powerful action of the external rotators, which are so feebly antagonized upon the opposite side.

In the case of an extracapsular impacted fracture, in addition to the second and third causes assigned as influencing the position of the limb in intracapsular fractures, there are other special causes. The cortical lamina on the posterior aspect of the neck, everywhere more frail than upon the anterior aspect, becomes greatly weakened as it approaches the trochanter by dividing itself into two laminæ, one of which penetrates toward the centre of the bone, and the other, the thinnest of the two, being scarcely thicker than a sheet of paper, forming the wall of the bone as it becomes continuous with the trochanter. This delicate papery wall easily gives way under the application of force, while the anterior wall yields only partially, constituting thus a sort of hinge upon which the rotation of the thigh is performed. It is probable, also, as suggested by M. Robert, that the angle at which the external surface of the trochanter unites with the neck increases the tendency to fracture and impaction posteriorly.

An explanation of the fact already stated, that in rare and exceptional cases the limb is inverted or the toes are permitted to point directly forwards, has been thought to be more difficult. Dr. Bigelow has had an opportunity of examining a specimen taken from an old woman in the dissecting-room, and he concludes that the inversion was due to the ex-

¹ W. J. Conklin, Ohio, Columbus Med. Journ., Nov. 1882.

² Robert Smith, op. cit., p. 26. A. Cooper by B. Cooper, op. cit., p. 151, note

tent of the comminution, which had separated the walls of the shaft so as to receive in the interval the whole neck, instead of the posterior wall only, as commonly occurs. Dr. Robert Smith, of Dublin, cites a similar case verified by the autopsy; and Dr. Bigelow remarks that the specimen numbered 248 in the Mütter museum, at Philadelphia, presents the same kind of impaction without either inversion or eversion.

Fracture of the neck of the femur within the capsule is not usually attended with much pain when the patient is at rest, but any attempt to move the limb produces intense suffering, and especially when an attempt is made to rotate the limb inwards, or to carry it upwards and inwards.

Occasionally, also, during the first few days or hours after the fracture, a spasmodic action of the muscles compels the patient to cry out

FIG. 131.



Horizontal section of neck of femur.
(From Bigelow.)

FIG. 132.



Extracapsular fracture, with inversion.
(From Bigelow.)

from the severity of the pain which it produces. At first the sufferer is unable to indicate clearly the seat of this pain, or, perhaps, it is diffused and uncertain in its position; but after a time he is able to refer it chiefly to the region of the groin, opposite the neck of the bone, or to near the point of attachment of the psoas magnus and iliacus internus.

There is also usually in this region a great degree of tenderness and an unusual fulness.

If now the limb be seized, and extension gradually but firmly applied, it will be soon made of the same length with the opposite thigh; but, the moment the extension is discontinued, the shortening and eversion will recur, accompanied with pain, and perhaps crepitus.

The trochanter major is less prominent than upon the opposite side, and if eversion of the limb exists, the trochanter may be felt indistinctly upwards and backwards from its usual position. The patient having been placed under the influence of an anæsthetic, we may prosecute the investigation still farther, and by rotating the limb inwards and outwards as far as it will admit, we shall notice that the trochanter describes the arc of a smaller circle than in the opposite limb, or that the length of its radius has been shortened. It ought to be said at once, however, that this amount of manipulation is often injurious, and seldom proper.

The patient is generally unable to move his limb, or to bear the least weight upon it; but many examples are on record of persons who walked some distance after the fracture had taken place, the capsule, and perhaps also the periosteum, not being torn, and consequently the fragments not being displaced; or, possibly, it was at first an impacted fracture.

On the 6th of May, 1875, Mrs. R., of Brooklyn, was ascending a flight of steps when her limb suddenly gave way under her, in consequence of an intracapsular fracture. Mrs. R. was 78 years of age, large, and rather fat. For several years she had suffered from rheumatism of the right leg, which compelled her, in walking, to bear her weight chiefly on the left, and it was this limb which gave way. She was assisted to her feet, and with the aid of her daughter ascended another flight of steps, bearing some weight on the broken leg. On the following day she got out of bed alone, and, unaided, walked a few steps, moving her limb very carefully. On the same day I saw her and found her in bed, the limb shortened half an inch and slightly everted. The head of the femur moved with the trochanter and without causing crepitus or pain. There was very little tenderness about the hip or groin; no swelling, and only a heavy, dull aching pain in the limb. The age, the manner of the accident, and the shortening of the limb were the only signs of fracture, but these were sufficient.

Finally, after having examined the patient as well as we are able to do, in the recumbent posture, if any doubt remains, and it is found practicable for the patient to be elevated upon his sound foot, this should be done. The broken limb can now be examined thoroughly on all sides, and a more accurate opinion formed of the amount of shortening and eversion. It will be especially noticed that if the weight of the body is allowed to rest upon the limb, in most cases it produces insupportable pain.

M. Maisonneuve has lately suggested and practised the following method of diagnosis in certain doubtful cases: Lay the patient flat on his belly, and then bring the suspected thigh into extreme extension backwards. If it is not broken, the neck will strike against the posterior lip of the acetabulum and the progress of the thigh in this direction will be arrested. If it is broken, it can be carried backwards

much farther.¹ Of this method as a means of diagnosis, it seems proper to say that, if the fragments have slid past each other and the limb is shortened, it is unnecessary; and if they are still in apposition, it will be pretty certain to cause displacement, and thus do irreparable mischief.

Prognosis.—The question of bony union after a complete fracture of the neck of the femur within the capsule has occupied the attention of the ablest surgeons and pathologists for a long period; and while great differences of opinion have been expressed as to the probability of the occurrence, and as to the value of the testimony on the one side or the other, very few have ventured to deny its possibility.

Among these latter are found, however, the distinguished names of Cruveilhier Colles, Lonsdale, and Bransby Cooper. It has been repeatedly affirmed, also, that Sir Astley Cooper taught the same doctrine, but with how much show of reason, the following paragraphs from his own pen will determine:

“In the examinations which I have made of transverse fractures of the cervix femoris, entirely within the capsular ligament, I have only met with one in which a bony union had taken place, or which did not admit of a motion of one bone upon the other. To deny the possibility of this union, and to maintain that no exception to the general rule can take place, would be presumptuous, especially when we consider the varieties of direction in which a fracture may occur, and the degree of violence by which it may have been produced. For example, when the fracture is through the head of the bone, with no separation of the fractured ends; when the bone is broken without its periosteum being torn; or when it is broken obliquely, partly within and partly externally to the capsular ligament, I believe that bony union may take place, although at the same time I am of opinion that such a favorable combination of circumstances is of very rare occurrence. Much trouble has been taken to impress the minds of the public with the false idea that I have denied the possibility of union of fracture of the neck of the thigh-bone, and, therefore, I beg at once to be understood to contend for the principle only, that I believe the reason that fractures of the neck of the thigh-bone do not unite, is that the ligamentous sheath and periosteum of the neck of the bone are torn through, that the bones are consequently drawn asunder by the muscles, and that there is a want of nourishment of the head of the bone; but I can readily believe, if a fracture should happen without the reflected ligament being torn, that as the nutrition would continue, the bone might unite; but the character of the accident would differ; the nature of the injury could scarcely be discerned, and the patient's bones would unite with little attention on the part of the surgeon.

“In proof of the correctness of my opinion, I enumerated, in the early editions of this work, forty-three specimens of this fracture, in different collections in London, which had not united by bone. At the present day these might be multiplied, were it necessary.

¹ Maisonneuve, *Traité du Diagnos. Malad. Chir.*, par Em. Foucher, tom. i. prem. part. p. 287.

“Such has been the accumulated evidence of the want of power of the neck of the femur to unite by bone, in my practice for forty years, during which period I have seen but two or three cases which militate against this opinion, for many of the preparations which have been brought for my inspection as specimens of united fractures of this part have proved to be nothing more than the result of the changes concomitant with old age; and in many of them the two thigh-bones of the same subject had undergone the same alteration in texture and in form.”¹

The following passages from a communication made by Sir Astley to the *London Medical Gazette*, for the 25th of April, 1834, are equally pertinent:

“I find in a report of the Baron Dupuytren's lecture that he attributes to me the opinion that fractures of the neck of the thigh-bone, within the capsular ligament, not only ‘never unite, but that it is impossible that they should unite by bone.’

“It is quite true that, as a general principle, I believe that those fractures unite by ligament, and not by bone, as do those of the patella and olecranon. But I deny that I have ever stated the impossibility of their ossific union; on the contrary, I have given the reason why they may occasionally unite by bone.

“The following are my words: ‘To deny the possibility of their union, and to maintain that no exception to this general rule may take place, would be presumptuous,’ etc. etc.

In conclusion, Sir Astley remarks: “I should not have given you this trouble, nor should I have taken it myself, but for the respect I bear my friend, the Baron Dupuytren; for although I have already submitted myself to be misrepresented by many individuals, yet I should be sorry to be misunderstood by so excellent a surgeon and so valuable a friend as Le Baron Dupuytren.”²

Sir Astley, then, so far from denying, frankly admitted the possibility of bony union when the neck was broken within the capsule, and explained the circumstances under which he believed it might occur. The true point in dispute was, whether certain cabinet specimens were actually examples of complete fractures, wholly within the capsule, united by bone. Some of them Sir Astley thought were only examples of chronic rheumatic arthritis, or of interstitial and progressive absorption. Some were partial rather than complete fractures; others were partly within and partly without the capsule; and for this he was accused of wilful blindness or stupidity, chiefly by those who, themselves being owners of these rare pathological treasures, might possibly have felt somewhat annoyed at seeing their value thus depreciated, and who, no doubt, would be quite as apt to fall into blindness and partisanship as Sir Astley himself. The truth is, however, that although the claim has been set up and stoutly maintained for more than thirty cabinet specimens, in one part of the world or another, a majority of these, including several whose claims

¹ Sir Astley Cooper on Dislocations and Fractures of the Joints, edited by Bransby Cooper, Amer. ed., p. 156.

² See also Sir Astley's letter to Prof. Cox, written in 1835, and published in the *Prov. Med. and Surg. Journ.* for July 12, 1848; *New York Journ. Med.* for Sept. 1848; and appendix to Cooper on Dis. and Frac., Amer. ed., 1851, p. 482.

were urged upon Sir Astley, have been at length declared by all parties unsatisfactory, or absolutely fictitious, and only a fraction of the whole number continue to be mentioned by any surgical writer as probable examples.¹

Robert Smith reduces the number to seven, but Malgaigne recognizes only three, namely: Swan's case, admitted by Sir Astley himself; Stanley's case, and one specimen in the Dupuytren museum. In neither of these cases, he affirms, has the neck lost anything of its form or length by absorption, from which we are to infer that he would reject as doubtful all such specimens as had undergone these pathological changes.

Indeed, I think, we are not left in doubt as to Malgaigne's opinion upon this point. Six of the nineteen cases which I have enumerated are declared by him to resemble much more rachitic alterations of the neck than true fractures; and yet Robert Smith admits three of the six as well-established examples; but as to the precise grounds upon which he rejects these cases, he shall speak for himself: "And it is sufficient that we consider the beautiful drawings designed by Sir Astley Cooper, to illustrate certain varieties of the alterations, to place us on our guard against every pretended consolidation which presents itself, accompanied with a shortening and deformity of the head and neck. When fractures unite by bone, they do not suffer such enormous losses of substance which it would become necessary to admit for the neck of the femur."²

A reference to Stanley's case, as reported by Robert Smith, will show that, contrary to Malgaigne's statement, this was also shortened and deformed, and that, consequently, according to his own rules of exclusion, it also must be rejected; after which only two remain, namely, Swan's case, admitted by Sir Astley himself, and No. 188 of the Dupuytren museum.

I should do injustice to my own convictions, moreover, were I not to refer my readers to the very judicious criticism upon Mr. Swan's case made by Dr. Johnson, and published in the *New York Journal of Medicine*, vol. ii. 3d series, p. 295.

Since writing the above, my friend Dr. Voss, of this city, has placed in my hands an elaborate paper on this subject, from the pen of Dr. Edward Zeiss, of Dresden, and which has been translated by Dr. R.

¹ The following European surgeons have claimed to have in their possession, each, one example: Langstaff (*Med.-Chir. Trans.*, vol. xiii. 1827); Brulatour (*Ibid.*, vol. xiii., 1827); Stanley (*Ibid.*, xviii.); Swan (*Swan on Diseases of Nerves*, p. 304); Adams (*Todd's Cyclop.*, p. 818); Jones (*Med.-Chir. Trans.*, vol. xxiv.); Chorley (*Amesbury on Frac.*, p. 125); Field (*Ibid.*, p. 128); Soemmering (*Chelius's Surgery by South*, vol. i. p. 621); South (*Ibid.*, p. 621). South also mentions another example as being in the museum of St. Bartholomew's Hospital. This is probably Jones's case, which Robert Smith says is preserved in this museum, and which has already been enumerated. Bryant (*Memphis Med. Rec.*, vol. vi. p. 108, from *British Med. Journ.*, March 14); Fawcington (*Amer. Journ. Med. Sci.*, vol. xv. p. 534, from *London Med. Gaz.*, Aug. 16, 1834); Harris (*Ibid.*, vol. xviii. p. 246, from *Dublin Journ.*, Sept. 1836). Robert Hamilton says that Prof. Tilanus showed him three specimens in the museum of the Hospital of St. Peter, at Amsterdam (*Ibid.*, vol. xxxi. 470, from *Lond. Med. Gaz.*, Jan. 6, 1843). Malgaigne says there are three specimens in the Dupuytren museum which have been described with the same interpretation. The whole number claimed by transatlantic surgeons is therefore nineteen.

² Malgaigne, *Traité des Fractures et des Luxations*, tom. i. p. 678.

Newman, Prosector to Chair of Surgery, Long Island College Hospital. Dr. Zeiss, after rejecting all other European specimens, claims that bony union has occurred within the capsule in a specimen now in his possession, and also in a specimen which may be found in the pathological cabinet of the Medico-chirurgical Academy of Dresden.¹ I regret that I am not able to publish these cases at length, as well, also, as the able review of their claims sent to me by Dr. Newman, in which Dr. Newman clearly shows that Dr. Zeiss has completely failed to establish the correctness of his opinions. There is no conclusive evidence that the bones were ever broken, nor, if they were broken, that the fractures were entirely within the capsule.

On this side of the Atlantic, the number of specimens for which the honor is claimed is nearly equal to the original number in Europe; but they have not yet, all of them, been subjected to the same sifting process as their foreign congeners; and it remains to be seen how many of them will come successfully out of a similar fifty years' contest.

Three of the specimens belonged to Reuben D. Mussey, late Professor of Surgery in the Miami Medical College, at Cincinnati, Ohio. He has himself furnished a complete history and description of the specimens, accompanied with drawings.² One may be found in the Wistar and Horner Museum at Philadelphia;³ one belongs to Willard Parker of this city;⁴ two to the Albany College Museum;⁵ two to the Harvard Medical College, Boston;⁶ one to the Mütter collection (Specimen B, 71); one to Dr. Pope, of St. Louis. Dr. Sands, of this city, has lately presented a supposed example to the New York Pathological Society.⁷ Dr. Adler has presented one to the College of Physicians of Philadelphia.⁸

I will add that Dr. Packard, of Philadelphia, has published an excellent critical notice of most or all of the published cases, and suggests that they all admit of the following explanation: The fractures were actually extracapsular; but, after union took place, that portion of the neck attached to the head underwent absorption, until the head was brought into contact with the trochanters.⁹

In three editions of this book I have examined the claims of several of these specimens very much at length; but as new specimens are every now and then being presented to our notice, for each of which special claims are set up, and inasmuch as no practical results are likely to follow upon a further discussion of this point, or upon its definite decision, I have concluded to refer those of my readers who feel a particular interest in the matter to either one of my earlier editions, and to the various monographs to which I have furnished references.

¹ Description of two specimens of intracapsular fractures of the neck of the femur, and union by callus, by Dr. Edward Zeiss, Dresden, 1864.

² *Amer. Journ. Med. Sci.*, April, 1857.

³ *H. H. Smith's Surgery*, p. 399.

⁴ Johnson's paper on Intracapsular Fractures, op. cit.

⁵ *Trans. New York State Med. Soc.*, 1858.

⁶ Bigelow on Dislocation, etc., of Hip, 1869, p. 125.

⁷ *New York Med. Rec.*, June 1, 1869.

⁸ *Am. Journ. Med. Sci.*, April, 1870.

⁹ *Ibid.*, Oct. 1867.

I have also in my own cabinet a femur of no inconsiderable pretensions, belonging clearly to that class of specimens recognized by Robert Smith. Its neck is greatly shortened, and this surgeon would regard it, I think, as an impacted intracapsular fracture, but its claim would be promptly denied by Malgaigne, on account of the absorption and distortion of its neck. Its history is as follows:

About the year 1833, Mrs. Wakelee, of Clarence, Erie County, New York, *æt.* 68, who was then very low with tubercular consumption, and so ill as to be scarcely able to walk across the floor, tripped upon the carpet and fell, striking upon her left side. She was unable to rise, but was laid upon a bed by her son, Dr. Wakelee, a very intelligent physician, residing in the same house, who did not suspect a fracture. Dr. Bissel saw her on the following day, and, on rotating the limb outwards, he says that he discovered a crepitus. His examination was greatly facilitated by her extreme emaciation.

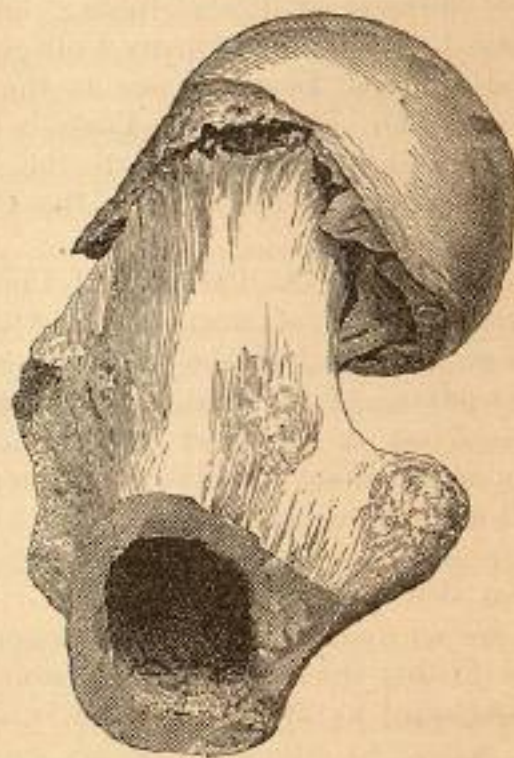
Mrs. W. was placed upon a double-inclined plane, with apparatus for extension, etc., and left in charge of Dr. Wakelee. On the fifth day the

FIG. 133.



Vertical section of Mrs. Wakelee's femur, acetabulum, and capsule.

FIG. 134.



Impacted fracture within the capsule. (From Bigelow.)

splint was removed, and from this time no dressings of any kind were applied. The reason for this change of treatment was, that she was likely to live but a few days, in consequence of the state of her lungs, and that such confinement would only hasten her death. Contrary, however, to all expectations, she gradually convalesced, so that after two or three

years she could walk on crutches, her toes turning out and her limb becoming somewhat shortened. Four years after the accident she died, and Dr. Bissel obtained from Dr. Wakelee the specimen, of which the accompanying drawing is a faithful delineation.

Dr. George K. Smith, of the Long Island College Hospital, has made a most valuable contribution to our knowledge of the anatomy and pathology of the hip-joint, which will explain in a great measure the discrepancies of opinion which at present exist among surgeons as to the character of certain specimens, and may hereafter enable us to decide with more accuracy, and may lead to a better agreement of opinion.

His observations prove that anatomists have not hitherto correctly described the attachment of the capsule; that the capsule is seldom, if ever, attached at the same point in different persons, while it is as uniformly found attached at the same point in the opposite femurs of the same person. In order, therefore, to determine whether the line of fracture in any given specimen was without or within the capsule, we must always compare the fractured bone with its congener, and not with the femur of another person.

He has further shown that after a fracture, and the consequent absorption of the neck, the normal position of the capsule is almost constantly changed; so that its present attachment does not declare what were the points of its attachment before the fracture occurred; and, finally, that the absorption proceeds unequally and irregularly, yet with great rapidity, in the two fragments; and as the bony union, if it ever takes place, probably occurs subsequent to the arrest of the absorption, the line of union cannot in itself alone determine whether the fracture was near the head or near the trochanters.¹

It seems to me probable that under certain favorable circumstances this union will occur; these favorable circumstances have relation to several conditions, such as age, health, degree of separation of the fragments, whether impacted or not, laceration of the periosteum and capsule, treatment, etc. Robert Smith thinks it is not likely to occur unless the fragments are impacted; but Sir Astley Cooper, as we have already seen, admitted its possibility whenever the reflected capsule and the periosteum were not torn, and at the same time the fragments were not displaced. If to these conditions we were to add moderate but not extreme age, with good health, we can see no sufficient reason why, under judicious treatment, bony union might not occasionally be expected. But such a combination of circumstances is probably exceedingly rare; and, what is more unfortunate, if they exist, the fracture is not likely to be recognized, and the surgeon will fail to avail himself of those advantageous coincidences which might, if understood and properly treated, secure a bony union. Dupuytren says, when the fragments are not displaced "its existence may be suspected, but cannot be positively asserted." There will not be wanting, however, examples in which surgeons will believe or affirm that they have recognized the fracture and wrought the cure. I have heard of many such instances, and Mr. Smith has referred

¹ George K. Smith, Insertion of the capsular ligament of the hip-joint, and its relation to intracapsular fracture. *Medical and Surgical Reporter*, Philadelphia, 1862.