

ing the lower third of the thigh and the upper third of the leg, and containing a posterior wooden splint. This dressing is intended to prevent a too great involuntary flexion, which might cause rupture of the intermediate substance or renew the arthritis; it is also intended to make walking easier and to allow a little beneficial exercise, and is to be worn only while the patient is walking.

This precaution will be taken for only five or six weeks if we find that the intermediate substance is solid, and if the separation has not increased. After that I shall prescribe the use of a rubber knee-cap during the day.

On the other hand, in case the separation should increase, and the knee, notwithstanding the disappearance of the arthritis, should remain very weak, the patient might use one of the more complicated knee-caps which by an arrangement of elastics or springs assist the action of the quadriceps, or may even supply its place entirely.

Whichever may be the apparatus used, you may be sure that after a few months it will be no longer necessary, and the knee will have recovered enough strength and solidity to no longer need any help.

III. *Sprain of the callus and appearance of relapse in a patient who had a fracture of the right patella a year ago.*—Here, gentlemen, is a woman whom I treated a year ago for fracture of the right patella, with bands dipped in collodion.

There remained, in spite of all my care, a separation of three-fifths of an inch, independent mobility of the fragments, and inability to raise the foot from the ground while keeping the knee extended. Flexion of the knee had not recovered its full extent, not going beyond a right-angle; nevertheless walking was easy, and I had advised the patient to wear a knee-cap, but she had soon neglected its use. Yesterday she made a mis-step, fell, and felt a slight crack and pain in the knee; she was, however, able to take a few steps, and then, thinking she had again broken the patella, she had herself taken to the hospital.

You may have noticed an ecchymosis on the anterior and inner portion of the right knee, and a very moderate swelling without appreciable effusion in the articulation. Movements are painful; flexion and extension are possible however, but the foot cannot be raised from the bed.

Let us not here commit the error which I have sometimes seen committed, that of believing in a complete rupture of the intermediate fibrous substance, and the reproduction of a fracture, and thence conclude that the patient ought to be subjected to a treatment of two or three months in order to re-establish the broken callus.

Instead of an iterative fracture this is simply a sprain with very limited rupture of the new tissue which unites the fragments, and it is because the bloodvessels of this tissue are numerous and fragile that a considerable ecchymosis has been produced by a very limited fibrous rupture. I say that this rupture is not complete, and even that it is very small, because the separation is not greater than when I last examined the patient, and because I still feel between the fragments a certain thickness of tissue which prevents my touching the condyles of the femur.

I also base the opinion upon two analogous cases, both in women, which the physicians first consulted supposed to be iterative fractures. As I had treated the cases fifteen months before, and as I found the parts in the same anatomical condition in which I had left them, I declared that it was only a sprain, and that the patients would be able to walk in a day or two, just as before the accident. The events justified the prediction.

In the present patient the lesion is the same, sprain of the fibrous callus, probably rather vascular, of the patella. The patient will remain three or four days in bed with poultices sprinkled with spirits of camphor; then she will replace her knee-cap and be able to walk.

The ecchymosis will gradually disappear, and furnishes no special indication.

## LECTURE XX.

### SIMPLE FRACTURES OF THE SHAFT OF THE FEMUR.

Simple fracture of the shaft of the femur—Commemoratives—Attitude of the patients—Deformity—Apparent shortening, real shortening—Abnormal mobility—Double manœuvre to seek it—Crepitation—Exact point of the fracture—Consecutive arthritis of the knee, of the hip-joint—Overlapping irreducible by the bands and simple bandages—Employment of chloroform—Scullet apparatus—Continuous extension—Reasons why it is not generally used in practice, its utility in certain cases—Preference given to Hennequin's apparatus.

GENTLEMEN: We have at this moment in the wards several patients affected with fracture of the shaft of the femur. I take the opportunity to show you the peculiarities presented by this lesion, which is quite common in practice.

I take as types the patients lying in Nos. 5, 11, and 46. All three represent their injury as caused by external violence. The first was run over by an omnibus, the others fell from a high place. Only one of them heard a crack at the time of the accident; the other two do not remember the circumstances of their fall. Neither was able to rise after the accident, and all were brought to the hospital by their comrades on stretchers.

You saw them lying in their beds, each one on his back and a little on one side, and they have kept that position since they were admitted; it is the one in which they suffer least. Raising the bed-clothing, we see a slight bending of the body, towards the right side in No. 5, towards the left side in the others. I told them to lie straighter, squarely upon the back; they were not able to do so, and the attempts which they made caused much pain. I asked them to raise the heel of the injured limb from the bed. This attempt also remained unsuccessful and caused renewed pain, while the uninjured limb executed the little manœuvre perfectly.

You noticed how the shape of the injured thigh differed from that of the other one, how it is gathered up and twisted about its axis. You also saw that the foot, as well as the leg, lay on its outer side. Here then are two signs of fracture: deformity, and outward rotation of the limb.

On a superficial examination our eyes detect only a slight shortening; but if we stretch a string from the spine of one ilium to that of the other, we see that its direction is oblique with reference to the axis of the body, and that the iliac spine on the injured side is sensibly lowered, whence we conclude that, although the shortening seems slight, it is really greater than it seems.

Then stretching the string from the anterior-superior spine of the ilium to the external tuberosity of the femur, and then to the external malleolus, and then making the same measurements upon the other side, we find that the injured limb of No. 5 is shortened at least an inch and a quarter; then measuring both limbs from the spine of the ilium to the internal malleolus, we find the same difference; there is then a very considerable real shortening, and as the patient assures us that he did not limp before his accident, this sign has a great value.

I then sought for abnormal mobility by two manœuvres. You saw that one consisted in raising the heel and the leg with one hand whilst the other was placed transversely over the middle and anterior portion of the thigh. Then giving a lateral movement to the limb with the first hand, I saw that the lower part of the thigh moved with the leg, while the upper part remained immovable, and I felt with my second hand that no movement which might have escaped detection by my eyes was transmitted to the upper part, and that the hinge or centre of movement of the movable part was a little below the middle of the femur. The same manœuvre executed upon No. 11 showed us that his fracture was situated at the centre of the bone, and in No. 46 the femur was broken high up, just below the great trochanter (Malgaigne's sub-trochanteric fracture).

To seek mobility by the second manœuvre, I passed my hand, by depressing the bed, under the injured thigh, and then raised it a little. By this movement the thigh was bent at the point of fracture, forming a projecting angle in front, while the same experiment repeated upon the uninjured leg did not give this result.

During these two manœuvres I had also felt crepitation. I am therefore perfectly sure of the lesion; our patients have fractures of the thigh, and it is not necessary to prolong the examination to make the diagnosis.

Our three patients have presented the same symptoms; but the prominence formed by the overriding of the two fragments of the femur seemed to us much higher in No. 11 than in No. 5, and much higher still in No. 46. In all the pain is greatest over the point of this prominence.

I have called your attention especially to the deformity of the thigh; but the knee also is increased in size. It is appreciable by the eye and by direct measurement. Passing a string around the condyles of the femur and the middle of the patella, I find that in one

patient the circumference of the knee upon the injured side is two-fifths of an inch greater than on the other, and in the other two patients the difference is three-fifths. Suspecting the presence of liquid in the articulation I grasped both its sides with my left hand, a little above, and with my right hand, a little below the patella, and then without changing the position of the hands I brought my right index finger upon the centre of the patella which yielded under the pressure and was forced backwards against the condyles of the femur. During this manœuvre I distinctly felt the other fingers raised up, which could be due only to the presence of liquid. Our three patients then have a considerable effusion within the knee-joint, and it is greatest in the one, No. 5, whose fracture is the lowest. Perhaps you think that this lesion is due to a concomitant contusion of the knee produced by the violence which caused the fracture.

It is not so; first, you find upon their knees no sign of a contusion, and then, our internes, who saw them when they were admitted yesterday, an hour or two after the accident, will tell you that the effusion did not then exist, and it is very probable that you will find that No. 11's effusion, which is very small to-day, will increase considerably to-morrow and the following days, with more pain on pressure.

It is too evident that the articular lesion which has so soon followed these fractures of the femur has not been caused by the prolonged immobility which Tessier, of Lyons, has indicated too absolutely as the cause of consecutive arthritis. It is the consequence of an early arthritis which might have been due to a concomitant contusion of the knee, but which, in these cases, seems to me to have been caused by the extension to the synovial membrane of some of the lesions belonging to the injury of the bone. In an autopsy of a recent fracture which I made in December, 1868, I found an infiltration of blood which, starting from the interfragmentary space, extended almost into the sub-synovial tissue of the knee, although the fracture was in the middle third. During our late war we had occasion to notice this same sub-synovial infiltration of blood, which M. Berger, Demonstrator of Anatomy, has further studied and confirmed by experiments upon animals, in a work not yet published.

I cannot say whether this dropsical arthritis, occurring upon these three patients soon after the accident, and which I have found during the last twelve years upon nearly all the patients whom I have treated for fracture of the thigh, is always the consequence of an infiltration of blood into the sub-synovial connective tissue, or whether it is not due in certain cases exclusively or principally to the propagation towards the articulation of the violent phlegmasia starting from the seat of the fracture. I only call your attention to this early arthritis, because, without being dangerous, without interfering with consolidation, it explains the principal origin of the articular rigidities which are one of the principal causes of the trouble in the movements after fractures of the thigh.

I looked to see if pressure was painful and if there was an appreciable swelling over the articulation of the hip. I found nothing there, and

cannot say that there is a coxo-femoral as well as a femoro-tibial arthritis.

Moreover, it is to be noticed that the articulation placed above the fracture, in this bone as in others, is more rarely affected with consecutive inflammation than is the articulation below. I do not say that it is never affected, for I have found in several patients after fracture of the thigh a prolonged stiffness of the hip which indicated the consequences of an arthritis. I only say that this complication is not common, while arthritis of the knee is almost constant.

We noticed at first sight that the thigh was gathered up on itself like a leech, and that it seemed to swell out forwards. Let us try to interpret this disposition and to determine what ought to be the reciprocal position of the fragments. It is clearly understood that the fragments have undergone a rotary displacement, for the leg and the knee lie upon their outer side, and an angular displacement for the centre of the thigh is very prominent. Moreover, since the limb is shortened, there is a third kind of displacement, that is, an overlapping or longitudinal displacement together with a transverse displacement. Shortening exists always in the adult, and can be explained, as our predecessors understood, by the obliquity of the fracture; but it is also found in cases where the fracture, instead of being purely oblique, is toothed, with or without fissure, described by Gerdy as spiral fracture. It is produced when the fragments, whatever may be the direction of the fracture, no longer meet one another directly, and it is due to the action of all the muscles of the thigh which draw the lower fragment upwards and inwards, and sometimes backwards, causing it to overlap the upper one more or less, and in any case, to an extent which will increase during the following days, as it will be easy for you to see in these patients. At the same time the upper fragment is drawn upwards and outwards by the psoas. We found the shortening in Nos. 5 and 11 to be an inch and a quarter, and in No. 46 it was about two inches and a quarter. This difference is due to the latter fracture being trochanteric, that is to say, situated much higher than in the two other cases, and to the upper fragment being drawn much more forcibly forwards and outwards by the psoas, while the lower one is drawn upwards, inwards, and backwards. In this case then there is not only overlapping, but also great angular displacement which increases the shortening.

The *prognosis* in these cases is not bad, in the sense that they will recover, but *they will probably not recover without shortening*. You still see in our wards a fourth patient who has been there for seventy-five days. He is beginning to walk, but his right thigh is two inches shorter than the left. Well, there is reason to fear that, notwithstanding all our care, those of whom I am speaking to-day will retain a shortening, and it is even probable that this shortening will be a little greater at the end of the treatment than it was after the limb had been set. That unfortunately is the rule in fractures of the thigh in the adult.

It is true that it will be corrected in part by the instinctive lowering of the pelvis, and in part by wearing a heel a little higher upon

the injured side, and that ultimately the deformity will scarcely be perceived.

Does that mean, in a word, that these patients will be lame?

Here, gentlemen, we must distinguish between the primitive or temporary, and the definitive results.

As for the first, there is no doubt; after the seventy-five or eighty days of confinement to the bed which are generally necessary for the consolidation of fractures of the shaft of the femur in adults, we shall allow the patients to walk. But they will only be able to do so with the aid of crutches, which they will continue to use for two, three, or four months. Three principal causes will prevent their doing otherwise; these are:—

1st. The difference in the length of the limbs, of which we have just spoken.

2d. The feebleness of the muscles resulting from the prolonged inaction, and from the slight atrophy which broken limbs always undergo, as I often have occasion to tell you (see page 71).

3d. The persistence, in the chronic condition, of the dropsical synovitis of which I spoke a moment ago. For if this synovitis resembles the others of this kind which I have seen, it will not be of short duration, as it is in children. It will continue during the whole time of treatment, and for a so much longer time thereafter as the patients are older. Thus I expect it to last much longer in No. 11, who is 56 years old, than in the two others, one of whom is 35, the other 41 years old.

After having walked upon crutches for a time, which will vary, according to the subjects, from two to six months, our patients will begin to use a cane, and will certainly limp very distinctly for several months. I estimate at about a year the time that is necessary for the walk to become what it can be and will be during the rest of the life. It is at the end of that time that we shall be able to determine what I called a moment ago the definitive results. I expect them to vary in these three cases.

No. 5, who is 35 years old, and whose fracture is in the middle of the femur, will undoubtedly limp very little, perhaps not at all, notwithstanding the shortening of from one to one and a half inches, which I presume he will retain, and this absence of limping will be due to this, that his muscles, although remaining slightly atrophied, will have recovered enough energy of contraction to correct the disadvantage resulting from the shortness of the lever. It will also be due to the fact that this shortness will not be excessive, and that the knee will have recovered all its movements, the synovial membrane not having retained any consecutive rigidity.

In No. 11 I expect the lameness to be more distinct, not on account of the shortening, which I presume will be about the same as in No. 5, but because he is older. For I fear that the muscles, after their prolonged inactivity and in spite of the integrity of their innervation, will not recover their former contractile energy; and I am also less certain about the consequences of the arthritis; for experience has taught me that subacute, spontaneous arthritis, passing to the chronic

condition, as arthritis following fractures almost always does, is followed by a synovial rigidity of which we see frequent examples in fractures of the lower extremity of the radius. Now these rigidities, as I have often told you and shall tell you often again, are more marked and permanent as the subjects are older.

Finally, in No. 46, the one who has the sub-trochanteric fracture, I expect, as a definitive result, a very marked lameness, partly on account of muscular weakness, partly on account of a certain degree of synovial rigidity which may remain, but chiefly on account of the shortening which is now two and a half inches, and may ultimately be three or three and a half, since, during the whole inflammatory period, that is to say, so long as the fragments are not united by a substance possessed of a certain solidity, the muscular tonicity will continue to act and will constantly increase the shortness.

My fear will not be justified in this patient if I can obtain by continuous extension a notable diminution of the shortening.

But I argue on the supposition, which may become a reality, that the apparatus for making extension will not be supported, or, if supported, will be insufficient.

*Treatment.*—In these three patients we have to meet the same indications as in all other fractures: make and maintain reduction.

To make the reduction, you saw to what manœuvre I had recourse: an assistant, placed on the injured side, pressed firmly with both hands upon the patient's iliac spines so as to fix the pelvis firmly. Another one, placed at the foot of the bed, grasped the foot as in fractures of the leg. He first straightened the foot which was rotated outwards, then by drawing it towards himself he made what is called extension, while the first assistant made counter-extension. Meanwhile I, standing beside the limb, tried with both hands to correct the deformity, pressing the upper fragment inwards and the lower fragment outwards. These two manœuvres caused great pain, and you saw what results I obtained.

The rotary displacement (rotation of the foot outwards) was perfectly corrected in all three patients. The angular displacement was also corrected in Nos. 5 and 11, but only imperfectly so in No. 46, who has the sub-trochanteric fracture, and in whom, as you know, the angular displacement is much greater on account of the powerful action of the psoas, which is inserted into the upper fragment and draws it forwards and outwards, and whose contraction it was impossible for us to overcome entirely.

But in no one of the patients were we able to correct the longitudinal and transverse displacements, displacements closely allied with one another, or of which the second, at least, is essentially dependent upon the first. For you understand perfectly that the contact of the lateral faces of the two fragments can only end when the femur has recovered its length.

I mention the impossibility of correcting the shortening by the manœuvre of simple reduction, because many of your classical authors do not lay sufficient stress upon this impossibility. Some of them speak of reduction as a thing which always succeeds if properly

made; others intimate that in a certain number of cases the only indication is to correct the angular and rotary displacements, and that nothing is to be done about overriding because it does not exist. This is perhaps true for some children, but it is not exact for adults. In them fracture of the shaft of the femur is always accompanied by overriding or, what amounts to the same thing, shortening or longitudinal displacement, and if in some cases it has not been recognized, it is because the surgeon has not measured the limb and has been deceived by the inclination of the pelvis which makes both legs seem of the same length. Not only is there shortening in fractures of the shaft of the femur in adults, but it cannot be corrected by ordinary simple reduction, such as is made with the hands, according to the indications of the authors, and during the first days which follow the accident.

Can it be afterwards corrected by other means? We shall examine that question in a moment.

But I wished first to formulate, from what has occurred in our three patients and from what I have seen in many others, these propositions: 1st, that the immediate correction of the shortening by the hands alone, and without the aid of anæsthesia, is impossible in most cases, and it is through prudence that I do not say in all cases, of fracture of the thigh in adults; 2d, that if this correction can be obtained early, it is by anæsthesia. It may be obtained tardily and slowly by the prolonged use of continuous extension combined with that of retention, but unfortunately this method encounters difficulties of execution which make us fear we shall not reach the desired end.

I now resume the history of our three patients, and I say that in all three I made the ordinary reduction without obtaining a satisfactory result so far as the shortening was concerned. But there is one of them, No. 5, the youngest of the three, and the one who seemed to me to be the least affected with alcoholism, upon whom you saw me use chloroform the next day and renew the attempt at reduction. A Scultet apparatus, arranged like the one for the leg, but extending from the groin to the foot, had been previously placed below the broken limb, and while an assistant held the foot firmly and was ready to make extension, and another pressed upon the pelvis for counter-extension, the patient was brought under the influence of chloroform with the ordinary precautions, and especially the ordinary intermittences. We had some difficulty to obtain resolution, and it was preceded by a period of great agitation, during which the patient moved the broken limb as freely as the other one, caused the upper fragment to project under the skin, and increased by the violent contraction of his muscles all the displacements with which you are acquainted. Standing on the outer side I had to hold the fracture very firmly with both hands to oppose this powerful muscular action, and you saw, nevertheless, that at certain moments my opposition was overcome, and I was obliged to ask another assistant to help me hold the fragments. Finally quiet was obtained, the muscles became soft, and I made the reduction. I measured the limb rather rapidly,