

knee outwards. If asked to place his knees in the same position, we see the foot and lower part of the leg turn inwards, that is to say, consolidation has taken place in this patient, not only with the slight projection of the upper fragment which you see, but with a rotary displacement, the upper fragment having turned about its axis from within outwards, and the lower one, with the foot, from without inwards.

This is a deformity, but it causes no trouble in walking. As soon as he gets rid of his arthritis he will walk, but with his foot turned inwards; and after all, when dressed, the deformity will not amount to much.

It was more than ten years ago that I first noticed this variety of deformity, which, so far as I know, has not been pointed out by our authors, and since then I have seen it five or six times.

I should like to be able to tell you what causes it, how it happens, and how it can be prevented, but I don't know much about it.

The rotary displacement does not exist at the beginning, or if it does exist, it is so easily corrected that we do not pay much attention to it. It appears especially in fractures with transverse displacement of the upper fragment difficult to reduce and to keep reduced. Thus far, I have seen it only in V fractures. It appears from the eighteenth to the twenty-fifth day, after the patients have been long under treatment, and all has been done that should have been done, and care has been taken to place the inner border of the foot and of the patella in the relations which I have indicated. If the surgeon continues, while watching the patient, to occupy himself only with the position of the foot, all seems to be going on well, but if, at the period of which I speak, he compares the position of the foot with that of the patella, he sees that the latter is turned outward. He then removes the apparatus to make sure of the fact, and finds that, the foot being kept in place, it is the upper fragment, and the femur with it, which have turned outwards. It takes place little by little, without pain; the patient does not notice it, and when the surgeon discovers it the effect is irremediable; for it is useless for you to try to correct this consecutive displacement.

For me, at least, whatever plan I have tried has failed; and it is easy to understand. The consolidation is already too far advanced to permit the deformity to be corrected. We might make the callus yield by violent manœuvres, but we might also fail, and even if we did succeed, the consecutive displacement might be reproduced during the new consolidation. Perhaps also the exaggerated osteitis thus produced might cause dangerous suppuration. I have, therefore, considered it prudent to confine myself to moderate attempts at reduction, and they have not succeeded.

From the notions which I have given you, you should draw this conclusion, that, notwithstanding all possible attention, deformities, which could not be prevented, are possible after fracture of the leg, and instead of attributing them to the carelessness of the surgeon, as non-professional people are so prompt to do, we must consider them due to peculiar and inevitable conditions which our authors have not

made sufficiently prominent. I shall add this other conclusion, that we cannot, in these cases of difficult fractures, give too much care and watchfulness during the first two or three weeks to the situation of the foot, with reference to that of the patella and knee. Perhaps, if you recognized this rotation from the beginning, you might remedy it, at least in part, and be more fortunate than I have been, for thus far I have only discovered it when it was too late to correct it.

### LECTURE XVII.

#### FRACTURES OF THE LEG.

- I. Fracture of the left leg more than a month old—Obliteration of the veins. II. Consolidation retarded. III. Pseudarthrosis with angular displacement; suture of the tibia; purulent infection.

GENTLEMEN: I. I called your attention during the visit to the patient, in No. 39, who has been treated for more than a month now in the wire trough for a fracture of the right leg. I could not apply an immovable apparatus on account of the numerous phlyctenæ and two small superficial eschars, the dressing of which required the leg to be left uncovered. The patient has had considerable œdematous swelling of the leg and foot for several days. This swelling, which occurred without pain, is not very rare in the course of fractures of the leg. You will find it rather upon adults and old men than in young people. What does it mean, and what will it become? It means that the venous circulation is obstructed in consequence of the coagulation of the blood. I do not think there is thrombosis of the femoral vein, for I did not feel a hard cord along its course, and pressure upon it did not cause the pain which is rarely absent in such a case. It is rather a thrombosis of the anterior and posterior tibial veins. We do not here find the pains which spontaneous phlebitis, with coagulation, often causes; but this pain is generally absent when only veins of the second order are involved. We cannot feel the hard cord because the veins are too deeply placed to be reached by our fingers, and the existing œdema increases the difficulty. I cannot, therefore, prove the existence of the thrombosis by physical signs; but I admit it because I know it has sometimes been demonstrated in autopsies after fracture, and also because I cannot otherwise explain the œdema. Notice that this is not an inflammatory swelling of the first period, for the tumefaction did not appear until towards the 27th day, long after the inflammatory phenomena had disappeared. On the other hand, we cannot attribute it to a disease of the liver, nor of the heart, nor to albuminuria, for the other foot is not œdematous, and the patient presents no symptoms of these different

diseases. This little complication is instructive from two points of view; first, because the thrombosis will undoubtedly last a long time, several months; the oedema will increase when the patient begins to walk, and this swelling will join the other causes, with which you are acquainted; rigidity of the articulations and tendons, weakness of the muscles, to oppose the re-establishment of the functions; second, because it explains the possibility of the fatal emboli, of which Professor Velpeau<sup>1</sup> and M. Azam, of Bordeaux,<sup>2</sup> have published cases. We ourselves had here, two months ago, a woman who, on the 27th day of her treatment for a fracture of the leg, was suddenly taken with oppression, precordial pain, and lipothymia, which we attributed to a pulmonary embolus too small to cause death, but which, if it had been a little larger, would have completely obstructed the pulmonary artery and killed the patient promptly.

I wish I could point out, as a complement of these facts, a way to prevent the detachment and passage toward the heart and pulmonary artery of clots which I suppose to exist in the tibial veins inflamed by their proximity to the osteitis of the callus. But I am not acquainted with any prophylactic measures against embolus. That is one of those unfortunate complications which the practitioner should know of, but which, in the present state of our science, he can neither prevent nor cure when it appears.

II. *Delay of the consolidation.*—Since I am speaking of the consecutive and tardy phenomena, I want to call your attention to two patients with broken legs, the consolidation of which is delayed.

One of them, No. 5, Ward St. Vierge, is a young man 23 years old, who was admitted with a compound fracture. Thanks to the occlusion which we made with collodion, there was no suppuration, and then I hoped everything would pass as in a simple fracture; the limb was placed in a trough; the patient suffered no pain, but, when at the end of forty-five days I removed the apparatus, I still found very marked mobility; the 20th January, two months after the accident, as the mobility persisted, I applied the immovable apparatus which is still upon the fractured limb.

The other is a woman in No. 17, Ward Sainte Catherine; her fracture is more recent than the preceding one, dating from only forty-five days ago; however, the mobility and the pains which, from the beginning, have been greater than usual, still persist and compel us to use restraining apparatus.

Here are two examples of consolidation that has made but little progress; but notice, gentlemen, that I do not say non-consolidation, pseudarthrosis. For we must not confound a delay with a non-existence of consolidation, and, like Norris, perform operations in cases which would doubtless have been caused by immobility. As for myself, I claim that at least a year must elapse before the word pseudarthrosis is to be pronounced in a fracture of the leg. But to what can we attribute the delay in our patients? I admit that I

<sup>1</sup> Velpeau, Comptes Rendus de l'Académie des Sciences, 14 April, 1862.

<sup>2</sup> Azam, Bull. de la Société de Chirurgie, 7 June, 1864.

find no cause. Syphilis, scurvy, pregnancy, nursing, have been invoked to explain pseudarthrosis; I cannot discover here the existence of any of these general causes; and if it is possible for syphilis to delay consolidation, our patients have not had it. If we examine the local causes we find, as a possible explanation of the delay, defective fixation of the fragments; but here immobility has been too well maintained for us to admit this cause. Finally it might be permitted to believe that there is, between the fragments, a piece of tendon, muscle, or aponeurosis, or a splinter which, by its interposition, prevents the callus from forming, but that is a thing which we cannot recognize, and which, indeed, we could not remedy.

We shall continue then to keep our patients' limbs completely immovable, and we shall give phosphate of lime internally, to hasten the formation of a long callus.

III. *Ancient non-consolidated fracture, or pseudarthrosis, with angular deformity of the leg; suture of the bones; purulent infection; death.*—Gentlemen, pseudarthroses due to non-consolidation of fractures of the leg are exceedingly rare. You sometimes hear me speak of delays, but you have never seen any of our patients remain without consolidation. During more than twenty years that I have practised in the hospitals of Paris, I have not seen a single one of the fractures of the leg which I have had to treat, remain in the condition of pseudarthrosis. I am surprised then to find in Malgaigne's work the statistics of an American surgeon, Norris, in which are found—

30	pseudarthroses of the humerus,
18	“ of the femur,
14	“ of the leg and tibia alone.

I wish to put you on your guard against the interpretation which has been given to certain observations in this table, and against the abuse which has been made of operations designed to cure pseudarthrosis.

The error is due to two causes: first, because, at a certain time, at the beginning of this century, when the operations of seton and resection had been proposed, some surgeons in America confounded delay in consolidation with non-consolidation, and considered fractures which still gave mobility during the second or third month, as having passed to the condition of pseudarthrosis. Now we know to-day that those fractures end by consolidating after four, five, or six months of treatment. The second cause is that they did not distinguish, among the pseudarthroses, those which they observed, or thought they observed, in patients who had been regularly treated, and those presented by patients who had remained without treatment, and whose limbs had never been set. Now you may be sure, gentlemen, that pseudarthroses, not only in the leg, but also in the humerus and femur, are exceedingly rare in patients who have been properly and perseveringly treated. If we remove from Norris's statistics the patients in whom they despaired of consolidation too soon, there would remain only those whose injury had not been treated at all. Now, those are extremely rare, for generally, fractures of the leg are so painful, that

the patients have to keep quiet, and so easily recognized that the diagnosis must be made, and lead to treatment by immobility.

You may, however, meet with patients who suffer little, and in whom the diagnosis is rendered difficult by certain anatomo-pathological conditions.

I once treated a child, six years old, who had had a fall three weeks before I was called to see him. At Geneva, where the little patient then was, the surgeon who was consulted had not detected the fracture, and had allowed the child to walk, which he did with a little difficulty at first, but afterwards quite easily. He was brought to Paris, where one day he made a misstep, and felt a new pain in his leg (it was the right one). I found, near its middle, a slight swelling, which I was told had existed since the first fall; also pain on pressure at this point, where there was, however, no ecchymosis; and, finally, after several unsuccessful attempts, I felt very distinctly a mobility and a crepitation which left me no doubt as to the existence of a fracture of the tibia, and probably of the tibia alone. I did not doubt that this fracture had existed since the first fall, and had been consolidated not at all, or so incompletely that the new accident had caused the imperfect callus to yield.

Several conditions in children and young people may render diagnosis difficult, not only of a fracture of the tibia, but also of a simultaneous fracture of the tibia and fibula. The first is the preservation, at the place of fracture, of the periosteum, which acts as a means of union. The second is the toothed disposition, with reciprocal interlocking of all the points, and little excavations which correspond to them upon the other fragment. These two conditions, which, moreover, may very easily exist together, not only oppose displacement, but may prevent detection of mobility and crepitation.

In a young man whom I treated in 1865, at La Pitié, and over whose right leg the wheel of an empty cab had passed, I was unable at first to recognize a fracture, and after several examinations, I made the diagnosis, *contusion of the leg*. The patient kept the bed because he suffered while standing, but he moved as much as he liked in it. It was only on the eighteenth day that, a small abnormal prominence appearing, I was led to examine it again, and I then felt a fine crepitation and a mobility, indicating a fracture of the tibia which I had mistaken at first for the reasons I have given. Suppose that in my little patient and in this latter, at La Pitié, new examinations had not been made, and they had continued to walk. Undoubtedly, consolidation would have been possible, but it might also have failed and a pseudarthrosis been established.

This is what probably took place in the young man, 19 years old, who was admitted into Ward St. Louis, No. 50, the 27th November, 1866. He told us that in December, 1864 (he was then 17 years old), one of his comrades had given him a violent blow with a stick upon the lower part of his left leg. He suffered, but did not fall; was not obliged to keep his bed, and continued to walk, though limping, without consulting anybody. He only knows that a small lump appeared at the place where he had been struck. A month after this

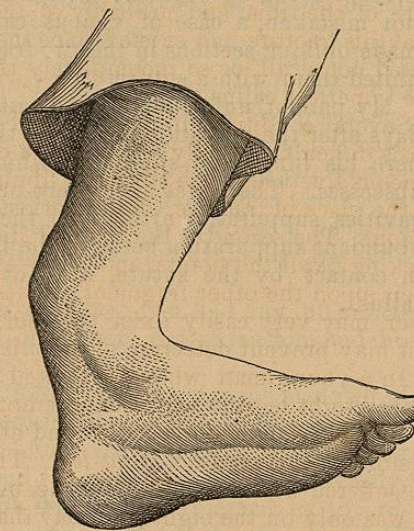
accident he fell while trying to jump over a ditch. The same leg gave him a great deal of pain; he was carried home, where he kept the bed for several days, and then resumed his work in a factory. But he could no longer endure the fatigue; his leg caused him pain after a few hours of walking.

A little later he fell again, and was admitted to the Hôtel-Dieu, where he remained ten days without anyone speaking to him of fracture. After that he walked with more and more difficulty without being able to bear his foot upon the ground; then he saw that his foot turned outwards, and that his leg bent, forming an anterior and internal angle. This bad conformation was increased by the manipulations of a bone-setter.

To-day we are struck with the deformity of this limb. The foot and the lower part of the leg are turned outwards, and the leg presents, at its anterior and inner portion, an angle, the opening of which is directed outwards. Grasping the leg above and below this angle, we feel a mobility from before backwards and transversely which is not very marked, but which does not allow us to doubt the existence of an imperfectly consolidated fracture, of a pseudarthrosis with incomplete vicious callus. For the last six months the patient has been able to walk only by the help of a wooden leg, upon which he rests his knee. He declares that he will not remain in this state, and that at any price he wishes his leg to be straightened and solidified; he has repeated this declaration so often during the week he has been here, that I have determined to make an oblique resection followed by suture of the two bones.

The operation was performed in the following way: An incision about three inches long, and parallel to the axis of the limb, was made along its anterior portion, and crossed by another about two inches long. The four flaps made by these incisions were dissected backwards, and the angle formed by the two fragments of the tibia exposed. I then divided the intermediate fibrous tissue which united the fragments, and, exposing the lower one, I made, with a small saw, an oblique section downwards and inwards on the inner and posterior faces of this fragment. I then made the upper fragment project, and made, on its outer face and anterior border, a similarly oblique section downwards and inwards, so that, the two sawn surfaces facing one another, I could bring them exactly together. I then replaced

Fig. 11.



Angular pseudarthrosis of the left leg.

the limb in its proper position, and with much difficulty perforated the fragments with a drill, and then passed a double silver wire through the holes, with which I fastened the bones together. The limb was then placed in a wire trough with cotton and oiled silk, and the wound, which was not united, was covered with a simple cerat dressing.

In short, the operation which you saw me perform was a mixture of resection and suture. Resection, without suture, was made in 1760, by White, and afterwards by a certain number of English and American surgeons. Then resection, followed by suture, was made in 1825, by Kearney Rodgers, an American surgeon, and by Flaubert, of Rouen, whose two cases were reported by Dr. Laloy.<sup>1</sup> It is true, that in all these cases the pseudarthrosis was of the humerus, and in all, except Flaubert's second, the section was perpendicular to the long axis of the bone. My operation was peculiar in this, that it was performed for a pseudarthrosis of the tibia, and that, conformably to the precept given by Flaubert after his second case, which was, if I am not mistaken, a case of vicious callus, and not of pseudarthrosis, I made oblique sections in the two fragments in opposite directions, and united them with a suture.

My patient, unfortunately, was attacked with purulent infection ten days after the operation, and died the 27th December. I show you here his lungs and spleen, in which you see numerous metastatic abscesses. There was also a sero-purulent effusion in the two pleural cavities, suppurative arthritis of the knee above the fracture, and an abundant suppuration between the fragments, which, though still held in contact by the suture, are not united by the beginning of a callus.

### LECTURE XVIII.

#### FRACTURES OF THE PATELLA.

Non-consolidated fracture of the left patella, dating from 18 years before; separation of two and a half inches—Study of the movements and functions of the limb.

GENTLEMEN: I stopped for a long time this morning at No. 25, Ward Sainte Vierge, to study and to show you the results of an old fracture of the patella, the fragments of which are widely separated from one another, and do not seem to be united by an intermediate fibrous substance.

The man, who is 50 years old, tells us that 18 years ago (in 1850) he was brought to the same ward for a fracture of the left patella.

Velpeau applied an immovable bandage, with which the patient

<sup>1</sup> Laloy, Thèses de Paris, 1839.

was allowed, he says, to walk after the tenth day. He assures us that the apparatus remained in place for four months, and that when it was removed the distance between the fragments was considerable. They then applied another apparatus which he cannot very well describe, but which seems to have consisted of two vertical straps fastened, one about the thigh, the other about the leg, with a circular bandage, and tied together over the patella; they were intended to keep the fragments near one another. This apparatus was removed every five or six days for about two months, and then, that is, six months after the accident, the patient left the hospital, walking with crutches, and with a considerable separation of the fragments.

He spent six months in the country, during which his walking improved so much that when he returned to Paris he could walk easily and without a cane, take long walks without being fatigued, and did not hesitate to resume his former occupation of bar-tender.

He comes to us to-day for a small contused wound of the right leg, and would not have spoken of his former fracture, of which he no longer thinks, if we had not noticed it ourselves.

You noticed a notable deformity of the left knee. Two small bony prominences appear over it, separated by a long depression. We can feel that these two prominences are nothing else than the fragments of an old transverse fracture of the left patella, and by pressing back the skin over the intermediate depression we can feel the condyles of the femur. When the limb is extended, the separation is two and a half inches; when bent, it is five inches. When the leg is bent, we can see the outlines of the condyles of the femur under the skin between the fragments.

The patient complains of no pain, and has never had any inflammation. There is the usual amount of flexion and extension, and no abnormal lateral mobility.

We studied the movements, and found that the patient made all of them easily except those which require the almost exclusive intervention of the quadriceps femoris. For example, while he was lying down, I asked him to flex and extend the knee; he did it quite easily, but I showed you that the extension might be explained by the relaxation of the flexors, and the pressure of the heel upon the bed. To see if he used the quadriceps normally, I asked him to raise the heel from the bed without previously bending the knee. He was not able to do it. I then told him to bend the knee and then raise his foot from the bed and carry it into the air. He could not do that either. It is true, that all the muscles of the thigh, and especially the quadriceps, are less voluminous than those of the opposite side, as is the case, I have often told you, with almost all muscles after fractures. But although diminished, these muscles are not paralyzed. You saw that they hardened during the attempts he made to do what we asked of him, and that even the lower fragment was drawn up a little. If the movement of elevation of the foot, in the production of which the psoas and iliacus aid a little, but for which the action of the quadriceps is absolutely necessary, cannot be executed, it is because this