

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.¹ 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

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

¹ Laloy, Thèses de Paris, 1839.

action is not sufficiently transmitted to the tibia through the ligamentum patellæ.

I then made the patient rise and walk before us. He did it without the slightest hesitation or limping.

While he was standing with his feet together, I asked him to move the left one forwards; he did it, but by flexing the knee. I asked him several times to bring the foot forward without thus bending the knee, but he was unable to do so. Why? Because as soon as the foot is detached by the action of the psoas, iliacus, and adductors, the knee is held too feebly, and the foot falls either by its own weight or by the action of the flexors which are not counterbalanced. In fact, it is the quadriceps alone which can keep the knee extended whilst the foot is carried forward.

Although the physiological analysis of the functions of the limb shows us the loss, or at least a great diminution of the contractions of an important muscle, it is nevertheless true that the patient makes up for this loss by means of the psoas and adductors, and has no great difficulty in walking. He mounts staircases quite easily, descends them with a little more hesitation, placing both feet upon each step; can easily walk five miles without a cane, and continues uninterruptedly his fatiguing occupation.

The anatomical deformities, or, if you prefer, the morphological vices of a fracture of the patella with separation, are here carried to their greatest degree. I should tell you that you will find similar ones in many patients, but to a much less degree.

We often see a smaller separation, of not more than an inch, for example, cause at first functional troubles as great as those of our patient, and then gradually the patient becomes able to use his leg almost as well as the other. He feels his infirmity only when descending a staircase, and the surgeon detects the lesion only by telling the patient to raise his heel from the bed or to move his foot forward without bending the knee. These two equally difficult movements indicate an old fracture of the patella. That is the ordinary result. Do not forget it, whether the separation is greater or less, the limb is neither more nor less weak; it remains weakened, that is incontestable, but the patients, except, perhaps, those who have to do heavy work, do not perceive it, or habit has taught them to counterbalance the defect of contraction so well, that they pay no more attention to it.

Bear in mind, however, that this proposition, relative to the mode of cure of transverse fractures of the patella, is not absolute, and does not apply to all cases.

I establish, like our classic authors, a distinction between fractures without separation, or a separation of a few lines only, in which part of the surrounding fibrous tissue remains intact, and fractures with separation of half an inch or more, in which the fibrous tissue is completely torn across.

In the first case the fracture heals without separation, and with a bony callus, and the functions of the quadriceps are entirely re-established.

It is in the second case only that persistence of the separation is the rule, that its increase during the first weeks is not very rare, and that the cure is not by a bony callus. A cellular or cellulo-fibrous substance is formed between the fragments, and if it is dense it allows partial transmission of the effects of the contraction of the quadriceps to the ligamentum patellæ; but if it is not dense, and it almost never is, it does not permit this transmission.

Such is the rule; but I add at once that exceptions are possible, and that you may be fortunate enough to obtain, by a well-directed treatment, or by the existence of favourable organic conditions in your patient, the exception which we always seek, that is, the cure of a transverse fracture with separation either by a bony callus, or by a fibrous one strong enough to permit perfect extension of the limb.

Now two questions naturally arise here. Why these results? Why do our methods of treatment succeed only exceptionally in getting better ones?

1st. Why do we have recovery with separation and a too soft fibrous callus, or none at all? On account of local and general causes.

The predominant local cause in the case of an unopposed or unsuccessfully opposed separation, is the communication of the fractured surfaces with the articulation, and with an articulation which, participating in the consecutive phlegmasia, fills up with blood and synovia, and remains full of liquid for several weeks. The materials which would serve for the formation of a callus fall into this liquid and are lost in it. This explanation was first given long ago; you will find it in all your books, and it is always true.

A second local cause is the absence, before and behind the fracture, of tissues which might help to form the callus. For I have supposed that the fibrous tissue, which performs the part of periosteum and establishes the continuity between the end of the triceps and the beginning of the ligamentum patellæ, is broken. What remains in front of the patella? Connective tissue and the synovial bursa; but these tissues, not having been torn, do not undergo the consecutive inflammation which would enable them to exude the materials of the callus, or if by chance they furnish some, they fall into the articulation, and are not kept between or about the fragments. This absence of torn tissues, in front of and about the fracture, serves for an answer to the objections of those who say you attribute the difficulty of consolidation to the effusion of the reparatory liquids into the synovial cavity; how then does it happen that the vertical and transverse fractures without separation, or with very moderate separation, recover with a bony callus? The answer is very simple; it is that there remains about the fragments in the last two cases a fibrous portion which keeps them together, which has been sufficiently torn to furnish reparatory materials, and which serves as support and gangue to the callus, which having begun in it extends gradually between the fragments. Furthermore, when the latter remain almost in contact, we may suppose that the reparatory glutinous substance of the first days

is retained upon their surfaces in sufficient quantity to furnish useful materials to the callus.

The general causes are inherent to the constitution. Remember, gentlemen, that this is a contest between two opposing forces; a tendency to repair, which exists for this bone as for all the others, and an effort constantly exerted by the tonicity of the quadriceps to keep up, and even augment the peculiar displacement which exists in this variety of fracture, displacement by separation through muscular action. Now, by increasing the separation, the quadriceps elongates the reparatory substance, disarranges it, and opposes its calcareous transformation.

Consequently, in fractures with considerable separation, you can have a bony or a very solid fibrous callus only if the surfaces of the fragments furnish materials capable of being rapidly transformed into solid substance, and if the muscles will remain inactive for a sufficient length of time during the treatment which you have instituted. We occasionally meet with patients in whom the reparatory tendency is sufficiently strong to furnish a solid intermediate substance during the time that we are acting upon the fracture. But we find more in whom the intermediate substance has not been able in this time to get the necessary solidity.

2d. Why do not our means of treatment always succeed in preventing this imperfect consolidation? You know why, if you have well understood the preceding details. We do not succeed for three reasons.

The first is that we find it difficult to bring the broken surfaces together, and to successfully oppose the action of the quadriceps. We sometimes succeed in bringing them into contact with the aid of certain apparatuses of which I shall speak. But this contact does not last very long. The quadriceps ends by slightly overcoming our opposition. If by chance it does not reproduce the entire separation, it reproduces it partially; or the fragments remain together in front, but separated behind. The second cause is that, in spite of the retention, the patient instinctively flexes the knee a little on account of the pain, and thus reproduces some of the separation. The third reason is that the contention is so exact that the patient suffers and loosens the apparatus, thus allowing the separation to again take place.

All three causes, or only two of them, often act at the same time, and in any case the same effect is produced, effusion into the articulation and immersion of the reparatory materials in the liquid which it already contains.

But that is not all; suppose that the mechanical problem has been solved, and that the fragments have been kept in place by the apparatus which you have chosen. If the consolidation is not complete when you remove this apparatus, from the 60th to the 80th day, for example, the quadriceps will recommence its unfavourable action. Its tonicity separates the fragments again, the intermediate substance yields, lengthens, and if the patient moves a little (and how are we to prevent him from moving after so long a time?), consolidation is

arrested, and you have a separation with a soft intermediate substance, which amounts to about the same as if you had no intermediate substance. It is only in young and healthy patients that, during the eight or ten weeks of the application of the apparatus, the exudation has the time to organize into a strong fibrous or fibro-calcareous tissue so solid that the quadriceps can no longer act successfully against it and reproduce or increase the separation.

LECTURE XIX.

FRACTURES OF THE PATELLA.—CONTINUED.

- I. Recent fracture of the patella with a separation of nearly three-quarters of an inch—Difficulty of the cure—Indications to be met—Different treatments by two kinds of apparatus; some closed, others open—Preference given to rubber rings. II. Sprain of the callus, and apparent relapse a year after a fracture of the patella.

GENTLEMEN: I. A man, 35 years old, a carpenter, whom we saw this morning during the visit (Ward Sainte Vierge, 28), caught his foot yesterday morning in his workshop among some pieces of wood which were lying on the floor. He fell forward, made a violent effort to save himself, and then fell backwards, feeling a painful sensation in his left knee. He was lifted up, and tried to walk, but could only take a few steps backwards, dragging his leg and leaning upon a comrade. He was at once brought to the hospital, and this is what we find:—

As physical signs:

1st. A notable swelling of the knee with a fluctuation that leaves no doubt of the existence of an effusion.

2d. A transverse depression in which the finger can easily lie, indicating a separation of nearly three-quarters of an inch, and increasing when the knee is bent.

3d. Above and below this depression a bony fragment, each of which can be easily moved sideways, and is evidently formed by one of the halves into which the patella has been divided.

As functional signs:

1st. Moderate pain when the patient does not move.

2d. Ability to flex the leg upon the thigh.

3d. Inability to then extend it without using his hands or pressing his heel forcibly upon the bed and making it slide downwards.

4th. Utter impossibility of detaching the heel from the bed, and notable increase of the pain in the knee when he makes the attempt.

By these signs you all recognize a transverse fracture of the patella