

He is 57 years old and has already been in our wards for a fortnight. You remember that on the first day I made reduction as in the preceding case. The attempt was successful, the characteristic deformity ceased, and, differing in this respect from the preceding one and from most of those in which I make the same attempt, the result was maintained, the displacement was not reproduced. Seeing that the reduction persisted, I did not apply the open apparatus which I habitually use, but contented myself with placing the forearm upon a long bag filled with chaff and a splint, and fixing it with a roller bandage. The cushion and the splint did not extend beyond the wrist, so that the hand was left free and flexed. This very simple apparatus, which was proposed by Robert, has the advantage of neither compressing nor immobilizing the hand too much, and it also diminishes the duration of the consecutive stiffness of the fingers. I removed it this morning, and you saw that the shape of the wrist was good, and that the functions, that is, the movements, although still very imperfect, were much less limited than in patients upon whom the ordinary restraining apparatus has been left for twenty-one days. I recommend this mode of treatment. It will not do for those patients in whom a first or second well-made reduction is not maintained. But it is excellent for those in whom the reduction maintains itself without retention. The immobility which it supplies is sufficient for the accomplishment of the consolidation, and it has the great advantage of diminishing the duration of the painful stiffness and immobility which, as you know, are the principal inconveniences of fractures of the lower extremity of the radius.

III. The last patient of whom I have to speak is a young man 18 years old, who fell from a ladder, a distance of about ten feet, striking upon the palm of his left hand.

We found upon him the first day the characteristic antero-posterior deformity, without marked inclination of the hand towards the radial or the ulnar side. In addition I easily felt mobility and crepitation, and I was able at once to make reduction, which, however, did not remain. Nothing in the way in which the accident was produced enlightened us upon the mechanism of the fracture; but in taking account of the age which authorizes us to believe in the existence of a non-rarefied and still very solid cancellous tissue, and of the facility with which I was able to move the lower fragment and feel crepitation, I think that the mechanism of crushing has not intervened, that the cancellous tissue has not broken into multiple fragments as is often the case in old people, that reciprocal penetration of the fragments has not taken place, and that finally the lower fragment has not split down to the radio-carpal articulation, as it does quite often in people advanced in age.

From all of this I conclude that the regular shape obtained by reduction and by the restraining apparatus which I applied the sixth day will be maintained, and that we shall not have consecutive deformity due to the disappearance, by absorption, of part of the cancellous tissue, as is sometimes observed after fractures by crushing and penetration.

I hope, furthermore, that the arthritis by proximity will be less severe and of shorter duration, for this arthritis, which takes place in almost all cases, is necessarily more marked in those in which the fracture invades the articular surfaces, than in those in which it does not. Finally, this is a young man who has never had rheumatism, and you remember that these conditions of age and health are favourable to the termination by resolution of traumatic arthritis.

I might have discussed the question of diagnosis, and asked if, instead of a fracture, I should not consider this a tearing off of the epiphysis. I do not think so, and for these reasons: the simple tearing off of an epiphysis is rare, and when solution of continuity takes place at the point occupied by an epiphysary cartilage, anatomical observation has shown that it is produced almost always partly upon the cartilage and partly upon the bone, so that a real fracture coincides habitually with rupture of the cartilage. Moreover, an epiphysary separation adds absolutely nothing to the results, nor, consequently, to the prognosis or treatment. All the clinical interest of the lesion, in such a case, lies in this peculiarity, that the spongy tissue is solid, not rarefied; that it must have escaped crushing, penetration, and multiple fragmentation, and that finally the age predisposes to the prompt return of the suppleness and polish of the articular and tendinous synovial membranes which have been consecutively inflamed. We have only reached the twelfth day, but I hope, if the patient consents to come back and see us two or three weeks after he leaves us, to be able to show you how much more rapid and indolent the restoration of the movements has been than in the older patients.

LECTURE XXVI.

FRACTURE OF THE CLAVICLE BY MUSCULAR ACTION.

Considerations upon the mode of production of fractures of this bone—Case of a fracture by muscular action—The fracture is without rupture of the periosteum and without displacement, as in children—Examination and criticism of apparatus invented for fracture of the clavicle—Preference given to the sling—Substitution of the double sling for Mayor's simple one.

GENTLEMEN: We have at this moment at No. 43, Ward Sainte-Vierge, a man, 40 years old, affected with fracture of the clavicle, in whom this lesion was produced in an unusual manner.

You know that, strictly speaking, fractures of this bone may be occasioned by direct causes, such as a heavy body falling upon the clavicle, or a violent blow with a stick. But cases of this kind are much the least frequent, and in any case I have not observed the more or less serious concomitant lesions, generally called *complications*, which, in other bones, are produced by the vulnerant bodies which cause the direct fractures: I refer to considerable effusions of blood,

phlyctænæ, eschars, and wounds. It is a remarkable fact that fractures of the clavicle are very rarely compound, and that the skin remains almost always intact, even when one of the fragments makes a very pointed and apparently very threatening prominence under it. I attribute this chiefly to the fact that direct causes rarely take part in their production.

The most frequent fractures are those which are produced indirectly by the action of causes which tend to increase the natural curves of the bone, and to make it break at some point of one of these curves, as when one falls upon his shoulder, or even the elbow, and the clavicle is thus subjected to exaggerated pressure between the sternum and the ground.

Another, which is observed quite rarely, is fracture caused exclusively by muscular action. To this category belongs the one of which I shall speak to-day.

On the 12th December, 1868, this man was helping to place upon the shoulder of a comrade a large, heavy piece of marble. At the moment when he lifted it, he felt a slight crack in his right shoulder, and was unable to continue. The next and the following days he was not able to work as usual; nevertheless, he waited a week before coming to the hospital.

As he had received no blow upon the clavicle, and had not fallen upon the shoulder, I did not think at first of a fracture, and I examined the deltoid region and the right scapulo-humeral articulation. Not finding any lesion at these points, I carried my eyes and then my fingers towards the clavicle. I found at the middle of this bone a round, quite uniform swelling. Then by pressing with one finger upon this point, and gently moving the two ends of the clavicle in opposite directions by seizing each one with one hand, I felt very distinctly a fine crepitation and abnormal mobility.

It is evident then that the clavicle was broken, and as there had been intervention neither of a direct blow, nor of the usual indirect cause, we are authorized to say that the fracture was produced by muscular action; that is to say, that the clavicle—drawn powerfully upwards by the sterno-cleido-mastoideus and the trapezius when the effort was made to lift the weight, and drawn downwards at the same time by the contraction of the deltoid and pectoralis magnus, which take their fixed point upon it to move the humerus—was so forcibly pulled in two different directions that it broke at the point where undoubtedly it was weakest.

It is true that if we consider the usual solidity of the bone we have to doubt whether it could be overcome by muscular contraction, and we ask ourselves whether the fracture had not been prepared in this patient by a fragility due to an osteo-sarcoma, or to syphilis, or to the peculiar osteitis which Malgaigne pointed out for other bones, and which must be placed in the category of rarefying osteites.

Now, the commemoratives were entirely opposed to the first opinion, for the patient had not before the present accident any tumour which could be considered as cancerous.

On the other hand, he has not had syphilis. And moreover, I am

by no means convinced, as I have already said when speaking of spontaneous fracture of the femur, that constitutional syphilis makes the bones fragile, and for the moment I know of no fact which proves that syphilitic osteitis sometimes takes on the rarefying form. Undoubtedly it is not impossible, but it has never been proved by observation, while, on the contrary, there is no lack of cases in which syphilitic periostitis, called also periostosis, has terminated in a permanent increase of size, or hyperostosis, indicating the intervention of a condensing osteitis.

As for the special osteitis pointed out by Malgaigne as preparing the way for spontaneous fractures, we have no positive sign which authorizes us to believe that it has existed in our patient. Rarefying osteitis of the compact tissue, indeed, is only manifested to us by physical signs, and the only functional symptom which might cause it to be admitted is prolonged pain at that part of the limb where rarefaction takes place. As our patient declares he has had no pain of this kind, I cannot say that his fracture has had a rarefying osteitis for predisposing cause.

Notice two things here: first, it may easily be that the slow and prolonged osteitis which terminates by rarefaction and fragility was indolent. Second, it is not impossible, as I have already explained, that the fragility may be due to a rarefaction independent of the inflammatory condition, rarefaction comparable to that which senility leads to in the cancellous tissue of many long bones and which is produced without pain. I there touch upon a question which has been but little studied. Our anatomo-pathological studies have made us acquainted with senile rarefaction of the cancellous tissue; but they have produced nothing yet for the analogous trouble of nutrition of which the compact tissue becomes the seat as age increases, and even without senility, or without the influence of a sort of premature senility. I should like to have this question studied; it might enable us to understand better than we can to-day the facility with which direct or indirect causes produce fracture of the most voluminous bones, such as the tibia, the patella. I have long asked myself whether, in such cases, premature senile rarefaction has not induced a fragility which has facilitated the production of the fracture by chance causes apparently quite slight, and it is a subject which I recommend to your investigations.

But it is not only with respect to its etiology that our fracture is an unusual one; it is so by its physical symptoms also.

I said that I had found a little mobility and fine crepitation; but I did not speak of a projection upwards of the inner fragment, nor of a lower prominence formed by the end of the outer fragment pulled downwards and pressed under the other. In other words, I have not spoken of the prominences and deformities which are most frequently found in fractures of the clavicle in adults. Why? Because these prominences and this deformity do not exist here. We see only a round tumour, rather voluminous, but regular and without inequalities. The fracture then is without displacement, and with a volume which is explained by the fact that it is a week old; that

during this time the patient has not been treated, and although he has not been working he has continued to use his arm.

Why this absence of displacement? Because there has been no rupture of the periosteum, or because the fracture is toothed, and the points have remained interlocked, and the periosteum has thickened, as it does in our experiments upon animals when the fracture has been without displacement, and the fragments have been kept end to end.

This variety is rare in adults, but much more common in children, where it merits special attention on account of the difficulty of the diagnosis. I show you from time to time at the hospital consultation children four, five, or six years old who are brought to us for fracture of the clavicle without rupture of the periosteum, the principal symptom of which is a swelling, painful on pressure, at some point of the bone. Immobilization with a sling for a fortnight is sufficient to reduce the volume of the tumour and to have it replaced by a solid and scarcely visible callus.

You saw me employ for this patient the treatment which I use for almost all cases of fracture of the clavicle. It is a sling similar to that of Mayor, but which, instead of being a single triangle, is a double one, or, if you prefer, a piece of cloth, such as a handkerchief, folded so as to form a triangle with two thicknesses. The forearm is placed in the fold formed by these two flaps. The extremities of the base of the double triangle are attached to one another behind the back; the point of the posterior flap passes in front of the uninjured shoulder, that of the anterior flap in front of the injured one, and they are fixed to the ends of a compress looped around the posterior and horizontal part of the sling, which ends pass over the shoulders to meet the two points to which they are then pinned or sewed.

This simple bandage has no other object than to keep the shoulder and the clavicle immovable, and to thus favor the consolidation. In the present patient there is no other indication to be met. But in those cases where there is displacement of the fragments, you see me use the same sling. I only add, when the inner fragment projects forcibly upwards, compression on it by means of a layer of cotton and two compresses placed under the junction of the anterior point of the sling and the compress to which it is fastened.

I do not mean to say that this simple apparatus always gives perfect results, that is, cure without deformity. For fractures of the clavicle are like those of the leg. Some are without displacement, like this one and like those which we often see in children, and then the most simple apparatus is sufficient if it immobilizes. Others have a displacement which it is easy to reduce and to keep reduced. The simple apparatus does very well for these also. Others, finally, are reducible, but very difficult to maintain, because the displacement is reproduced by the slightest movement. In such cases I claim, and it is the opinion already expressed by M. Nélaton,¹ that a simple, well applied sling gives as good results as any of the more or less complicated apparatuses proposed at different times.

¹ Nélaton, *Eléments de Pathologie chirurgicale*, tome 1er, p. 721.

In fact, if we study these apparatuses, we see that the principal object of most of them is to meet a proper indication. A great number, for example, from the time of Hippocrates to the end of the eighteenth century, are intended to carry upwards and backwards the outer fragment which is lowered and carried forward. Such especially was the object of those described in the works on surgery under the name of Heister's cross, Brasdor's corset, and Brunninghausen's strap.

At the end of the last century Desault showed that it was necessary to carry the outer fragment not only upwards and backwards, but also and especially outwards. For that purpose he proposed the axillary arrow-head cushion, intended to carry the humerus, and with it the scapula and clavicle, outwards, while a figure-of-8 bandage passed around the elbow of the injured side and the opposite axilla, and crossed over the broken clavicle, and held the shoulder and outer fragment up and back. Boyer's corset was also constructed to meet the same triple indication.

All these apparatuses, one after the other, have had to undergo about the same criticisms.

Desault justly reproached all that had preceded his with not meeting all the indications, with troubling the patients, and often giving a cure with prominence of the inner fragment.

Boyer objected to Desault's bandage because its hard cushion caused pain, because it interfered with respiration, and after all did not always prevent displacement of the fragments.

Boyer's apparatus is open to exactly the same objections, and when Mayor, of Lausanne, in 1834, proposed to suppress the arrow-head cushion and the complicated bands, and to substitute for them a simple sling which would carry the elbow inwards and upwards, and consequently the shoulder and the outer fragment of the clavicle outwards and upwards, he had no difficulty in showing that this bandage, reduced to its most simple expression, gave results not inferior to those of the complicated apparatuses previously used.

I have modified Mayor's sling by making it double instead of single, and thus fixing it more solidly. But I add that the main indication which it meets is that of keeping the clavicle and shoulder immovable.

Before applying it I make as complete reduction as possible by the manœuvre which consists in carrying the elbow inwards and upwards with one hand, while with the other, placed at the inner and upper part of the arm, I draw the shoulder further outwards. That having been done, I press the upper fragment downwards, and while the reduction is made I apply the sling as before described; on the following day I raise the anterior point of the sling and renew, if it has become relaxed, the pressure exerted upon the upper fragment by the compresses. But I do not believe, like all of my predecessors and some of my contemporaries, that I can maintain reduction of all fractures with displacement. I maintain some of them, but there are many which are maintained only very imperfectly, and which recover with a slight deformity and shortening. But as the objections made successively to all the methods of treatment prove, to my mind, that these defective results were inevitable and depended upon the condi-

tions of the fracture, I accept them as such, and do not claim to be able to avoid them. These irregular calluses, moreover, cause very little inconvenience; on the one hand, they do not interfere in any way with the functions of the limb, and on the other hand, they diminish with time because the point of the upper fragment is absorbed little by little. That which remains would be disagreeable only in case the patient were a young lady and compelled to appear in society with bare shoulders.

To avoid criticism, and to protect his responsibility, the surgeon should, in such a case, give the preference to Desault's bandage, the application of which, because it requires minute care, excuses the imperfection of the result. Indeed he might, in imitation of the fact cited by Mayor,¹ propose manual retention, that is, retention with one hand left permanently upon the fracture, as the only means of certainly obtaining a cure without deformity.

I have a last remark to make upon the treatment of fractures of the clavicle. It is not necessary to leave this bone immovable for a long time; twenty to twenty-five days are sufficient for an adult, fifteen to twenty days for a child.

At the end of this time it is necessary to examine carefully the condition of the bone, and allow movement if mobility and crepitation are no longer found. In those cases where the functions of the limb are slow to become re established, it is due most often to this, that, the apparatus having been kept on too long, the articulations, and especially the small ones of the hand, have taken on, in consequence of the immobility, a greater rigidity than they would otherwise have done.

¹ Mayor, *Chirurgie simplifiée*, tome ii.

PART III.

TRAUMATIC OSTEITIS AND NECROSIS.

LECTURE XXVII.

TRAUMATIC OSTEITIS OF LONG BONES.

Exposed wounds of the bones—Acute osteo-myelitis, suppurating, and putrid—Its relations with septicæmia (traumatic fever and purulent infection)—Its anatomical characteristics—Its coincidence with simple phlebitis and putrid phlebitis.

GENTLEMEN: I gladly take the opportunity which is offered to-day to show you the pieces coming from three patients who have succumbed, one of them to traumatic fever, the other two to purulent infection, after injuries which had placed the bones in contact with the air and had exposed them to suppurating traumatic osteitis.

I shall speak to you on some other occasion¹ of the relation which exists between acute suppurating osteitis and these two dangerous diseases which it often engenders: traumatic fever and purulent infection or pyæmia.

To-day I leave the latter aside to call your attention solely to the first, the osteitis, which you will not find described in our classical authors with all the details which it deserves.

I. Notice first these two tibias: they belong to that one of our patients who was admitted six days ago for fracture of the middle portion of the right leg complicated by a quite large contused wound. The skin was not gangrenous, the wound was covered with blood clots, exudations, and small superficial eschars, which are seldom lacking in the first period, that during which suppuration of the contused wound is preparing. At the same time an abundant and fetid liquid escaped from the superficial and deep layers. Twenty-four hours after the admission of the patient a burning fever came on, with 125 to 140 pulsations, the temperature rising to 105° in the evening, and varying between 103° and 104° in the morning. Then, after two days, delirium set in, so that the patient had to be tied in his bed; then the abdomen swelled, and at the end of six days, during which the leg had notably increased in size, and the wound had not ceased to furnish an abundant and reddish fetid discharge of which I shall speak in a moment, death occurred.

The fever was not preceded by a chill.

¹ See Lecture xxix.