

LECTURE XXV.

FRACTURES OF THE LOWER EXTREMITY OF THE RADIUS—CONTINUED.

- I. Early phenomena and symptoms of recent fracture—Study of the mechanism—Inflection, tearing off, crushing, and penetration—Treatment—Immediate reduction—Restraining apparatus the sixth day—Necessity for great watchfulness if it is applied sooner. II. Immediate reduction—Simple retention with Robert's apparatus. III. Recent fracture in a young man 18 years old—Absence of crushing and penetration—Probability of a cure without deformity and with prompt return of the functions.

GENTLEMEN: We have at this moment in our wards three patients affected with recent fracture of the lower extremity of the radius.

I. The first is the one in whom the symptoms are the most marked. He is a man 58 years old who slipped on the ice yesterday morning and fell. While falling he threw both hands forwards, and the weight of his body was received principally upon the palm of his right hand. No crack was heard, but sharp pain was immediately felt in the corresponding wrist, and the patient, on looking at it, was struck to find it sensibly deformed. He was not able to use it, and saw at once the necessity of coming to the hospital.

You notice the deformity of the wrist. It is perfectly characteristic, and is sufficient in itself alone to establish the diagnosis. Without going into many details, which would tell you less than the simple sight of it, I call your attention only to three things:—

1st. An exaggerated projection backwards immediately above the articulation of the wrist, with a smaller projection upon the palmar surface, below which is a slight depression corresponding to the prominence on the dorsal surface; these prominences and depressions together constituting what Velpeau called *talon de fourchette*.¹

2d. The level of the styloid processes. That of the radius instead of having its point one-third of an inch lower than that of the ulnar, as in the normal condition, is exactly on the same level, that is, it has been carried up the arm. This symptom, to which I attach great value, was pointed out by Professor Laugier.

3d. If, while the wrist is flexed, you press upon the dorsal surface of the forearm immediately above the prominence I mentioned, you feel first the depression, and then in front of it, and deeper, a sort of tense elastic cord, formed by the tendons of the radial muscles (*extensores carpi radiales longior and brevior*) which have been removed from their normal position by the projection of the lower fragment backwards. This sign also was indicated by Velpeau, who gave it the name of the cord of the radials.

¹ Silver-fork fracture of the English writers.—TRANS.

The hand is very slightly inclined towards its ulnar border, and consequently has not been drawn outwards, as occurs in certain exceptional cases which undoubtedly were seen quite often by Dupuytren, and led this great surgeon to use a curved metallic ulnar splint, with external convexity, along which he bound the cubital border of the hand so as to correct the deviation outwards.

I have made very little search for crepitation and mobility. The patient suffered a great deal and I did not need these symptoms to complete my diagnosis. The deformity was sufficient, for it could not be explained otherwise than by a fracture of the lower extremity of the radius, a lesion which offers this clinical peculiarity that it can be recognized in many cases by the deformity alone. There is, however, a circumstance which might lead us into error, I mean a contusion or a sprain occurring in a wrist which remained deformed after an old fracture of the radius. The patient would then present himself to us with the characteristic deformity due to the anterior fracture, and in addition the pain and difficult movements caused by the recent injury. It would then be quite natural to think of a recent fracture. To avoid this error I questioned the patient. I asked him if he had ever had his wrist broken, and it was after having received an absolutely negative answer that I admitted without the slightest hesitation the existence of a recent fracture.

Let us see, before going any further, 1st, by what mechanism the fracture has been produced; 2d, the cause of the characteristic deformity.

1st. As for the mechanism, I have to tell you that in this fracture, as in most others, the information furnished by the questioning and examination of the patient does not solve the problem.

We find indicated in our authors three principal modes according to which the lower extremity of the radius may be broken.

According to most of them, to speak only of contemporaneous ones, the radius is caught, at the moment of a fall upon the palm of the hand, between two opposing forces, the resistance of the ground and the weight of the body transmitted through the arm and forearm to the ball of the hand. The lower extremity of the radius tends to bend backwards under this double pressure. If the movement is carried too far, it breaks, and the more easily if the cancellous tissue has been rendered more fragile by the spontaneous rarefaction which is the consequence of age, which arrives more or less early according to the subjects, and indeed in certain persons is really premature. I do not claim that this theory of inflection has been presented in an absolute and exclusive manner, but it has at least been formulated as one of the conditions of the mechanism in certain works and notably in those of Foucher,¹ Am. Bonnet, and Philippeaux.²

Others, and especially Nélaton³ and Voillemier,⁴ insisted upon this circumstance, that in the fall upon the palm of the hand the

¹ Foucher, Bulletin de la Société Anatomique, 1852.

² Philippeaux, Bulletin de Thérapentique, 1850, p. 207.

³ Nélaton, Eléments de Pathologie, tome 1er.

⁴ Voillemier, loc. cit.

radius might be broken by the pressure to which its cancellous tissue is subjected. I regret that they did not use more explicitly the word *crushing*, which would have made the idea more easily comprehended. But, if the word is not at all or not sufficiently accentuated, the fact certainly is, and it was the theory of crushing which led M. Voillemier to study penetration which is only a consequence of crushing.

More recently M. O. Lecomte, in a long and interesting work,¹ has opposed the theory of crushing, which he makes the mistake of not designating by its real name, and which he calls the *theory of the direct transmission of the shock to the radius*, and, developing a theory which had already been advanced with reserve by Voillemier and Foucher, maintains that in falls upon the palm of the hand the wrist draws backwards and stretches the anterior ligaments of the radio-carpal articulation, that these ligaments exert traction upon the anterior portion of the lower extremity and detach it by a mechanism which is that of tearing.

Here then are three theories—forced inflection, crushing, and tearing. Which must we adopt for this patient? Which must I advise you to adopt for most cases? Neither one exclusively, and all three together, with predominance of one or the other of them according to the age of the subject.

For, as I told you a moment ago, the clinical documents do not furnish any peremptory reason in favour of the intervention of one of these mechanisms rather than of another; and, on the other hand, I do not feel disposed to apply to this patient, any more than to all others, the results of experiments upon the cadaver. I know that some surgeons, especially Nélaton, Voillemier, and O. Lecomte, have tried to clear up the question by experiments of this kind. But there are two conditions which cannot be reproduced upon the cadaver, and which contribute greatly to the production of the lesion upon the living subject.

The first is muscular contraction. I would not go so far as to admit with Pouteau² fracture of the lower extremity by muscular contraction, and especially by that of the long supinator, but I do not the less admit that in a fall upon the palm of the hand, the contraction of all the muscles of the forearm, excited by emotion and the instinctive desire to avoid danger, ought to draw the ball of the hand upwards and increase the pressure of the bones of the carpus against the articular facet of the radius, a pressure which favours crushing.

The second condition is this peculiar fragility induced by senile rarefaction. It varies much according to the subjects, and it was not noted if it existed or to what degree it existed in the cadavers used for the experiments.

If, for these reasons, I cannot tell you with absolute certainty what took place in our patient at the moment of the accident, I can at least offer you well-founded presumptions. Now, there is one condition which exists in him as in most of those who have passed the age of

¹ Lecomte, Archives de Médecine, 1860, tomes xvi. and xvii.

² Pouteau, Œuvres posthumes, tome ii. p. 251.

fifty years, that is, the rarefaction of the spongy tissue and the fragility which results from it. Notice that everybody falls, while walking, upon the palm of the hand, that everybody in so simple a fall does not break the radius, and that especially young people, and adults up to the age of 45 or 50 years, escape this injury. To be produced in them it needs a more energetic cause, such as a fall while running or from a high place.

What is there then peculiar in old people that can explain this lesion? It is not the weight of the body nor the rapidity of the fall which accounts for the easy production of the fracture. It is and can be nothing else than the fragility in question. Now this fragility is put to the proof especially by the crushing, that is, by the pressure from above downwards and from below upwards, to which the radius is subjected in a very simple fall, and the intervention of this mechanism has the advantage of explaining equally well the fractures after a fall upon the palm and those upon the back of the hand. I admit that in a fall upon the palm inflection backwards and tearing intervene to a certain extent, and that the anterior portion of the solution of continuity may be produced principally by them, but the crushing of the posterior portion is always the principal and even initial phenomenon.

I said that in the second place we had to explain the deformity. It is the consequence of what we know of the mechanism. At the moment of the fall the lower fragment is forced backwards by the pressure of the ball of the hand against it, undergoing, as Foucher pointed out, a slight movement of rotation about its transverse axis. Sometimes this movement is very slight, or when once produced it corrects itself, and this is what explains fractures without deformity or with a very slight one; sometimes the fragment remains in its new place, fixed there by muscular tonicity or by penetration, and then the deformity persists, being remediable if the muscles are not too energetic, or if the penetration is not accompanied by an insurmountable interlocking, and irremediable, on the contrary, if the opposite conditions exist.

As to the prognosis, remember that we have not to deal here with a serious disease; first, because life is not at all endangered, and then because in all probability consolidation will be soon obtained. In general, 20 to 25 days of immobility and retention suffice. At the end of this time, of course, the functions will not have recovered their integrity, and it will need considerable time for the articulations of the wrist and hand, as well as the neighbouring tendons, to recover their motions and their normal suppleness. But the consolidation will take place by a perfectly bony callus. The callus of course would only remain fibrous in case the patient was still older.

The gravity of the affection lies in the slowness of the return of the functions, slowness of which I have already had occasion to speak, and which will be all the greater here since the patient is nearly sixty years old.

As for the treatment, I remind you of the precept which you often hear me mention for fractures of the upper limb, that of not employing a restraining apparatus at first, and to wait until the inflammatory

period is over to envelop the limb and immobilize the fracture. I applied flaxseed poultices sprinkled with lead-water or spirits of camphor, and told the patient to stay in bed. To be sure, he might be allowed to get up, keeping his hand and forearm in a sling; but the movements would probably cause pain, and it is better to keep quiet. Before applying the first poultice I made the manoeuvre of reduction. While one assistant held the upper part of the forearm firmly with both hands, and even drew it slightly backwards, and another grasped the patient's hand and drew it forward with a certain force, I embraced the wrist with both hands and exerted the pressure necessary to press the lower fragment forwards and the upper one backwards, and thus correct the deformity. I did thus correct it, and you may have seen that when we laid the arm down, the wrist had recovered its normal shape. At first I hoped that this result would be maintained, as I have seen on several occasions, and that then it would be useless to have recourse afterwards to a restraining apparatus. But my hope was not realized. In a few moments you saw the deformity reappear, and you must have concluded, as I did, that if we wished to suppress it definitively it was necessary to maintain, by means of a restraining apparatus, the result obtained by the reduction.

Now for what reason did I decide to wait a few days before applying this restraining apparatus? Because in certain cases the apparatus, if applied immediately, is found to be too tight and causes pain, eschars, and even complete gangrene of the hand and forearm. Do not forget these two things; in fractures of the lower extremity of the radius, as in all others, there is, during the first five to eight days, an inflammatory period, during which the limb swells. Then you have here two quite superficial arteries, circulation through which is easily diminished or checked by the compression exerted by the apparatus. If, then, you apply too tight a bandage, you may thereby stop the circulation and cause the accidents I mentioned. If you apply one which is not too tight at first, it may happen that, inflammatory swelling of the forearm occurring, the apparatus may exert at the end of twenty-four or forty-eight hours a constriction upon the tumefied limb which it did not at the beginning. I am far from wishing to exaggerate the danger. Certainly you may apply an apparatus early if you are sure of not making it too tight, and especially if you are able and willing to see the patient twice a day, and to loosen or even remove the bandage in case pain or purple swelling of the fingers warns you that the circulation is troubled.

Beware of the first of the symptoms, the pain. I know the lamentable history of a woman, 70 years old, whose surgeon applied the first day a roller bandage for a fracture of the lower extremity of the right radius. A distance of two leagues separated the patient and the surgeon. It was agreed that the latter should be sent for if rather severe pain should be felt, but that otherwise he should come only at the end of six days. The patient did not suffer, or suffered too little to send for the surgeon, and when he arrived he found the hand and forearm gangrenous. A very unpleasant litigation resulted.

It is to avoid a complication of this kind that I advise you not to

apply an early apparatus unless you are sure of being able to watch it, and it is still better to apply only poultices during the first five or six days. These recommendations, which are good for all subjects, are especially applicable to children, women, and old people, that is, to all feeble subjects whose circulation is easily checked by compression of the radial and ulnar arteries. It is for those especially that I recommend you not to place an apparatus upon the broken forearm before the fifth day, whether it is a fracture of the extremities or of the shaft. You may reserve, if you choose, immediate application for vigorous adults, but always on condition of exercising a very close watch over it.

At the hospital you see that I reject in all cases the immediate use of the constricting bandage, because, on the one hand, I wish to fix in your minds the possible dangers of its use, and because, on the other hand, this action does not affect disadvantageously the after-treatment and the consequences of the injury. I see only one inconvenience in it for the patient—that of being compelled to remain in bed; for the simple envelopment in a poultice does not sufficiently immobilize the fracture, and exposes it to painful jars if the patient leaves his bed and walks about.

The treatment for this patient will be as follows:—

Poultices sprinkled with spirits of camphor will be kept on for five days, and on the sixth I shall apply the restraining apparatus which I have already described (see page 193), the one which I borrow from Malgaigne, and by means of which pressure is made upon the dorsal and palmar prominences. It is completed by graduated compresses and splints kept in place by three strips of diachylon plaster four feet long and two inches wide, so as to form what I call an open apparatus, by means of which the parts can be watched between the pieces of the apparatus, and relieved by loosening the bands if it is found that, in spite of the late application, the constriction has become too great.

The bands will be removed at the end of a week, the forearm carefully examined, and a new attempt at reduction made if it is found that the shape is not all that could be desired. The apparatus will then be reapplied as at first, and left in place until the twenty-first day, counting from the time of the accident. I advise you never to leave bandages for fracture of the lower extremity of the radius in place beyond this time; first, because twenty-one days are sufficient to obtain consolidation, and then because a more prolonged immobility would increase the painful stiffness of the fingers which I have pointed out as one of the consequences of the immobility caused by apparatuses for fracture of the upper limb.

Finally, after the bandage shall have been removed, I shall prescribe communicated movements, friction, massage, and sulphur baths, so as to shorten as much as possible the duration of the powerlessness to which the patients are condemned for a longer or shorter time, according to their age, in consequence of these fractures of the wrist.

II. The second patient of whom I have to speak interests you especially from a therapeutical point of view.

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,