On the treatment of fracture of the lower extremity of radius / by Alexander Gordon.

TREATMENT

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LOWER EXTREMITY OF RADIUS.

BY

ALEXANDER GORDON, M.D., L.R.C.S.Ed.,

PROFESSOR OF SURGERY, QUEEN'S COLLEGE, BELFAST, AND
SURGEON TO THE BELFAST GENERAL HOSPITAL.

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FRACTURE OF RADIUS.

Of all the bones of the body, none is so frequently fractured as the radius. The fracture usually occurs at, or about an inch above, its carpal end. I believe fractures of this bone, in this situation, are almost as frequent as all the other fractures conjoined. This fact renders any attempt to improve the treatment at present pursued deserving of serious consideration, especially because that accident frequently entails much suffering,—often great impairment of the functions and structure of the wrist joint, and often happens in persons whose subsistence depends mainly upon manual labour.

I have no hesitation whatever in stating, that the methods of treatment which have been hitherto pursued in this common accident have failed. I do not mean to assert that they have not been beneficial. I acknowledge that the functions of the limb have, in many cases, been almost perfectly restored, and the amount of subsequent deformity very much diminished. I do, however, affirm, that they do not afford such a solid support to the radius as is requisite for the restoration of its natural form; nor, if the form be restored by coaptation, will they maintain it until firm osseous union has taken place. The main cause of failure has been the imperfect adaptation of splints to the shape of the forearm. When the forearm is supine, the external border of the carpal end of the radius looks directly outwards, and is on the outer border of the forearm,—above, at the elbow joint, the external border of the forearm is formed by the supinator and extensor

muscles, the head of the radius occupying nearly the centre of the posterior surface. When the hand is prone, the carpal border of the radius, which in supination looked outwards, is now directed inwards, the position of the head of the radius being unchanged. If we now look at the radius, and trace its course, we shall find it, as we ascend, to pass from the inner to the posterior aspect of the forearm. If we now place a narrow pad along the front of the forearm, and over this a splint, it will be quite evident that pressure thus made is chiefly sustained by the muscles in the centre of the forearm, and that the radius is very imperfectly supported, and especially at the part where it is most frequently broken. These reflections led me to adopt the mode of treatment which I shall presently describe.

The fracture is usually transverse, and both fragments,—that is the upper end of the lower fragment, and the lower end of the upper fragment,—are displaced forwards and inwards. Of this double displacement, I regard the inward as of secondary importance, because, if we counteract the forward displacement, the fragments, in resuming their natural position, will incline outwards, just in the same way as a straight, or slightly curved, piece of wood, when broken, with the fragments still in apposition, will resume its straight or slightly curved form when the deflection is counteracted. This fact, I think, has probably been too much overlooked hitherto in the treatment of this very common fracture; and hence too much importance has been attached to the necessity for counteracting the action of the pronator quadratus, and other muscles, by maintaining the hand in a state of adduction. Adduct the hand as we may, the deformity and its consequences will persist if the forward displacement be not thoroughly rectified.

The practice hitherto adopted may be said briefly to have consisted of the application of a pad resting against the palmar surface of the forearm, extending as far as, or below, the lower end of the upper fragment, and supported by a splint; of graduated compresses upon the posterior surface of the carpal fragment and carpus, and over these of a straight or pistol-shaped splint; and of adduction of the hand.

Dupuytern applied the ordinary apparatus for fractures of the forearm, and relied chiefly upon an ulnar splint, to which the hand was held adducted, evidently overlooking the main displacement forwards.

Nelaton applies a compress doubled at its lower end, so as to form a thick border, which he places immediately above the lower end of the upper fragment, and over that a splint, which extends beyond it, leaving between this splint and the lower end of the forearm a space which corresponds to the lower fragment; in fact, on the palmar surface of the lower fragment there is no pressure exerted. Posteriorly, however, he places across the posterior surface of the carpus and the carpal fragment of the radius, two or three graduated compresses of a wedge shape, with the base directed outwards, and over these a splint. Thus, according to Nelaton's plan, the lower end of the upper fragment is pushed backwards by the palmar compress and splint, whilst the carpus and carpal end of lower fragment are pushed forwards and inclined towards pronation.

A little reflection will shew us, especially when we examine attentively the conformation of the forearm, when placed midway between pronation and supination, that any pad applied in front and covered with a splint will exercise its chief pressure along the centre of the forearm, and will not

be sufficiently oblique to restore or maintain fully and effectually the concavity of the radius.

The splint which I use has attached to its radial border a piece of wood, so bevelled that it fills up and fits accurately the natural concavity of the radius. (*See Plate.*) The fracture renders the palmar surface of the radius convex instead of concave, its normal form. The surface of the attached piece of the splint is also convex, and covered with tow, a piece of spongiopiline (the best material), or some other soft substance. The splint being thus covered is then applied to the forearm. The convexities of the splint and radius are mutually brought into apposition; about half an inch, or perhaps a little more, of the lower end of the radius is unsupported, because of the alteration in its form. A thick pad, similar to that used by Nelaton, is now applied over the posterior surface of the carpal fragment of the radius and carpus, and over this a splint, extending from the upper and back part of forearm to the metacarpus. The action is very simple. The radius, at the seat of fracture, is convex instead of being concave; the convexity of the splint is pressed against the convexity of the radius. The lower end of the carpal fragment, the carpus, and metacarpus, being inclined unnaturally backwards, are pressed towards the palmar surface, acting as a lever, whose fulcrum is the convexity of the radius. The displacement forwards of the radius gradually yields, and if the pressure by the bandages be cautiously and continuously maintained the convexity of the splint slowly and steadily forces the displaced fragments backwards until at last the convexity of the splint rests in the concavity of the radius, and just as the inclination forwards of the fragments disappears, so does the displacement inwards; and so perfectly does the radius regain its normal form, that, in most cases, it would be difficult to

detect the seat of fracture. In one case I tried in how short a time the splint would reduce the deformity under pressure from straps and buckles. The patient was a boy, thirteen years of age, who had "sprained his wrist" nearly three weeks previously. The inclination forwards was even greater than usual. The splint was applied at 10 o'clock, A.M., and at 8 o'clock, P.M., of the same day, the straps were tightened by one of the resident pupils of the General Hospital. The patient, in the mean time, made no complaint of pain, and on the following morning the radius had perfectly regained its shape. Yet I do not recommend that the correction of the deformity should be left to the splint and pressure alone. I merely mention it as a fact, repeatedly observed, that the splint, if properly applied, and aided by a tight bandage, will, as it were, mould the radius upon it, and restore its natural form.

A very important question arises at this stage of the inquiry, Can the methods of treatment recommended by Dupuytren, Nelaton, Dr. R. W. Smith, and others, restore the natural form of the radius; or can they maintain it, when it has been restored by manipulation, until firm osseous union has taken place? I believe they cannot, and for this simple reason, they do not afford a sufficiently solid mechanical support effectually to counteract the action of the supinator radii longus, the adductors of the thumb, and the other muscles, when there is a tendency to displacement,—and, if they do not, are those disastrous consequences, which too frequently follow the accident, to be referred to the injury inflicted at the time of its occurrence; or are they the result of inflammatory action, subsequently set up in consequence of alterations in the natural relation of the parts?

When the radius is restored to its natural form, and thus maintained, the "stimulus of imperfection" ceases, and, as in other fractures, very little serious inflammatory action follows. I have so often witnessed relief of the pain, which was very severe before the application of the splint, that I regard pain as indicative of displacement rather than of fracture. In some persons, especially those in whom the general health is not good at the time of the accident, the subsequent inflammatory action may be great, and the result of the primary injury. When once it has commenced, it may continue until it ends by impairing the functions of the limb permanently. Still, my firm conviction at present is, that in most cases the inflammation is not of primary, but of secondary occurrence, and that it is indirectly due to the non-restoration of the natural form of the radius. If we examine a case carefully by dissection, in which there has been a slight inclination forwards of the concavity of the radius, we shall see changes sufficient to account for it. Do not the same train of symptoms arise in cases of fracture of the fibula, in which, after the consolidation of the fracture, the weight of the body is thrown more inwards upon the tarsus than it was before the patient met with the accident?

I have before me six specimens of the radial fracture, and in none of them has the natural concavity of the radius been restored. Dr. R. W. Smith, in his admirable treatise on Dislocations and Fractures in the Vicinity of the Joints, says, "In not one of the twenty specimens which I have lately examined has this object (the restoration of the natural concavity of the radius) been accomplished; in some it has been so far effected that the carpal surface looks directly downwards, but in none of them does the posterior surface

exceed the anterior in length; in those which present the nearest approach to the natural form of the bone, these surfaces are of equal length."

Now, what are the alterations which result from the changed position which the carpal surface of the radius occupies. The inclination forwards of the upper end of the carpal fragment, causes its carpal surface to look downwards and slightly backwards, which is also further increased by the greater absorption of the posterior half, evidently showing that the movements of the carpus upon the carpal surface of the radius are directed more towards its posterior border than natural; or in other words, the centre of motion between the carpus and the carpal surface of the radius is displaced backwards. Indeed, whilst the length of the palmar surface of the lower or carpal fragment seems to be little, if at all altered, the posterior surface is shortened one or two lines by the progressive absorption of the posterior half of the carpal surface. One of the effects, then, of this accident is to wear away, if I may use the expression, the posterior half of the carpal surface, and cause shortening of the posterior surface, in some instances by two lines at least; and leading to increased capability of extension, and diminished capability of flexion of the hand upon the forearm; also alteration in the line of action of the extensor muscles behind, of the flexors in front, and of all the other muscles which pass from the forearm to be inserted in the hand.

I have seen absorption of the vertical thickness of the scaphoid and semilunar bones. In one of the specimens of this accident which I have before me, the vertical thickness of the scaphoid and semilunar bones is unquestionably diminished, but as there is evidence of the presence of that morbid action to which the name of Chronic Rheumatic

Arthritis is given, the alteration may be as much the effect of this morbid process as of the accident.

From the inclination inwards of the upper end of lower fragment, the styloid process of the radius ascends, drawing with it the hand; giving to the extremity the appearance as if the hand had suffered a slight partial dislocation outwards; causing projection of the lower end of the ulna, elongation of the internal lateral ligament, and increased mobility of the carpal end of ulna.

We may now perceive very plainly, from the changes in the natural relations of parts, and consequently in their actions,—that the ligaments and sheaths of the tendons sustain a sort of chronic sprain, which, exciting inflammation, ultimately ends in greater or less impairment of the functions of the forearm and hand; that these occurrences are almost entirely referable to the displacement of the lower fragment of the radius; and that every mode of treatment which does not effectually restore the concavity of the radius, must necessarily be followed by those distressing consequences, which most surgeons have regarded as unavoidable and irremediable. That these distressing sequelæ may be almost entirely prevented, I have not the slightest doubt; but if so, this can only be accomplished by a splint accurately fitting the concavity of the radius and effectually maintaining it. The treatment of fracture of the lower end of the radius will then be as easy as that of any other fracture, and unattended with any serious consequences as regards the future usefulness of the limb.

I have often been told by practitioners, that they have efficiently treated fractures of the lower end of the radius by compresses in front and behind, covered by straight or pistol-shaped splints. To this I reply: That your patient

has had a fracture of the lower end of the radius, I admit; that you have set the fracture, restoring the natural form of the bone, I also acknowledge; that compresses and splints have been applied is another fact, and also that the patient has regained the perfect use of the limb. All these facts I admit, but I cannot admit, from what I have seen of this accident, that compresses supported by straight or pistol-shaped splints are adequate to restore the concavity of the radius, and maintain its natural form, if there be a tendency to displacement, because they are not adequate to the correction of the displacement; and, being mechanically imperfect, deformity of the radius and its disastrous consequences must result.

Every practitioner who has carefully observed cases of this accident, and treated them according to the most approved methods hitherto adopted, must, if possessed of ordinary candour, admit the existence of the serious consequences which too frequently attend it, and which have been faithfully described by Dr. R. W. Smith. "The sequela of this injury is a source of great inconvenience to the patient, and of annoyance to the surgeon, who is often unjustly blamed for its occurrence; the practitioner will, therefore, act with prudence in warning his patient, at the commencement of the attendance, that stiffness of the wrist-joint and an incapability of flexing the fingers, during a period of several months, are by no means unfrequent results of a fracture of the lower end of the radius." (Page 139.)

It would be presuming too much to affirm, at present, that these untoward circumstances can be entirely prevented. Still, I am bound to state, from considerable experience, that under proper treatment they are very rare; so rare, indeed, that their occurrence neither need be anticipated nor dreaded.

In the formation of the splint there are several points which should be carefully observed. The breadth of its lower or carpal end should not exceed that of the forearm at the wrist; it should not project so much internally as to be on a level with the inner border of the forearm. On the radial side it should project beyond the radius, and the bevelled piece, for filling up the concavity of the radius, should be attached half an inch at least internal to that border. By this arrangement, the ulnar side of the forearm sustains the pressure of the bandage or straps. The reverse is the case on the radial side. The radial border of the splint alone is pressed upon; this pressure forces the bevelled portion inwards upon the concavity of the radius and pushes it backwards, whilst, at the same time, the outer border of the radius is protected from pressure. If the ulnar margin of the splint projected beyond the ulnar border of the forearm it would be pushed outwards when we applied the bandage, and the bevelled portion would be removed from the concavity of the radius and left unsupported. The upper end of the splint should be well hollowed to adapt itself accurately to the convexity of the upper part of the palmar surface of the forearm. In this, as in other fractures, I prefer broad straps, with buckles, to the ordinary calico or linen bandage, as they are more easily removed and less liable to loosen. Indeed, for some time past, in the treatment of fractures generally, I have entirely discarded the ordinary circular bandages, using in their stead broad straps with buckles attached; and whether we regard the comfort of the patient, or the satisfaction which the straps afford to the surgeon, the advantages are so obvious that calico or linen bandages cannot bear comparison with them.

Another point to which my attention has been particularly

directed for some time has especial reference to the diagnosis of injuries of the wrist and ankle joints, and may be of some importance to the junior practitioner. Fractures of the lower end of the radius are usually caused by falling upon the upper part of the palmar surface of the hand, when the patient instinctively extends his arms whilst falling to prevent his face coming in contact with the ground. If, after falling in this manner, a patient complains of having sprained his wrist severely, and is immediately afterwards unable to move it unless with great pain, it is the radius and not the wrist-joint that has suffered. I cannot bring to my recollection a single instance of severe sprain caused in this manner. I do not mean to deny the possibility or probability of the wrist being sprained in this way, but I wish to impress upon the junior practitioner the importance of a maxim, which I have laid down for my own guidance, and it is this:—When a patient comes to me and says, "I have sprained my wrist, and I am unable to use my hand," I assume the injury sustained to be a fracture of the radius and not a sprain, until I have satisfied myself to the contrary. When a patient requires my assistance for a severe sprain of the ankle-joint, caused by the foot being twisted either inwards or outwards, I assume that he has fractured the fibula, and that the whole injury is a fracture and not a sprain, until, by the most careful examination, I have satisfied myself to the contrary. Sprain of the wrist, from falls upon the palm of the hand, is a very rare accident. I do not remember having met with a single instance of it. Sprains of the ankle-joint, from twisting of the foot, I also regard as very rare accidents; whereas fractures of the radius and fibula are very common.

PLATE.

FIG. 1.—**A** The bevelled piece of the splint applied to the radius. **B** The margin of its body projecting outwards and protecting the radius from pressure. **C** The dorsal splint and pad.

FIG. 2.—**A** Shows the form of the bevelled portion; inferiorly it is convex from without inwards, and from before backwards. **B** The body of the splint.

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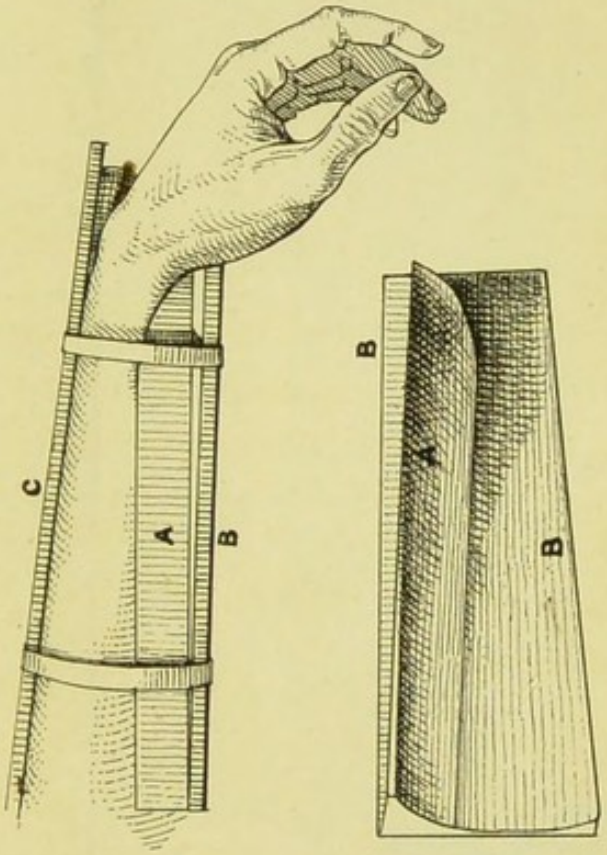
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