

supination is frequently impaired, and sometimes entirely lost, pronation is rarely affected; and that lateral displacements are much more common than displacements forwards or backwards. How this position, semi-pronation, may tend to the production of a permanent pronation, I have fully explained when speaking of fractures of the head of the radius; and in the influence of the same position, the forearm resting upon its ulnar margin in the sling, in the production of a lateral deviation, is also easily understood. If the arm rests upon the sling so that its weight bears more upon the point of fracture than upon the extremities of the bones, then the ulna, or both ulna and radius, will incline gradually to the radial side, and the hand will fall off to the ulnar side; or if the sling rests under the wrist or hand chiefly, the hand will ascend to the radial side, and the broken ends of the two bones will project to the ulnar side.

If this plan be adopted, viz., laying the hand and forearm upon its back, instead of upon its ulnar margin, the elbow should remain at the side, the humerus falling perpendicularly from its socket; and the forearm should rest in the sling directed forwards from the body.

The following is the method usually employed by the author:

Two thin, but firm, wooden splints are prepared, of uniform breadth, sufficiently wide that when the roller is applied it shall touch only lightly

FIG. 122.



Palmar splint.

the radial and ulnar margins of the forearm. The palmar splint should be long enough to extend from the bend of the elbow, the arm being flexed, to the metacarpo-phalangeal articulations, the fingers being flexed. The dorsal splint should be a little shorter, or of a length to extend from the base of the olecranon process to the carpus. Both of these splints must be covered with cloth, and properly padded with cotton-batting; taking care to leave but little of the cotton placed where it might press upon the radial and ulnar arteries and median nerve; that is, at the front of the wrist.

The splints, being carefully fitted, are applied while the forearm is held at a right angle with the arm, and in a position midway between pronation and supination, one to the palmar and the other to the dorsal surface of the forearm, and secured with a roller. There must be no pressure against the humerus at the bend of the elbow; and the fingers must be flexed easily over the lower end of the palmar splint. The dorsal splint should not extend beyond the lower end of the radius and ulna. It is understood, of course, that while the splints are being secured in place, extension and counter-extension are maintained for the purpose of securing coaptation of the broken extremities as far as possible. The dressing being completed, the forearm is suspended in a sling.

Finally, whatever may be the mode of dressing, let me repeat the injunction to examine the arm frequently. No surgeon can do justice to himself, or to his patient, who does not look at the arm at least once in twenty-four hours during the first ten or fourteen days, and in some cases the patient ought to be seen twice daily.

When the fracture is compound, it is often quite impossible to retain

the forearm in the half-pronated position; since, when thus placed, and only slightly supported, as it must necessarily be, it inevitably falls over upon its palmar surface.

There can be no doubt that in such a case we ought, from the first, if it is found practicable, to place it upon its back, in a position of complete or nearly complete supination. For this purpose, a single broad splint, carefully cushioned, and covered with oiled cloth, is the most suitable. Upon this the forearm is to be laid, and secured gently with a few turns of the roller. If the patient is able to do so, and wishes to walk about, the board may be suspended to the neck, as recommended by M. Mayor.

I have said that we ought, in cases of compound fracture, to lay the forearm upon its back, if practicable. I am sure, however, that the surgeon will find very many patients who cannot endure this position, and he may be compelled, therefore, to lay the limb upon its palmar surface, or to leave it to assume any other position in which it may be the most at ease. In conclusion, I desire again to call attention to the splint employed by Dr. Scott, and of which an illustration is given in the chapter which treats of Fractures of the Radius.

Recently, in a letter from Dr. G. W. Burke, of New Castle, Indiana, I am informed that in the case of an oblique fracture of both bones of the forearm, occurring in a man thirty years of age, and at the junction of the lower and middle third, the fragments were thrust downwards and outwards until they had nearly penetrated the skin. Finding, after repeated efforts, that he was unable to extricate them from the muscles and fascia which they had penetrated, he made an incision, exposed the bones, and replaced the fragments. The arm was subsequently dressed in the usual way, and he made a good recovery. Resection of the fragments was not required. The practice in this case was no doubt sound, inasmuch as in no other way could the bony union of the fragments have been assured.

Of the 37 examples of *delayed and non-union* recorded by Muhlenberg, 30 were subjected to treatment. Of 4 treated by manual friction, 1 was cured and 3 failed. One treated by section was cured. Of 17 treated by resection, 11 were cured and 6 failed; 4 were treated by drilling, and all failed. Of 4 treated by mechanical appliances and immobilization, 2 were cured and 2 failed.<sup>1</sup>

## CHAPTER XXV.

### FRACTURES OF THE CARPAL BONES.

ALL of the cases of fracture of the carpal bones which have come under my observation were, without exception, compound and complicated, and have resulted in the complete loss of the hand, or in some less serious, but never inconsiderable, mutilation or maiming.

<sup>1</sup> Muhlenberg, Agnew's Surg., op. cit., vol. i. p. 805.



In no case has a treatment been adopted which might be regarded as having reference to the fracture, or the purpose of which was to insure apposition and union of the fragments.

It may be proper to assume in a matter so easily comprehended, what actual and recorded experience has not proven, namely, that simple fractures of these bones will demand very little surgical interference, and that they will unite generally without much displacement, and without any considerable maiming. It is, indeed, quite probable that some degree of ankylosis between their adjacent surfaces will occur, yet even in the normal condition they enjoy so little motion as to render it doubtful whether its complete loss would be very sensibly felt.

In cases of comminuted, compound, and otherwise complicated fractures of the carpal bones, which accidents are sufficiently common, the surgeon has only, I conceive, to follow carefully those general or special indications which may happen to be present, the precise character of which it would be difficult to anticipate, and for the treatment of which it would be unsafe to attempt in a written treatise to provide.

## CHAPTER XXVI.

### FRACTURES OF THE METACARPAL BONES.

*Development of Metacarpal Bones.*—These bones are each formed from two centres of ossification. In the case of the metacarpal bones of the four fingers there is one centre for each shaft, and one for each distal extremity; but in the case of the metacarpal bone of the thumb there is one centre for the shaft and one for the proximal extremity. All these epiphyses unite with the shafts at about the twentieth year.

*Causes.*—They are generally broken by direct blows; and in that case the injury is often of such a character as to demand amputation, and does not therefore belong to that class of accidents of which it is the purpose of this volume to treat. Not an inconsiderable number, however, are the results of indirect blows, and especially of blows upon the knuckles received in pugilistic encounters. Thus, in a record of sixteen fractures, I find this cause assigned in seven; in one other instance it was occasioned by falling upon the clenched fist, and in one by striking a board; so that the fracture has resulted from a blow upon the ends of the bones in nine of the sixteen examples.

*Point of Fracture; Direction of Displacement; Symptoms.*—Once the fracture has occurred in the metacarpal bone of the thumb; eight times in the metacarpal bone of the index finger; once in the second finger; three times in the ring finger, and three times in the metacarpal bone of the little finger. Two of those belonging to the ring finger, and the three occurring in the little finger, were produced by blows with the clenched fist, and in each instance the fracture was in the lower or distal third of the bone. Three of the fractures of the metacarpal bone of the

index finger were produced also in the same way; two of which were near the middle of the bone, and one near the proximal end. Of the whole number, seven were broken through the lower third, five through the middle, and four through the upper third.

In every instance where the bone is known to have been broken by a blow upon the knuckles, the distal end of the distal fragment was thrown toward the palm, and this fragment was salient backwards at the point of fracture.

In the following case the bone was probably separated at the epiphysis:

Thomas Rose, æt. 8, fell down a flight of steps, September 11, 1855, breaking the metacarpal bone of the index finger of the right hand near its lower extremity, and apparently at the junction of the epiphysis with the diaphysis.

I saw the lad about sixteen hours after the accident. The lower fragment, projecting abruptly into the palm of the hand, could be easily replaced, or with only moderate effort, yet immediately when the support was removed it would become displaced. There was no crepitus.

It was dressed very carefully with a splint and compress; but, notwithstanding our continued efforts to keep the fragments in place, the epiphysis united considerably depressed toward the palm.

In one instance, also, I think the bone was rather bent, or partially fractured, than broken completely. This was the case of fracture of the metacarpal bone of the ring finger, produced in a gymnasium by striking with the clenched fist against a board, and to which I have already alluded. I did not see the young man until four weeks after the accident, when I found the lower end of the bone depressed toward the palm, and the angle made at the point of fracture was rather rounded and quite smooth; it was also tender at this point, but the bone was firm and unyielding. Four years after I was permitted to examine it again, and I found the same slight deformity still continuing.

A partial explanation of the fact that the distal end of the distal fragment is generally displaced toward the palm, may be found in the natural curve of these bones, which is such that when the fracture has been produced by a counter-stroke, the distal end would almost necessarily be driven in this direction; and a farther explanation has been suggested by Mr. B. Cooper, namely, the action of the interossei.

*Results.*—Generally, when the fracture is simple, and the displacement is not considerable, the nature of the accident is overlooked, and some deformity must inevitably ensue. In a majority of the cases which have come under my observation this has been the fact, and the bone has remained slightly bent at the seat of fracture, but without affecting in any degree the value of the hand.

The following example has furnished the most serious result of any case of simple fracture of these bones which has come under my notice:

Louis Mooney, æt. 25, struck a man with his clenched fist, November 4, 1856, breaking the metacarpal bone of the index finger of the right hand near its middle. Great swelling and suppuration followed the injury.

February 21, 1857, nearly four months after the injury was received,



he consulted me. There existed at this time a complete ankylosis at the wrist-joint, and a partial ankylosis in the fingers. The hand was deflected forcibly to the radial side. At the point of fracture the fragments were salient backwards and quite prominent, but firmly united.

Even when the existence of the fracture is recognized, it is not always easy to retain the fragments in place, as the case of epiphyseal separation already mentioned, and the following case will illustrate:

Miss E., of Erie Co., N. Y., æt. 18, fell, August 7, 1853, striking upon her right hand with her fingers forcibly bent into the palm of the hand. On the following day she consulted me at my office, and I found the metacarpal bone of the ring finger broken about three-quarters of an inch from its distal end, and the distal extremity of the fragment depressed toward the palm. A feeble crepitus, with distinct motion, completed the diagnosis. The young lady was very anxious to have a perfect hand, and I was determined if possible to accomplish it. Finding that the joint end of the distal fragment was constantly disposed to fall toward the palm, I constructed a gutta-percha splint for the hand and fingers, and after placing a pad directly underneath this fragment, I secured it firmly with a roller. From this time until the end of four weeks she remained under my care, visiting me as often as once or twice a week, and at each dressing I found the distal fragment slightly displaced in the same direction as at first, nor was I able ever to make it resume completely its position.

Ordinarily, however, no such difficulty is experienced, and the bone, supported by such simple means as I shall presently direct, unites quickly and without deformity.

An engineer was struck by a piece of iron in such a way as to break his right forearm and the second metacarpal bone of the same hand. The fracture of the metacarpal bone was compound and about three-quarters of an inch from its proximal extremity. When he called upon me, which was immediately after the injury was received, I found the proximal fragment projecting directly backwards, its sharp point rising above the skin, into which position it was evidently drawn by the action of the extensor carpi radialis longior muscle. By pressure alone it could be replaced, but it was much more easily reduced when the hand was forcibly carried backwards on the forearm. I therefore secured the hand in this position with appropriate splints, and it was maintained in this posture during most of the subsequent treatment. Union finally took place, but not without some backward displacement. Four months after the accident occurred, on the 31st of December, 1858, I examined the hand, and found the skin healed over completely, the end of the fragment having become rounded and smooth, so as not to give him any degree of annoyance. His wrist was as flexible and as strong as before. No doubt the projection of the fragment might have been prevented entirely by cutting at the point of its attachment the tendon of the muscle, but this would have sensibly weakened the wrist-joint, and I preferred the alternative of a projection of the fragment.

*Treatment.*—With moderate extension made upon the finger corresponding to the broken bone, while the fragments are forced home by firm pressure, the bone may generally be brought at once into line, and

we may now proceed to adapt a gutta-percha, felt, or thick pasteboard splint, to either the whole surface of the back or palm of the hand and fingers, while they are held in a position of easy flexion. It is not very material to which of these surfaces the splint is applied; or rather, I may say, it ought to be applied to the one or the other according as circumstances seem to indicate. It should be well padded, and especially at certain points, in order to the more effectual support of the fragments. It is then to be secured in place with several turns of a roller. When either of the metacarpal bones, except those of the great or ring finger, is broken, the splint must be wide enough to secure the sides of the hand against the pressure of the roller.

Thus dressed, the hand may be laid in a sling beside the chest, or while sitting it may rest upon a table.

The apparel must be examined daily, and readjusted as often as it shall become disarranged, or as a doubt shall arise as to the condition of the parts.

When the fracture is followed by much inflammation, or occurs near, and especially if it actually involves a joint, the same precautions must be adopted to prevent ankylosis as in the case of similar fractures in other bones.

## CHAPTER XXVII.

### FRACTURES OF THE FINGERS.

*Development of the Phalanges of the Hand.*—The phalanges of the hand are formed from two centres of ossification, namely, one for each shaft and one for each proximal end. Ossification commences in the shafts at about the sixth week; in the epiphyses of the first phalanges between the third and fourth years, and in the epiphyses of the last two phalanges somewhat later. Complete bony union takes place between the epiphyses and the shafts at from the eighteenth to the twentieth year.

*Causes.*—I do not remember to have seen a fracture of one of the phalanges produced by a counter-stroke; I am aware, however, that they are occasionally produced in this way, as by falling upon the ends of the fingers, and especially by the stroke of a ball in the game of base.

The fact, however, that they are generally the consequence of a direct blow, and that the finger bones are small and only protected by a thin covering of skin and tendons, renders them peculiarly liable to comminution and to other serious complications. Thus, in a record of thirty fractures, only eighteen were sufficiently simple to warrant an attempt to save them; and only five are recorded as simple fractures without complications.

*Point of Fracture and Direction of Displacement.*—In the following case there was probably an epiphyseal disjunction. A lad four years old was admitted to the Buffalo Hospital of the Sisters of Charity, Dec. 24,



1849, with a simple fracture of the first phalanx of the ring finger of the left hand; the fracture being at the proximal end of the bone, and at the junction of the epiphysis with the shaft.

The finger was so much swollen at first, that no dressings were applied until the fifth day, at which time a gutta-percha splint was moulded to it carefully. It resulted in a perfect cure.

I have not seen the fragments much overlapped, except in one instance. Occasionally there has been no perceptible displacement; but generally there will be found a slight displacement in the direction of the diameter of the bone.

The case to which I refer as presenting an extraordinary overlapping was that of an Irish laboring woman, aged about thirty-five years, who, having fallen down a flight of steps, broke the first phalanx of the thumb below its middle. Dr. Congar was first called on the day following the accident, but was unable to reduce the fracture, and on the same day invited me to see the patient with him. The distal fragment was displaced backwards, overlapping the proximal fragment a little more than one-quarter of an inch. We made repeated efforts, by pulling upon the thumb with a sliding noose, and with all the strength of our four hands, but to no purpose. The fragments could not be reduced for one moment; and we left the patient as we had found her, only somewhat the worse for our violent and repeated extensions and manipulations. The finger was already considerably swollen when we began our efforts, and we cannot therefore say what might have been accomplished at an earlier moment, but I confess that our defeat was unexpected, and does not seem to me to be satisfactorily explained.

*Results.*—At least ten have left no appreciable lameness or deformity, and possibly several more. It is therefore probably true that these consequences may be avoided with proper care in one-half of the examples in which we attempt to save the finger; and perhaps it will occasion surprise that a perfect result may not be claimed in a larger proportion; but when we consider how frequently the accident is compound, and that even when it is not, the blow having generally been received directly upon the point of fracture, how promptly swelling ensues, it will be easily understood that it will be often found difficult to determine whether the bone is exactly in line or not, or to maintain it in this position after absolute coaptation has been once secured.

I have seen the finger in two or three cases deviate laterally, or become permanently deflected to one side or the other; and once I have found it united, but rotated on its own axis. This latter case is not without instruction.

A girl, *æt.* 6, had her little finger caught by a door violently shut, breaking one of the phalanges, and nearly severing the finger. I closed the wound, and dressed the finger with a moulded pasteboard splint. My dressings were repeated often, and applied carefully; nor did I detect the rotation which the lower fragment had made upon its own axis until the union was consummated. I then found the extremity of the finger turned so that its palmar surface presented diagonally toward the ring finger.

If the surgeon believes that this ought to have been prevented, and

that the result evinces a lack of skill or of care, its record may still serve one of the purposes for which it was designed, and secure to the patient sometimes hereafter more faithful and assiduous attention.

*Treatment.*—Boyer, and after him Bransby Cooper, have taught that when the extreme phalanx is broken, from the small size of the bone, and from its having attached to it the nail and its matrix, it is better in all cases to amputate at once, as the process of reparation is in such case extremely slow and uncertain.

Whether in any of the cases treated by myself, or which have been seen by me, the fracture involved the last phalanx, I am not now able to say, but my impression is that such cases have come under my notice which have been successfully treated, and I cannot but regard the rule established by these gentlemen as much too stringent. Examples must, no doubt, sometimes occur, in which the fracture is so simple in its character as to render prompt reunion pretty certain; and even though the restoration should prove tedious, this ought scarcely to be regarded as a sufficient justification for so serious a mutilation as these surgeons propose, since the loss of even an extreme phalanx is not only a deformity, but must prove in many occupations a troublesome maiming.

Prof. J. Lizars, of the Toronto School of Medicine, C. W., has reported to me a case exactly in point: "A man in the employ of the Toronto Rolling Mills Company fractured the distal extremity of the ring finger of the right hand. The fracture was transverse, and the nail was severely bruised, the accident being caused by a direct blow. Crepitus distinct. A dorsal splint and bandage were applied, and in a short time the fragments were united firmly by bone. The nail subsequently fell off, and a new one was formed."

The rule ought still to be held inviolate, which surgeons have so often repeated in reference to injuries inflicted upon the hand and fingers, namely, that we should save always as much as possible.

It is remarkable, too, how much nature, assisted by art, can do toward the accomplishment of this purpose. If the bone of a finger is not only severed completely, but also all of its soft coverings, save only a narrow band of integument, are torn asunder, a chance remains for its restoration. And it is especially interesting to observe what recuperative powers are possessed by the articular surfaces of these smaller joints, so that although they may be broken into, or sawn through, or comminuted, and although small fragments be entirely removed, a complete restoration of their functions is sometimes permitted. I have seen and reported some such examples. It is true, however, that such fortunate results are rare, and they are rather to be hoped for than anticipated.

Since, in the case of these delicate bones, the slightest deviation from the natural form or position determines in the end an ugly deformity, it becomes exceedingly necessary, especially with females, that we should open the dressings and examine the fingers carefully from day to day, so that, as the swelling subsides, we may discover and correct any displacement which may happen to exist.

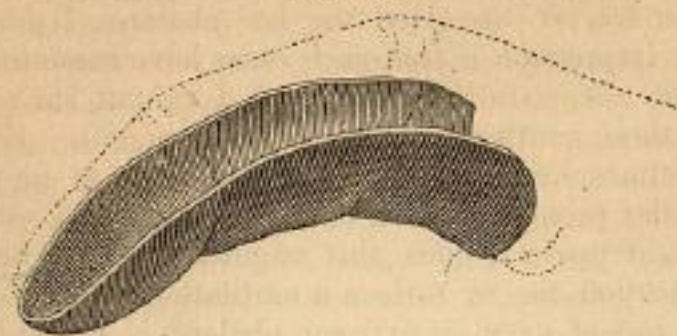
As a splint, I have found nothing so convenient as gutta percha, moulded accurately to either the dorsal or palmar aspect of the finger; and the form of which I have found it generally necessary to change



slightly every third or fourth day, until consolidation is nearly or quite completed.

If the fracture is near or extends into a joint, the finger ought to be a little flexed, so as to place it in the most useful position in the event that ankylosis should occur; and as early as the end of the second week the joint surfaces should be slightly moved upon each other, in order to the prevention of fibrous or bony adhesions. Nor is there

FIG. 123.



Gutta-percha splint for finger.

much danger of preventing the union of the bone by moving the joints at this early day. Union occurs between these fragments very speedily, and I have never met with a case of non-union of the phalanges, nor do I remember to have seen a case reported.

It is the lateral inclination of the distal end of the finger which, according to my experience, it will be found most difficult to obviate, and which may, perhaps, in some cases be most successfully combated by laying the two adjoining sound fingers against the broken finger, and then applying a moulded splint to the palmar surface of the whole. In other cases it will be more convenient to apply the splint only to the broken finger.

Rotation of the lower fragment on its own axis is especially to be guarded against, as the deformity which it occasions is more unseemly, and the impairment of utility more decided, than that occasioned by a lateral deviation.

It may be well also to remind the surgeon of the convenience of extending the splint beyond the end of the last phalanx, and moulding it to this extremity, in order that the finger may be protected against injuries, and that when, from time to time, the splint is removed it may be reapplied with accuracy.

In all cases the splint should be lined with cotton cloth, soft flannel, or sheet tint, and secured in place with narrow and neatly cut cotton rollers. Bandages of this width should never be torn, but carefully cut with scissors.

## CHAPTER XXVIII.

## FRACTURES OF THE PELVIS, AND TRAUMATIC SEPARATIONS OF ITS SYMPHYSES.

*Development of the Os Innominatum.*—This bone is formed from eight centres, three of which are called primary, and five secondary. The three primary centres belong respectively to the ilium, ischium, and pubes, and by their extension form eventually the greater portion of the innominatum. They have a common point of union in the acetabulum; and the ischium unites with the pubes, also, by the junction of their rami. These conjunctions occur usually between the fifteenth and twentieth years of life. The secondary centres do not begin to ossify until the age of puberty, and may therefore properly be considered as epiphyses. One forms the crest of the ilium; one its anterior inferior spinous process; one forms the symphysis pubis; one the tuberosity of the ischium; while the fifth constitutes the centre of the bottom of the acetabulum. The epiphyses become joined to the primary bones, or the bodies of the innominata, at about the twenty-fifth year.

## § 1. Pubes.

## (a) Separations at the Symphysis Pubis.

Lente, in his reports from the New York Hospital, mentions the case of a young man, *æt.* 18, who was crushed between a couple of cars, in consequence of which he died two days after. The autopsy disclosed a separation of the symphysis pubis, unaccompanied with any other fracture. The right side was displaced backwards about half an inch, so that the fingers could be passed between the bones. There was also a wound in the top of the bladder large enough to admit the thumb.<sup>1</sup> Similar accidents have been several times met with by surgeons. Hall reports a case in the *Provincial Medical and Surgical Journal*, May 1, 1844, in which the pubes, thus separated, was actually thrust into the bladder; but in this example the ilium was broken also. I need scarcely add that this patient died;<sup>2</sup> but Sir Astley Cooper has furnished us with an example of a simple fracture or traumatic separation at the symphysis, from which the patient after a long time almost completely recovered. The following is Sir Astley's account of the case:

"Case 79. Richard White, *æt.* 22, was admitted into Guy's Hospital on the 30th of July, 1832, having sustained a severe injury in consequence of a large quantity of gravel having fallen upon his back while in the act of stooping. It knocked him down; and on rising, which he did with considerable difficulty, he attempted to walk; this produced violent pain in the region of the bladder, extending upwards in the course of the ureters to the kidneys. Upon inquiry, he stated that

<sup>1</sup> Lente, *New York Journ. Med.*, 2d ser., vol. iv. p. 286.

<sup>2</sup> Hall, *Amer. Journ. Med. Sci.*, vol. xxxiv. p. 248.