

Moore (E. M.)

A

LUXATION OF THE ULNA

NOT HITHERTO DESCRIBED,

WITH A PLAN OF REDUCTION AND MODE OF
AFTER TREATMENT;

INCLUDING THE

MANAGEMENT OF COLLES' FRACTURE.

BY

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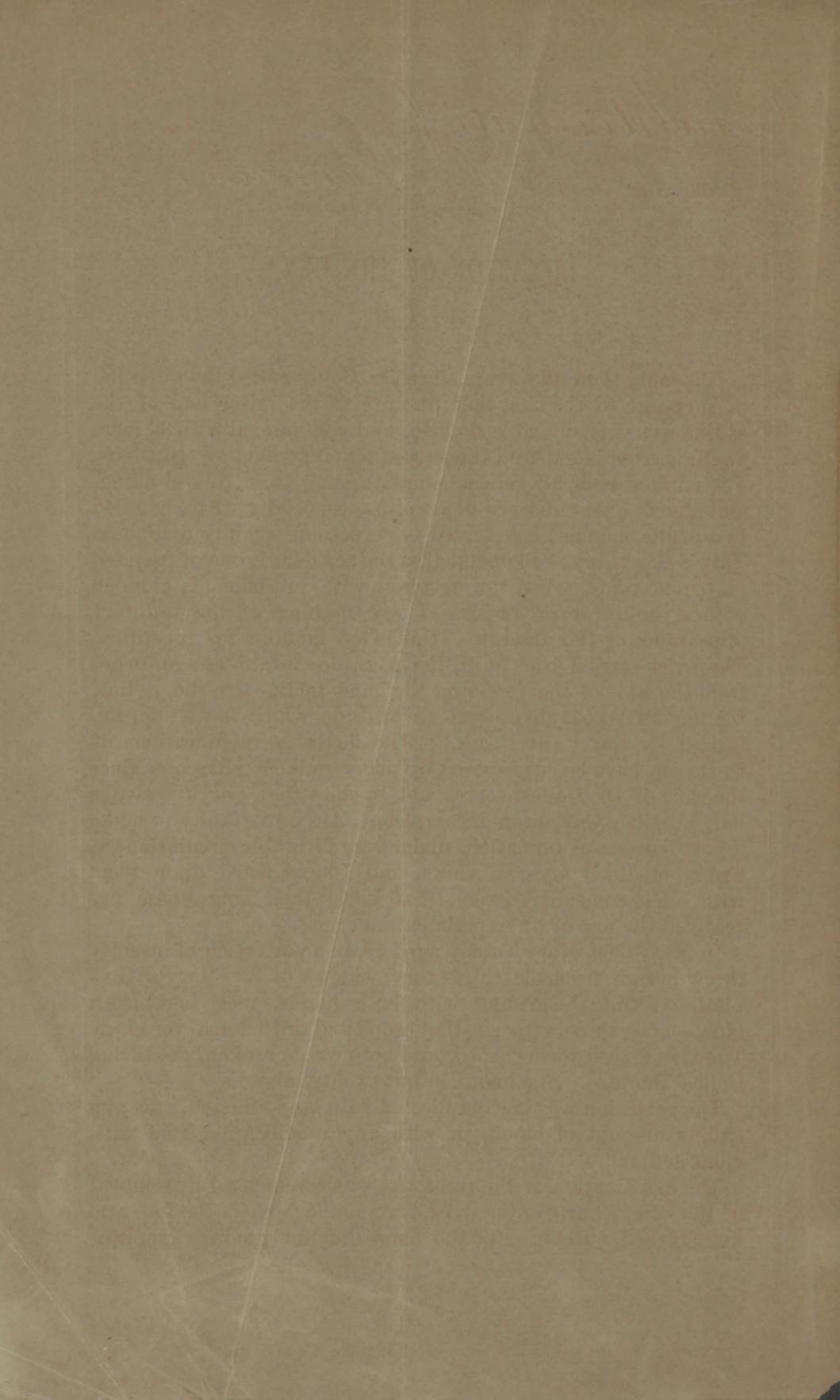


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LUXATION OF THE ULNA.



It is more than fifty years since Dr. Colles called the attention of surgeons to the fact that fracture of the lower end of the radius was very often overlooked, and confounded with a mere swelling from blood, and the subsequent inflammatory effusions. The confusion of all salient points arising from this swelling, and the frequent absence of crepitus, especially when handled in a gentle manner, has served to perpetuate a faulty diagnosis. This is the more to be lamented, as the accident is one of frequent occurrence, and, when not restored with precision, is clouded with a doubtful prognosis. I say nothing of the ordinary appearance of this fracture—this is too familiar for repetition. The wrist carried backward, the ulna downward and outward from the axis of the fore-arm, the hand inclined to the radius, the fingers flexed, all present an attitude which is well formularized by the "silver-fork." The fact that modifications of treatment have been proposed by many eminent surgeons since the time of Dr. Colles, serves but to show that our knowledge has, in some way, been incomplete. An opportunity to make a post-mortem examination, under very favorable circumstances, had so modified my own views, and I have acted upon them with such constant success, that I feel their correctness has received the test of an experimentum crucis.

In May, 1869, Mary Tumey aged 45, in a paroxysm of insanity threw herself from the third-story window of St. Mary's Hospital, striking the ground with both hands, receiving also a blow on the spine, opposite the second and third dorsal vertebræ. The spinal cord was crushed, and both wrists broken, producing Colles' fracture. She breathed but twenty minutes.

The condition was uncomplicated with any effusion, except a trifling amount of blood, or with any modification from muscular action.

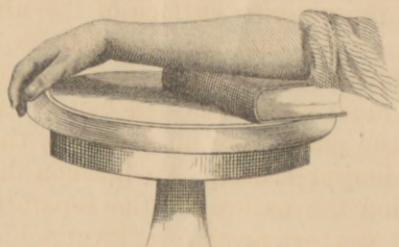
The examination of the right arm was commenced by removal of the skin, from over the wrist, leaving the fascia of the fore-arm undisturbed. Rotation of the hand did not produce crepitus.

The projection of the wrist backward was that of an extreme case of this fracture, and the ulna was carried well downward and outward from the axis of the fore-arm. On raising the fascia, the lower fragment was seen to ride the back of the upper one, or the main shaft of the radius, and to be placed at right angles to its natural position, while the hand was in state of extreme flexion in relation to it. There was not the slightest impaction. The absence of crepitus was explained by the fact that the rough surfaces were not in contact. The fracture was transverse and the surface of the lower fragment, which was about half an inch in length, came in contact with the periosteal surface of the back of the upper fragment or main shaft. The entanglement permitted rotation, but not crepitus. The next step in the manipulation was to press the displaced fragment into its place. I was surprised to find a resistance which seemed like muscular action. This being manifestly impossible, the cause was again sought for by a repetition of the movement, when the same result was produced giving an elastic rebound.

The solution was found in the peculiar position of the ulna, its luxation and ligamentous entanglement.

It will be remembered that the ulna does not articulate with the wrist-joint, but that its head, although covered with cartilage, and provided with a synovial membrane, and of course a complete joint surface, articulates with the triangular fibro-cartilage. The anatomists emphasize this arrangement so decidedly, that we are apt to forget the important fact of the articulation by the triangular fibro-cartilage on its distal surface with the wrist-joint. Thus the ulna has a mediate articulation with the wrist-joint, a fact of great practical significance. It will also be remembered that the fascia of the fore-arm is very much strengthened at its lower end, and that the extensor muscles run in grooves constructed from it, and that its transverse fibres, under the name of the posterior annular ligament, run across to the pisiform bone, some of them passing over the head of the ulna. The internal lateral ligament passes from the end and inner surface of the styloid process to the cuneiform bone. The triangular fibro-cartilage also subserves the purposes of a ligament, making an insertion in the pit at the base of the styloid process, but with a stronger attachment to the radius. The ulnar extensor runs in a sheath of the fascia, and as can be seen and felt upon the living arm, takes a course between the styloid process and head. But while it is really on the back of the fore-arm, it is so far upon its side that the tendon plays upon the side of the head and

Fig. 1.



View from radial side.

Fig 2



Injured and uninjured arm.

furnishes a lateral support. The tendon is just above the internal lateral ligament. The cause of rebound now became manifest; for the styloid process was so far projected as to catch the fibres of the annular ligament, and the ulna being prevented from rising, forced the wrist back. Various attempts at reduction were made at this stage of the examination. The ordinary plan of bending the hand toward the ulnar border of the fore-arm resulted in tightening the annular band on the styloid hook, and no pressure on the anterior surface of the ulna could cause its liberation, but, on the contrary, insured its retention. Simple extension also failed to relieve the entanglement and restore the luxation, but a movement described below was entirely successful, and when the parts were all replaced, the tendency to displacement was inappreciable. An incision through the annular ligament revealed the nature of the separation. The internal lateral ligament was torn away from its attachment to the styloid, by separating the scale of compact bony tissue composing its end and inner surface (the ligament proving stronger than the bone), thus leaving the styloid as a rough and ragged hook to hold the annular ligament. The attachment of the triangular fibro-cartilage to the styloid was also torn off, but the rent was through the cartilage, leaving a few tags at the pit. The complete severance of all ligamentous restraint permitted the ulna to bulge outward and downward; and as the hand is carried backward and upward, the styloid hook is moved forward and held at the pisiform bone by the annular ligament. The ulnar extension was carried toward the radial side of the ulna. When the ulna became free from the annular ligament, its head was moved toward the radius, and through the fibro-cartilage, rested against the wrist-joint, thus holding the hand out at full length, keeping the fractured ends of the radius in apposition, and furnishing the best of all splints—an entire parallel bone, in place. Thinking it possible that the condition found might be peculiar, I proceeded at once to a similar examination of the left wrist. The fracture was oblique in two directions. Commencing within a quarter of an inch of the wrist-joint on the palmar surface, the line ran back to three-fourths of an inch, inclining to the ulna. The position of the ulna was the same as on the right side; the rupture of the internal lateral ligament took place in the same way, carrying rather more of the bone tissue than on the right side. The triangular fibro-cartilage was torn out with similar tags, and the annular ligament was folded into a similar cord, causing a rebound when the lower fragment

of the radius was carried down into its place. The only point in which the two differed was in the line of fracture, which seemed not to bear the least upon the question of reduction or retention.

The fibres of the pronator quadratus were a little torn in both cases, but I could not perceive that there was any influence exerted by it or any other muscle or tendon in preventing reduction. As before stated, the autopsy exhibits a case of what may be termed an extreme condition of this form of injury.

It is altogether probable that fracture of the radius may occur with which there is no complication of ulnar luxation. In these cases the restoration and retention would be easy.

A good result with almost any treatment would also be probable. But a force competent to fracture the radius, if not expended, would generally be able to rupture the ligaments, in consequence of the immense leverage that the hand acquires with the head of the ulna resting mediately on the carpus. When the internal lateral ligament and triangular fibro-cartilage yield, the annular ligament becomes slipped over the head and on the styloid hook. In order to determine the succession of movement in the ligamentous rupture, I subjected the arm of a cadaver to a force gradually applied, after having made a fracture of the radius just above the wrist-joint. This was effected by strapping the arm firmly down and attaching a lever to the hand, then bending the latter well back with a slow but irresistible force. The hand began at once to describe a circular sweep upward, backward, and toward the ulna; in short, such a movement as would necessarily occur with the short fragment held by the radio-ulnar ligament. The bulging of the ulna outward and downward preceded the rupture of the internal lateral ligament. But the fascia of the fore-arm lying on the ulnar head became stretched, and fibres of the annular ligament slipped over it. As the force was continued, a double snap, loud and sharp, was produced by the breaking of the internal lateral ligament and the triangular fibro-cartilage—apparently in the order stated. The end and internal surface of the styloid was broken off. The annular ligament at the same moment was caught on the styloid, presenting precisely the appearance shown by the autopsy.

If there should be an arrest of movement before ligamentous rupture, the difficulty is one of simple fracture uncomplicated with luxation of the ulna. The annular ligament, though drawn a little over the ulnar head, would not be likely to interfere with

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Fig 1.



View from radial aspect .

Fig 2



The injured and uninjured side compared .

reduction. But when the internal lateral ligament and triangular fibro-cartilage give way, the displacement of the ulna assumes a definite shape, and in this resembles the other regular luxations which are determined by constant forces.

The autopsy and subsequent experiment render it evident that we have, in the injury usually known as Colles' fracture, not a mere break of the bone, but a luxation, to deal with.

The displaced ulna is always noted, and surgeons have had various suspicions of ruptured ligaments. But it has not been regarded in the light of a luxation with a regular position, which must be rectified before replacement of the fracture should be made, and without which imperfect results are to be expected. This, I am convinced, is the key of the difficulty. Reduction of the luxation must first be made, and then the fracture is probably of all others the most insignificant. But no theory can be of much importance without the support of cases, and it has been my good fortune to have the results of my treatment subjected to tests sufficiently numerous to place the matter at rest as a practical plan. The mode of procedure is as follows:

The patient may be etherized or not. An assistant holding the fore-arm of the patient, the surgeon grasps his hand, the right with the right, and *vice versa*. With the other hand placed under the fore-arm above the fracture, he is enabled to bring the thumb over the back of the ulna, the fingers wrapping around the radius. Traction is first made by extension, then drawing the hand laterally to the radial side, then backward, next keeping it held backward, and while making extension, it is swung toward the ulna side, bending well laterally, when the extension of the hand is changed for flexion, thus describing nearly a semi-circle in circumduction. The position of the hand grasping the fore-arm undergoes constant change, as it is the antagonist of the other hand in every thing but the extension. As the backward position of the hand, when it is carried to the extreme ulnar side, is changed to flexion of the hand, the thumb of the surgeon rolls around the border of the ulna, and is below when the manœuvre is complete. The test of reduction is to be found by the presence of the head of the ulna on the radial side of the ulnar extensor.

The head of the ulna rests mediately, through the triangular fibro-cartilage, on the cuneiform bone, and is restrained from going backward by the annular ligament, holding on each side the tendons of the extensor minimi digiti, and the extensor carpi ulnaris, thus making a concavity corresponding in form to a

socket. When it is pressed into this pocket, and the hand flexed so that the head is supported by the wrist, the position of the hand is also restored in its relation to the radius. As a result of the displacement of the ulnar, the ulna extensor is carried from its place above the styloid process to the opposite side of the ulna, in an extreme displacement, but sometimes remains above its centre. To disentangle the styloid and swing the tendon of the ulnar extensor over into its place, is the purpose of the manœuvre. The hand is drawn toward the radius, to pull off (by stretching) the annular ligament. The backward motion, accompanied with extension, renders the ulnar extensor tense, which serves to draw the annular ligament backward. This is effected by pressing the thumb upon the ulna. The circumduction carries the tendon over the side. Its character as a luxation is still further shown by the fact that the restoration is often accompanied by a snap, both tangible and audible. If restored, the reversion is effected by a compress and bandage of adhesive plaster. When the manœuvre described has been completed, the hand is flexed, and the thumb of the surgeon rests on the under side of the ulna. Its head appears on the back of the wrist, and corresponds with the opposite arm in every respect, except the swelling from blood effusion. As in the treatment of any other luxation, the effort should not be abandoned until the deformity is removed and the ulna extensor in its place—a fact that can be determined at once. The dressing I propose is intended to hold the head of the ulna up in its fascial socket, by bringing the weight of the hand to bear upon the ulna to retain it home. If the thumb of the surgeon is kept under the ulna after reduction, it will be found that the weight of the hand is sufficient to keep it in place. As a substitute for the thumb, I place along the ulna, from the pisiform bone upward, a cylindrical compress about two inches in length, and about half an inch in thickness—in fact, a single headed roller. This is placed against the ulna, resting also on its radial border against the tendon of the flexor carpi ulnaris. A band of adhesive plaster of the same width is wrapped firmly around the wrist, and over the compress, extending downward to the extreme point of the radius, thus grasping the bones neatly and tightly. The ordinary rule of loose dressing on the first visit to a fracture is one that I distinctly reject. I propose to bring all the parts into close relation. The patient is allowed to cut the bandages along the back of the wrist in about six hours, if the swelling and pain seem to demand it. But I find it is not

Fig 3.

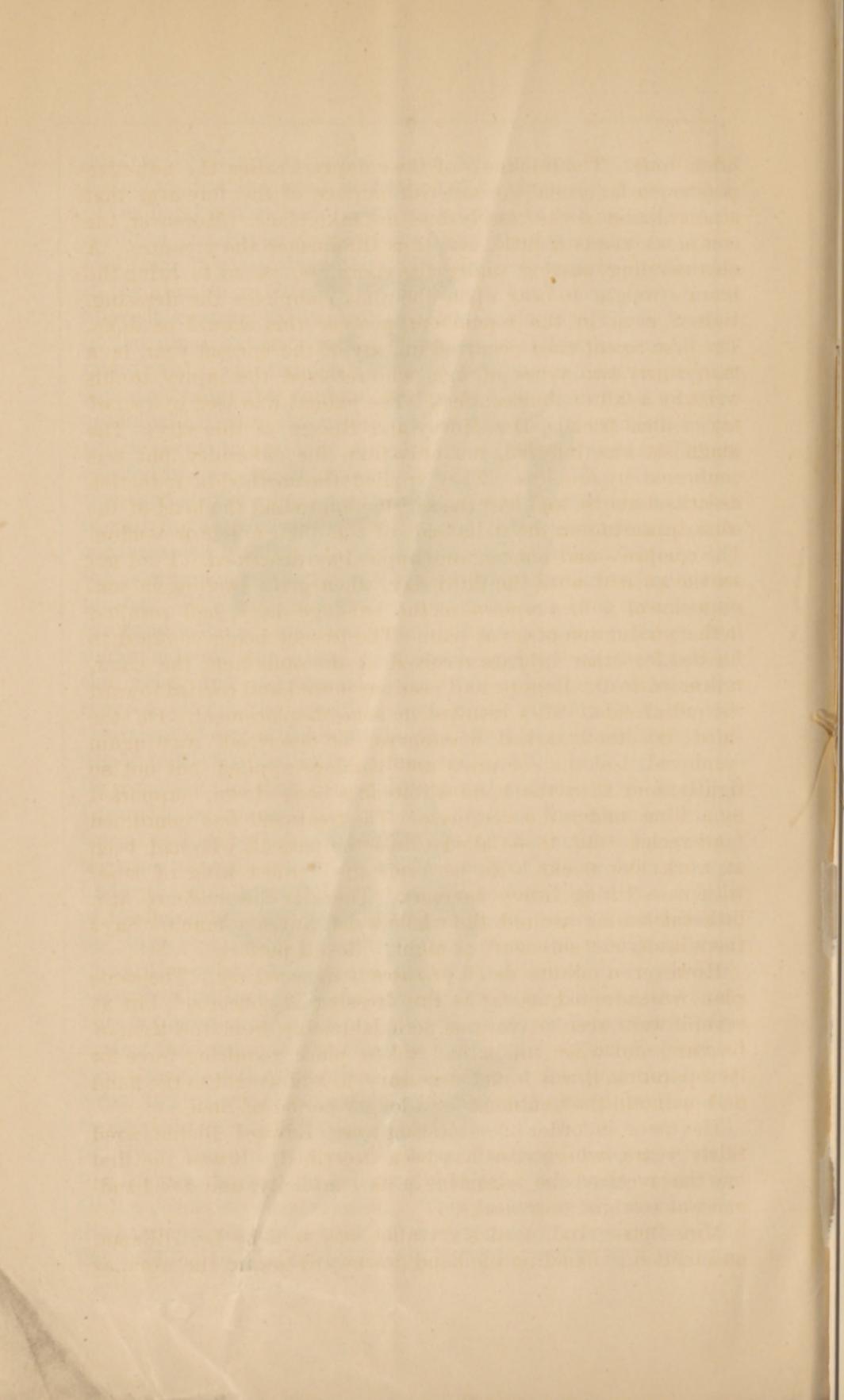


Compress in position .

Fig 4.



Compress held in place by adhesive strap.



often done. The thickness of the compress raises the adhesive plaster so far from the anterior surface of the fore-arm that strangulation of the vessels does not take place. Moreover, the compress yields a little, and thus diminishes the pressure. A narrow sling passing under the compress, so as to bring the hand's weight to bear upon the ulna, completes the dressing. Indeed, even in the recumbent posture this should be done. The first recent case occurred in July of the current year, in a man thirty-two years of age, who received the injury to his wrist by a fall of fourteen feet. The patient was seen by two of my medical friends, Drs. Hovey and Rogers, of this city. The diagnosis was inferred, not only from the deformity, but was confirmed by crepitus. They applied the method of reduction described above, and had the satisfaction to find the head of the ulna appearing on the radial side of the ulnar extensor tendon. The compress and plaster were applied as described. I did not see the patient until the third day, when great swelling, in consequence of a firm renewal of the bandage daily, had resulted in the production of great pain. The patient being confined to his bed for other injuries received at the same time, the hand, unknown to Dr. Rogers, had been supported and carried toward the radial side. This resulted in some displacement. On the third day the surgical manœuvre, as described, was again employed, and the compress and bandage applied, but not so tightly, and then the hand allowed to hang down, supported by a sling under the compress. The treatment was continued four weeks. *Oct. 18.*—Called to see the patient, who had been at work five weeks. He performs the hardest kind of labor with ease (lifting heavy lumber). There is the evidence of a little thickening around the whole wrist, but not much. Says there is slight "soreness" at night. Result perfect.

However, a minute detail of cases is unnecessary. The same plan was adopted, as far as the dressing is concerned, but as several were seen at various periods remote from the time of fracture, and when union had taken place, requiring force for its separation, it was found necessary to add weight to the hand and maintain the treatment for a longer period of time.

The cases in order of succession were, Edward Blohm, aged thirty years, whose case has been described. It was the first one that received the treatment in its simplicity, and the bandage was retained four weeks.

Mrs. Betsey Tod, aged sixty-nine, was seen by Dr. Hillman, and treated by bending the hand downward toward the ulna, as

commonly practiced, and retained by an angular splint. At his request I saw the patient ten days afterward. Restoration had not occurred, and Dr. Hillman gave his opinion that no change had resulted from the dressing. The patient was etherized, and reduction effected at once. Treatment continued thirty days.

This patient is the only one in whom the result was in any way imperfect. The inflammation was rather unusual, and although the reduction was complete, the ligamentous repair was not as perfect as in the other cases, and the ulna gradually slid away laterally, producing a consecutive luxation. This result admonishes us to extend the period of treatment when there is much inflammation.

Mrs. Sarah Wise, aged sixty-nine, was treated with an angular splint four weeks. Great swelling and pain resulted, and continued until the time of reduction. I first saw her on the thirty-fifth day after the fracture. A good deal of force was necessary to effect the object, but it was accomplished by the hands alone. The swelling has continued far more than in any other case, but restoration is complete and the use of the hand returning. In no other case has the swelling or inflammation been more than trifling. The treatment was carried out for forty days, aided by the use of a shot-bag, weighing three-fourths of a pound, during fifteen days.

Mrs. Amanda Smith, aged fifty-three, was not treated at all, as she thought it "was only a sprain." Not improving, but, on the contrary, following the usual course of the unreduced fractures, she grew worse and applied for advice. On the forty-first day she was etherized. The radius was so firmly united, that it required all the strength I could exert to break it off, bending the hand backward. After the separation, the hand was swung into its place and retained by compress and bandage, aided by a shot-bag three-quarters of a pound in weight. This was used for fourteen days, and then the weight of the hand alone was relied on for fourteen days more. These cases all presented some difficulties, which would not generally occur. The time that had elapsed from the injury to the reduction rendered the restoration more difficult.

Miss Mason, aged sixty, was the first case I saw immediately after the accident. I need hardly describe the case. Suffice it to say, that the condition was one of moderate severity; under the ether, reduction was effected, and the dressing applied tightly, with direction to cut the strap on the back of the arm

if it became painful. This was done in a few hours, but the plaster retained its position and was continued to the end of the treatment. On the thirteenth day the bandage was removed, and the direction given to use the hand. The restoration was rapid and complete.

Mrs. Van Ness, aged fifty-two. Seen by Dr. Hillman on the day subsequent to the injury. She had been seen immediately after the accident by Dr. Swinburne, who diagnosticated the fracture, but the patient preferred to refer the case to her own medical adviser (Dr. Hillman), who also recognized the fracture, both by the deformity and the crepitus. He at once applied the treatment as above, which was continued until the eighteenth day. At this period I saw her for the first time, and at once removed the dressing, directing the use of the hand. The industrious wife of a farmer found an abundant use for it, and took my advice literally, employing it at hard work. It has been a perfect result, indeed one of the most rapid in improvement.

The last case, Robert Crabtree, a laborer, aged thirty-five, had broken his wrist nine days before reduction, which was effected, under ether, with an audible snap. The strap and compress were removed on the thirteenth day.

Of the children, John Dean, aged fourteen, was treated by Dr. Menzie, of Caledonia, after the plan proposed. The dressings were removed on the twenty-eighth day. Charles Harman, aged eight years, dressed by Dr. Holman with the pistol-shaped splint. I was requested by the medical attendant to see the patient on the eighth day. It was plain that reduction had not taken place, but this was effected by circumduction. Treatment was continued four weeks—result perfect. Michael Kelly, aged nine years, reduced four weeks after the accident. Much force was required to break it over, but the reduction and retention were not difficult. Dressing removed on the fourteenth day. Two more cases of fifteen and seventeen repeat the same story.

Since my attention has been especially directed to the study of this fracture, I have become convinced that there are more cases of separation at the radial epiphysis during childhood than have been suspected. The cases of five children, from eight years of age to that of seventeen, in the practice of my medical friends and myself, occurring simultaneously with seven cases in adult life, are a larger proportion than is commonly supposed to exist between the two periods of life. But if the diagnosis is often overlooked, the restoration is more easy

in children. The rounded character of the bones and general flexibility of the child's wrist conspire to render the reduction easy. Simple extension will probably answer in most cases. The popular notion, that every deformity is caused by "something out of joint," has, in these cases, more justification than usual. One lad of fifteen came to me after reduction by some of his companions, who pulled at it "because it was out of joint." Every case, except one, that has been treated by the method described may be said to be perfect. This phrase does not mean to exclude the tenderness and swelling incident to such an accident, but conveys a correct statement of the anatomical relations of the injured and separated part, including the radius and ulna. I very much doubt whether any comminution of the lower fragment, upon which much stress has been laid, would materially affect the result. When the ulna is in place the full length of the fore-arm is attained, and the traction on the muscle would allow the broken part to come down far enough to permit the irregularities to become adjusted with more than usual facility. The extensor tendons, placed upon the stretch by the drooping hand, retain the broken fragments with neatness on the back, while the adhesive strap, drawn with decided force, brings them together laterally. The method is essentially painless after reduction.

A short period of time for continuing the treatment, which has been adopted in the recent cases, has been justified by the results, and has been entered on for two reasons: Motion as early as possible after ligamentous repair is a cardinal principle in the treatment of luxation, and therefore desirable in these cases. Moreover, the fractured surfaces are broad and neatly opposed, and are in cancellated bone. These considerations induced the trial of fourteen days as the standard of time, which has been fully justified by the results.

To the plan of direct extension, which has some strenuous advocates, I am disposed to attribute more successful terminations than to that of immediate lateral bending toward the ulna. For extension is the means of reducing luxations so generally, that it would be likely to prevail here, but I am satisfied that it cannot be relied on for maintaining the neat and close fit required for the ulnar head in its facial socket. Apparatus will become raised, and if the extension yields, there is a tendency of the ulnar head to slide downward. This can be verified by merely removing the support from beneath the ulna after reduction. Hence the plan of bending the hand laterally,

Fig. 5.



Collé's Fracture .
Dressing complete.

which has been the almost universal practice, is justified by its success in retaining the ulna; but the plan so often fails in the restoration, that we must believe it has generally been pulled into its place by extension first in the cases that had a successful termination. The shortening of the radius and the lateral twist of the hand have usually been explained on the ground of impaction of fragments. This is rendered unlikely by the well-known fact that the head is carried backward of the line of the radius. If impacted, the line of force should be in the axis of the radius. But nothing can be more evident than the fact that this can never be the case. The doctrine is, however, fortified by cases. Erickson reports an examination of a case, twelve days after fracture, and found the lower fragment split and impacted to the depth of half an inch, so as to require some force for its separation. The piece was tilted upward and backward. Now I submit that the adhesion in twelve days would be sufficient to render the question of impaction a difficult one to determine, and as they (the lower fragments) were tilted upward and backward, they were moving at the moment of injury in a direction not to be impacted.

The absence of crepitus is easily understood in those cases when the fracture is transverse, and the broken surface of the lower fragment is brought in contact with the periosteum. And, indeed, rotation can be made readily, without crepitus, when there is mere interlocking of broken surfaces.

I have made some measurements, both as tests of the fact and amount of displacement, which I have not known to have been made before. By placing a plane surface behind the elbow and the fore-arm at right angles to the arm, a measurement to the extreme point of the ulna and radius shows, in the normal condition, that the distance is the same. But when the radius is broken and the ulna luxated, a shortening of the radius takes place, of from a quarter to nearly three-quarters of an inch. At the same time the breadth of the wrist, measured by placing two plane surfaces on each side, is increased by the lateral bend of the broken radius.

These measurements I regard as of great importance, in making a diagnosis in the absence of crepitus.

Robert Crabtree measured :

Left radius.....	11 $\frac{3}{8}$ inches.
“ ulna.....	11 $\frac{3}{4}$ “
Width of uninjured side.....	2 $\frac{5}{8}$ “
“ injured side.....	3 “
After restoration at once.....	2 $\frac{3}{4}$ “
Length perfect.	

Michael Kelly, aged nine :

Length of radius.....	7 $\frac{3}{8}$ inches.
“ ulna.....	7 $\frac{1}{2}$ “
Injured side, breadth.....	2 $\frac{1}{8}$ “
Uninjured.....	1 $\frac{7}{8}$ “
Restored.....	Alike.

One of the serious difficulties in the fracture and luxation I have described arises from the doubt in diagnosis. Effusions around the wrist take place with great ease upon injuries by falls on the hand, and as crepitus is rather the exception than the rule, our pathognomonic sign of the fracture is often lost, and when absent I believe the measurement will prove a sure test. If there is fracture and the length is normal, crepitus will be present, for the fractured surfaces will be in opposition.

RESUMÉ.

1. The lower fragment is carried back over the radius, turned toward a rectangular position, and is not impacted. This accounts for the shortening of the radius and the bending of the hand to the radial side of the fore-arm.

2. The internal lateral ligament and triangular fibro-cartilage are usually broken, and when this occurs, the posterior annular ligament is slipped over the head of the ulna and caught on the styloid process, holding its point close to the pisiform bone.

3. The diagnosis of fracture is revealed by measurement or crepitus, or both.

4. The diagnosis of luxation is made out by the relation of the head of the ulna to the tendon of the extensor carpi ulnaris.

5. All difficulty in treatment disappears when the luxation is restored.



