AN INVESTIGATION OF THE END-RESULTS
OF COLLES'S FRACTURES.

BY

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THE following account is based on the examination of about 50 cases of Colles's fracture sustained at least two years previous to our examination, in an endeavour to ascertain the causes for the imperfect results that obtain from the usual methods of treatment at present adopted. Our investigation was made on different lines from those of Edwards and Clayton, whose interesting analysis of 424 fractures of the lower end of the radius in adults appears in the *British Medical Journal* for January 12th (p. 61), but we feel that this account may be of value, particularly when compared with theirs.

In each case investigated the original x-ray plates were obtained when possible and the out-patient card traced. On re-examination the following observations were made: (1) Range of movement compared with the uninjured wrist. (2) Localized areas of tenderness. (3) Symptoms complained of by the patient. (4) Deformity. (5) Functional result—patient's own opinion.

The accompanying table, indicating the results in the first 20 cases, is quite typical.

Table showing the End-results in Twenty Cases of Colles's Fracture Treated by the Usual Methods.

Initials.	Disp. of orig. fract.	Flexion.		Dorsi-flexion.		Radial dev.	Ost. arthr. inf. R.U. jt.	Pain.	Result.
		F.	N.	F.	N.				
J. C.	- N.R.	75	85	70	70	-	(++)	++	Fair.
M. C.	- N.R.	75	90	80	80	+	-	++	Poor.
W. K.	+ R.G.	80	85	70	75	-	-	(+)	Good.
A. H.	++ N.R.	0	80	0	70	+	++	+++	Bad.
M. W.	+ N.R.	60	85	80	80	+	-	-	Good.
M. M.	- N.R.	Full		Full		(+)	-	-	Good.
S. K.	- N.R.	Full		Full		-	-	-	Good.
J. D.	- N.R.	30	80	80	80	-	-	-	Good.
E. S.	+ R.G.	60	80	80	80	-	-	(+)	Good.
M. T.	- N.R.	Full		Full		-	++	++	Fair.
M. W.	+ R.G.	40	80	75	85	-	+	++	Fair.
S. K.	- N.R.	Full		Full		-	-	-	Good.
E. W.	- N.R.	30	75	Full		-	-	-	Good.
H. R.	+ N.R.	30	60	60	60	-	+++	+++	Bad.
S. G.	- N.R.	Full		Full		-	-	-	Good.
L. W.	- N.R.	Full		Full		-	-	-	Good.
A. O.	- N.R.	Full		Full		-	-	-	Good.
S. W.	++ R.G.	0	70	20	70	++	+++	+++	Bad.
A. C.	++ R.G.	50	80	60	70	+	++	+++	Bad.
E. J.	- N.R.	60	70	75	75	-	-	-	Good.

Disp. of orig. fract. = Displacement of original fracture. N.R. = No reduction. R.G. = Reduced with gas. In columns 3 and 4, F. = Fractured, and N. = Uninjured wrist. Ost. arthr. inf. R.U. jt. = Osteo-arthritis in inferior radio-ulnar joint. Radial dev. = Radial deviation.

From this table it is seen that the results were good in 60 per cent. of cases, fair in 15 per cent., poor in 5 per cent., and bad in 20 per cent. The proportion of good results (60 per cent.) would appear quite satisfactory, but it is interesting to compare those fractures in which there was little or no displacement with those in which displacement was a marked feature; thus:

Without displacement	...	...	...	12=60 per cent.
With displacement	...	...	...	8=40 "

It is seen, therefore, that, as would be expected, uniformly good results obtain where no displacement had occurred, but of the remaining cases 50 per cent. are bad, 12½ per cent. poor, and 37½ per cent. fair.

From our investigation it would appear that the results of Colles's fractures with any displacement will in two years be bad in half the cases and unsatisfactory in the remainder. In our series not one result could be described as good, the majority were thoroughly bad.

It is reasonably assumed, where existing displacement of the fragments of a fracture has been reduced and good anatomical apposition restored, that, provided no comminution has occurred, the functional result would be satisfactory, in the same way that a simple fracture without displacement provides a perfect functional result. Our attention was therefore directed to this factor—incomplete or imperfect reduction—as a predisposing cause of bad results.

In case A. H., the fourth in our series, the apparent displacements of the distal radial fragment are (1) backward rotation, (2) radial deviation and rotation. The effect of these displacements is manifest in the inferior radio-ulnar joint, which becomes the seat of marked osteo-arthritis. It will be observed that the articular surfaces are at an angle as seen in the antero-posterior view (Fig. 1), and are markedly out of alignment in the lateral plane. The case of S. W., the eighteenth in our series, was identical, and showed marked unreduced radial deviation with consequent arthritis. Both of these patients were unable to use their wrists or perform any manual work;

FIG. 1.—Old Colles's fracture with marked radial deviation and displacement. Ununited fracture of the styloid process of the ulna.

FIG. 2.—Case of S. W. Tracings of x-ray photographs taken at time of injury (August 19th, 1924), showing uncorrected radial displacement and backward displacement.

FIG. 3.—Case of S. W. Tracings of x-ray photographs taken November 17th, 1926, more than two years later, showing radial displacement and backward rotation of distal radial fragment. Advanced osteo-arthritis in radio-ulnar joint.

they represent the most unsatisfactory result of inadequate treatment and imperfect reduction. In every bad case it was possible to demonstrate osteo-arthritis by x-ray examination as in these two cases, and care was taken to exclude those in whom generalized arthritis was present in other joints.

Tracings of the plates of S. W. taken on August 19th, 1924, are reproduced for comparison with those of November 17th, 1926 (Figs. 2 and 3), and it is seen that (1) the radial displacement has not been reduced; (2) the backward rotation has been reduced without previous disimpaction, with the result that the backward displacement persists. It will be seen that the backward rotation is,

however, still present in the x-ray photographs taken on November 17th, 1926, showing that disimpaction must be obtained before any attempt at reduction is made, and that immobilization was not sufficiently prolonged.

The concomitant fracture of the styloid process of the ulna, so frequently seen in association with Colles's fracture, remains ununited in approximately 50 per cent. of cases; but it was found in this investigation that, contrary to the usual teaching, no symptoms or pain arise from this injury in the event of non-union. No case in our series exhibited symptoms that could be definitely attributed to non-union of the ulnar styloid, and we agree with Edwards and Clayton that fracture of this bone makes no difference to the end-result.

From this early review of our results (our investigation is not complete) the causes of imperfect function of the wrist after a Colles's fracture would appear to be (1) backward rotation of the distal radial fragment; (2) radial deviation and displacement of the distal radial fragment. As the most usual complaint was of pain, it was found difficult to decide how much disability could be attributed to weakness of the wrist due to loss of mechanical efficiency of the flexor tendons when the backward tilting of the radial fragment is uncorrected. In most cases the pain from arthritis in the inferior radio-ulnar joint was sufficient to render the wrist useless and "apparently" weak, but in all cases it was possible to demonstrate well-marked arthritis where the fragments had not been restored to perfect anatomical apposition. For this reason, whatever the immediate result of treatment, the most important cause of bad results would appear to be osteo-arthritis ensuing as an ultimate sequel to imperfect anatomical restoration of the fragments, and this necessitates reduction of both the backward displacement and the radial deviation and displacement.

TREATMENT.

In undertaking the treatment of Colles's fractures every effort should be made to restore complete anatomical position of the fragments, which we believe can only be obtained by complete disimpaction of the fragments before manipulation and by immobilization for a longer period than at present advised.

Choice of Anaesthetic.—Although the majority of cases are reduced under gas anaesthesia, complete relaxation is seldom obtained, and when possible a general anaesthetic is very much to be preferred. We feel that many imperfect results follow the rapid, incomplete manipulation necessitated by a short "gas" anaesthetic.

Manipulation.—Complete disimpaction of the fragments is essential before any attempt at manipulation is made. The method advocated by Sir Robert Jones is adopted, and manipulation is continued until free movement is permissible between the fragments. Reduction of the deformity is then obtained, with restoration of the true anatomical apposition. It is at this stage that a general anaesthetic is preferable to gas, as adequate time can then be taken for the application of the splints—a most important part of the treatment. It is possible to obtain an excellent reduction of the fracture with short anaesthesia, but if the patient commences to struggle before the splints have been applied—a frequent occurrence with gas anaesthesia—the deformity may readily be reproduced, or the operator contents himself with a "satisfactory" instead of a "perfect" reduction.

Splints.—The diversity of splints that have appeared for the treatment of this particular fracture testifies to the difficulty in obtaining a really satisfactory splint which will suit every case. Carr's splint is almost universally adopted as the routine splint, but is not suitable for every case. The practice of maintaining the wrist in a fully flexed position for twenty-four hours we believe to be unsatisfactory, and does not fulfil the important function of keeping the fragments in position, as has been claimed for it. The many special splints invented are too expensive and complex for routine treatment. Since commencing this study we have made use of two common splints—the

anterior angular splint in conjunction with a straight back splint, both made of wood, simple in construction, and usually readily obtained. This method of splinting Colles's fractures is similar to that described by Scudder, but we prefer an anterior angular splint to the straight splint he uses. It is, of course, too early to be dogmatic about this method of treatment, but our results have been encouraging enough to prompt us to offer the method as a suggestion for others who may adopt it and give it a trial. We claim no originality, as the method is fully described by Scudder; rather we would revive this simple and efficient method, which is as follows:

An anterior angular splint is chosen so that when lightly padded it will extend to the ball of the thumb. The straight posterior splint should be long enough to extend from the elbow to the metacarpo-phalangeal joint. Each splint is padded separately for each case with a single layer of wool, and in the posterior splint a pad of wool is placed so that it will rest immediately below the distal radial fragment. The anterior splint is similarly stuffed with a pad of wool placed so that it will rest opposite the lower end of the proximal radial fragment, and, in addition, is padded so that it will fit the

FIG. 4.—Diagram illustrating method of application of splints and strapping in suggested form of treatment for Colles's fracture.

contour of the front of the forearm. It is to be noticed that the back of the forearm is quite straight when the forearm is supinated. The posterior splint is applied first with the forearm supinated, and the anterior splint follows, the fracture being as it were squeezed between the splints. Three strips of strapping are next applied, the first round both splints immediately over the fracture, the second in front of the elbow, also around both splints, and the third across the palm of the hand, fixing the hand to the posterior splint but allowing free movements of the fingers. The strapping should not be applied too tightly on account of the subsequent swelling which invariably occurs, and when applied pressing the splints together should render them slack. The forearm is then fully supinated and the whole firmly bandaged. By this means the fragments are securely immobilized and a good position maintained, and the fingers are free to commence active movements from the first. In addition, the hand may be fixed in adduction to overcome the radial deviation by the third piece of strapping. The arm is supported in a sling. The patient is seen the next day, and if there is any swelling the splints are carefully reapplied, the patient being encouraged to move the fingers as much as possible. The splints are not removed permanently for a week, after which massage and gentle movements are instituted, but this period between the injury and the commencement of massage will vary with individual cases. The advantages of this method are that the splints are comfortable in spite of the position of supination, and the position of the fragments is maintained, also that the method can be applied to every case, including the severely comminuted fracture and T-shaped fractures, both of which seem to do well when immobilized in supination.

CONCLUSIONS.

1. Colles's fractures without displacement yield uniformly good results, as observed two years after the injury.
2. Where displacement was a marked feature of the fracture the results two years after the injury are invariably unsatisfactory.
3. The disability was in each case due to osteo-arthritis in the inferior radio-ulnar joint, resulting from incomplete reduction of the fracture.
4. Non-union of the fractured ulnar styloid process does not affect the functional result.
5. Emphasis is laid upon restoration of anatomical apposition as important in the treatment, and a method of splinting is suggested.

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