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EXTERNAL FIXATION FOR REDISLOCATED COLLES' FRACTURES

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Rereduction was carried out in 5% of all treated Colles' fractures and they were externally fixated with a one-bar Hoffmann apparatus. The results of 57 of the first 69 patients treated with a follow-up time of at least 1 year are presented. Using Frykman's criteria, 18 patients were judged as "excellent", 25 as "good" and 14 patients were judged as "unsatisfactory". The anatomical analysis showed no increase of deformity during the fixation. The final mean results were a 3.0 mm radial shortening and the articular plane of the radius at a right angle to the long axis. Among the first patients, five cases of pin-loosening were seen, but there were no adverse effects in the final result. There were no pin-tract infections. The results justify using the method as a routine when a redislocated Colles' fracture is rereduced.

Key words: Colles' fracture; fracture fixation; fracture reduction; immobilization; radius fracture; treatment.

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The functional result after a Colles' fracture is correlated with the accuracy of bone apposition (Gartland & Werley 1951, Lidström 1959, Frykman 1967). Some fractures redislocate when treated with a dorsal plaster splint (Gartland & Werley 1951, Collert & Isaksson 1978, Fenyö & Johansson 1974) and the risk of redislocation is still high after rereduction (Lidström 1959). The relevance of different techniques of plaster fixation has been studied (Sarmiento et al. 1975, Blichert-Toft & Jensen 1971, Wahlström 1982, Van Der Linden & Ericson 1981), but the results are contradictory. Like others (Cole & Obletz 1966, Green 1975), we have earlier tried transfixing pins incorporated in a plaster cast (Dahlstedt & Jonsson 1981) with promising results, in spite of some infections.

After rereduction of unstable Colles' fractures, we used a Hoffmann external fixator. In order to analyze the anatomical and functional end results, the first patients treated have been studied retrospectively.

PATIENTS AND METHODS

All dislocated Colles' fractures were initially reduced by manipulative traction under local anesthesia. A dorsal plaster cast, which also supported the ulna and the radius on the volar side, was applied. The hand was in the neutral position with a slight ulnar deviation and the forearm was slightly pronated. A radiographic examination was done immediately after reduction and after 10–14 days. When the fracture position had deteriorated to such an extent that rereduction was considered necessary, external fixation was used. No strict criteria for rereduction were used, but following Lidström (1959) and Frykman (1967), radial shortening was regarded as more unfavourable than dorsal angulation. Consideration was given to the age of the patient, the occupation and the general functional demands. Of 2,150 Colles' fracture treated at our clinic from June 1979 to October 1982, 110 fractures (5%) were rere-

Table 1. Fifty-seven redislocated Colles' fractures classified according to Frykman

	No.
1. Extraarticular fracture without fracture of the distal ulna	0
2. Extraarticular fracture accompanied by fracture of the distal ulna	11
3. Intraarticular fracture involving the radio-carpal joint but without fracture of the distal ulna	0
4. As 3, but accompanied by fracture of the distal ulna	1
5. Intraarticular fracture involving the distal radioulnar joint but without fracture of the distal ulna	4
6. As 5, but accompanied by fracture of the distal ulna	18
7. Intraarticular fracture involving both the radiocarpal and the distal radioulnar joint but without fracture of the distal ulna	5
8. As 7, but with fracture of the distal ulna	18
	57 patients

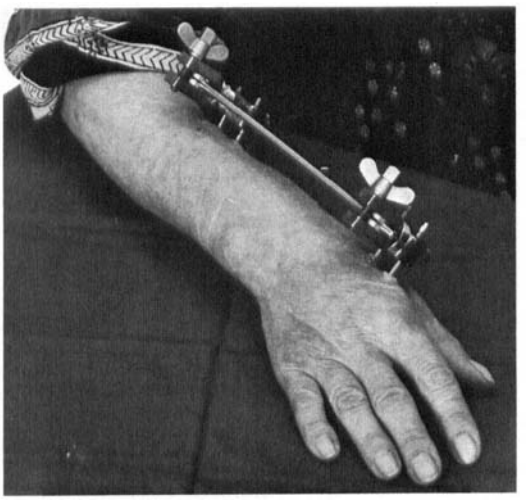


Figure 1. The fixation is shown without the dressing which is used to fix the skin around the pins to minimize pin-tract problems.

duced. The study includes only the first patients treated. Among these 69 patients with a follow-up of at least 1 year, six were excluded because they had a previous Colles' fracture on the same side. One patient died and five patients did not attend the final examination.

Fifty-seven patients with one fracture each were included. There were six men and 51 woman. The mean age was 59.2 years with a range between 30 and 76 years. The observation time ranged from 12 to 22 months, with a mean of 15 months. A classification of the fractures according to Frykman is shown in Table 1.

Operative technique

The procedure was done in an operating theatre under sterile conditions. In 21 cases some form of regional block was used, while the other cases were done under general anesthesia. A skin-incision about 10 mm long was made to avoid skin-pull and to enhance drainage from the pin-tract. With a low-speed power drill, two self-drilling, self-tapping (Ø 3 mm) half-pins were placed in the dorsoradial aspect of the radius, proximal to the fracture site. In a plane 45° to the palm, two pins were placed in the second metacarpal, thus avoiding the sensory radial nerve and the extensor tendons to the index finger. After reduction, checked by an X-ray image-intensifier, the pins were connected with one bar (Figure 1). A slightly compressive dressing was wrapped around the pins and the whole apparatus was generally covered. The patients were treated by 12 different surgeons.

Post-operative treatment

A radiographic control was done after reduction, at removal, and after 1–2 years. Thirty-one patients were treated as out-patients; 21 patients stayed at the hospital for 1–3 days; and five patients had to stay longer because of other injuries. The patients were instructed to use their hand for all but heavy activities and received a schedule for daily training. The fixation was kept for 6 weeks. The pins were removed without anesthesia. Most patients worked with a physiotherapist for some time after removal of the pins.

Follow-up

Functional examination. All patients were examined by the author. Motion of the wrist, the range of pronation and supination, and radial and ulnar deviation were recorded. Strength of grip was measured with a Vigorimeter (Martin, W. Germany).

The configuration of the wrist and any pain on touch was noted. The functional end-results were evaluated according to the criteria of Frykman (1967), which were similar to those used by Lidström (1959).

Anatomical evaluation. The radial shortening was evaluated from the frontal radiograph (Figure 2a), compared to the uninjured wrist or to the means of 12.2 mm for woman and 13.7 mm for men given by Lidström (1959).

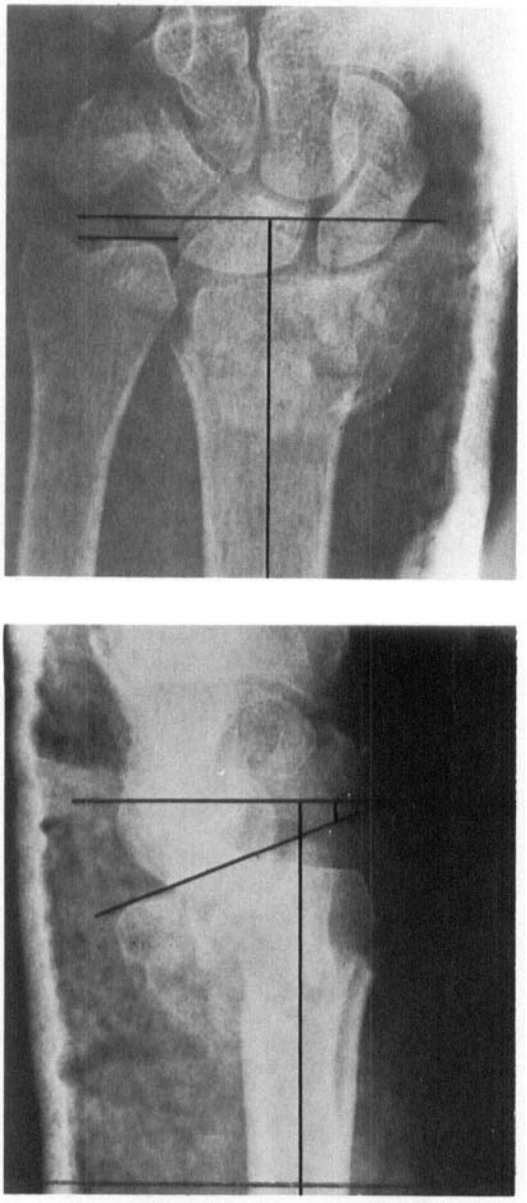


Figure 2. The interval X-ray check-up after 12 days reveals an unacceptable redislocation of this Frykman type 8 Colles' fracture.

Upper. Radial shortening is evaluated from the projected distance between the radial styloid and the distal articular surface of the ulna. Mean for woman is 12.2 mm, for men 13.7 mm (Lidström). The shortening in this case is measured to 8 mm.

Lower. The dorsal angle is defined as the angle between the articular surface and a line perpendicular to the radius' long axis. As a mean, the angle is 9.5° volar (= minus) (Lidström). Dorsal angulation in this case is 23 degrees.

The dorsal angulation was measured on the lateral radiograph (Figure 2b). It was not compared to the mean volar tilt of 9.5°.

Statistics

Differences between the groups were analyzed with Student's paired and unpaired two-tailed *t*-tests. $P < 0.05$ was regarded as significant.

RESULTS

Functional results

The mean time before rereduction was 12.9 days. The mean external fixation was 41.3 days.

Eighteen patients were judged as "excellent", 25 patients as "good", 11 patients as "fair" and three patients were regarded as "poor". The patients in the groups "fair" and "poor" are regarded as "unsatisfactory" in the following discussions. No patient suffered from continuous pain, nor from pain on pro- or supination. However, 13 patients said that they occasionally had some pain after heavy exercise. The most common reason that patients were not placed in a better group was weakness of grip.

Anatomical results

Mean radial shortening at different times during the treatment is listed in Table 2. There was no significant change of mean shortening during the period of external fixation. In a few cases some

Table 2. Means for radial shortage and the dorsal angle of all the patients at different times during treatment

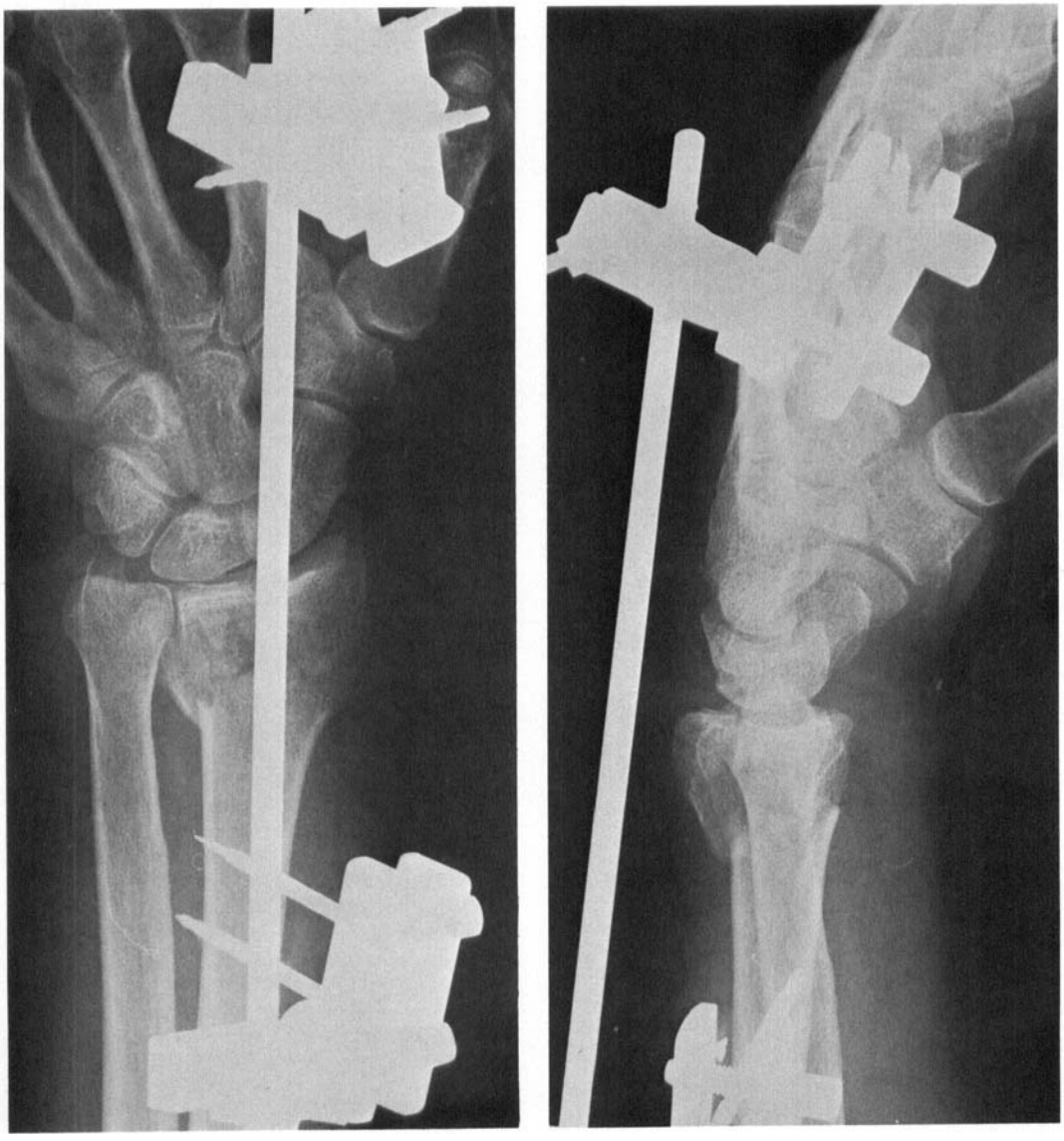
	Radial shortage in mm (±1 s. d.)	Dorsal angulation in degrees (±1 s. d.)
After first reduction	3.8 (±3.4)	5.8 (±8.4)
Prior to rereduction	8.1 (±4.2)	18.9 (±13.0)
After rereduction	3.1 (±2.4)	2.5 (±6.4)
Final results	3.0 (±2.6)	0.0 (±6.3)

Table 3. A comparison of the final anatomical results in the three functional groups "excellent", "good" and "unsatisfactory". There is no difference between the groups (unpaired t-test; $p < 0.05$)

	Radial shortage in mm (±1 s. d.)	Dorsal angulation in degrees (±1 s. d.)
Excellent	2.2 (±2.1)	–0.2 (±5.6)
Good	3.4 (±2.7)	–0.2 (±5.4)
Unsatisfactory	3.2 (±2.8)	–0.4 (±8.6)

small changes were seen, the largest increases were 3 mm in two cases. During the period of external fixation, there was a significant 2.5° decrease of dorsal angulation. According to the anatomical end results, there were no significant differences among the different functional groups, as seen in Table 3.

Figure 3 a & b. After rereduction and external fixation, the anatomical position is good. The fracture healed in almost the same position.



a b

Complications

Ten patients had complications. Loosening of the pins was seen in five early cases and was due to improper fixation of one or two pins in the deeper cortex. The earliest loosening was at the 22nd day and this patient was treated with a plaster splint for another 2 weeks. The other loosenings occurred after a mean time of 36 days but no significant losses of reduction were noted as sequelae. No pin-tract infections were seen.

One patient suffered from a shoulder-hand-finger syndrome and her functional end-result was very poor. Median nerve symptoms were noted in two patients. One patient improved after decompressive surgery; the other had spontaneous regression. One patient with ulnar nerve symptoms and one patient with radial nerve disturbance in the index finger also recovered.

DISCUSSION

Some Colles' fractures are unstable when placed in a plaster cast (Lidström 1959, Gartland & Wearly 1951, Collert & Isaksson 1978). Lidström (1959) and Frykman (1967) showed a correlation between anatomical and functional end-results and they stressed the unfavourable influence of radial shortening.

Frykman also stated that involvement of the distal radio-ulnar joint is an important negative factor for the functional outcome. In his series, 38% of the fractures had such an involvement. Although as many as 45/57 of the fractures in the present study had a radio-ulnar involvment, the functional end-results are as good as Frykman's. A possible explanation for these good functional results, in spite of radio-ulnar involvement, is that external fixation allows better alignment of the distal radio-ulnar joint. This is supported by the fact that no patient suffered from pain on pro- or supination. Cooney et al. (1979) reported similar good functional results on 60 patients with a Colles' fracture treated with external fixation, primarily applied in half the cases. He also showed a good fracture retention ability. In the present series there was even a small decrease in dorsal angulation during treatment.

Pin-tract infection is a common problem when external fixation is used (Fischer 1979), but in the wrist-region the risk of pin-tract infection is not very high (Cooney et al. 1979, Rasquin et al. 1979). The low infection rate was confirmed by this study. Other complications like neurological disturbances and a case of shoulder-hand-finger syndrome were not more frequent than seen among Colles' fractures in general (Frykman 1967, Cooney et al. 1980).

Decreased grip strength was the patients' most common problem. Since there were no significant losses of reduction, even among the cases with the shortest fixation time, we have now decreased the fixation time after rereduction to 5 weeks. This might result in an even better return of grip strength.

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