

External fixation versus percutaneous pinning for unstable Colles' fracture

Equal outcome in a randomized study of 60 patients

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60 patients > 20 years of age, with comminuted distal radial fractures of type Older 3 or 4, were randomly allocated to two treatment groups: external fixation a.m. Hoffmann or percutaneous Kirschner wire pinning combined with immobilization in a plaster cast. The groups were similar in age, gender, fracture type and dislocation.

All patients were immobilized for 6 weeks and the

outcome was assessed after 6 months. The groups showed similar results with respect to radiographic parameters and function. All fractures healed and no difference in complication rate was observed.

We conclude that most unstable distal radial fractures, classified as Older's type 3 and 4, can be treated with percutaneous pinning and a plaster cast, which is simpler and cheaper than external fixation.

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Although distal radius fracture is the commonest type of fracture and represents approximately 20% of all fractures in an emergency hospital (Sahlin 1990), there is surprising disagreement about classification, treatment and the correlation between radiographic and functional outcome (Lenoble et al. 1995). Nevertheless, in recent years, a consensus has developed on a treatment protocol which takes into consideration the fracture type and advocates differentiated treatment, with additional fixation for unstable fractures (Editorial 1989, Cooney 1989).

Several methods of fixation are advocated, the commonest being either K-wires and a plaster cast or an external fixation device (Green 1975, Cooney 1983, Kaukonen et al. 1989, Habernek et al. 1994, Sommerkamp et al. 1994). We designed a randomized study to compare the radiographic and clinical outcomes of unstable fractures of the distal radius treated either by Hoffmann's external fixation or 3 percutaneously inserted Kirschner wires, combined with a plaster cast.

Patients and methods

From 1992 to 1994, all patients above 20 years of age with Colles' fracture type Older 3 with more than 5 mm of radial shortening or type Older 4 (Older et al. 1965, Solgaard 1985), without previous injuries of the wrist or hand, at our 2 hospitals, were included in the

study. Following inclusion, the patients were randomly allocated to one of the treatment groups by drawing a closed envelope. 74 patients participated in the study, 14 were excluded because of inadequate follow-up (Table). The external fixation group, 27 women and 2 men, had a mean age of 61 (31–80) years. The pinning group, 26 women and 5 men, had a mean age of 58 (31–89) years.

Treatment was performed within 5 days after the injury and was carried out in the operating theater with general or regional anesthesia, and with image intensifier control of the reduction and pin-positioning. External fixation was performed with two 3 mm self-drilling and self-tapping half pins placed in the shaft of the radius distal to its midpoint and two pins in the index metacarpal. An extension bar was applied and with a combination of extension and closed manipulation the fracture was reduced and the frame was locked with the forearm in neutral or slight supination. The fixator was removed in the outpatient department without anesthesia after 6 weeks.

Pinning was performed after reducing the fracture by manual traction. Three 1.6 mm K-wires were drilled from distally to proximally, 2 of them from the radial styloid process from the dorsal and ventral aspects, respectively, in an ulnar direction and through the cortex proximal to the fracture. The third pin was positioned from the dorsal ulnar corner of the radius and directed in a radial and volar direction to engage the cortex proximal to the fracture (Figure 1). Plaster

Table. Type of fracture and treatment

	Pinning	External fixation	Total
Older 3	14	12	26
Older 4	17	17	34
Total	31	29	60

cast and pins were removed in the outpatient department after 6 weeks without anesthesia.

The patients were followed for 6 months, with radiographic and clinical examinations at 2 weeks, 6 weeks, 3 months and 6 months. Axial radial shortening, dorsal angulation of the distal radial joint surface in relation to the long axis of the radius and radial angle (Figure 2) were measured on the radiographs and compared to the normal wrist. If the other wrist had previously been fractured, the mean values of all the other intact wrists were used for comparison (Abbaszadegan et al. 1989). Overcorrection was expressed by negative values. Function was evaluated using a modification of the Gartland-Werley scoring system (Solgaard 1988). The range of motion was recorded by goniometric measurements of dorsal and volar flexion, radial and ulnar deviation, pronation and supination and the sum was calculated as the percentage of the unaffected wrist (Solgaard et al. 1986). Grip strength was measured with a Collin dynamometer, and expressed as percentages of the unaffected wrist. The differences between mean values were compared.

Statistical analysis was performed as recommended by Matthews et al. (1990) for serial measurements, where area under the curve was used to summarize the function-score and the difference between the post-reduction and 6-month values for the radiographic parameters. The means of the latter summarized measurements were compared and the 95% con-

fidence interval for the difference was calculated.

Results

The radial angle difference was consistently less in the pinning group than in the external fixation group, but repeated measurement analysis resulted in a mean value of 1 degree in both groups (Figure 3). Radial shortening increased mainly up to 6 weeks in the pinning group, whereas in the external fixation group it continued to increase after removal of the frame at 6 weeks (Figure 4). 10 patients with external fixation had a shortening of 2 mm or more after removal of the frame. Comparison of the summarized measurements of the shortening in the 2 groups gives mean values of -1.6 mm and -2.4 mm in the external fixation and pinning group, respectively (95% CI for the difference: -0.4 mm to +1.9 mm), thus there was no significant difference. The variations in the dorsal angulation in the 2 groups were almost identical and both groups were restored to a neutral position with a residual deformity of approximately 10 degrees which then remained constant throughout the follow-up period (Figure 5). Radial length in the uninjured wrist, expressed by ulnar variance (Abbaszadegan et al. 1989), showed a remarkable individual variation from +3 mm to -4 mm, mean 0.1 mm. The mean volar angulation of the distal radial joint surface in the uninjured wrists was 10 degrees and the mean radial angle was 24 degrees, without any significant difference between the groups.

Function was the same in both groups: At 6 months the external fixation group (pinning group) had 12 (14) excellent results, 12 (13) good, 4 (3) fair and 1 (1) poor result (Figure 6). Both patients with a poor result had signs and symptoms consistent with reflex sympathetic dystrophy.

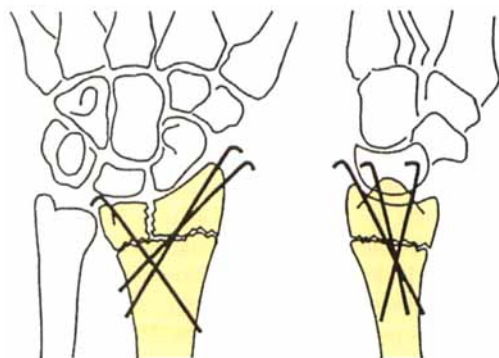
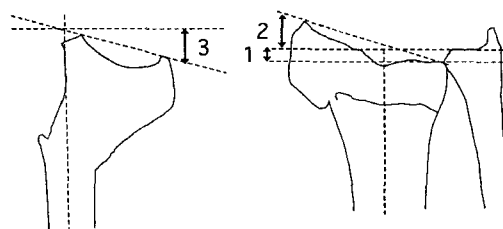


Figure 1. Fracture fixation with K-wires. 3 converging K-wires in the distal radius, securely fixed in cortical bone proximal to the fracture.

Figure 2. Radiographic parameters.



- 1: Axial radial shortening. The difference between the distal ulnar surface and the ulnar part of the distal radial surface.
- 2: Radial angle. The angle of the distal surface in relation to the long axis of the radius in the frontal plane.
- 3: Dorsal angle. The angle of the distal surface in relation to the long axis of the radius in the sagittal plane.

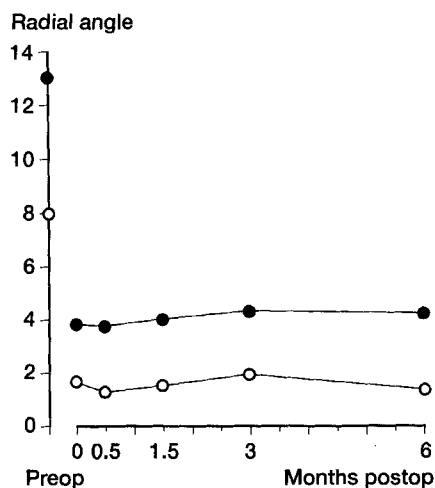


Figure 3. Radial angle changes during follow-up. ● external fixation, ○ pinning.

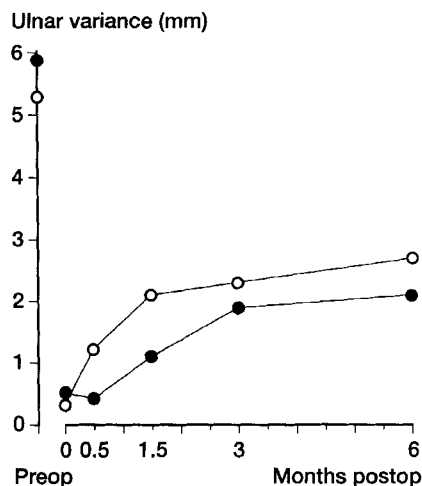


Figure 4. Radial shortening changes during follow-up. ● external fixation, ○ pinning.

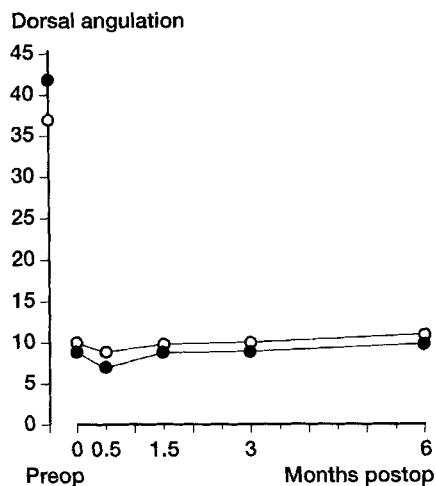


Figure 5. Dorsal angulation changes during follow-up. ● external fixation, ○ pinning.

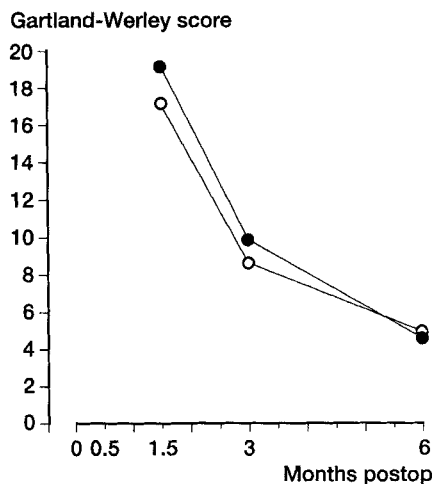


Figure 6. Modified Gartland-Werley score during follow-up. ● external fixation, ○ pinning.

Injury of the superficial radial nerve was found in 13 patients and was persistent in 5 patients, 3 of whom were in the external fixator group and 2 in the pinning group. There were no injuries of the median or the ulnar nerve. Reflex sympathetic dystrophy occurred in 4 patients (3 in the external fixator group and 1 in the pinning group), with no statistically significant difference.

5 patients had drainage problems, 3 in the external fixation group and 2 in the pinning group. None of them had a positive bacterial culture, none required treatment other than local care and none of them led to pin loosening or other problems necessitating changes in treatment. Antibiotic treatment was not used and the drainage resolved in all patients after removal of the pins at 6 weeks.

9 patients experienced complications in the external fixation group and 5 patients in the pinning group, with no statistically significant difference.

Discussion

Radial shortening is claimed to be the main displacement in Colles' fracture (Solgaard 1985, Villar et al. 1987, Abbaszadegan et al. 1989). Any treatment aiming at an improved outcome, compared to immobilization in a plaster cast, must reduce or prevent this deformity. External fixation has been advocated by many authors as the best treatment for unstable distal radial fractures (Abbaszadegan et al. 1989, Editorial 1989, Kaukonen et al. 1989). However, complications

such as stiffness, pin tract infection, pin loosening and reflex sympathetic dystrophy, have been reported by several authors (Clyburn 1987, Schuind et al. 1989).

Percutaneous pinning with Kirschner wires was first recommended by Green (1975) as a simple and cheap procedure. It has been claimed, however, that redisplacement of certain fragments, particularly in intra-articular fractures, cannot be prevented by this method (Saffar and Cooney 1995, Fernandez and Jupiter 1996). In contrast Habernek et al. (1994), Pritchett (1995) and Lenoble et al. (1995) have shown good results with various techniques of pinning.

In our study, both techniques gave predictably good results, with a low rate of complications not exceeding those reported by others. We believe that our pinning technique, with 3 pins converging in both planes, is essential in preventing the radial shortening, described as a potential problem with this method. In accordance with others (Lenoble et al. 1995, Fernandez and Jupiter 1996) but, contrary to the findings of Solgaard (1988), we observed a progressive shortening of the radius throughout the whole period of observation, with a remarkable nearly twofold increase from 6 weeks to 3 months in the external fixation group (Figure 4). This finding supports previous reports which suggested that loss of reduction may occur if the external fixator is removed at 8 weeks or earlier (Sommerkamp et al. 1994). The observed shortening, however, is only a mean of 1 mm (Figure 5) and will probably have no influence on function. This effect must also be balanced against the increasing risk of reflex sympathetic dystrophy when the immobilization is maintained for more than 5 weeks (Saffar 1995). Moreover, the fact that our functional results are better than those observed with immobilization in a plaster cast alone (Solgaard 1988, Hove 1994), and are comparable to other reports about patients treated operatively (Kaukonen et al. 1989, Sommerkamp et al. 1994), hardly justifies an additional 3-4 weeks of immobilization.

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