

External fixation or plaster cast for severely displaced Colles' fractures?

Prospective 1-year study of 46 patients

Hassan Abbaszadegan and Ulf Jonsson

In a prospective randomized study of 47 severely displaced Colles' fractures, 23 had external fixation and 24 had a dorsal plaster cast. Five fractures in the plaster-cast group redislocated and were externally fixed at rereduction after the 11-day follow-up. Three patients in the external-fixation group had a noncomplicated pin-tract infection, and 1 patient had a transient sensory disturbance arising from the cutaneous branch of the superficial radial nerve. After 1 year, the patients allocated to primary external fixation had a better radiographic and functional end result; according to Lidström's grading, 19/22 were excellent or good after external fixation as compared with 12/19 after plaster-cast treatment.

The conventional treatment of a displaced Colles' fracture by reduction and plaster-cast immobilization frequently leads to early redisplacement (Gartland and Werley 1951, Bacorn and Kurtzke 1953, Lidström 1959, Frykman 1967). External fixation of severely displaced Colles' fractures have been recommended by several authors (Cooney et al. 1979, Jonsson 1983, Kongsholm 1987, Howard et al. 1989, Solgaard 1989, Editorial 1989).

We have compared primary external fixation with conventional plaster-cast treatment of severely displaced Colles' fractures.

Patients and methods

The study included 47 consecutive patients with severely displaced Colles' fractures Types 3 and 4 (Older 1965). There were 36 women and 11 men with a mean age of 63 (22-75) years. Severe displacement was defined as radial compression of 5 mm or more (Abbaszadegan and Jonsson 1989). Excluded were patients over aged 75 years, addicts,

senile patients, neuromuscular disturbances, and Warfarin treatment.

After a radiographic examination and the consent of the patients, they were allocated to either treatment with a plaster cast or primary external fixation. The patients in the plaster-cast group had their fractures reduced under local anesthesia and were immobilized in a below-the-elbow plaster cast for 4 weeks (mean 31 days). The patients allocated to external fixation had a coarse reduction of their fractures under local anesthesia without a following radiographic examination, and they were temporarily immobilized in a dorsal plaster cast. External fixation with a Hoffmann device was carried out on the first to third day under regional intravenous anesthesia (mean fixation time 31 days). Two pairs of self-tapping 3.0-mm Hoffmann half-pins were inserted through a 1-cm skin incision through the middle of the second metacarpal bone and two pins in the radius.

There were 24 patients in the plaster-cast group and 23 patients in the external-fixation group. One patient in the external-fixation group died 6 months later, leaving 22 patients for follow-up after 1 year.

A radiographic examination with anteroposterior and lateral projections (Friborg and Lundström 1976) was made initially, after reduction, after 10-12 days, after 4 weeks, and finally after 8 weeks. Radiographs of the contralateral wrist were used for comparison.

Table 1. Mean radial shortening (mm) and dorsal angulation (°) of 47 Colles' fractures initially, after reduction, 10 days, 4 weeks, and 8 weeks

	Radial shortening				Dorsal angulation			
	Cast	P-value	P	S	Cast	P-value	P	S
Initial	7.0	0.09	6.8	6.8	124	0.7	123	127
At reduction	0.9	0.1	0.2	1.2	92	0.09	89	95
10 days	3.0	0.0001	0.7	5.2	101	0.0001	89	110
4 weeks	3.6	0.005	1.9	3	102	0.0001	88	86
8 weeks	4.2	0.001	2.3	3	105	0.0001	89	90

P Primary external fixation.

S Secondary external fixation.

Table 2. Follow-up after treatment of a displaced Colles' fracture with a plaster cast or external fixation according to pain and subjective function (VAS 0-10) as median values and range of movement (flexion + extension) as a percentage of the uninjured wrist

	Pain			Function			Range of movement		
	Cast	P-value	P	Cast	P-value	P	Cast	P-value	P
8 weeks	3	0.4	2	5	0.1	7	64	0.5	68
12 weeks	2	0.1	1	7	0.7	7	73	0.2	78
24 weeks	2	0.009	0.5	8	0.1	9	80	0.008	90
1 year	1	0.002	0	9	0.02	10	83	0.0002	95

P Primary external fixation.

The initial radial shortening was 7 mm in the plaster-cast group and 6.8 mm in the external-fixation group (Table 1). The mean dorsal angulation was respectively 124° and 123°.

The patients were clinically examined after 4, 8, 12, and 24 weeks, and finally after 1 year.

For estimation of subjective function, we used a visual 0-10 analogue scale, where 10 was equivalent to normal function of the wrist.

For the final evaluation, we used the Lidström (1959) system (Table 3).

Five fractures in the plaster-cast group redislocated after 11 days to such an extent that rereduction and external fixation were necessary. Three cases of pin-tract infection were observed in the external fixation group. The symptoms disappeared after antibiotic treatment and did not cause either pin loosening or osteomyelitis. One patient had a transient sensory disturbance from the cutaneous branch of the superficial radial nerve.

For statistical analysis, the Student's *t*-test, the Mann-Whitney test, and the chi-square-test were used with *P* < 0.05 regarded as significant.

Results

The patients in the external-fixation group had a better radiographic outcome on the 11th-day control, and this difference between the groups persisted at the final radiographic examination after 8 weeks (Table 1).

According to the functional outcome, the patients in the external-fixation group had better results as regards pain and range of motion (flexion/extension) after 24 weeks and 1 year. There were no differences between the groups as regards forearm rotation and radial and ulnar deviation at any follow-up occasion. The difference according to the subjective function was significant only at the 1-year follow-up (Table 2).

The corresponding results for the secondary external fixation group were in between the plaster-cast and the primary-external fixation group. Grip strength measured with a balloon vigorimeter did not differ between the two groups.

At the 1-year follow-up, 19/22 patients in the external-fixation group were excellent or good as compared with 12/19 in the plaster-cast group (Table 3).

Table 3. Evaluation according to Lidström's grading 1 year after a Colles' fracture. External fixation primary (P) or secondary (S) after failed plaster-cast fixation

Functional outcome	Plaster cast	P	S
Excellent ¹	6	12	2
Good ²	6	7	1
Fair ³	3	2	1
Poor ⁴	4	1	1
Total	19 ^a	22	5

^aChi-2 test, $P < 0.005$.

¹Function unimpaired. No subjective symptoms. No deformity. Loss of dorsiflexion or palmar flexion not exceeding 15°.

²Function unimpaired. Negligible subjective symptoms. Deformity accepted if not giving subjective symptoms.

³Function less satisfactory for activities requiring special strength or extreme movements, which must be avoided. Most preinjury activities possible. Loss of motion without symptoms.

⁴Working capacity diminished or everyday living affected. Cases with continuous pain.

Discussion

The radiographic end result was better after external fixation, but was not perfect. The main part of the redislocation occurred during the fixation period and not after removal of the device, although our fixation time of 4 weeks was relatively shorter. Kaukonen et al. (1989) immobilized the fractures for 6 weeks, Howard et al. (1989) for 5-6 weeks, and Vaughan et al. (1985) for 8 weeks. To minimize early redisplacement, some authors (Kaukonen et al. 1989 and Howard et al. 1989) have used a distraction bar and increased the distraction during the first few weeks. It seems reasonable to presume that the function after external fixation is correlated with the radiographic position. This accords with the results presented by Kongsholm (1987), Solgaard (1989), and Howard et al. (1989). It must be emphasized that, although our study was randomized, five fractures in the plaster-cast group were excluded because of redislocation and secondary external fixation. Their mean radiographic and functional end results were in between the results of the plaster-cast treated and the primarily externally fixed fractures.

It is interesting to observe that the primarily externally fixed wrists did not achieve a better functional result than the plaster-cast treated wrists until 6 months after the injury.

The complication rate after external fixation has been reported by Cooney (1983) as 34 percent, Vaughan et al. (1985) as 14 percent, Howard et al. (1989) as 12 percent, and Solgaard et al. (1990) as 53 percent.

We conclude that primary external fixation for severely malpositioned Colles' fractures might lead to a better radiographic and functional end result than conventional plaster-cast treatment.

References

- Abbaszadegan H, Jonsson U, von Sivers K. Prediction of instability of Colles' fractures. *Acta Orthop Scand* 1989; 60 (6): 646-50.
- Bacorn R W, Kurtzke J F. Colles' fracture. A study of two thousand cases from the New York State Workmen's Compensation Board. *J Bone Joint Surg (Am)* 1953; 35: 643-58.
- Cooney W P, Linscheid R L, Dobyns J H. External pin fixation for unstable Colles' fractures. *J Bone Joint Surg (Am)* 1979; 61 (6): 840-5.
- Cooney W P. External fixation of distal radial fractures. *Clin Orthop* 1983; 180: 44-9.
- Editorial. Differentiated treatment of Colles' fracture. *Acta Orthop Scand* 1987; 60 (5): 511-2.
- Friberg S, Lundström B. Radiographic measurements of the radio-carpal joint in normal adults. *Acta Radiol (Diagn) (Stockh)* 1976; 17 (2): 249-56.
- Frykman G. Fracture of the distal radius including sequelae shoulder hand finger syndrome, disturbance in the distal radio-ulnar joint and impairment of nerve function. A clinical and experimental study. *Acta Orthop Scand (Suppl 108)* 1967.
- Gartland J J, Werley C W. Evaluation of healed Colles' fractures. *J Bone Joint Surg (Am)* 1951; 33: 895-907.
- Howard P W, Stewart H D, Hind R E, Burke F D. External fixation or plaster for severely displaced comminuted Colles' fractures? A prospective study of anatomical and functional results. *J Bone Joint Surg (Br)* 1989; 71 (1): 68-73.
- Jonsson U. External fixation for redislocated Colles' fractures. *Acta Orthop Scand* 1983; 54 (6): 878-83.
- Kaukonen J P, Karaharju E, Luthje P, Porras M. External fixation of Colles' fracture. *Acta Orthop Scand* 1989; 60 (1): 54-6.
- Kongsholm J. Colles' Fractures. A clinical, experimental and anatomical study. Thesis, University of Uppsala, Uppsala, Sweden 1987.
- Lidström A. Fractures of the distal end of the radius. *Acta Orthop Scand (Suppl 42)* 1959.
- Older T M, Stabler E W, Cassebaum W H. Colles' fracture: Evaluation and selection of therapy. *J Trauma* 1965; 5: 469-76.
- Solgaard S. External fixation or a cast for Colles' fracture. *Acta Orthop Scand* 1989; 60 (4): 387-91.
- Solgaard S, Bünger C, Sølund K. Displaced distal radius fractures. A comparative study of early results following external fixation, functional bracing in supination, or dorsal plaster immobilization. *Arch Orthop Trauma Surg* 1990; 109 (1): 34-8.
- Vaughan P A, Lui S M, Harrington I J, Maistrelli G L. Treatment of unstable fractures of the distal radius by external fixation. *J Bone Joint Surg (Br)* 1985; 67 (3): 295-9.