K-wire fixation for redislocated Colles' fractures

Malunion in 8/21 cases

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One therapeutic alternative for redislocation of Colles' fractures is closed reduction and transstyloid Kirschner-wire fixation. We describe our results concerning 21 redislocations treated in this way. According to Older's classification, 8 fractures were type 3 and 13 fractures type 4. After a median follow-up period of 2 years, most patients had regained normal volar tilt, but significant loss of radial tilt and radial length was found in 11 patients. Malunion occurred in 8 wrists due to either fracture comminution or insufficient K-wire fixation. According to Gartland and Werley's point system, the end-results were poor in 2, fair in 11, good in 4, and excellent in 4 wrists. There was no statistically significant difference in secondary displacement and functional end-result between Older's type 3 and type 4 fractures. We conclude that K-wire fixation is frequently not firm enough and external fixation might be a better alternative for stabilizing redislocated distal radial fractures.

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External fixation is commonly used for redislocated distal radial fractures (Cooney et al. 1979), but percutaneous K-wire pinning is an alternative. It offers the advantage of a minimally invasive procedure with the ability to move the wrist early, while anatomic radiocarpal alignment is being achieved (Rayhack 1993).

We have evaluated the anatomical and functional results of K-wire fixation performed for redislocated distal radial fractures of Older's type 3 (extraarticular) and Older's type 4 (intraarticular) fractures (Older et al. 1965).

Patients and methods

During the period 1987–1994, 21 patients (15 women) with a dorsally redislocated distal radial fracture were operated on at our hospital. The wrist fracture resulted from an accidental fall in 17 and a traffic accident in 4 cases. The mean age was 57 (25–78) years. The total incidence of distal radial fractures at our department is 300–320 per year. About 40 wrists were primarily operated during the observation period (Oskam et al. 1996). Secondary treatment by K-wire fixation was annually performed in 2–3 patients, corresponding to a frequency of 1% of all distal radial fractures.

Every fracture was initially treated with a dorsal plaster splint after reduction. Redisplacement was diagnosed on a routine radiograph within 12 days. Closed reduction and operative fixation were performed within 2 weeks. 3 (12 cases) or 2 (9 cases) 1.8 mm K-wires were inserted percutaneously and were drilled through the radial styloid process anteriorly and posteriorly into the opposite cortex. The wires were left subcutaneously. Postoperatively, all wrists were immobilized with a dorsal splint for 2 weeks, and thereafter the patients were allowed to move the wrist. Wires were removed 6 weeks after the operation.

Radiographic assessment

The fractures were classified according to Older's system, which is designed for dorsally displaced distal radial fractures (Older et al. 1965). An Older's type 3 (extraarticular) fracture was found in 8, and an Older's type 4 (intraarticular) fracture was found in 13 wrists (Table 1).

The dislocation pattern was described by 3 radiographic parameters: the radiocarpal angle on the lateral projection, the radial inclination angle and the relative ulnar length (ulnar variance) on the antero-posterior projection. The relative ulnar length was used as an indirect measure of radial length.

The 3 radiographic parameters were measured on the preoperative, the postoperative and the follow-up routine wrist radiographs. We used the following criteria, for good radiocarpal alignment which were con-

Table 1. Comparison of findings in 21 redislocated distal radial fractures treated with K-wire fixation, using Older's classification and the end-results using Gartland and Werley's point system

Older's classification	n	Excellent/ good	Fair	Poor
1 & 2	–	–	–	–
3	8	5	2	1
4	13	3	9	1
Total	21	8	11	2

1 & 2. Not displaced or displaced with minimal comminution—dorsal angulation, radial articular surface not lower than 3 mm below ulnar head.
3. Displaced with comminution of dorsal radius, radial surface below ulnar head, minimal comminution of distal fragment.
4. Displaced with severe comminution of radial head, radial articular surface 2–8 mm below ulnar head

Table 2. Mean (SD) radioanatomic parameters measured at different intervals before and after K-wire fixation in 21 patients

	Preop.	Postop.	Follow-up
Radiocarpal angle (degree)	22 (13)	–1 (5) [a]	–1 (7) [a]
Radial inclination (degree)	14 (7)	23 (3)	20 (5)
Relative ulnar length (mm)	4 (3)	1 (2)	3 (2)

[a] volar dislocation

sidered to be physiological: a radiocarpal angle between 10° volarly or 10° dorsally, a radial inclination of 20°–30°, and an ulnar variance of –2 to +3 mm (Friberg and Lundström 1976, Steyers and Blair 1989). If at least 1 of the 3 radiological parameters was not in the physiological range, the result was considered a malunion.

Follow-up examination

A follow-up study comprising clinical and radiographic examinations was performed after mean 2 (1–8) years. Motion was measured in both wrists, using a goniometer, and the result is expressed as a proportion. Wrist motion exceeding 80% was considered normal.

The point system of Gartland and Werley was used to assess the end-result. In a personal interview, residual deformity, subjective evaluation of impairment, objective evaluation of wrist movement and complications like arthrosis were assessed. The end-results were graded as excellent (0–2 points), good (3–8 points), fair (9–20 points), or poor (more than 21 points) (Gartland and Werley 1951).

The Student's t-test for matched pairs was used to test for differences between pre- and postoperative radioanatomic measurements. The binomial (Z) test was used to test for differences in proportion. A p-value < 0.05 was considered a level of significance in both statistical tests.

Results

Secondary displacement

Fracture displacement in the postoperative period occurred in 12 wrists. A change in radiocarpal angle exceeding 6 degrees was found in 8/21 wrists, radial inclination decreased up to 16 degrees in 11 wrists, and radial shortening (2–12 mm) occurred in 11 patients (Table 2).

Secondary displacement was observed in 3 Older's type 3 fractures, and 9 Older's type 4 fractures. This difference was statistically not significant ($p = 0.2$). A malunion of the distal radius was found in 8 wrists, of which 6 had been classified as Older's type 4.

Wrist function

Wrist pain during daily activities was reported by 11 patients. 2 patients could not resume their daily activities and complained of severe pain with decreased grip strength (poor result). Clinical signs of reflex sympathetic dystrophy occurred in 1 patient. According to Gartland and Werley's point system, the end-results were poor in 2, fair in 11, good in 4, and excellent in 4 wrists.

A good or excellent result was found in 5 of 8 Older's type 3 fractures, while 3 good or excellent results were observed in the 13 Older's type 4 fractures (Table 1). This difference was statistically not significant ($p = 0.1$).

Discussion

It appeared that the radiocarpal angle remained almost unchanged during fracture healing. However, radial tilt and radial length could not be maintained in all patients. Apparently, the distal radius could still slide over the K-wires, and both unfavorable anatomical or functional results occurred. Secondary displacement after K-wire pinning has been reported before, and is explained by residual instability due to fracture comminution or osteoporosis (Mah and Atkinson 1992, Lenoble et al. 1995). It has been argued that K-wire pinning is suitable in both extraarticular fractures and fractures with minimal intraarticular involvement (Rayhack 1993). However, the observation that displacement is a common complication in both extra- and intraarticular fractures conflicts with

this view. Therefore, we doubt if K-wire fixation is firm enough to obtain good anatomical results in redislocated distal radial fractures.

There is general agreement that K-wire fixation is not indicated in severely comminuted fractures of the distal radius (Mah and Atkinson 1992, Lenoble et al. 1995). In a controlled study, Haas and de la Caffiniere (1995) observed significant secondary displacement after intramedullary K-wire pinning in unstable intra-articular fractures. Moreover, it appeared that the anatomical results of external fixation were better than with intramedullary K-wire pinning. It has been shown in several other studies that the results of external fixation are good, with minimal postoperative morbidity, in at least 80% of unstable distal radial fractures (Cooney et al. 1979, Riis and Fruensgaard 1989, Schuild et al. 1995). We feel that external fixation would have been a better alternative than K-wires for treating the redislocated distal radial fractures in our series.

References

Cooney W P, Linscheid R L, Dobyns J H. External pin fixation for unstable Colles' fracture. J Bone Joint Surg (Am) 1979; 61 (6): 840-5.

Friberg S, Lundström B. Radiographic measurements of the radiocarpal joint in normal adults. Acta Radiol Diagn 1976; 17: 249-56.

Gartland J J, Werley C W. Evaluation of healed Colles' fractures. J Bone Joint Surg (Am) 1951; 33 (4): 895-907.

Haas J L, Caffiniere de la J Y. Fixation of distal radial fractures: Intramedullary pinning versus external fixation. In: Fractures of the distal radius (Eds Saffar P, Cooney W P). Martin Dunitz London 1995; 27: 229-39.

Lenoble E, Dumontier C, Goutallier D, Apoil A. Fracture of the distal radius. A prospective comparison between transstyloid and Kapandji fixations. J Bone Joint Surg (Br) 1995; 77 (4): 562-7.

Mah E T, Atkinson R N. Percutaneous Kirschner wire stabilisation following closed reduction of Colles' fractures. J Hand Surg (Br) 1992; 17 (1): 55-62.

Older T M, Stabler E V, Cassebaum W H. Colles' fracture: evaluation and selection of therapy. J Trauma 1965; 5: 469-76.

Oskam J, Kingma J, Klasen H J. Fracture of the distal forearm. Epidemiological trends in the period 1971–1995. Submitted 1996.

Rayhack J M. The history and evolution of percutaneous pinning of displaced distal radius fractures. Orthop Clin North Am 1993; 24 (2): 287-300.

Riis J, Fruensgaard S. Treatment of unstable Colles' fracture by external fixation. J Hand Surg (Br) 1989; 14: 145-8.

Schuild F, Donckerwolke M, Burny F. Treatment of distal radial fractures by external fixation: techniques and indications. In: Fractures of the distal radius (Eds Saffar P, Cooney W P). Martin Dunitz London 1995; 25: 203-9.

Steyers C M, Blair W F. Measuring ulnar variance: a comparison of techniques. J Hand Surg (Am) 1989; 14 (4): 607-12.