



The Journal of Bone & Joint Surgery

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Attendees: Mr PJ Harwood, Mr T Goff, Mr S Harrison, Mr I Abulkareem, Mr J Messner, Mr J Tebby, Mr M Mokwem

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Theme: Upper Limb – Management of distal radius fractures

Presented Papers:

- 1) **Kreder HJ, Hanel DP, Agel J, McKee M, Schemitsch EH, Trumble TE, Stephen D.** Indirect reduction and percutaneous fixation versus open reduction and internal fixation for displaced intra-articular fractures of the distal radius: a randomised, controlled trial. *J Bone Joint Surg [Br]* 2005;87-B:829-36.
- 2) **Egol K, Walsh M, Tejwani N, McLaurin T, Paksima N.** Bridging external fixation and supplementary Kirschner-wire fixation versus volar locked plating for unstable fractures of the distal radius, a randomised prospective trial. *J Bone Joint Surg [Br]* 2008;90-B:1214-21.
- 3) **Azzopardi T, Ehrendorfer S, Coulton T, Abela M.** Unstable extra-articular fractures of the distal radius: a prospective, randomised study of immobilisation in a cast versus supplementary percutaneous pinning. *J Bone Joint Surg [Br]* 2005;87-B:837-40.

Distal radius fractures are frequently encountered ranging from high energy injuries in young patients to low energy osteoporotic fractures in the elderly. There are various treatment modalities with much on-going debate about which is most appropriate for any given fracture pattern, especially when patient age and functional demand are considered. We review some recent literature which has tried to answer these difficult questions and debate the use of these treatments in our institution.

Paper 1 - Reviewer: Mr T Goff

Summary

1. Purpose

The purpose of this study was to compare indirect reduction and percutaneous fixation with open reduction and internal fixation for displaced intra-articular fractures of the distal radius.

2. Methods

Patients aged 16 to 75 years with displaced intra-articular fractures of the distal radius seen at any of the 3 participating centres were screened for entry into the trial after initial closed reduction in the emergency department. Those who then had a minimum of 2 mm of either step-off or gap were eligible for the trial. Including fractures with dorsal angulation of $>10^\circ$, or comminution of more than one-third of the AP diameter of the shaft.

Exclusion criteria included any history of a previous fracture of the wrist, congenital anomaly or other severe problems of the wrist, if they were not fit for surgery, if definitive treatment could not be administered <1 week from injury, if they were mentally incompetent or if they were unable to answer a

written questionnaire in English. Open fractures, patients with associated injuries of the ipsilateral upper limb or other significant systemic injuries were also excluded.

3. Results

A total of 1269 patients were screened, 247 met the criteria of which 179 were enrolled in to the study. 88 patients in the indirect group and 91 in the open group, with similar characteristics. 166 returned for follow-up at six months (93%), 140 at one year (78%) and 118 at two years (66%). Those undergoing internal fixation were statistically more likely to have bone grafting (50% vs 13%, $p < 0.001$).

4. Conclusions

The authors recommend that open reduction be preceded by an attempt at minimally invasive percutaneous reduction. If an acceptable reduction is achieved then open reduction is unnecessary and function may be superior in the longer term. Patients need not be followed up beyond one year, unless complications have arisen.

Critique

Strengths

- All patients were evaluated according to the 'intention-to-treat' principle.
- All patients achieved union.
- Standardised radiological and clinical assessment at follow up.

Methodological Concerns

- High numbers of cross over (but analysed on intention to treat basis)
- Wide variety of implants used, often supplemented by exfix and bone graft
- Loss to long term follow up
- DASH not used

Paper 2 - Reviewer: Mr I. Abdulkareem

Summary

1. Purpose

This is a prospective randomised controlled trial to evaluate the outcome of displaced unstable fractures of the distal radius. Comparing the radiological, clinical, and functional outcomes of patients treated with either bridging external fixation +/- K-wire fixation or Volar locking plate for a displaced fracture of the distal radius.

2. Methods

280 consecutive patients were enrolled in a prospective database, and 88 met the inclusion criteria for surgery.

Patients were randomised to either bridging external fixation +/- K-wire fixation or Volar locking plate and screws. Both groups were similar in biodata, hand dominance, fracture pattern, socio-economic status and medical co-morbidities.

The clinical information obtained includes mechanism of injury, DASH functional scores, neurovascular status, and radiological assessment.

The fractures were classified according to the AO/OTA classification, with type C fractures mostly allocated to the external fixation group. Open fractures were classified according to de Souza, Gustillo and Meyer.

Patients who met the criteria for initial closed treatment were reviewed within one week, and re-examined clinically and radiologically to assess the maintenance of their reduction.

The criteria assessed include residual dorsal angulation $<10^\circ$ from neutral, loss of height of $<2\text{mm}$ compared with the contralateral side, articular step-off $<1\text{mm}$ and no associated instability of the DRUJ.

If the reduction was maintained, the patient was reviewed weekly for 3 weeks radiologically, surgery was recommended if reduction was lost, if the fracture was open, or unstable due to the presence of any three of the following: Initial dorsal angulation of $>20^\circ$, Initial shortening of $>5\text{mm}$, dorsal comminution $>50\%$, intra-articular fracture, age >60 years, associated ulna fracture, or associated fracture/dislocation of the wrist.

All operations were performed by one of four post-fellowship surgeons with extensive experience in both forms of surgical treatment. All the operations were performed under regional or GA, and tourniquet was used at the discretion of the operating surgeon.

The External fixation group had closed reduction with placement of two pins in the base of the 2nd metacarpal, and two in the distal third of the radius in an open surgical manner. If acceptable reduction could not be achieved, K-wires were used to reduce the fragments anatomically.

All the volar plate patients had the standard Henry's approach, and removable Velcro splint for comfort to allow for free movements of their wrists and fingers.

Post-operatively, all patients were placed in volar splint and dressings and sutures removed after one week. The patients were followed-up at two and six weeks and also 3, 6, and 12 months.

External fixation patients began finger exercises and were seen every two weeks for radiological follow-up.

The external fixators were removed at 6 weeks in the clinic without anaesthesia

Critique

Previous studies suggested that the functional outcome is improved when anatomical articular alignment at union is achieved. Imperfect reduction of the fracture may not result in post-traumatic OA.

There are certain recognised complications of ORIF such as irritation and rupture of the extensor tendons, joint penetration and infection. External fixation also has complications such as stiffness of the fingers, loss of reduction, nerve injury, and pin-track infection.

Although the patients treated by volar plating had a statistically significant early improvement in the ROM of the wrist, this advantage diminished with time and in absolute terms, the difference in ROM was clinically unimportant.

Radiologically, there were no clinically significant differences in the reductions, although more patients with AO/OTA type C fractures were allocated to the external fixation group. The function at one year was similar, and no clear advantage could be demonstrated with either treatment, but fewer re-operations were required in the external fixation group.

Paper 3 - Reviewer: Mr S. Harrison & Mr J. Tebby

1. Purpose

- To assess the difference in the treatment outcomes of extra-articular distal radius fractures with forearm cast immobilisation alone and with casting and percutaneous pinning in an elderly population.

2. Methods

Patients older than 60 years were identified in the time period August 1997 to December 2000.

Fractures that were classified as unstable, dorsally angulated and extra-articular were included.

Patients were randomised by the toss of a coin to one of two groups:

- closed reduction and cast vs.
- reduction with percutaneous pinning and cast.

Patients were excluded if they had dementia; psychiatric illness; previous wrist fracture; an open, intra-articular, volar angulated fracture or stable fracture.

57 patients were included: 27 to the closed reduction group and 30 to the percutaneous pinning group.

Analysis was performed on an intention to treat basis

Procedure

All procedures were carried out within 24 hours of injury under the care of the senior author

Closed reduction performed under fluoroscopic guidance and then a well moulded, three-point fixated forearm cast applied.

Percutaneous pinning was performed utilising crossed smooth 1.6mm Kirschner wires via stab incisions.

One inserted through the radial styloid and the other either through Lister's tubercle or the dorso-ulnar border of the distal fragment. Both wires engaged the opposite cortex. The pins were left protruding the skin. The wrist was then immobilised in a well moulded, forearm cast.

The wires and plaster casts were removed at 5 weeks post-operatively.

Outcome

- Clinical and radiological review performed at one, two and five weeks, four months and one year.
- Outcome assessed by a lone physiotherapist.
- Range of motion was measured using a goniometer and expressed as a percentage of the uninjured side.
- Grip strength was assessed using a Jamar dynamometer taking the mean of three readings. A 10% reduction in grip strength was permitted for a non-dominant hand distal radius fracture.
- Activities of daily living were assessed at each visit, examining four unilateral activities and six bilateral activities.
- Pain was assessed using the visual analogue scale.
- SF-36 questionnaire was completed at four months.
- AP and lateral radiographs were taken. Angulation, inclination and length of the radius, as well ulnar variance were recorded. These were examined with comparable films of the uninjured wrist.

Statistical analysis

- This was performed using Minitab. Student's t-test was used for continuous variables. The Mann-Whitney U-test was used for the continuous variables of non-parametric data.

3. Results

- 54 patients were included in the analysis. There were 27 patients in each group. Patient demographics were well matched in each group.
- Six patients did not attend follow-up at one year.
- Range of motion demonstrated significant difference only in ulnar deviation ($p = 0.009$) between groups.

- There was no statistically significant difference in grip strength, activities of daily living, pain and the SF-36 questionnaire scores between groups.
- There was a statistically significant difference in radiological assessment between groups after five weeks and one year for dorsal angulation, and also for radial length and inclination at one year. No statistical significance was demonstrated for ulnar variance.
- One patient had their K-wires removed on account of infection.
- One patient's fracture redisplaced in the closed group and subsequently had percutaneous pinning.

4. Conclusion

- Supplementary K-wire fixation does not provide better clinical outcomes in unstable extra-articular, dorsally angulated fractures of the distal radius.

5. Critique

- This paper aims to assess whether supplementary K-wire fixation of an extra-articular fracture of a distal radius provides a better outcome than simply cast immobilisation.

Strengths

- States the aims of the study clearly
- Analyses a very specific common injury
- Identifies suitable inclusion and exclusion criteria
- Good comparison between groups
- Comparable methodology
- Good quantified outcomes
- Fractures were assessed and treated within 24 hours
- Statistical tests identified

Weaknesses

- Small sample size
- No power calculation
- Closed reduction required theatre session and carries risks of anaesthetic and there are costs associated with theatre space and time

From this study it would seem that very little additional function is achieved from supplementary K-wire fixation in this very specific fracture pattern, in the elderly population.