Management of displaced fractures of the waist of the scaphoid: meta-analyses of comparative studies

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CRD summary
The review found that displaced fractures of the scaphoid had a four times higher risk of non-union than undisplaced fractures with plaster cast treatment. Risk of non-union was significantly lower for surgery versus a plaster cast for displaced scaphoid fractures. The authors' conclusions may not be reliable due to the indirect meta-analysis performed and evidence limitations.

Authors' objectives
To compare the efficacy of plaster cast versus surgery for displaced fractures of the waist of the scaphoid.

Searching
MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials, SCOPUS and Web of Science were searched up to October 2011 with no language restrictions; search terms were reported. Bibliographies of retrieved studies were handsearched for additional studies. Unpublished studies were excluded. Authors were not contacted.

Study selection
Observational studies of displaced fractures of the waist of the scaphoid treated in a plaster-cast (non-operative group) or surgically (operative group) were eligible for inclusion (no randomised or case studies comparing an operative group with a non-operative group were found). Studies had to report the rate of fracture union as the primary outcome. To be eligible, displacement had to be noted on radiography or computed tomography scans; the criterion used for displacement was limited to a gap or step of over 1mm. For the non-surgical group, observational studies with consecutive cases including both displaced and undisplaced fractures treated in a plaster cast were selected.

In the included studies, the non-surgical group treatments included a below-elbow plaster cast, long and short thumb spica cast, or short thumb spica cast; the length of immobilisation varied from six to 10 weeks. The surgical group of studies were case series, all using headless screws (further surgical treatment details were reported); only a third of the studies included a comparative group with undisplaced fractures. Further details of the individual displacement definitions were provided. All the studies defined non-union as a clear gap at the fracture site on radiographs after 12 weeks. The mean age of participants ranged from 25 to 34 years; the percentage of women ranged from 8% to 24% (where reported).

The reviewers (number not stated) independently performed the study selection.

Assessment of study quality
The authors did not assess study quality as they were not aware of any relevant methods. Instead they assessed confounding factors that could introduce heterogeneity such as patient age and gender.

Data extraction
The number of participants was calculated for the non-surgical group and the surgical group of studies. For the surgical group, there was no loss to follow-up and data were extracted on all patients. Data were extracted for the non-surgical group, but based on the patients that were not lost to follow-up. Data were extracted on the number of patients with union and non-union, and the number of patients with and without displaced fractures to calculate relative risks or odds ratios with 95% confidence intervals.

The reviewers independently extracted data using a predefined checklist.

Methods of synthesis
Results were pooled for the non-surgical group using a random-effects model (DerSimonian Laird) since a high level of heterogeneity was expected. Between study heterogeneity was determined using $I^2$ and $T^2$. A continuity correction was
used to adjust for the one study where one group had no events. One outlier study was omitted from the meta-analysis. Subgroup analyses were performed omitting earlier (pre-1980) studies. Publication bias was investigated visually using funnel plots.

Since there was no comparative group for the surgical group, a descriptive analysis was performed. A two-way contingency table was used to calculate the odds ratio of non-union between the operative and non-operative groups.

**Results of the review**

Fourteen studies were identified for inclusion in the review (2,219 patients, range 14 to 732). The six surgical studies were all case series (324 patients, range 14 to 126). The loss to follow-up for the eight non-surgical observational studies (1,895 patients, range 45 to 732) was 365 (19%, range zero to 32%). Follow-up ranged from 0.5 to 10 years for non-surgical patients and one to 4 years for surgical patients.

For the non-surgical group (eight studies), one study was excluded from the meta-analysis since all the patients with fracture non-union were found to have had inadequate (late) initial treatment. For the remaining seven studies, there was a significantly higher risk of fracture non-union for displaced fractures (RR 4.40, 95% CI 2.23 to 8.67; $I^2=54\%$) versus undisplaced fractures (OR 5.52, 95% CI 2.48 to 12.3; $I^2=55\%$).

Four of the six studies in the surgical group did not have a comparative group and had a 100% union rate after surgery, so a meta-analysis was not possible. Only two of the 157 displaced fracture cases in the six studies failed to heal after surgery.

The two-way contingency table analysis gave a significantly higher risk of non-union for treatment with a plaster cast versus surgery (OR 16.8, 95% CI 3.8 to 75.2).

There was no evidence of publication bias for the main analysis and findings were not significantly altered in subgroup analysis.

**Authors’ conclusions**

Displaced fractures of the scaphoid had a four times higher risk of non-union than undisplaced fractures when treated in a plaster cast. The risk was significantly lower after surgical fixation of displaced fractures of the scaphoid.

**CRD commentary**

The review addressed a well-defined question for interventions and the relevant outcome but relevant study designs and participants were less clear. Relevant databases were searched, but unpublished studies were not included, so some relevant studies could have been missed. Efforts were made to reduce error and bias in study selection and data extraction.

A formal assessment of study quality was not made since the authors were not aware of suitable methods for non-randomised studies but some relevant data was provided. Relevant study details were reported, but the types of study design were still unclear. Study design appeared to be different for the non-surgical group and surgical group of studies. The surgical studies were case series, which had limited reliability. An indirect meta-analysis was performed, so the validity of the meta-analysis was unclear. Also relative risks and odds ratios were compared, which would not be consistent. There was a significant level of heterogeneity and wide confidence intervals. Relatively few studies were identified and the number of participants in the surgical study group was much smaller than those in the non-surgical group. Also, follow-up for surgical patients was shorter than for non-surgical patients.

Given the nature of the data, the indirect meta-analysis performed and other uncertainties, the evidence and authors’ conclusions may not be reliable.

**Implications of the review for practice and research**

**Practice:** The authors recommended that patients should be advised of the risk of non-union of displaced fractures of the scaphoid if treated in a plaster cast.

**Research:** The authors calculated that a randomised study comparing surgery versus a plaster cast for displaced scaphoid fractures would require a multi-centre study with 150 participants. Further studies should investigate whether
immobilisation periods required for displaced fractures can be shortened with internal fixation.

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