Treatment of acute scaphoid fractures: systematic review and meta-analysis

CRD summary
The authors concluded that operative treatment of acute nondisplaced or minimally displaced scaphoid waist fractures is associated with an increased risk of complications and possibly an increased risk of scaphotrapezial joint osteoarthritis compared with non-operative treatment, but there were no between-treatment differences for other outcomes. This was generally a well-conducted review and the authors' conclusions are likely to be reliable.

Authors' objectives
To compare operative and non-operative treatments and different types of casting methods for acute scaphoid fractures.

Searching
PubMed and the Cochrane Controlled Trials Register were searched. Some details of the search strategy were reported. The references of relevant studies were also handsearched. Studies were only included if they were published as full reports in English.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) and quasi-RCTs were eligible for inclusion in the review. The duration of follow-up ranged from 6 months to 11.7 years in the included studies.

Specific interventions included in the review
Studies that compared operative with non-operative treatment, or compared different types of casting methods, were eligible for inclusion. The main operative treatments had to be either closed reduction with percutaneous fixation, or open or arthroscopic reduction with internal fixation by Kirschner wires or screws. The included studies evaluated the following treatments; percutaneous and open reduction internal fixation; above and below elbow thumb spica cast; casts with thumb free and enclosed; casts with wrist flexion and wrist extension; and long and short thumb spica cast.

Participants included in the review
Studies of adults of either gender or any age, with clinical and radiographic evidence of any type of acute scaphoid fracture, were eligible for inclusion. The patients in the primary studies included those with acute waist nondisplaced fractures and fractures of other parts of the scaphoid including the distal and proximal pole. The patients were predominantly male, with an average age of between 24 and 37 years.

Outcomes assessed in the review
Studies that reported nonunion of acute scaphoid fractures were eligible for inclusion. The review also assessed return to work, grip strength, range of movement (ROM) of the wrist, complications, patient satisfaction and osteoarthritis.

How were decisions on the relevance of primary studies made?
Two reviewers independently selected the studies and resolved any disagreements through consensus.

Assessment of study quality
Two reviewers independently assessed validity using the following criteria modified from the PEDro scale: specification of eligibility criteria; randomisation; allocation concealment; baseline similarity of the treatment groups; co-interventions avoided or similar across treatment groups; clearly defined outcome measures; blinding of the outcome assessors; outcomes reported for at least one measure for at least 85% of patients allocated; intention-to-treat analysis; and reporting of statistical comparisons and point measures and variability for at least one outcome. Studies that met at least three of the following criteria were classified as ‘high quality’: randomisation, allocation concealment, blind assessment and intention-to-treat analysis. Any disagreements were resolved by discussion, with the aid of a third reviewer where required.
Data extraction
Two reviewers independently extracted the data. For each study, differences in treatment effect sizes between treatment groups were calculated with 95% confidence intervals (CIs). Relative risks (RRs) were used for dichotomous data and weighted mean differences (WMDs) for continuous data.

Methods of synthesis
How were the studies combined?
The studies were grouped by outcome and combined statistically where there were sufficient data. Pooled RRs with 95% CIs were calculated for dichotomous data and pooled WMDs or standardised mean differences (where studies used different measures to assess the same outcome) with 95% CIs for continuous data. Methods used to input values for missing standard deviations were reported. Fixed-effect models were used where I-squared was less than 50%, while random-effects models were used for higher values of I-squared (>50%).

How were differences between studies investigated?
Statistical heterogeneity was assessed using the I-squared statistic. Sensitivity analysis was conducted by using a random-effects model where I-squared was more than 25%, assuming best- and worst-case scenarios for missing dichotomous data and using only pooled data from high-quality studies.

Results of the review
Seven studies (n=692) were included. Four studies (n=228) compared operative versus non-operative treatment and three (n=464) compared different types of casting.

All of the included studies had methodological flaws. Five studies reported the randomisation method and two used quasi-randomised methods. In none of the studies was the outcome assessor blinded. Five studies reported drop-outs or losses to follow-up, but only one used intention-to-treat analysis. Two studies were classified as high quality.

Nonunion was significantly less common in patients undergoing operative compared with non-operative treatment (RR 0.26, 95% CI: 0.07, 0.91, p=0.04; based on 4 studies; I-squared 47.8%). The results were not robust to sensitivity analysis. Reanalysis using a random-effects model and analyses assuming best- and worst-case scenarios for missing data showed no significant difference between treatments. When limiting the analysis to the two high-quality studies, the RR approached statistical significance in favour of operative treatment (RR 0.06, 95% CI: 0, 0.94, p=0.05).

Return to work was significantly faster in patients undergoing operative compared with non-operative treatment (WMD -5.47 weeks, 95% CI: -9.97, -0.98, p=0.02; based on 3 studies) but significant heterogeneity was found (I-squared 92.7%). Substantial heterogeneity remained when the analysis was limited to the two high-quality studies (I-squared 96.2%).

Complications were significantly more common in patients undergoing operative treatment than non-operative treatment (RR 12.23, 95% CI: 2.32, 64.60, p=0.0003; based on 4 studies); no significant heterogeneity was found (I-squared 0%). The results were robust to best- and worst-case scenarios for missing data and analysis using only data from the high-quality studies.

In one study with 12-year follow-up, there was a non-statistically significant increase in the risk of osteoarthritis of the scaphotrapezial joint in patients undergoing operative compared with non-operative treatment (RR 2.43, 95% CI: 0.98, 6.03), but no significant difference between treatments in symptomatic osteoarthritis. There was no significant difference between treatments in radiocarpal osteoarthritis or symptomatic radiocarpal osteoarthritis.

There were no consistent significant differences in operative and non-operative groups across all time periods reported for grip strength (4 studies) or ROM of the wrist (4 studies), and no significant differences between treatments in patient satisfaction (2 studies).

The three studies that compared different types of cast found no differences in rates of nonunion between treatments.

Authors' conclusions
Operative treatment of acute nondisplaced or minimally displaced fractures of the scaphoid waist is associated with an increased risk of complications and possibly an increased risk of scaphotrapezial joint osteoarthritis compared with non-operative treatment. However, there were no differences between treatments for nonunion, return to work, grip strength, range of wrist motion and patient satisfaction. There was insufficient evidence to determine which cast type should be used in non-operative treatment of nondisplaced scaphoid fractures.

CRD commentary
The review addressed a clear question that was defined in terms of the participants, intervention, outcomes and study design. Limiting the search to English language publications listed in two databases raises the possibility of publication and language bias, and might have resulted in the omission of other relevant studies, which the authors acknowledged. Methods were used to minimise reviewer error and bias in the study selection, validity assessment and data extraction processes. Validity was assessed using specified criteria and the results of this assessment reported. Where possible, studies were pooled using meta-analysis, statistical heterogeneity was assessed, and various sensitivity analyses were conducted to test the robustness of the results. Limitations of the review and the evidence were discussed. This was generally a well-conducted review and the authors’ conclusions are likely to be reliable.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that good-quality RCTs are required to compare operative and non-operative treatments for acute fractures of the proximal pole of the scaphoid, and to compare different type of casts for the non-operative treatment of nondisplaced scaphoid fractures.

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