Management of calcaneal fractures: systematic review of randomized trials

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CRD summary
The authors’ conclusion that there was insufficient evidence to prove the superiority of operative over non-operative management for calcaneal fractures seemed reliable. Surgery was found to be beneficial for some general health outcome measures. Potential limitations in the review process and acknowledged limitations in the evidence should be born in mind when interpreting the conclusions.

Authors' objectives
To evaluate the safety and effectiveness of different management strategies for calcaneal fractures.

Searching
MEDLINE, EMBASE, CINAHL, Cochrane Central Register of Controlled Trials (CENTRAL) and Cochrane Musculoskeletal Injuries Group Trials Register databases and Google Scholar were searched from inception to 5 December 2008 for publications in any language; search terms were reported. Only peer-reviewed publications were included; reviews were excluded.

Study selection
Randomised and quasi-randomised trials that compared interventions for treating calcaneal fractures were eligible for inclusion. Cadaveric and biomechanical studies and studies of surgical techniques were excluded. Articles that performed a retrospective analysis of different aspects of a trial not originally included in the trial design were excluded.

Most of the included studies were of operative versus non-operative management; there were single studies of impulse compression versus no impulse compression for fractures treated non-operatively and foot pump versus no foot pump for preoperative oedema reduction. Outcomes were divided into four types: general health outcome measures; disease specific scores; radiographic parameters; and complication rates. Mean follow-up was less than 17 months in most trials and for up to 15 years in two trials. Two ongoing trials of operative versus non-operative management were described.

Two reviewers performed the selection. Disagreements were resolved by discussion.

Assessment of study quality
Two reviewers independently assessed quality using the Cochrane Collaboration 12-item scale with criteria for: allocation concealment; intention-to-treat analysis; blinding of outcome assessors, participants, and treatment providers; comparable treatment and control groups; identical care programmes other than trial options; inclusion and exclusion criteria clearly defined; clearly defined intervention and outcome measures; diagnostic tests for outcomes clinically useful; and appropriate follow-up time. Each criterion was scored 0, 1 or 2 to a maximum overall total score of 24.

Data extraction
Numbers of events for each outcome were extracted in order to calculate peto odds ratio (OR) and 95% confidence intervals (CI). Weighted mean differences (WMD) with 95% CIs were calculated for continuous data.

The authors did not report how many reviewers performed data extraction.

Methods of synthesis
Results were summarised by type of intervention. Where possible, peto odds ratios and weighted mean differences were pooled by type of intervention. Weighted mean differences were pooled using a fixed-effects model.

Results of the review
Seven studies were identified (n=611): five randomised controlled trials (RCTs) (n=531, range 23 to 424) and two quasi-
randomised trials (quasi-RCTs, n=24 and n=56). The quasi-RCTs had the lowest quality scores of 6 and 10; scores for the RCTs ranged from 11 to 14. No study reported confirmation of allocation concealment.

Operative versus non-operative management (five studies): Most outcomes were measured only in individual studies.

**General health outcomes:** There was a significant benefit for operative management with a reduction in use of analgesia (OR 0.19, 95% CIs 0.05 to 0.70), inability to wear the same shoes (OR 0.39, 95% CIs 0.16 to 0.92; three studies), inability to return to the same work (OR 0.28, 95% CIs 0.11 to 0.72; three studies), limitations to daily activities (OR 0.13, 95% CIs 0.02 to 0.86) and a reduced need for subtalar arthrodesis (OR 0.17, 95% CIs 0.07 to 0.40). There were no significant differences for pain (two studies), pain using a visual analogue scale (VAS) score, limited walking distance, can walk less than six blocks, limp, not at previous recreational level, reduced subtalar movement, reduced ankle movement and SF-36 Health Survey scale.

**Injury specific scores:** Operative management gave a significantly higher calcaneal functional score (MD 31.70, 95% CI 17.68 to 45.72) but no significant differences in hindfoot score (American Orthopaedic Foot Ankle Score), Foot Function Index and calcaneal fracture score.

**Radiographic parameters:** Operative management gave a significant improvement in Bohler’s angle (OR 0.02, 95% CIs 0.00 to 0.45) and for mean difference in Bohler’s Angle (MD 12.13, 95% CI 7.24 to 17.02). There was no significant difference in calcaneum height.

**Complications:** One study reported no significant difference in the number of complications. This study found improved results for surgery when patients who received workers’ compensation were removed from the analysis, which included significantly higher satisfaction scores (p=0.001) compared to those who received non-operative management.

**Impulse compression versus no impulse compression control (one study):** Impulse compression gave a significant decrease in pain using VAS scores at six months (MD -1.90, 95% CIs -3.18 to -0.62), but not after one year, and significantly improved subtalar movement (MD 13.90, 95% CIs 3.17 to 24.63).

**Foot pump versus no foot pump control for preoperative oedema reduction (one study):** There was a significant reduction in foot volume with foot pump use compared to controls over days one to two (p=0.02) and days one to three (p=0.02); it was not significant for days one to four (p=0.09).

The results of further subgroup analyses were reported for some studies.

**Authors' conclusions**
The authors concluded that results favoured surgical management on ability to return to the same work and to wear the same shoes as before the fracture, but did not have a significant effect on residual pain. Surgery also reduced the need for subsequent subtalar fusion; workers’ compensation affected the outcome. It was unclear whether general health outcome measures, injury specific scores and radiographic parameters improved after surgery and whether the benefits of surgery outweighed the risks.

**CRD commentary**
The review addressed a well-defined question in terms of participants, interventions and study design. Relevant outcomes were not clearly defined. Relevant databases were searched in any language. Unpublished studies were not considered and some relevant studies may have been missed. Publication bias was not assessed. Study quality was assessed using suitable criteria. Study selection and validity assessment were carried out with efforts to reduce error and bias; it was not reported whether this process applied to data extraction. Relevant study details were reported, but no details of the age or gender of patients were given. It was difficult to interpret the tabulated results due to poor table construction. Statistical heterogeneity was not assessed. The statistical method used for the meta-analysis seemed appropriate, although a pooled analysis was possible only for four outcomes. Subgroup analyses for individual studies were reported. The studies were generally of relatively poor quality and most had small sample sizes. Follow-up was relatively short in most studies. The authors were concerned that in some studies comparative groups were not matched for fracture severity.
In view of potential limitations that arose from the review process and the acknowledged limitations in evidence, the authors’ conclusion that the evidence was not sufficient to prove superiority of operative over non-operative management seemed reliable.

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

**Practice:** The authors did not state any implications for practice.

**Research:** The authors identified a need for large well-designed trials that compared surgery and non-operative management. Recommended trials included: trials of other forms of fixation such as external fixation or minimally invasive internal fixation compared to conventional surgery; trials for highly comminuted fractures that compared joint reconstruction versus primary subtalar fusion; trials of impulse compression versus placebo; and trials to find the best non-operative way of managing extra-articular calcaneal fractures. All trials should be fully randomised, with adequate allocation concealment, blinded at baseline and follow-up and with follow-up for at least two years. The authors also gave details of many recommended outcomes.

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