Internal fixation compared with arthroplasty for displaced fractures of the femoral neck: a meta-analysis

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CRD summary
This review compared the effects of arthroplasty and internal fixation on mortality, revision surgery and post-operative complications. The authors concluded that arthroplasty reduced the risk of revision surgery, but increased infection rates, blood loss and operative time, and possibly early mortality rates. This was a well-conducted review, and the conclusions seem appropriate and are likely to be reliable.

Authors' objectives
To determine the effect of arthroplasty, compared with internal fixation, on the rates of mortality, revision, pain, function, operating time and wound infection in patients with a displaced femoral neck fracture.

Searching
MEDLINE was searched from 1969 to June 2002; the search terms were reported. The Science Citation Index and the Cochrane Controlled Trials Register were also searched, and the reference lists of key articles checked. Four orthopaedic journals were handsearched (1998 to June 2002), as were the bibliographies of two orthopaedic textbooks, and poster presentations of three orthopaedic societies (1996 to 2002). Five orthopaedic traumatologists were also contacted. Only studies or abstracts published in the English language were included in the review.

Study selection
Study designs of evaluations included in the review
Randomised or quasi-randomised trials (patients allocated according to known characteristics such as date of birth) were eligible for inclusion.

Specific interventions included in the review
Studies of internal fixation (with a screw and a side plate, or with multiple screws) compared with arthroplasty (hemiarthroplasty, bipolar arthroplasty or total hip arthroplasty) were eligible for inclusion. Included in the review were screw and side plate, and multiple screw internal fixation techniques, and hemiarthroplasty, bipolar arthroplasty and total hip arthroplasty techniques.

Participants included in the review
Studies with patients aged 65 years or older who had a displaced femoral neck fracture were eligible for inclusion.

Outcomes assessed in the review
Studies reporting mortality were eligible for inclusion. Other outcomes reported were revision surgery, pain, function, complications (wound infection, hip dislocation, nonunion, avascular necrosis and post-operative confusion), blood loss and surgical time taken.

How were decisions on the relevance of primary studies made?
Three reviewers, blinded to the author, institution, journal and results, assessed the relevance of the primary studies. It was not reported how consensus was reached when any disagreements occurred.

Assessment of study quality
The criteria used to assess quality were: the definition of the eligibility of participants; the method of randomisation and allocation concealment; whether the patient or assessor were blinded during the study; the length of follow-up; the reporting of withdrawals or drop-outs; and the use of an intention-to-treat analysis. Each study was given a score out of
100. Four reviewers, blinded to the author, institution, journal and results, independently assessed the quality of each study. It was not reported how consensus was reached when any disagreements occurred.

**Data extraction**

Two reviewers independently extracted data from the included studies. Two reviewers determined the proportion of patients with overall good post-operative function, defined as the patients ability to independently carry out activities of daily living. It was not reported how consensus was reached when any disagreements occurred. Summary data extraction sheets were sent to an author from each study, to verify the accuracy of the data extraction.

**Methods of synthesis**

**How were the studies combined?**

Pooled relative risks (RRs) and 95% confidence intervals (CIs) were calculated using the random-effects model of DerSimonian and Laird. A pooled risk difference, weighted by study size, was used to calculate the number-needed-to-treat (NNT). For continuous data, means value, weighted by study size, were calculated. Publication bias was investigated using a funnel plot.

**How were differences between studies investigated?**

The Breslow-Day test was used to assess statistical heterogeneity between the studies. An analysis was conducted on pooled data from all three arthroplasty techniques, as well as on each arthroplasty technique separately. Sensitivity analyses to examine the effect of study quality were reported.

**Results of the review**

Twelve studies and two abstracts were eligible for inclusion (n=1,933).

Funnel plots for mortality and revision surgery showed no evidence of publication bias.

**Mortality.**

There was no significant difference in mortality after arthroplasty compared with internal fixation at 4 months (9 studies: RR 1.27, 95% CI: 0.84, 1.92, P=0.25), 1 year (12 studies: RR 1.04, 95% CI: 0.84, 1.29, P=0.68), or after 1 year (10 studies: RR 1.12, 95% CI: 0.90, 1.43, P=0.30). Statistically significant heterogeneity was found for the results at 1 year and after 1 year, but not at 4 months. The type of arthroplasty did not significantly alter the risk of mortality, whereas the type of internal fixation did.

**Revision surgery.**

Arthroplasty significantly reduced the risk of revision surgery compared with internal fixation (14 studies: RR 0.23, 95% CI: 0.13, 0.42, P=0.0003; NNT 6). These results showed statistically significant heterogeneity. The reduction in risk was more pronounced when studies of lower quality were excluded from the analysis. The type of arthroplasty did not significantly alter the risk of revision surgery, whereas the type of internal fixation did.

**Pain, function and infection.**

Compared with internal fixation, there was no significant difference in the need for pain relief (6 studies: RR 1.12, 95% CI: 0.88, 1.35), or function (12 studies: RR 0.99, 95% CI: 0.90, 1.10) after arthroplasty. The risk of infection was significantly increased after arthroplasty than after internal fixation (12 studies: RR 1.81, 95% CI: 1.16, 2.85, P=0.009; NNT 29.4).

**Blood loss and surgical time.**

Compared with internal fixation, there was a significant increase in blood loss (4 studies: weighted mean difference, WMD 176.4 mL, 95% CI: 132.4, 220.4, P<0.05), and surgical time (5 studies: WMD 29 minutes, 95% CI: 23.2, 34.8, P<0.05) after arthroplasty.
Authors’ conclusions
Arthroplasty significantly reduces the risk of revision surgery at the cost of greater infection rates, blood loss and operative time, and possibly an increase in early mortality rates.

CRD commentary
The review question was clear in terms of the intervention, participants, outcomes of interest and study design. Efforts were made to locate published and unpublished research, and the possibility of publication bias was investigated. The study selection, data extraction and validity assessment processes were carried out by two or more reviewers independently, thus reducing the potential for error and bias, although it was unclear whether or how consensus was reached when any disagreements arose. Validity was assessed in duplicate, using specified criteria. The pooling of the included studies might not have been appropriate, as they were both clinically and statistically heterogeneous. Statistical heterogeneity was explored by evaluating the influence of study quality, cognitive impairment, type of arthroplasty and type of internal fixation. The conclusions drawn by the authors are consistent with the evidence presented.

Implications of the review for practice and research
Practice: The authors stated that the 77% reduction in risk of surgical revision (with narrow CIs), and the further reduction in risk when highest quality studies were analysed separately, provide a strong argument for performing an arthroplasty.

Research: The authors suggested that larger trials to resolve the question of the impact on early mortality are required.

Bibliographic details

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.