Plate fixation or intramedullary fixation of humeral shaft fractures: an updated meta-analysis
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CRD summary
The review concluded that there were no statistically significant differences between plates and nails in the treatment of humeral shaft fractures. However, the included studies were small and had methodological limitations and further research is needed. This was a generally well-conducted review. The authors' conclusions seemed to reflect the evidence and their recommendation for further research seemed appropriate.

Authors' objectives
To update the evidence comparing plate fixation versus intramedullary nails in the treatment of humeral shaft fractures.

Searching
PubMed (from 1967), EMBASE, The Cochrane Library, SUMSearch, Bandolier and Trip databases were searched up to November 2007 without language restrictions. Search terms were reported. Google search engine was used and Orthopaedic Trauma Association's Annual Meeting Archived Presentations were manually searched for relevant abstracts.

Study selection
Prospective randomised controlled trials (RCTs) and quasi-RCTs that compared plate fixation with intramedullary nail fixation in participants with fractures of the humeral diaphysis were eligible for inclusion. The primary outcome of interest was total complications due to surgery: (non-union, infection, implant failure, nerve damage, malunion, reduced range of movement (ROM) of the shoulder, reduced ROM of the elbow, intraoperative comminution (breaking of the bone), wound haematoma, delayed union, hardware requiring removal, impingement, shoulder pain and elbow pain. Secondary outcomes were specific complications that included infection, non-union, nerve palsy and reoperation rate.

Included studies assessed open reduction internal fixation with plates or rigid intramedullary nails. Where reported, the mean age of patients who received plates ranged from 34 to 49 years and the mean age of patients who received nails ranged from 33 to 40 years.

Two reviewers independently screened studies for inclusion.

Assessment of study quality
A previously published checklist (CLEAR NPT) was used to assess study quality based on selection bias (allocation concealment), performance bias (comparability of provision of care other than the intervention between comparison groups), detection bias (outcome assessment) and attrition bias (protocol deviations and loss to follow-up).

The authors did not state how many reviewers performed the validity assessment.

Data extraction
Two reviewers extracted complication rates for plate fixation and rigid intramedullary nails to calculate relative risks (RRs) and their 95% confidence intervals (CIs).

Methods of synthesis
Relative risks and 95% CIs were pooled using a random-effects model. Due to the significant differences in the design and function of flexible intramedullary nails and rigid nails, only rigid nails were used in the primary analysis. Statistical heterogeneity was assessed using the $X^2$ test and $I^2$ statistic. Sensitivity analysis was undertaken to assess the effect on the findings of studies available only as abstracts.

Publication bias was assessed by visual inspection of funnel plots.
Results of the review
Four RCTs (n=203) were included in the review. Study quality was reported to be generally poor.

There were no statistically significant differences in overall complication rate between plate fixation and intramedullary rigid nails (four RCTs, $I^2=53\%$).

There were no statistically significant differences in the rates of specific complications (secondary outcomes) between the two treatment groups. There was evidence of statistical heterogeneity for reoperation ($I^2=58\%$).

Where sensitivity analyses were possible for primary and secondary outcomes, this did not significantly alter the results. Funnel plots showed evidence of publication bias.

Authors' conclusions
The evidence suggested that there were no statistically significant differences between plates and nails in the treatment of humeral shaft fractures. However, the included studies were small and had methodological limitations, which suggested a need for further research.

CRD commentary
The review question and supporting inclusion criteria were clearly defined. A comprehensive search of the literature was undertaken without language restrictions and included a search for unpublished data. There was evidence of publication bias, which the authors acknowledged. Study quality was assessed and reported to be generally poor, although no other data were presented. The authors performed study selection and data extraction in duplicate; the process was not reported for study validity, so reviewer error and bias could not be ruled out. The authors reported clinical and methodological heterogeneity and acknowledged several other limitations (such as the small number of studies and sample sizes, statistical heterogeneity and potential for bias).

This was a generally well-conducted review and the authors' conclusions seemed to reflect the evidence. The recommendation for further research seemed appropriate.

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

Research: The authors stated a need for a large well-conducted multicentre randomised clinical trial to definitively determine the optimal treatment. Future studies should assess patient-based outcomes (self-reported information from the patient's perspective).

Funding
Partly funded by a Canada Research Chair, McMaster University.

Bibliographic details

PubMedID
20170424

DOI
10.3109/17453671003635884

Original Paper URL

Other URL
http://ukpmc.ac.uk/abstract/MED/20170424
Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Bone Nails; Bone Plates; Fracture Fixation, Intramedullary /adverse effects /instrumentation /methods; Humans; Humeral Fractures /surgery; Outcome Assessment (Health Care); Reoperation; Treatment Outcome

AccessionNumber
12010003271

Date bibliographic record published
04/08/2010

Date abstract record published
20/10/2010

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.