CRD summary
This generally well-conducted review concluded that plate fixation of humeral shaft fractures may reduce the risk of reoperation and shoulder impingement, but cumulative evidence remained inconclusive. The conclusions reflect the evidence presented, but the authors' acknowledgement that the small number of studies with small sample sizes may have led to an overestimated treatment effect appears justified.

Authors' objectives
To assess the effect of plate fixation or intramedullary nailing of diaphyseal fractures of the humerus on rates of reoperation and other secondary outcomes.

Searching
MEDLINE, The Cochrane Library and SciSearch were searched for published studies from 1969 to 2004; search terms were reported. There was a discrepancy in search dates between the abstract and methods. Additional studies were sought through: reference lists of key articles; searches from 1996 to January 2004 of the Journal of Bone and Joint Surgery (American and British), Journal of Orthopaedic Trauma, Clinical Orthopaedics and Related Research and presentations or posters of meetings (American Academy of Orthopaedic Surgeons, Orthopaedic Trauma Association, Canadian Orthopaedic Association); bibliography searches of two major trauma textbooks in orthopaedics; and consultation with an expert.

Study selection
Randomised controlled trials (RCTs) or quasi-randomised controlled trials in individuals with fractures of the humeral diaphysis that compared plate fixation and intramedullary nail fixation were eligible for inclusion. The primary outcome of interest was reoperation (any subsequent humeral surgery following the index procedure resulting from nonunion, infection, implant failures or impingement and nerve palsies). In the included studies the mean age ranged from 33.5 to 46.0 years (total age range 18 to 83 years), the proportion of men ranged from 61% to 78% and proportion of closed fractures ranged from 76% to 100%.

Two authors selected studies for inclusion in the review.

Assessment of study quality
Two authors assessed the quality of RCTs using the 21-point quality assessment scale of Detsky et al. (1992) to assess studies for: eligibility criteria; adequacy of randomisation; description of therapies; assessment of outcomes; and statistical analysis.

Data extraction
Data were extracted to derive the relative risk (RR) and odds ratios (OR), with 95% confidence intervals (CIs). Only relative risks were reported in the results. Data were obtained or confirmed with authors where possible. Risk differences and numbers needed to treat (NNT) were calculated for reoperation and shoulder impingement. Two authors undertook the data extraction.

Methods of synthesis
The studies were combined in meta-analyses. Pooled relative risks or odds ratios, and their 95% CIs, were calculated using a DerSimonian and Laird random-effects model. Heterogeneity was assessed using the Breslow-Day and $I^2$ tests; significant heterogeneity was defined as $p<0.1$ or $>40\%$. Sensitivity analysis was undertaken using study quality score (>50 versus ≤50), publication status (published versus unpublished), randomisation (concealed versus unconcealed) and nail insertion (antegrade versus retrograde).
Results of the review
Three RCTs were included in the review (n=155 patients). Study quality scores were 38, 75 and 76. None of the studies applied blinding and two studies concealed random allocation.

Compared with intramedullary nailing, plate fixation gave a significantly lower relative risk of reoperation (RR 0.26, 95% CI 0.07 to 0.88, NNT=10) and a significantly reduced risk of shoulder impingement (RR 0.10, 95% CI 0.03 to 0.42, NNT=6). There was no statistically significant heterogeneity for these analyses. Plate fixation did not yield greater risks of nonunion, infection or radial nerve palsy.

For reoperation, sensitivity analysis using study design, publication status, and nail insertion did not alter the findings.

Authors' conclusions
Plate fixation of humeral shaft fractures may reduce the risk of reoperation and shoulder impingement. The cumulative evidence remained inconclusive.

CRD commentary
The authors had clearly stated inclusion criteria and a number of relevant sources were searched for eligible studies. It was unclear whether language restrictions were applied. There appeared to be no specific attempts to locate unpublished studies. Therefore, language and publication biases may have been present and some studies may have been missed. Appropriate attempts were made to minimise the potential for reviewer error or bias at each stage of the review process. Suitable criteria were used to assess study quality. Appropriate methods were employed for the meta-analysis with suitable methods undertaken to assess statistical heterogeneity. Sensitivity analyses were undertaken to explore potential sources of heterogeneity.

The authors' conclusions reflect the evidence presented. This was generally a well-conducted review. The authors' acknowledgement that the small number of studies with small sample sizes may have led to an overestimated treatment effect appears to be justified.

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

Research: The authors stated that a large randomised trial was required to assess the effect of plates and intramedullary nails in patients with humeral shaft fractures.

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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.