A meta-analysis of circumferential fusion versus instrumented posterolateral fusion in the lumbar spine

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CRD summary
This generally well-conducted review concluded that, for patients undergoing spinal fusion surgery for lumbar spine degenerative disease, circumferential fusion could increase the fusion rate and reduce the reoperation rate compared with instrumented posterolateral fusion, but it also increased the complication rate and blood loss. However, variable patient characteristics and small sample sizes reduce the reliability of the authors' cautious conclusions.

Authors' objectives
To compare the clinical efficacy of circumferential fusion and instrumented posterolateral fusion and to collate the scientific evidence to find a useful fusion method.

Searching
PubMed, Cochrane Central Register of Controlled Trials (CENTRAL) and EMBASE were searched to December 2007 for articles published in English. Search terms were reported. Three key journals were handsearched. Experts in the field were contacted.

Study selection
Randomised controlled trials (RCTs) of instrumented posterolateral fusion and circumferential fusion in adult patients who underwent spinal fusion surgery for degenerative disease of the lumbar spine were eligible for inclusion. Trials had to follow patients up for at least one year after surgery. Patients with acute spinal fracture, infection, tumour, osteoporosis or rheumatoid arthritis were excluded.

The primary outcomes of interest were global assessment of clinical outcomes and complication rate. Secondary outcomes were fusion rate, blood loss, operating time and reoperation time. Trials were excluded if they did not report on at least one relevant outcome.

Included trials compared posterolateral fusion combined with titanium CD-horizon, posterolateral fusion combined with variable screw placement or instrumented posterolateral fusion versus circumferential fusion plus an anterior lumbar interbody fusion Brantigan cage plus posterior instrumentation, posterolateral fusion plus transfemoral lumbar interbody fusion, posterolateral fusion plus posterior lumbar interbody fusion, or posterolateral fusion combined with variable screw placement and interbody fusion. The mean age of patients ranged from 42 to 58.6 years.

Two reviewers independently performed study selection; disagreements were resolved by discussion or consultation with a third reviewer.

Assessment of study quality
Two reviewers independently assessed trial quality according to criteria established by Koes et al, using 16 quality items including drop-outs, homogeneity, blinding and intention-to-treat. Each trial was given a score out of 100, with trials scoring more than 60 points deemed best studies. Disagreements between reviewers were resolved by consensus.

Data extraction
Two reviewers independently extracted data on the primary and secondary outcomes, and used the data to calculate odds ratios (OR) or mean differences, together with 95% confidence intervals (CI). Disagreements between reviewers were resolved by consensus.

Methods of synthesis
A random-effects meta-analysis was undertaken to calculate pooled odds ratios or weighted mean differences (WMD), together with 95% confidence intervals. Statistical heterogeneity was assessed using the $I^2$ statistic and $X^2$ test.
Results of the review
Four RCTs were included in the review (n=437 patients), with sample sizes that ranged from 30 to 149 patients. Three trials scored at least 60 of the Koes scale and were deemed best studies; one trial scored 43 points. The main quality issues were small sample sizes and a lack of detail regarding outcome assessor blinding. Length of follow-up ranged from two to five years.

Primary outcomes: There was no statistically significant difference in global assessment of clinical outcomes between the two procedures, 75.9% for instrumented posterolateral fusion versus 74.2% for circumferential fusion (OR 0.96, 95% CI 0.59 to 1.55; I²=0%; three trials). Compared with instrumented posterolateral fusion (16.1%), circumferential fusion (26.8%) had a statistically significantly greater complication rate (OR 1.89, 95% CI 1.14 to 3.14; I²=0%; three trials).

Secondary outcomes: Compared with instrumented posterolateral fusion, circumferential fusion had a statistically significantly greater fusion rate (OR 2.11, 95% CI 1.06 to 4.19; I²=0%), a statistically significantly lower reoperation rate (OR 0.44, 95% CI 0.25 to 0.77; I²=0%), and a statistically significantly greater blood loss (WMD 349.95, 95% CI 138.26 to 561.64; I²=27%). There was no statistically significant difference in operating time.

Cost information
The cost-effectiveness was reported in one study; circumferential fusion was significantly cheaper than instrumented posterolateral fusion using a long-term societal perspective ($55,624 versus $68,567).

Authors' conclusions
Compared with instrumented posterolateral fusion, circumferential fusion could increase the fusion rate and reduce the reoperation rate, but it could also increase the complication rate and amount of blood loss. No significant difference was found in global assessment of clinical outcomes.

CRD commentary
Inclusion criteria for the review were clearly defined. Several relevant databases were searched. There was potential for language bias, as only English language articles were included. Publication bias was not assessed, and could not be ruled out (which the authors acknowledged). Attempts were made to reduce reviewer error and bias throughout the review process.

Quality assessment was conducted using a standard checklist, which indicated the low to medium risk of bias in the trials. The authors acknowledged the small number and small sample sizes of the included trials. Trials were pooled using meta-analysis; statistical heterogeneity was assessed.

Overall, the review was generally well conducted, but the small sample sizes and the differences in patient characteristics reduce the reliability of the authors' cautious conclusions.

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

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