The efficacy of minimally invasive discectomy compared with open discectomy: a meta-analysis of prospective randomized controlled trials

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CRD summary
The review concluded that minimally invasive discectomy and open discectomy produced substantial and equivalent improvements in leg pain in patients with lumbar radiculopathy. Incidental durotomies were more frequent with minimally invasive surgery; overall complications did not differ. The limited number, uncertain quality, and variation between trials, and limitations in the review processes mean that the conclusions may not be reliable.

Authors' objectives
To evaluate complications and improvement in leg pain with minimally invasive discectomy versus open discectomy in patients with radiculopathy.

Searching
MEDLINE and EMBASE were searched for articles published in English between January 1990 and January 2011. Search terms were reported and the reference lists of pertinent reviews were searched.

Study selection
Randomised controlled trials (RCTs) of open discectomy versus minimally invasive discectomy using a tubular retractor, in patients with disc herniation, were eligible for inclusion. Trials had to report the intensity of leg pain on visual analogue scales and have a minimum follow-up of one year. Trials of patients undergoing surgery for recurrent disc herniation were excluded.

The included trials studied open discectomy (with or without an operating microscope) versus minimally invasive discectomy (using micro-endoscopic discectomy, operating microscope with tubular retractor system, or full endoscopy). The mean age of patients, where reported, ranged from 30 to 46 years. Most patients were affected at vertebral levels L4 to L5 and L5 to S1.

Multiple reviewers independently selected trials, and disagreements were resolved by consensus.

Assessment of study quality
Trial quality was assessed using the Jadad scale, which appraised randomisation, blinding, and withdrawals and dropouts. Multiple reviewers independently assessed quality, and disagreements were resolved by consensus.

Data extraction
Data were extracted on the pain visual analogue scores, operating time, incidental durotomies, and infections, and used to calculate risk ratios, with 95% confidence intervals. Two reviewers independently extracted the data, and disagreements were reconciled.

Methods of synthesis
Random-effects meta-analysis appears to have been used to calculate pooled risk ratios, with 95% confidence intervals. Statistical heterogeneity was assessed using $I^2$ and Cochran Q. Publication bias was assessed using funnel plots and the Begg and Egger tests. Sensitivity analysis was performed by using the inverse-variance weighted random-effects model.

Results of the review
Six RCTs were included in the review (n=837); sample size ranged from 22 to 328 patients. The length of follow-up ranged from 16 to 24 months. Five trials did not report blinding, and three trials did not report their randomisation methods.

Compared with open discectomy, minimally invasive discectomy was not associated with a statistically significant difference in short-term pain visual analogue scores (RR 0.81, 95% CI -4.71 to 6.32; $I^2=90%$; four RCTs) and long-
term pain visual analogue scores (RR 2.64, 95% CI -2.15 to 7.43; I²=83%; six RCTs); both groups had equivalent reductions in visual analogue scores.

There was a non-statistically significant trend favouring open discectomy for total complications (RR 1.50, 95% CI 0.97 to 2.33; I²=19%; six RCTs). There was no statistically significant difference in operating time and reoperation for recurrent herniation. Incidental durotomies were significantly more common in minimally invasive patients than in open discectomy patients (RR 2.05, 95% CI 1.05 to 3.98; I²=0; five RCTs).

**Authors' conclusions**
Minimally invasive discectomy and open discectomy led to substantial and equivalent short- and long-term improvements in leg pain for patients with lumbar radiculopathy. Incidental durotomies were more frequent with the minimally invasive procedure, but total complications did not differ.

**CRD commentary**
Most of the inclusion criteria were defined and two relevant databases were searched. There was the potential for language bias, as only trials in English were included. Unpublished data were not sought, but publication bias was assessed and was not detected in any of the analyses; the meaningfulness of these analyses, with less than 10 trials, is limited. Attempts were made to minimise reviewer error and bias throughout the review. Quality assessment was undertaken using a standard checklist, which indicated that most of the included trials were poorly reported and the quality of the evidence was uncertain.

Several different operating techniques were used in the trials, which the authors acknowledged. Trial data were pooled using meta-analysis and statistical heterogeneity was reported. Several analyses showed high statistical heterogeneity, which could indicate that the data were not suitable for pooling. The results generally lacked precision, given the relatively wide confidence intervals, limiting the reliability of the findings. The authors noted that there could be a learning curve for minimally invasive discectomy.

The limited number of trials, variation, uncertain quality of the evidence and limitations in the conduct of the review mean that the conclusions may be too strong and they may not be reliable.

**Implications of the review for practice and research**
**Practice:** The authors stated that adequate decompression in patients with radiculopathy might be the primary determinant of pain relief, regardless of the type of surgery.

**Research:** The authors did not state any implications for research.

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