Microendoscopic versus open discectomy for lumbar disc herniation: a prospective randomised study

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ABSTRACT

Purpose. To compare the outcomes of microendoscopic discectomy (MED) versus open discectomy for lumbar disc herniation.

Methods. 80 men and 32 women aged 26 to 57 (mean, 37) years with a single-level disc herniation were randomised to undergo MED (n=55) or open (fenestration/laminotomy) discectomy (n=57). Patients were assessed pre- and post-operatively (at week 6, month 6, and year one). The 2 groups were compared with respect to surgical time, anaesthesia time, duration of hospital stay, intra-operative blood loss, weight of disc material removed, and self-evaluated low back pain and functional outcome (using the Oswestry low back pain disability questionnaire).

Results. Surgical and anaesthesia times were significantly longer, but blood loss and hospital stay were significantly reduced in patients having MED than open discectomy. The improvement in the Oswestry score in both groups was significant at week one, but not at other follow-ups. The complication rate was similar in both groups. One patient with MED had a recurrence of disc herniation after 7 months and was treated with open discectomy.

Conclusions. Both methods are equally effective in relieving radicular pain. MED entailed shorter hospital stay, less morbidity, and earlier return to work. Nonetheless, it is a demanding technique and should not be attempted without specific instruction and training.

Key words: diskectomy; endoscopy; intervertebral disk displacement; lumbar vertebrae

INTRODUCTION

The success rate of lumbar discectomy is about 70 to 90%. Microdiscectomy and minimally invasive discectomy decrease surgical exposure and trauma and have success rates of approximately 90%. These techniques include chemonucleosis and manual,
automated, and laser percutaneous discectomy.5 Spinal endoscopic techniques have evolved more slowly, because of the complex anatomy and difficult access.6 Endoscopic extraction of disc fragments became feasible, as anatomic structures can be visualised using small-calibre, high-resolution glass fibre optics (Fig. 1). Nonetheless, the endoscopes are expensive and standardisation of size is lacking.4 Minimally invasive techniques reduce postoperative morbidity and the incidence of perineural and intraneural fibrosis,7 preserve the epidural venous system,8–12 and minimise the development of instability and spondyloarthropathy.10 We compared the outcomes of microendoscopic discectomy (MED) versus open discectomy for lumbar disc herniation.

**MATERIALS AND METHODS**

Between January 2002 and December 2005, 80 men and 32 women aged 26 to 57 (mean, 37) years with a single-level disc herniation were randomised to undergo MED (n=55) or open (fenestration/laminotomy) discectomy (n=57). In the respective groups, 31 and 41 patients had disc herniation in L4–L5, and 24 and 16 patients in L5–S1. Patients who had persistent radiculopathy (despite at least 6 weeks of conservative therapy) and positive tension signs in both straight and crossed leg raising tests with absence of correlative neurological deficits were included. Patients who had central or lateral stenosis of spinal canal, previous operations, severe degenerative narrowing of the disc space at the index level, drug dependency, cauda equina syndrome, or known psychological disorders were excluded.

Conservative treatment included bed rest for a short period (4–7 days) with restriction of lifting, bending, climbing and heavy exertional activity. No patient received steroids. All patients received non-steroidal anti-inflammatory drugs, muscle
relaxants (combination of diclofenac, paracetamol, and chlorzoxazone), and enzymatic preparation for a minimum of 2 weeks and underwent standard physiotherapy (including microwave or short wave diathermy and exercises).

Patients were assessed pre- and post-operatively (at week 6, month 6, and year one). Clinical examination entailed the straight leg raising test, tests for knee and ankle jerks and for sensory loss, and muscle charting. Radiological examination included radiography, magnetic resonance imaging, and electrophysiological study. Neurological improvement was assessed using muscle charting and electromyography. Low back pain and functional outcomes were self-evaluated using the Oswestry low back pain disability questionnaire and were assessed by an independent observer. Outcome was considered satisfactory if radicular symptoms had ceased, tension signs had become negative, and the patient had returned to his previous occupation or normal activities.

The 2 groups were compared with respect to surgical time, anaesthesia time, duration of hospital stay, intra-operative blood loss, weight of disc material removed, and improvements in self-evaluated Oswestry scores, using the Student’s t test, the Wilcoxon rank sum test, Fisher’s exact test or the Pearson Chi squared test as appropriate.

**Operative techniques**

The open (laminotomy) discectomy was performed in a standard fashion. For MED, the paraspinous approach was used. The appropriate disc space was marked approximately one fingerbreadth from the midline. A long guide wire was inserted percutaneously under image intensification until it hit the superior lamina, and its position was identified (Fig. 2). Progressively increasing sizes of dilators were used to split the muscles away from the field. An endoscopic light source with a camera was fitted to the tubular retractor (16–18 mm in diameter) after removing the dilators. The superior lamina with the ligamentum flavum below was visualised and incised. Nerve roots and dura were identified and protracted using a nerve root retractor. Any protruded disc fragment was separated from the root and cord. Bleeding epidural veins were coagulated using the bipolar cautery and by pressure using ‘gel-foam’. An incision in the annulus was made using the sheathed knife blade after identifying the disc space. Disc material was curetted out using pituitary forceps and curettes. Final movement of nerve roots was checked to ensure they were free and not entrapped. The axilla of nerves were checked for any sequestrated fragment. Haemostasis was achieved. The scope and sheath were removed and skin sutured.

**RESULTS**

The demographic distribution of both groups was similar, as were the clinical and electrophysiological findings and indications for surgery (Table 1). Surgical and anaesthesia times were significantly longer, but blood loss and hospital stay were significantly reduced in patients having MED than open discectomy (Table 1). The improvement in the Oswestry score in both groups was significant (p<0.005) at week one (with greater improvement in the MED group), but not at week 6 (p=0.43), month 6 (0.89) and year one (0.45) [Table 2]. In the respective groups, 35 and 26 patients were satisfied at week 6, 44 and 37 at month 6, and 53 and 54 at year one. The clinical, neurological, and electrophysiological improvement was similar in both groups. Adequate decompression was achieved, and the weight of disc material removed was similar in both groups. Both methods were equally effective in relieving radicular pain by reducing the tension on the nerve root caused by the herniated disc.

**Figure 2**  Endoscopic views of (a) the facet joint and ligamentum flavum, (b) the spinal cord and nerve root, (c) incision of the annulus with sheathed knife, (d) removal of disc material, and (e) checking of movements of nerve root and spinal cord.
In the MED group, 5 dural leaks occurred, of which 4 were in the first 25 cases and one in the next 30 cases. All were controlled using gel foam, foot end elevation, and a 3-day course of acetazolamide. In the open discectomy group, 5 dural leaks occurred and were controlled. One of them was repaired using a 6-0 monofilament suture. In the respective groups, 4 and 6 patients developed temporary urinary retention and needed catheterisation; none developed a persistent bladder problem. Three patients with open discectomy acquired a urinary tract infection, which was resolved after 5-day antibiotic treatment and ample fluid replacement; none occurred in the MED group. One patient with open discectomy had a foot drop. Two patients with MED had transient S1 dermatome neuralgia after an L5-S1 discectomy. No patient had nerve root damage or wound infection. One patient with MED had a recurrence of disc herniation after 7 months, and was treated with open discectomy; a sequestrated fragment was found to be compressing the nerve root.

**DISCUSSION**

The MED is akin to microdiscectomy in its approach to the canal, compressed nerve root and the herniated disc. It is less traumatising to the paravertebral muscles, results in less fibrosis inside the canal and less morbidity, shorter hospital stay, earlier return to work, and greater overall patient satisfaction. In our study, the surgical time for MED was longer in the initial cases, reflecting the learning curve, and progressively decreased thereafter. The mean surgical time was 84 minutes, which is shorter than 106 minutes in another study of 25 patients treated by MED. Most studies on microdiscectomy and percutaneous discectomies report a surgical time of 40 to 120 minutes.

In our study, the satisfaction rate for MED at year one was 96%; it was 100% for a study at month 40 and another at month 5. The short-term (4 months to 2 years) satisfaction rates after open discectomy ranged 70 to 95%. In our study, hospital stay was significantly shorter in patients having MED than open discectomy (3 vs. 12 days, p<0.001), consistent with a study comparing MED to Love's method (8 vs. 24 days). The shorter period of postoperative disability may be attributed to the absence of the epidural fibrosis and tethering of nerve roots that commonly ensue after laminotomy. The epidural venous systems are not disturbed during MED. This helps to prevent venous stasis and chronic nerve-root oedema. The minimum surgical trauma inflicted on myoligamentous structures may facilitate rapid recovery. Also it does not entail traumatic nerve root dissection, extra bone removal or large skin incisions. The risk of complications from scarring, blood loss, infection and anaesthesia is considerably reduced or eliminated.

For MED, the surgeon needs to adjust the depth perception, as video images were 2-dimensional. This is probably the explanation of the 4 dural leaks

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<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient demographics and outcomes</th>
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<tbody>
<tr>
<td>Parameter</td>
<td>Mean±SD (range)</td>
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<tr>
<td>Microendoscopic discectomy</td>
<td>Open discectomy</td>
</tr>
<tr>
<td>Age (years)</td>
<td>37±8 (27–55)</td>
</tr>
<tr>
<td>No. of male:female</td>
<td>36:19</td>
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<tr>
<td>Duration of symptoms (months)</td>
<td>11.6±9.5 (2–36)</td>
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<tr>
<td>Surgical time (minutes)</td>
<td>84±36 (45–195)</td>
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<tr>
<td>Anaesthesia time (minutes)</td>
<td>217±76 (150–490)</td>
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<tr>
<td>Blood loss (ml)</td>
<td>41±12 (20–60)</td>
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<tr>
<td>Weight of removed disc (g)</td>
<td>3.7±0.9 (1.9–5.1)</td>
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<tr>
<td>Hospital stay (days)</td>
<td>3±1 (1–4)</td>
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<th>Table 2</th>
<th>Improvement in Oswestry score in both groups</th>
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<tr>
<td>Time</td>
<td>Mean Oswestry score</td>
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<tr>
<td>Microendoscopic discectomy</td>
<td>Open discectomy</td>
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<tr>
<td>Preop*</td>
<td>25.78</td>
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<tr>
<td>Postop week 1</td>
<td>13.02</td>
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<tr>
<td>Postop week 6</td>
<td>11.62</td>
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<tr>
<td>Postop month 6</td>
<td>3.29</td>
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<tr>
<td>Postop year 1</td>
<td>1.75</td>
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* p=0.54 at baseline
in the early 25 cases. As the surgeon became more experienced and had better depth perception, only one dural leak occurred in the latter 30 cases. Dural leaks are difficult to suture via endoscopic procedure; it can be converted to open procedure if needed. In our study, no conversion to open discectomy was required secondary to dural leak, compared to a study reporting conversion to open discectomy in 4 of 149 MED patients.23

In our study, the incidence of failure and complication after MED was similar to other studies of microdiscectomies and conventional discectomies.16 There was no problem in identifying the correct interspace. Nonetheless, MED for lumbar disc herniation is a demanding technique and should not be attempted without specific instruction and training.

The short follow-up period (12–18 months) is the shortcoming of this study, as is the lack of objective/quantitative outcome assessment. Larger groups of patients with longer follow-up are needed to confirm these results.

REFERENCES