Minimally invasive tubular microdiscectomy

Minimally invasive tubular microdiscectomy in the lumbar spine results in a small, but statistically significant, advantage in length of stay compared to conventional open microdiscectomy. While small on an individual basis, this difference may translate to substantial economic savings over time when one considers how many discectomies are performed in aggregate.

The clinical outcome of minimally invasive tubular microdiscectomy is comparable to the reported success rates of other minimally invasive techniques. The dural tear rate is not associated to higher morbidity or worse outcome. The technique is an equally effective and safe treatment option for recurrent LDH.

The traditional MI transpedicular thoracic discectomy approach can be further refined and enhanced by stereotactic navigation to expand the limitations of the MIS technique allowing for an increased number and types of patients eligible for minimally invasive surgery. Therefore, Minimally invasive tubular microdiscectomy with stereotactic navigation is a novel, safe, and effective improvement in feasibility from the traditional minimally invasive transpedicular thoracic discectomy technique.

Case series

2017

A retrospective study was conducted using prospectively collected data from a consecutive cohort of all 1241 patients operated for single-level lumbar disc herniation with tubular microdiscectomy by a single surgeon who already had extensive experience with this technique. They collected demographic and perioperative data and consequently tracked all complications, recurrent herniations, and other reoperations. Additionally, 495 patients (40%) provided complete outcome scores on a numeric rating scale for back and leg pain and the Oswestry Disability Index at baseline, 6 weeks and 12 months postoperatively.

A decrease in surgical time (p <0.001) and recurrent herniations were observed (p =0.012) over time. Increased leg pain at six weeks was independently associated with recurrent herniation (p =0.01). Fifty-six patients (4.5%) experienced ipsilateral recurrent herniation.

Relevant improvements in clinical results were seen even after surgeons had already accumulated extensive experience. Any future studies should unambiguously report the level of experience of the participating surgeons, possibly including the number of cases previously treated using a particular technique.

Minimally invasive tubular microdiscectomy (MITD) has been reported as an equivalent treatment to traditional approaches and may have better utility for revision surgery. A retrospective review of MITDs performed by the senior surgeon (F.A.S.) on 42 patients with single-level, recurrent disk herniation was analyzed. Surgical technique, preoperative and postoperative visual analogue score, modified Macnab criteria, and complication rate were compared with similar patient series in the literature. One case is reviewed and the technique is described in detail. There were no significant differences across age (49.5±14.1), sex, or obesity status. Visual analogue scores improved significantly from 7.24±1.75 to 2.45±2.12 (P<0.001). Successful clinical outcome (excellent or good
Macnab score) was reported in 83.3% of patients. There were no postoperative complications, including dural tears or wound infections: fewer than any reported series of this size to date. MITD can be safely performed for revision discectomies with low morbidity. A paramedian approach helps to decrease the exposure to preexisting scar tissue and may offer a significant advantage over the traditional midline approach to treat recurrent disk herniation.

**2016**

Thirty consecutive patients who underwent minimally invasive tubular microdiscectomy for recurrent LDH were included in the study. The preoperative and postoperative visual analog scale (VAS) scores for pain, the clinical outcome according to modified Macnab criteria, and complications were analyzed retrospectively. The minimum follow-up was 1.5 years. Student t-test with paired samples was used for the statistical comparison of pre- and postoperative VAS scores. A p value < 0.05 was considered to be statistically significant.

The mean operating time was 90 ± 35 minutes. The VAS score for leg pain was significantly reduced from 5.9 ± 2.1 preoperatively to 1.7 ± 1.3 postoperatively (p < 0.001). The overall success rate (excellent or good outcome according to Macnab criteria) was 90%. Incidental durotomy occurred in 5 patients (16.7%) without neurological consequences, CSF fistula, or negative influence to the clinical outcome.

Instability occurred in 2 patients (6.7%).

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**2011**

From 2005 to 2010, Lee et al. analyzed 109 patients who underwent elective, single-level lumbar discectomy for central or paracentral disc herniations. A retrospective analysis of medical records was performed for perioperative complications. Tubular discectomy was not associated with increased rates of durotomy, nerve root injury, wound complications, or recurrent disc herniations requiring additional surgery. Minimally invasive tubular discectomy in the lumbar spine results in a small, but statistically significant, advantage in length of stay compared to conventional open microdiscectomy. While small on an individual basis, this difference may translate to substantial economic savings over time when one considers how many discectomies are performed in aggregate.

**2010**

Under general anaesthesia and fluoroscopic guidance, a guidewire was placed over the inferior aspect of the superior lamina. A 2.5-3 cm midline skin incision was made, followed by paramedian lumbar fascia incision. Then, dilators were sequentially introduced (muscle-splitting approach). Finally, a tubular retractor was fixed directly over the interlaminar space. Further stages of the procedure were performed using an operating microscope and standard microdiscectomy equipment. The first 13 consecutive patients operated on using this method were analysed. Twelve patients were operated on at one level and 1 at two levels. Disc herniation was centro-lateral in 10 cases, lateral in 2 and central (broad-based) in 2 patients.

Regression of radicular pain was noted in all patients. No postoperative complications were observed.
except for prolongation of wound healing in 2 patients. According to modified MacNab criteria, excellent late outcome was achieved in 8 patients and good in 4 patients. There were no cases of recurrent radicular pain or need for surgical revision for herniation recurrence. One patient was reoperated on because of low back pain (implantation of an interspinous spacer).

Microscopically assisted lumbar discectomy using the METRx X-Tube system seems to be safe and effective. This method combines the advantages of modern minimally invasive techniques while avoiding the limitations of endoscopy.

Moliterno et al. retrospectively reviewed the cases of 217 patients who underwent tLMD for single-level LDH performed identically by 2 surgeons (J.B., R.H.) between 2004 and 2008. Evaluation for LDH recurrence included detailed medical chart review and telephone interview. Recurrent LDH was defined as the return of preoperative signs and symptoms after an interval of postoperative resolution, in conjunction with radiographic demonstration of ipsilateral disc herniation at the same level and pathological confirmation of disc material. A cohort of patients without recurrence was used for comparison to identify possible risk factors for recurrent LDH.

Of the 147 patients for whom the authors were able to definitively assess symptomatic recurrence status, 14 patients (9.5%) experienced LDH recurrence following single-level tLMD. The most common level involved was L5-S1 (42.9%) and the mean length of time to recurrence was 12 weeks (range 1.5-52 weeks). Sixty-four percent of the patients were male. In a comparison with patients without recurrence, the authors found that relatively lower body mass index was significantly associated with recurrence (p = 0.005), such that LDH in nonobese patients was more likely to recur.

Recurrence rates following tLMD for LDH compare favorably with those in patients who have undergone open discectomy, lending further support for its effectiveness in treating single-level LDH. Nonobese patients with a relatively lower body mass index, in particular, appear to be at greater risk for recurrence.

2002

One hundred thirty-five patients underwent surgery in which the METRx-MD system was used; most procedures were performed on an outpatient basis, and general anesthesia was induced in all cases. All patients were followed prospectively. Outcomes were measured using a visual analog scale (VAS), the Oswestry Disability Index (ODI), and the Short Form-36 (SF-36) questionnaires. Follow-up data were collected by an outside company, which also tabulated the data. Data were collected in 129 of 135 patients. Improvement was seen on the VAS (Scores 7-2), ODI (Scores 57-16), and SF-36 scales (bodily pain Scores 20-60). Patient satisfaction with results was 94% and with office services 88%. Thirty-six percent of patients returned to work at 0 to 2 weeks, 38% at 3 to 5 weeks, and 25% at 5 to 26 weeks. Hospital charges decreased by $2395 (18%). The mean operative time was 66 minutes, and the mean blood loss was 22 ml. Complications included one superficial wound infection, one discitis, three durotomies, and three cases of excessive bleeding (> 100 ml). There were five reoperations: four for recurrent disc herniations, (two ipsilateral and two contralateral to the index site) and one for spinal stenosis contralateral to the index site.

Minimally invasive surgery in which the METRx-MD system is used is clinically effective and cost effective. Patient satisfaction was high. A mean per case cost savings of $2395 was realized. Complications rates were comparable with those associated with traditional microdiscectomy procedures.


