Microscopic Assisted Fenestration as a Minimal Invasive Technique for Lumbar Discectomy

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ABSTRACT

Background: Microsurgical discectomy is the gold standard technique widely used for discectomy. Newer percutaneous microdiscectomy is a less invasive procedure with comparable clinical outcomes and potential advantages over standard microdiscectomy claiming less blood loss, less postoperative pain, shorter hospitalization and earlier return to work. These new techniques require lots of expertise, in addition to expensive equipments which are not available at every center. Objective: The aim of this study is to evaluate the outcome of microscopic assisted fenestration for single level lumbar discectomy as a minimally invasive surgery (MIS). Patients and Methods: This study included twenty four patients operated by fenestration discectomy. Pre- and postoperative and follow up scores for three months based on visual analogue scales (VAS, 0 to 10) for low back pain, and leg pain were recorded. Operative complications were also noted. The MIS parameters in this study were the operative time, amount of bleeding, length of surgical incision and duration of postoperative hospitalization. All data were summarized using mean and standard deviation. Results: According to the average VAS, leg and back pain improved from 8.48, 4.8 preoperatively to 0.93 and 2.3 respectively after three months. The average length of surgical incision was 4.4 cm, operative time was 108 min, amount of bleeding was 77 ml and postoperative hospitalization was 1.4 days. Complications were recorded in three patients; in the form of intraoperative incidental durotomy in two patients, with no postoperative cerebrospinal fluid (CSF) leak, and superficial wound infection in one patient which was properly managed by repeated dressing. Conclusion: fenestration lumbar discectomy is a safe and effective surgical option in treatment of lumbar disc prolapse, with comparable results to other less invasive percutaneous techniques.

INTRODUCTION

Between 70% and 95% of adults will suffer from low back pain during their lifetime. Lumbar disc herniation is among the most common causes of low back pain and sciatica. Treatment often involves patient education, physical therapy, and pharmacotherapy. If these fail, surgical intervention is usually recommended. In 1909 Krause and Oppenheim made the first successful removal of a ruptured disc. The lesion which was resected transdurally. It was thought to be an enchondroma. The first intentional discectomy surgery was performed by Mixter and Barr in 1932, a transdural wide laminectomy approach was used. In 1939, Love described the interlaminar, extradural approach, which has been refined by William in 1978 through introducing operating microscope to facilitate better visualization of dural sac, nerve roots and other inter-spinal structures including the prolapsed disc.

His technique, although modified with improved lighting, magnification, and retractors, remains a staple approach today. Mishra et al compared laminectomy and fenestration for disc excision and concluded the superiority of later approach in respect to early postoperative mobilization, early return to work and low incidence of postoperative backache as it is less extensive. More recent surgical techniques like percutaneous microdiscectomy, and percutaneous endoscopic discectomy need lots of expertise, and expensive equipments which are not available at every center. Minimal invasive surgery could be defined as a procedure which involve small incisions, less blood loss, and less postoperative pain aiming for faster recovery, less hospital stay, and less total cost of care. In this study length of incision, operative time, blood loss, and postoperative hospitalization were defined as parameters for minimal invasive surgery in patients diagnosed with single level virgin lumbar disc prolapse undergoing microscopic assisted interlaminar fenestration discectomy.

PATIENTS AND METHODS

This is a prospective study in which the authors reviewed their own experience in management of twenty four patients operated by interlaminar fenestration discectomy for a single level lumbar disc prolapse.
prolapse from October 2010 to June 2012, at the Department of Neurosurgery, Cairo University.

**Inclusion criteria were:** failure to respond to conservative treatment for six weeks duration, or severe disabling sciatica. Exclusion criteria were: patients with more than one level disc prolapse, revision surgeries and patients presented with cauda equina syndrome were not included.

All patients were subjected preoperatively to lumbosacral dynamic X-ray views, preoperative lumbosacral magnetic resonance imaging (MRI) studies were done to twenty three patients, and only one patient was assessed by computed tomography (CT) due to a past history of metallic cardiac valve replacement. The results of imaging were matching with the physical findings and symptomatology in all patients.

Demographic data including patient sex and the age at presentation were collected. Clinical data including the presenting symptoms, signs, operative time, length of surgical incision, amount of bleeding, duration of postoperative hospitalization, operative complications, pre- and postoperative scores based on visual analogue scale (VAS, 0 to 10) for low back pain and radicular pain with three months minimum duration of follow-up were reported and analyzed. all patients were subjected preoperatively to lumbosacral dynamic x-ray views, preoperative lumbosacral magnetic resonance imaging (MRI) studies were done to twenty three patients, and only one patient was assessed by computed tomography (CT) due to a past history of metallic cardiac valve replacement. The results of imaging were matching physical findings and symptomatology in all patients.

**Surgical technique**

Endotracheal intubation, with normotensive anesthesia is maintained all through the operation. All patients were operated in the prone position over Wilson frame to allow flexion of lumber spine. This usually open the interlaminar space. C-arm image was used to verify the space. A 4-6 cm longitudinal midline skin incision, followed by unilateral subperiosteal separation of the paravertebral muscles, then a proper sized hemilaminectomy was done. Williams retractor was placed. operating microscope was brought into the field, a few millimeters of the lower edge of the above lamina is resected whenever needed (Figure 4), ligamentum flavum is incised longitudinally using number 11 blade, and excised. After disc excision, the neural foramen was assessed and if necessary, a selective foraminotomy was performed (was required in fifteen patients). Inadvertent dural tear occurred in two patients, prolene 5-0 suture was used for repair in one. In the other patient, the tear was not accessible. Double layer barrier of fat and gelfoam was used to repair the tear. Meticulous hemostasis and closure in three layers without drain was done for all patients.

After full recovery, early ambulation was encouraged. In the two cases of intraoperative incidental durotomy, the patient was kept in bed for 24 hours.

If not complicated, patients were discharged home on the next day postoperative, prolonged bending, and lifting heavy objects were avoided. Patients usually were off work until 4 weeks, and they were advised a regular home back exercise.

**Outcome assessment and follow-up**

Follow-up visits were maintained for all patients for 3 months. Clinical outcome was determined according to the visual analogue score. Radicular pain was assessed on day 1 postoperative, and reassessed after 3 months, while low back pain was assessed after 3 months.

**RESULTS**

The study included twenty four patients with lumbar disc prolapse underwent interlaminar fenestration discectomy. There was a slight male predominance (thirteen cases = 54.2%). Mean age at surgery was 40.1 ± 9.5 years (range 17 to 59 years). Eight patients (33.3%) were heavy manual workers. Eleven patients (45.8%) were overweight or obese.

The mean duration of symptoms was 11.7 months. For the low back pain was 17.7 months (range 3 weeks to 10 years), and for the radicular pain was 5.8 months (range 2 weeks to 4 years). Left radicular pain was the presentation in seventeen patients (70.8%), while right sided radicular pain was affecting seven patients (29.2%). Straight leg raising test was positive in twenty three patients, radicular sensory affection was detected in eight patients, while muscle stretch reflex was affected in four patients.

The most common level operated was L5-S1 in thirteen patients (54.2%), followed by L4-5 in ten patients (41.7%), and L3-4 upon one patient (4.2%) (Figure 1). The most common site of disc prolapse was posterolateral in fifteen patients (62.5%), followed by paracentral in six patients, and foraminal in three cases. Downward migrating disc prolapse was encountered in eight patients, upward in one patient (Figure 3).

The mean VAS for leg pain improved significantly from a preoperative value of 8.48 ± 0.94 (range 6.8- 10) to 1.84 ± 1.14 (range 0.7- 6.8) on day one postoperative, a further reduction was noted in the perceived leg pain after three months to 0.93 ± 0.5 (range 0-2). The mean VAS scale for back pain changed significantly from a preoperative value of 4.8 ± 1.32 (range 2.1- 7.1) to 2.3 ± 1.02 (range 0.7- 4.1) after 3 months (Figure 2).
The mean operative time was about $108 \pm 19.9$ minutes (range 90-150 minutes). With longer time needed for obese patients. The average blood loss was $77 \pm 16.7$ ml (range 50-100 ml). The mean length of surgical incision was $4.4 \pm 0.6$ cm (range 4-6 cm), and again more lengthy incisions were required in obese patients. Mean hospital stay (start counting from the first postoperative day) was $1.4 \pm 0.9$ days (range 1-4 days).

Intraoperative complications in the form of inadvertent dural tear occurred in two patients (8.3%) which has been surgically repaired in one patient, while was inaccessible for repair in the other patient. There was no hypotension headache, CSF leak, or pseudomeningocele thereafter.
**DISSCUSION**

Prolapsed intervertebral disc occurs in about 5-10% of all backache patients and is a common cause of sciatica. The standard treatment of lumbar disc prolapse after failure of conservative management is surgical excision, though the methods of discectomy vary. A review of the literature reveals success rates for lumbar discectomy ranging from 46–96%, and the outcome depends more on patient selection rather than the surgical technique\textsuperscript{10,11,12}.

The traditional view has been that wide laminectomy produces increased morbidity compared to less extensive procedures \textsuperscript{13}. In the last few decades, minimal invasive approaches with less tissue destruction, and shorter period needed for recovery continued to gain popularity.

The aim of our study is to evaluate the outcome of the microscopic assisted fenestration discectomy and compare the results with the less invasive techniques with special emphasis on the MIS parameters.

Several recent prospective studies have compared open discectomy to less invasive percutaneous discectomy and success rates have been found to be similar \textsuperscript{14,15,16,17}. For example, our results showed improvement in VAS of the radicular pain from 8.48 to 0.93 after three months, which is comparable to the results achieved by Majeed et al who recorded improvement in VAS for the leg pain from 7.23 to 0.77 after 6 months in thirty nine patients underwent minimal invasive discectomy \textsuperscript{18}. The results in this study are comparable to results achieved by Righesso et al with twenty one patients underwent microendoscopic discectomy with improvement of leg pain from 8 to 1 after three months \textsuperscript{16}.

In terms of minimal invasive surgery, the estimated intraoperative blood loss was minimal. In this study, the estimated blood loss was 60 ml (range 50 -100 ml), which is comparable to 50 ml (range 10-700) in Righesso et al study, 68 ml in Majeed et al, and 30 ml (10-500ml) in one hundred eighty eight patients underwent surgery for herniated disc using the tubular retractors by Kulkami et al\textsuperscript{19}. Regarding the postoperative hospital stay, our results showed that the
average stay was 1.42 days (range 1–4), and these results show slight difference compared to the results achieved by Righesso et al, which was 24 h (range 11–72 h), and results obtained by German et al which was 0.82 ± 0.28 day in minimally invasive group. This difference from the minimal invasive group could also be attributed to causes not related to the surgical technique itself. In this study nineteen cases (79.2%) were discharged on the next day, and hospital stay was extended for cases with intraoperative dural tear (two patients), residual radicular pain (one patient), and one patient with past history of cardiac valve replacement who required postoperative adjustment of his bleeding profile.

Regarding the length of the surgical incision and operative time, in this study, was 4.4 cm (range 4–6 cm), and 108 min (range 90 to 150 min) respectively with the lengthy incisions and longer time needed in obese patients. These results are significantly more than those obtained in microendoscopic discectomy. They were 2.1±0.2 cm, and 82.6±21.9 min in Righesso et al respectively, and 1.8–2 cm and 50 min (range 20-90 min) in Kulkami et al.

Regarding the intraoperative complications, it occurred in two patients (8.3%). They were in the form of inadvertent dural tear. One of them was amenable for direct repair. The other was in accessible. Both patients did not experience postoperative hypotension headache, or wound leak. This incidence was close to the incidence of dural tear reported in other studies. It ranged from 0 to 6.7%. No iatrogenic root injuries were recorded in our study.

CONCLUSION

Interlaminar microscopic assisted discectomy is a safe and effective procedure for treatment of single level lumbar disc prolapsed. Its outcome is comparable to the less invasive percutaneous discectomy technique. In terms of MIS, the results are also close, being more accentuated in overweight, and obese patients.

Declaration

The author(s) declare no conflict of interest or any financial support and confirm the approval of the submitted article by the concerned ethical committee.

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