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Success rate of interlaminar endoscopic discectomy with laminotomy in patients with lumber disc prolapse

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Abstract: Purpose: The purpose of this prospective study is to evaluate the clinical outcome and complications in patients with single and two level lumbar disc prolapse treated with Interlaminar endoscopic discectomy with laminotomy (IELD) using the Karl Storz system. **Methods:** 300 patients with manifestations of lumbar disc prolapse were included according to the inclusion criteria. After taking written informed consent all patients were operated through interlaminar endoscopic approach using Karl Storz system. This study was conducted in Doctors hospital after the approval of ethical committee of the hospital between 1st Jan 2016 to 31st Dec 2019. Patients were assessed pre- and post-operatively (at 2weeks, 6weeks, 3months, 6months, and year one). Clinical examination entailed the straight leg raising test, tests for knee and ankle jerks and for sensory loss, and muscle charting. Preoperative MRI was mandatory. Low back pain and leg pain was assessed on visual analogue scale (VAS) and functional outcomes were evaluated using the Modified Macnab criteria. **Results:** According to modified MacNab's criteria, 87% (n=261) patients had an excellent outcome, 11 % (n=33) had a good outcome, 2% (n=6) had fair outcome, and no patient in this study had poor outcome. The mean VAS scale for leg pain improved from 4.15 to 0.7 and the mean VAS scale for back pain improved from 4.0 to 0.9. **Conclusions:** We concluded that I.E.L.D is a safe alternative to open and microdiscectomy. I.E.L.D has advantages of decrease morbidity, faster post op recovery, decrease hospital stay, early return to work and cosmesis.

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Introduction

The success rate of lumbar discectomy is about 70 to 90% [1, 2]. Microdiscectomy and minimally invasive discectomy decrease surgical exposure and trauma and have success rates of approximately 90%. Spinal endoscopic techniques have evolved more slowly, because of the complex anatomy and difficult access [3]. Endoscopic extraction of disc fragments became feasible, as anatomic structures can be visualized using small-caliber, high-resolution glass fiber optics. Minimally invasive techniques reduce postoperative morbidity, hospital stay and the incidence of perineural and intraneural fibrosis [4] preserve the epidural venous system [5, 6] and minimize the development of instability and spondyloarthropathy [7]. The purpose of this prospective study is to evaluate the clinical outcome and complications in patients with single and two level lumbar disc prolapse treated with Interlaminar endoscopic discectomy with laminotomy using the Karl Storz system.

Materials and methods

300 patients with manifestations of lumbar disc prolapse were included. All patients were operated through interlaminar endoscopic approach using Karl Storz system between 1st Jan 2016 and 31st Dec 2019.

Inclusion criteria

Patients who presented with lumbar disc prolapse with failure of medical and physical treatment for at least 6 weeks and patients with recurrent disc herniation were included in this study.

Exclusion criteria

Patients who had cauda equine syndrome, those with far lateral disc herniation and patients indicated

for spinal fixation e.g.: isthmic spondylolisthesis were excluded from the study.

Pre-op & Post-op Evaluation

Patients were assessed pre- and post-operatively (at 2weeks, 6weeks, 3months, 6months, and year one). Clinical examination entailed the straight leg raising test, tests for knee and ankle jerks and for sensory loss, and muscle charting. Preoperative MRI was mandatory. Low back pain and leg pain was assessed on visual analogue scale (VAS) and functional outcomes were evaluated using the Modified Macnab criteria.

Data Analysis

Results were statistically analyzed by SPSS version16. Paired t test was used for parametric data. Wilcoxon signed rank tests were used for non-parametric data. Chi-Squared was used for qualitative variables.

Operative technique

For ILED, the para spinal approach was used. The appropriate disc space was marked approximately one finger breadth from the midline. A long guide wire was inserted percutaneously under image intensification until it hit the superior lamina, and its position was identified. One inch incision placed. Fascia incised and 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 (22 mm in diameter) after removing the dilators. The superior lamina with the ligamentum flavum below was visualised. Laminotomy done at this point along with removal of ligamentum flavum. Laminotomy added to gain better view. 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 and confirming the disc space under C-arm. 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. Hemostasis was achieved. The scope and sheath were removed and skin sutured.

Results

The mean age of the patients was 46 years (range 16-78years). There were 197 males and 103 females in the study. There were 154 patients had L5-S1 level disc prolapsed, Ninety six patients with L4-5, forty five patients had L3-4 prolapsed disc and five had L2-3. The number of patients having unilateral sciatica was 273 whereas 27 patients were suffering from bilateral sciatica, in which 105 patients suffering from sciatica less than 6 month and the 195 patients suffered sciatica for more than 6 months. There were no statistical differences between the outcome at one month and at one year regarding the duration of sciatica in this study. The mean operative time per level was about 50 minutes (range 30-90 minutes). Dural punctures occurred in 1% cases. Average blood loss was 30 ml (range 10-100 ml) while no nerve root injury was encountered. One patient had wound infection which needed debridement and four patients presented later on with recurrent disc herniation (Table 1).

Table 1. Qualitative measures of samples

Gander	Male	197
	Female	103
Age	Maximum	78 years
	Minimum	16 years
Disc prolapse	L1-S1	154
	L4-5	96
	L3-4	45
	L2-3	5
Sciatica pain	Unilateral	273
	Bilateral	195
Duration of sciatic pain	< 6 months	105
	>6 months	195
Duration of procedure	Maximum	30 minutes
	Minimum	90 minutes
Blood loss during procedure	Maximum	10 ml
	Minimum	100 ml

All patients mobilized within 6hrs after surgery except those who had dural tears who were mobilized after 24hrs. All patients discharged within 24-48hrs after surgery. Patients who had dural tears were repaired intraoperatively using 6/0 prolene and strengthened with dural patch and fibrin glue expet one patient who had axillary tear which managed with dural patch and fibrin glue. These patients kept flat for 24hours and mobilized after raising head end gradually 10 degree per hour up till 30degree and discharged on 2nd post-op day. According to modified MacNab's criteria, 87% (n=261) patients had an excellent outcome, 11 %(n=33) had a good outcome, 2 %(n=6) had fair outcome, and no patient in this study had poor outcome. The mean VAS scale for leg pain improved from 4.15 to 0.7 and the mean VAS scale for back pain improved from 4.0 to 0.9.

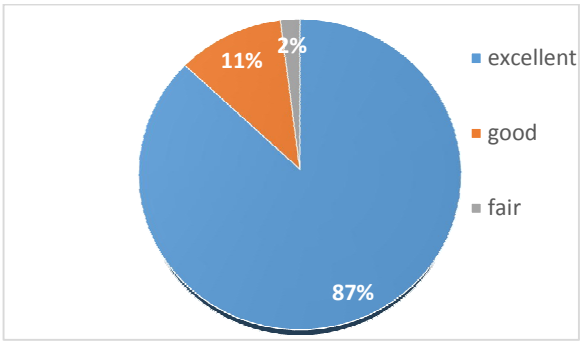

Figure 1. Success rate of procedure

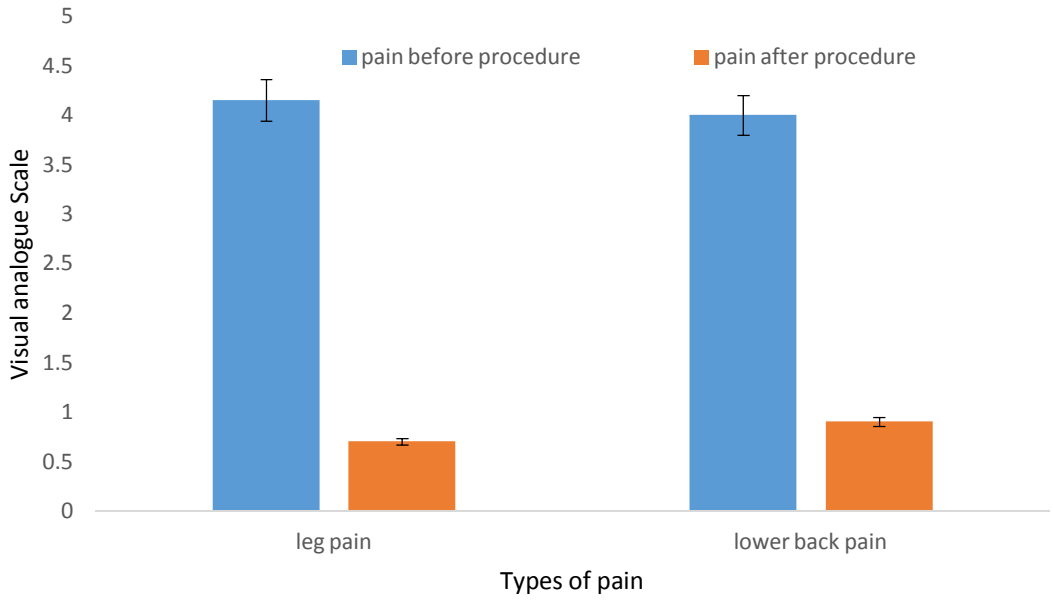

Figure 2. Reduction in pain on VAS system

Discussion

Open hemilaminectomy to treat symptomatic intervertebral disc herniation, was first described by Mixter and Barr in 1934, which set the standard for subsequent surgical techniques [8]. The trend since has been to develop less invasive surgical procedures for the treatment of radiculopathy secondary to herniated disc. The concept of minimally invasive spine surgery is to provide surgical options that optimally address the disc pathology without producing the morbidity commonly associated with open surgical procedures (e.g. morbidity associated with incision of the paraspinal muscle in traditional open techniques). Minimally invasive techniques are not, however, a perfect procedure for all lumbar disc pathology. These techniques are designed to treat nerve root compression alone as the source of radiculopathy in patients with acute primary disc herniation. The goal of minimally invasive techniques is either disc debulking or selective fragment removal subsequently relief nerve root compression. Selective fragmentectomy may remove an obstructive disc herniation mechanically. However, intradiscal depressurization and lavage with saline also may improve symptoms without significant change in neural anatomy. Good results have been achieved without significant change in neural anatomy following the procedure. The governing factor in

considering a minimally invasive procedure is patient selection [9]. Depending on the previous statements we chose our inclusion criteria for this study. The overall results of standard discectomy range from 68% to 95% in different series [10-14]. Jhala and Mistry [15] in their report stated that "Since microdiscectomy introduced by Caspar and Yasargil, it is considered the gold standard procedure in single lumbar disc prolapsed patients. Its results also range from 88% to 98.5%. The two procedures were tested over many decades and resulted in good outcome". In their report comparing between standard discectomy and microdiscectomy, Katayama concluded that microdiscectomy gave better lighting, magnification and subsequently decreased the length of incision and posterior spinal tissue trauma [16]. Foley and Smith in 1997 [17] introduced the microendoscopic approach, which allows even smaller incisions and less tissue trauma, compared with standard open microdiscectomy. The MED potentially provides additional long-term outcomes over other open procedures because it significantly induces less iatrogenic injury to the posterior spinal muscles. Kamper and colleges in their systematic review revised twenty-nine reports, 16 of them were randomized controlled trials (RCTs) and 13 non-randomized studies (n = 4,472 patients). They stated that, clinical outcomes were not different between the surgery types (conventional microdiscectomy, MED, transforaminal endoscopic discectomy). They concluded that there is moderate to low quality evidence of no differences in clinical outcomes between MED surgery and conventional microdiscectomy for patients with sciatica due to lumbar disc herniation [18]. Also, Kulkarni and colleges studied 188 consecutive patients who underwent surgery for herniated disc using the tubular retractors between April 2007 and April 2012. They stated that, MED for herniated discs effectively achieves the goals of surgery with minimal access [19]. On the other hand; Evaniew and colleges studied 10 trials in the lumbar discectomy group of a total 1159 patients. They found that minimally invasive surgery did not improve long-term function [20]. Nygaard and colleges [21] in year 2000 found a strong correlation between the duration of preoperative leg pain and postoperative outcome in patients with lumbar disc herniation. Leg pain lasting more than 6-8 months correlates with an unfavorable outcome. In the current report, the excellent and good outcomes were different and better in group of patients with history of sciatic leg pain ≤ 6 months duration than in patients with history of sciatic leg pain > 6 months duration both at one month and one year follow up periods. Despite that, this difference was statistically insignificant. We choose one month period of follow up because most of the patients returned to their previous work by this time postoperatively. Additionally, this study results came along with the results of Baldwin [21] and Khoo *et al*., [22], who found that the duration of radicular symptoms is important in the patient selection criteria [23]. The advantages of endoscopic discectomy; using tubular retractors; over open discectomy (OD) include small incision, better cosmesis, early ambulation, less postoperative pain, less blood loss, short hospital stay, less analgesics, short time to return to work and thus less cost of treatment [19, 24-27]. It also gives the surgeon the comfort he needs due to bimanual surgical technique. In our study skin incision was 1.8-2.5 cm in length initially which after healing became shorter leading to better cosmesis. Katayama et al. compared microdiscectomy against macrodiscectomy and concluded that; both the procedures have the same overall outcome, then the procedure with lesser tissue invasion, lesser length of incision, lesser use of postoperative analgesics with an early return to work becomes the procedure of choice [16]. Bookwalter and colleges reported that 40% of their patients returned to work in fewer than 5 weeks proving its cost effectiveness [28]. Caspar et al. reported a mean return-to work time of 18.6 weeks [29] and Foley and Smith reported a mean return-to-work time of 17.6 days [30]. In this study, 35 patients (81.4%) returned to their previous work 4 weeks after surgery. In their preliminary series, the developers of this technique reported a complication rate of one patient in 41 (3%), with all patients reporting a good to excellent results in follow-up based on modified MacNab criteria [6]. As we are doing I.L.E.D in routine so we included all patients either with acute disc herniation or calcified discs. Due to experience in technique and adding laminotomy to procedure reduced dural tear incidence to 1% as compared to what mentioned in literature. In 2014, Evaniew and colleges [20] mentioned that; the evidence suggested overall higher rates of nerve-root injury, incidental durotomy and reoperation with minimally invasive surgery than with open surgery. But they said that infections were more common with open surgery than with minimally invasive surgery. In our series, we encountered two disc recurrence cases throughout the whole period of follow up and one postoperative wound infection while no nerve root injury was encountered.

Conclusions

IELD is a modern and safe method to achieve goals of surgery. IELD has advantages of decrease morbidity, faster post op recovery, decrease hospital stay, early return to work and cosmesis. We concluded that IELD is a safe alternative to open and microdiscectomy

Recommendations

The endoscope allows the surgeon to obtain more wide visualization through the oblique lens, so it can be possible to operate in the field beyond the confines of the tubular retractor. With experience surgeon can address foraminal stenosis and recurrent disc herniations.

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