

# Postoperative Wound Pain and Hospital Stay in Patients of Open Lumbar Discectomy (OLD) Versus Endoscopic Lumbar Discectomy (ELD) in Lumbar Disc Herniation (LDH)

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## ABSTRACT

**Background:** Endoscopic lumbar discectomy is also beneficial regarding relieving wound pain, less hospital stay and smaller incisions. We compared visual analog scores (VAS) and hospital stay in patients treated with either endoscopic lumbar discectomy or open lumbar discectomy postoperatively.

**Material and Methods:** Half patients underwent open lumbar discectomy – OLD (group A) and half operated with endoscopic lumbar discectomy – ELD (group B). The pain was quantified through visual analog score (VAS) observation in all patients. A preoperative medical management included prescribing a combination of an analgesic and a muscle relaxant along with physiotherapy with an avoidance of lifting heavy loads. Mann-Whitney (U) tests were applied for the comparison of postoperative VAS and hospital stay between groups.

**Results:** 85% patients were having left sided prolapsed paracentral disc, and 15% were having right sided prolapsed paracentral disc. The mean postoperative VAS was 4 in patients treated with ELD and it was 1.32 in patients treated with OLD. The mean hospital stay was 1.5 days in ELD treatment, whereas, it was 2.5 days in OLD treatment. A significant difference ( $p=0.037$ ) was found in the comparison of mean post-operative VAS between two vertebral levels (i.e., L4-L5 & L5-S1). The post-operative VAS and hospital stay (days) in ELD group were statistically significantly higher than the OLD group ( $p$  values 0.000).

**Conclusion:** ELD procedure was effective as compared to open lumbar discectomy in terms of postoperative wound site pain and hospital stay. Endoscopic Lumbar discectomy is a minimally invasive procedure for discectomy.

**Keywords:** Open Lumbar Discectomy (OLD); Endoscopic Lumbar Discectomy (ELD); Visual Analogue Score (VAS); Lumbar Disc Herniation (LDH); Left/Right Sided Prolapsed Paracentral Disc; L3-L4, L4-L5, L5-S1.

## INTRODUCTION

Spine disorder from a degenerative disc is the main cause of disabilities in adult population worldwide. It was estimated that around 1.5 million disc surgeries are being performed every year around the globe. The incidence of sciatica is 5 in 1000 per year.<sup>1-2</sup> Lumbar

Date of Submission: 21-1-2020 ) is a more common source of  
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sciatica. More than 50% patients recover with non-surgical therapies.<sup>3</sup> Lumbar disc herniation (LDH) has been ranked 5<sup>th</sup> among all diseases related to the frequent hospital admission, cost of the treatment and absent from the work.<sup>2</sup> A survey of 2008 showed that almost 26% of the U.S. population had low backache.<sup>1</sup> The current study was focused to compare mean pain

scores and hospital stay in endoscopic lumbar discectomy (ELD) and open lumbar discectomy (OLD) treatments in patients with lumbar disc herniation (LDH) postoperatively. In lumbar spine complications, a lumbar disc herniation is a commonest pathology. Sciatica is a severe lower backache which radiates towards ipsilateral leg in the distribution of spinal nerve involved. Lumbar disc herniation is a significant cause of a lower backache. Lumbar disc herniation occurs due to the degeneration of the annulus fibrosis. Factors associated with lumbar disc herniation are age, improper working posture, bearing heavy loads, trauma and smoking, etc.<sup>5</sup> Common age for lumbar disc herniation is 30 – 45 years, with a male to female ratio of almost 3:1.<sup>6</sup> The Lumbar disc herniation is commonly occurs at either postero-lateral (para-central) or lateral, but sometimes posterior (central) herniation is also reported. Among the vertebral levels L4 – L5 and L5 – S1, the intervertebral disc is herniated in almost 95% patients with 22 – 50 years of age. A level above L4 is relatively common in an older age.<sup>7-8</sup> The clinical symptoms depend on the level of disc herniation as well as its direction. The symptoms include lumbago, sciatica, motor or sensory deficit along with the distribution of nerve root involved and claudication.<sup>9</sup> MRI is a gold standard investigation for the diagnosis and treatment planning,<sup>10</sup> which divides the herniated lumbar disc into four grades (I, II, III & IV). The management of grades I & II is conservative that includes analgesics, muscle relaxants, bed rest and physiotherapy. Grade III can also be managed conservatively in almost 85% of cases.<sup>11</sup> A surgical intervention is indicated in case refractory to medical therapy, i.e., failure of medical therapy of six weeks or the progression of symptoms despite on medication in grades III & IV.<sup>11</sup>

When a conservative therapy fails, a surgical option is then used especially when a patient reports an excruciating pain or when a deteriorated neurological deficit is observed. During 1980s-1990s, the microsurgical techniques were used to reduce the surgical invasiveness to some extent, however, now new endoscopic techniques are being incorporating to attain a maximum reduction in the invasiveness.<sup>12</sup> Mixter and Barr (1934)<sup>13</sup> were the first who had described the conventional laminectomies and discectomies for the treatment of lumbar herniated disc. These techniques had no excellent outcomes with regard to pain reduction. Therefore, less invasive microsurgical discectomies were developed by using a surgical microscope and monosegmentar.<sup>14-16</sup> Surgical

telescope had been replaced by a microscope in a similar technique as well.<sup>17</sup> Smith and Foley (1998)<sup>18</sup> developed an endoscopic technique which was considered a minimal invasive surgical option for lumbar disc herniation (LDH). In this approach, the herniated disc has been used to resect posteriorly with a small incision and a tubular retractor (with a diameter of 16-18 mm). The ELD approach was considered to cause less damage of tissue as compared to OLD. A significant reduction in postoperative pain was also noted in ELD option. It was also observed that those patients who were treated with microendoscopic, had returned back to their work much earlier as compared to those patients who were treated with open microdiscectomy.<sup>3</sup> A latest research of Siepe and Sauer, (2018)<sup>12</sup> has indicated that a significant reduction in invasiveness is particularly beneficial to the elderly, less mobile patients and obese people. With endoscopic technique, infection and healing problems are minimal, because of smaller skin incision, uniform flow with sterile saline solution as well as a withdrawal of the retractor system. However, considerable surgical skills are required for a lengthy learning curve in endoscopic techniques.<sup>12</sup> Recent explorations have introduced the concept of minimum invasive surgical techniques and endoscopic lumbar discectomy (ELD) for spine. Full-endoscopic interlaminar technique was proposed by Ruetten et al (2006).<sup>19</sup> This technique obtains a decompression via interlaminar window which is used to enter the specific area. This technique is particularly beneficial for L5 – S1 disc herniation. Spine surgeons are now recommending endoscopic lumbar discectomy, because it includes the same path of surgery with familiar anatomy. This technique is found more effective and minimally invasive. But, an accurate understanding of this approach is required to prevent postoperative complications emerge from its steep learning curve.<sup>20</sup> However, the complication rate is significantly lower as compared to the other microsurgical technique. The use of this ELD approach is increasing because it has an ability to minimize soft-tissue damage and reduce number of days in hospital stay. Few spine surgeons use an interlaminar endoscopic discectomy technique in L4 – L5 herniation as reported earlier.<sup>21</sup> A percutaneous full-endoscopic discectomy with interlaminar approach was recently used by Nakamura and Yoshihara, (2017).<sup>21</sup> They evaluated the initial outcomes as well as complications of full-endoscopic discectomy with an interlaminar approach for L4 – L5.

Based on the calculation of mean operative time, they concluded that this technique can be considered as a standard procedure for any intracanalicular disc herniation.<sup>21</sup> Sencer et al (2014)<sup>22</sup> reported that endoscopic lumbar discectomy either with interlaminar or transforaminal surgeries are safer and effective treatments for lumbar disc herniation from the evaluation of the visual analogue score (VAS). But with this new surgical approach, better results would be acquired through sufficient skills and experience of spine surgeons.

## **MATERIAL AND METHODS**

### ***Study Design***

A prospective randomized control trial from January 2015 to December 2017 was conducted at the Neurosurgery Department of Jinnah Hospital, Lahore. A non-probabilistic, consecutive sampling was done.

### ***Inclusion Criteria***

Male and female patients who were having symptoms of sciatica were selected with ages between 20 – 60 years. Those patients included who were taking medicines for last six weeks and experience no improvement in pain.

### ***Exclusion Criteria***

Patients who were clinically diagnosed with cauda equina syndrome were excluded. Patients who were diagnosed with central lumbar disc prolapse on the MRI lumbosacral spine were also excluded.

### ***Data Collection***

A total of 80 patients were admitted from the outpatient department of the hospital. Informed consent were taken from all patients. Patients were grouped either for open lumbar discectomy – OLD (Group A; n = 40) or endoscopic lumbar discectomy – ELD (Group B; n = 40), based on randomization through a lottery method. All procedures were done by the same surgeon. All patients were given same analgesics post operatively, i.e. Inj. Ketorolac 30 mg I.V. TDS. The pain was calculated at 24 hours with the help of a visual analogue score (VAS) ranging from 0 – 10. The duration of hospital stay was calculated at the time of discharge. The data was entered on self-designed Proforma. The surgical outcome was evaluated in terms of wound site pain and hospital

stay. The patients were discharged when either symptoms of sciatica were resolved or when the wound site pain score was found lesser than three and when no discharge was seen from the wound site. Through a designed visual analog score (VAS), the pain was quantified by observing the patient and asking certain questions regarding severity of pain.

### ***Surgical Procedure of Endoscopic Lumbar Discectomy (ELD)-Interlaminar Approach***

The level of the intervertebral disc to be operated was marked with a spinal needle and confirmed by a fluoroscope. A 20-gauge spinal needle was inserted into the Para spinal musculature around one finger-breadth (1.5 cm) lateral to the midline side of the patient to be operated at the appropriate disc level. The position of the needle was changed until it positioned directly over the symptomatic disc space. The needle was then removed at the vertical incision of almost 1.5 cm (15mm) that was made just over the disc space.<sup>23</sup> The incision length made should be about the diameter of the respective tubular retractor. The dilators were inserted by the twisting motion sequentially up to the desired size. A fluoroscope was used to confirm the position of the dilators. The trocar was then passed over the dilators and attached to the self-retaining arm (**Figure 1**). An endoscopic telescope



**Fig. 1:** *Dissection Performed in Endoscopic Lumbar via Tubular Retractor.*

was attached to the high definition camera. The soft tissue over the lamina and interlaminar space was removed. Bony landmarks can also be identified by palpation using a long instrument like a suction nozzle tip and lateral fluoroscopy. The lamina was exposed. A hemilaminotomy was then performed and the ligamentum flavum was dissected. The ligament was penetrated with the curette using a twisting motion, peeled back caudally and dorsally, and then resected with a Kerrison punch. The dura and traversing nerve

root were then identified. The nerve root was retracted medially. An annulotomy was performed using a micro knife (if required), while protecting the nerve root with the suction retractor (**Figure 2**). The disc material was removed with the help of the pituitary rongeur (**Figure 3**). Skin was closed using a single stitch (**Figure 4**). The term percutaneous has been frequently used as a prefix of endoscopic lumbar discectomy, but we do not recommend the use of this term as a prefix, as percutaneous is a procedure in which the portal of entry is created via. needle or



**Fig. 2:** Sheathed Micro-knife is being used to perform an Annulotomy in Endoscopic Lumbar Discectomy.



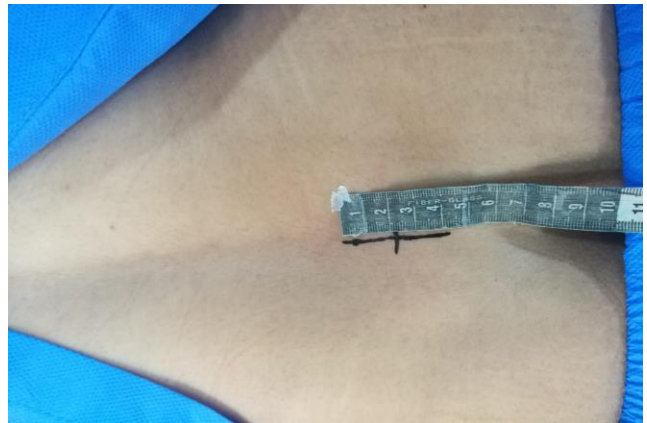
**Fig. 3:** Disc Material Retrieved Endoscopically. trocar not requiring an incision, whereas in endoscopic lumbar discectomy, we created a small stab incision and subsequently dilating it.



**Fig. 4:** Surgical Wound of Endoscopic Lumbar Discectomy.

### **Surgical Procedure of Open Lumbar Discectomy (OLD)**

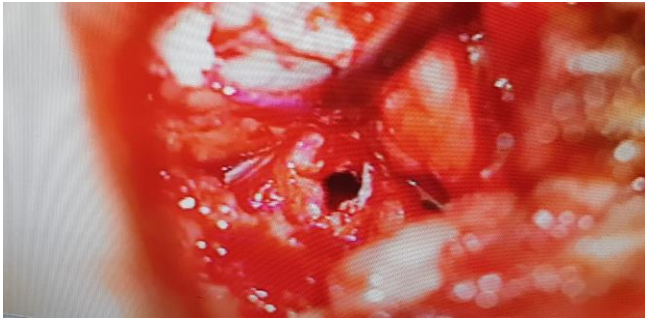
The patient was placed in a prone position. Fluoroscopy was used for the localization and surface anatomy was utilized. A 3 – 4 cm (30 – 40mm) midline incision is made and self-retaining retractors were applied (**Figure 5**). Subperiosteal dissection of tissue from spinous process and lamina on the



**Fig. 5:** Incision marking of almost 4 cm.

symptomatic side were performed. Supraspinous and interspinous ligaments should be preserved. A retractor was placed. Partial laminectomies of superior and inferior lamina of identified level. Ligamentous flavum was removed (English correction). The nerve sleeve and dura were gently retracted medially. The posterior longitudinal ligament and annulus fibrosus were incised from medial to lateral. Disc material was

removed with a pituitary rongeur (**Figure 6**). The skin was closed with stitches (**Figure 7**).



**Fig. 6:** Disc space after removal of herniated disc material.



**Fig. 7:** Surgical Wound of Open Lumbar Discectomy

### Medical Management

A trial of medical management was given to all patients for a maximum six weeks. Almost 80% of patients responded well to this medication therapy and did not require any surgery. A preoperative medical management included prescribing a combination of an analgesic and a muscle relaxant along with physiotherapy with an avoidance of lifting heavy loads. We prescribed Tablet Piroxicam 20 mg once daily and Tablet Tizanidine 2 mg thrice daily. Those patients were considered for the surgery who did not report a relive in pain with medicine therapy of six week.

### Statistical Analysis

All data was evaluated on SPSS v.23.0 (IBM Corp., Armonk, New York, US). Mean, minimum, maximum

values of following parameters, i.e., age, pre-operative visual analog score (VAS), post-operative visual score (VAS) and hospital stay (in days) were calculated for both groups. A chi-square test was applied to see the association between both groups for each parameter, i.e., age, gender, left/right side disc and vertebral levels. A significance level was considered with p-value less than 0.050. A chi-square (cross-table) was conducted to see significance or non-significance of association in both groups (A & B) with respect to pre-operative & post-operative VAS. Chi-square tests were also applied to determine the significance or non-significance of association between both groups (A & B) in the stratification or distribution of post-operative VAS and hospital stay related to mean post-operative VAS in age classification ( $\leq 40$  years of patients &  $> 40$  years of patients), in gender classification, in disc side (left/right) classification and in vertebral level classification. Before conducting a comparative analysis between group A (patients treated with OLD) and group B (patients treated with ELD), a Shapiro Wilk test was conducted to confirm normalization or non-normalization in the data of post-operative VAS (visual analog score) and hospital stay (days). A post-operative visual analog score (VAS) was stratified according to age and gender ( $n = 80$ ) and Mann-Whitney (U) test was applied for the comparison of post-operative VAS between two groups in following: age, gender, disc side and vertebral levels. Similarly, hospital stay data stratification according to age and gender ( $n = 80$ ) was done and another Mann-Whitney (U) test was applied for a comparison of hospital stay (days) between two groups in following: age, gender, disc side and vertebral levels. A second Mann-Whitney (U) test was applied for the comparison of post-operative VAS and hospital stay between groups A (OLD) & B (ELD).

### RESULTS

There were total 80 patients and among them.

#### Gender Distribution

There were 45 (56%) male patients and 35 (44%) female patients. Patients were grouped for open lumbar discectomy – OLD (Group A;  $n = 40$ ) and endoscopic lumbar discectomy – ELD (Group B;  $n = 40$ ). There were 57.5% male & 42.5% female in group A and 55% male & 45% female in group B.

**Age Incidence**

There were 59 (74%) patients who were less than 40 years and 21 (26%) patients who were more than 40 years of age.

**Side Involved**

There were 68 (85%) patients with left sided prolapsed paracentral disc and 12 (15%) patients with right sided prolapsed paracentral disc.

**Level Involved**

There were 40 (50%) patients who had L4 – L5 vertebral level, 39 (49%) had L5-S1 vertebral level, whereas, there was only 1 (1%) patient with vertebral level L3-L4 level.

**Mean, Minimum and Maximum Values (Pre & Postoperative VAS)**

**Table 1** describes mean, minimum, maximum values of following parameters, i.e., age, pre-operative visual analog score (VAS), post-operative visual score (VAS) and hospital stay (in days) for both groups. The mean age of patients was 35.5 years in group A and 32.6 years in group B. Mean post-operative VAS was 4.0 in group A and 1.32 in group B. Minimum post-operative VAS was 1 and the maximum was 6 in group A, while, minimum post-operative VAS was 1 and the maximum was 3 in group B. Mean of post-operative VAS was significantly reduced in group B patients who were treated with endoscopic lumbar discectomy (ELD). There were 12 patients of group A (treated with OLD) whose post-operative VAS was 5, whereas, there were 30 patients of group B (treated with ELD) whose post-operative VAS was 1. Mean hospital stay

was 2.5 days with minimum 1 day and maximum 6 days in group A (treated with OLD) patients, whereas, mean hospital stay was 1.5 days with minimum 1 day and maximum 3 days in group B (treated with ELD) patients. There were 12 patients who stayed two days in hospital after OLD surgery, whereas, there were 23 patients who stayed only one day after ELD surgery.

**Stratifications of Visual Analog Score (VAS) and Hospital Stay**

There was a non-significant association (**Table 2**) between groups A and B related to pre-operative and post-operative visual analog scores according to chi-square ( $\chi^2 = 1.667$ ; p-value = 0.1966). The stratifications of post-operative VAS and hospital stay (days) related to age classification, gender classification, left or right prolapsed paracentral disc classification and vertebral levels (L3 – L4, L4 – L5, L5 – S1) in both groups (A and B) was done and no significant association was found between the groups with p-values = 1, 1, 1, 1 ( $\chi^2 = 0, 0, 0, 0$ ) respectively. Similarly, the stratifications of hospital stay (days) related to age classification, gender classification, left or right prolapsed paracentral disc classification and vertebral levels (L3 – L4, L4 – L5, L5 – S1) in both groups (A and B) was done and no significant association was found between the groups with p-values = 0.465, 0.809, 0.850, 0.465 ( $\chi^2 = 0.533, 0.058, 0.0356, 0.533$  and) respectively.

**Shapiro-Wilk Statistics (W) Test Results**

Shapiro-Wilk Statistics (W) test (1) which was conducted to determine normalized/non normalized distribution of post op VAS score and hospital stay (dependents) in gender, age, disc side and vertebral level groups (factors). According to the p-value < 0.050, all of the data was found non-normalized. Therefore, for comparisons a Mann-Whitney (U) test

**Table 1:** Mean, min, max values of relevant parameters with respect to patients groups: OLD & ELD\*.

Parameter	Open Lumbar Discectomy (OLD) Group A (n = 40)			Endoscopic Lumbar Discectomy (ELD) Group B (n = 40)		
	Mean ± S.D.	Min.	Max.	Mean ± S.D.	Min.	Max.
Age (Years)	35.55 ± 8.726	20	50	32.675 ± 8.300	20	49
Pre-Operative VAS**	5.05 ± 1.518	2	8	5.825 ± 1.852	2	9
Post-Operative VAS	4.025 ± 1.671	1	8	1.325 ± 0.615	1	3
Hospital Stay (days)	2.5 ± 1.240	1	6	1.525 ± 0.678	1	3

\*OLD: Open Lumbar Discectomy, ELD: Endoscopic Lumbar Discectomy; \*\*VAS: Visual analog score

**Table 2:** Distribution of mean pre-operative and post-operative VAS in groups: OLD & ELD.

VAS	Surgery Options		Chi Square (χ <sup>2</sup> )	p value
	Open Lumbar Discectomy (OLD) (n = 40)	Endoscopic Lumbar Discectomy (ELD) (n = 40)		
Pre-operative VAS	5.05	5.082	1.667	0.1966
Post-operative VAS	4.025	1.325		
Total	9	7		

was applied. A second Shapiro-Wilk Statistics (W) test determined a non-normalized distribution of post-operative visual analog scores and hospital stay in Groups A & B (i.e., OLD & ELD). Therefore, for further comparison, a Mann-Whitney (U) test was applied.

**Mann-Whitney (U) Test Results**

According to Mann-Whitney (U) test, a significant difference (p value 0.037) was only reported between vertebral levels (i.e., L4 – L5 & L5 – S1) in the comparison of mean post-operative VAS. A second Mann-Whitney U test indicated (Table 3) that post-operative VAS in group A was statistically significantly higher (p value < 0.000) than the group B. This Mann-Whitney U test also indicated that hospital stay (days) in group A was also statistically significantly higher (p value < 0.000) than the group B.

**DISCUSSION**

We compared the mean (pain) visual analog scores (VAS) and hospital stay (in days) after endoscopic lumbar discectomy (ELD) and open lumbar discectomy (OLD). Recent research has recommended an interlaminar based endoscopic lumbar discectomy for the treatment of lumbar disc herniation (LDH).<sup>20,21</sup> In current research, the mean post-operative VAS was 4.0 in group A (treated with OLD) and 1.32 in group B (treated with ELD). As the minimum post-operative VAS was 1 and the maximum was 6 in group A (OLD), while, minimum post-operative VAS was 1 and the maximum was 3 in group B (ELD). Therefore, mean post-operative VAS was significantly reduced in group B patients, who were treated with endoscopic lumbar discectomy (ELD). It is noteworthy that there

**Table 3:** Mann Whitney U Test Results-Comparison of mean post-operative VAS and mean hospital stay (days) between groups A (OLD) & B (ELD).

Parameter	Mann-Whitney (U)	Wilcoxon (W)	Z Score	p value
Post-operative VAS	123	943	-6.792	< 0.000†
Hospital stay (days)	427	1247	-3.795	< 0.000†

† Highly significant

were 12 patients of group A (OLD) whose post-operative VAS was 5, whereas, there were 30 patients found in group B (ELD) whose post-operative VAS was 1. The mean hospital stay was 2.5 days in group A patients, whereas, mean hospital stay was 1.5 days in group B patients. It was worth to note that there were 12 patients who stayed two days in hospital after OLD surgery, whereas, there were 23 patients who stayed only one day after ELD surgery. A significant difference (p value 0.037) was found in the comparison of mean post-operative VAS between two groups in vertebral levels (i.e., L4 – L5 & L5 – S1). Mann-Whitney U test indicated that post-operative VAS in group A was statistically significantly higher (p value = 0.000) than the group B. Mann-Whitney U test also indicated that hospital stay (days) in group A was statistically significantly higher (p value = 0.000) than the group B.

Our results regarding endoscopic lumbar discectomy (ELD) approach are comparable to that of other published studies. Many reports have proved the efficacy of ELD as compared to the OLD.<sup>23,25-26</sup> The mean postoperative was 1.32 in patients who were treated with endoscopic lumbar discectomy and it was 4 in patients treated with open lumbar discectomy. This result was statistically significant between both groups (p < 0.0001). Haung et al (2013)<sup>27</sup> showed that the VAS in patients of endoscopic lumbar discectomy was 1.4. Teli et al (2016)<sup>28</sup> also showed that the average post-operative pain was 3 on VAS scale in endoscopic lumbar discectomy. Hsu et al (2012)<sup>29</sup> observed that the patients who underwent endoscopic

lumbar discectomy had a post-operative VAS of 1.6. Similarly, we observed a reduction in hospital stay in patients who were treated with endoscopic lumbar discectomy (mean 1.5 days) as compared to patients who were treated with open lumbar discectomy (mean 2.5 days). This result was also statistically significant between both groups ( $p < 0.0001$ ). Lee et al (2009)<sup>30</sup> reported that the average hospital stay was around 1 day in endoscopic lumbar discectomy. Haung et al (2013)<sup>27</sup> mentioned that the postoperative hospital stay was less than 4 days in an endoscopic lumbar discectomy group. While, according to Teli et al (2016)<sup>28</sup> the average hospital stay was 54 hours in the same group. The outcomes of ELD were found better than that of the OLD group in terms of hospital stay and post-operative wound site pain. A retrospective study conducted by Xie et al (2017)<sup>20</sup> to evaluate the complications of the new technique. Xie et al (2017)<sup>20</sup> treated around 200 cases of L4 – L5 herniation and observed a good outcome. They mentioned that this approach has not many complications if properly handled. They reported less complications that were due to the observed nerve root injury, paresthesia and incomplete decompression. It was recommended that with effective measures, precise surgical procedure, targeted perioperative management as well as expertise and skills in such surgery can further reduce complication rates.<sup>20</sup> Choi et al (2011)<sup>31</sup> reported complication rate around 18% by an endoscopic approach. Phan et al (2017)<sup>32</sup> conducted a meta-analysis to evaluate the effectiveness of full and micro endoscopic discectomies with open discectomy in treating lumbar disc herniation. Although, Phan et al (2017)<sup>32</sup> found similar results in both approaches related to visual analogue score (VAS leg) and Oswestry disability index (ODI), but an improved outcome in terms of patient satisfaction, less operative time, less blood loss and hospital stay were reported with an endoscopic approach. It was concluded that although, both of these approaches were safe and effective, but still further research is required for an adequate validation.<sup>32</sup> Choi et al (2013)<sup>33</sup> reported that mean VAS (back and leg) were significantly improved in percutaneous endoscopic lumbar discectomy with both approaches, i.e., transforaminal vs. interlaminar. The significance of endoscopic spine surgical approach has also been tested in serious conditions such as large lumbar herniation where conventional surgery does not work in herniated disc evaluations.<sup>34</sup> Choi et al (2016)<sup>34</sup> compared the clinical outcomes of endoscopic lumbar discectomy (ELD) with an open

lumbar technique (OLD). It was reported that ELD was more effective for large lumbar herniation as compared to OLD in terms of an earlier recovery, reduction in pain and disc height preservations. A study compared the outcomes of percutaneous endoscopic lumbar discectomy with open lumbar microdiscectomy in patients with recurrent disc herniation. A significant reduction ( $p$  value  $< 0.001$ ) in operation time and hospital stay was found in ELD group. The less rate of complication, improvement in backaches and adequate disc height preservation were reported in ELD group as well.<sup>30</sup> A retrospective study also reported that ELD approach in recurrent disc herniation was effective.<sup>35</sup> Another study reported through the evaluation of VAS and ODI, that full endoscopic surgical option has a safer implementation and a good alternative to open microsurgery in patients with lumbar disc herniation. Although, they found same clinical outcomes with both approaches, but they achieved advantages with endoscopic option in terms of reduced traumatization and backaches.<sup>36</sup> It was mentioned by Ruetten et al (2008)<sup>36</sup> that with proper procedures and surgical instruments, the endoscopic lumbar discectomy either with interlaminar or transforaminal options, the inside/outside spinal canal in LDHs (lumbar disc herniations) can sufficiently be removed. Sencor et al (2014)<sup>22</sup> mentioned complications in a few patient who were treated with full endoscopic lumbar discectomy as dysesthesia (2.4%), deteriorated neurological status (3%) and dural tears (3.7%). Dysesthesia was resolved in time, and deteriorated neurological condition was restored without any intervention.<sup>22</sup> Jhala and Mistry (2010)<sup>26</sup> and Ranjan et al (2006)<sup>37</sup> reported hospital stay of 1 – 2 days with endoscopic lumbar discectomy in around 100 cases. A study by Schizas et al (2005)<sup>38</sup> compared the outcomes of microendoscopic discectomies with standard microsurgical discectomies and noted that the former were at least equally effective for the treatment of large contained disc herniation. Less tissue invasions, lesser intake of analgesics and an early return to activities have been associated with ELDs.<sup>26</sup>

Katayama et al (2006)<sup>39</sup> compared the results of an open lumbar discectomy versus endoscopic lumbar discectomy and found no difference in the surgical outcomes with both techniques. An endoscopic “lumbar discectomy provide better lighting, magnification and reduce the incision length and tissue invasion”.<sup>39</sup> It was reported that with endoscopic lumbar discectomy, the patients returned to the functional state much earlier even with the lesser



intake of postoperative narcotic analgesics. Therefore, if both procedures have the even same outcomes, than a less invasive procedure with a lesser use of postoperative analgesics and an early return to life or work should be the procedure of choice. Endoscopic Lumbar Discectomy (ELD) was introduced to combine standard lumbar microsurgical techniques with an endoscope and therefore, spine surgeons can handle factors related to free-fragment disc pathology and lateral recess stenosis successfully.<sup>40</sup> The endoscopic approach includes smaller incisions and less tissue trauma as compared to standard open discectomy. Long term potential should also be evaluated to maintain standard endoscopic discectomy.<sup>26</sup> In our setup, the patients were operated with only 15mm (average) skin incision and postoperative MRIs showed lesser signal changes in the paraspinal muscles. Endoscopic Lumbar discectomy will rise all over the world due to its minimal invasive approach and improved outcomes, but its long term outcomes are yet to be established. The safe removal of the prolapsed disc and improved VAS have convinced neurosurgeons to adopt an ELD procedure. But, it demands an endoscopic procedural skills as it has a steeper and a lengthy learning curve. We performed ELD in our institution and our results have shown that ELD is superior to open discectomy in terms of reduced VAS and hospital stay.

### **CONCLUSION & RECOMMENDATION**

Open lumbar discectomy had been the procedure of choice. As surgical specialties are moving to minimal invasive techniques, the neurosurgeons have moved from open discectomy to micro discectomy and ending up to endoscopic discectomy. Although, the results of microdiscectomy are favorable but endoscopic discectomy also proving its place and the patients are getting benefits regarding less wound site pain, less hospital stay and smaller incisions. Endoscopic Lumbar discectomy is a minimally invasive procedure for discectomy in early encouraging results. It has a steep learning curve initially, but once the expertise is maintained over this technique, the results are more acceptable in terms of safety and effectiveness as compared to open lumbar discectomy related to postoperative wound site pain and hospital stay.

More research is required regarding evaluating maximum benefits, well- designed standard procedures, skills and reducing complications with endoscopic lumbar discectomies.

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**sAdditional Information**

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**Human Subjects:** Consent was obtained by all patients/participants in this study.

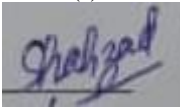
**Conflicts of Interest:**

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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<b>AUTHORSHIP AND CONTRIBUTION DECLARATION</b>			
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2.	Usman Ahmad Kamboh	2. Data collection and calculations	
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