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Original Research Article

A comparative study of conventional microlumbar discectomy and endoscopic lumbar discectomies

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ABSTRACT

Background: Low back pain is fairly common in India and lumbar disc herniation is its most common specific cause. In the present study we compared three minimally invasive surgical modalities for treating lumbar disc herniation.
Methods: This prospective observational study was conducted on patients who presented to our department with low back pain with radicular symptoms. Twenty-five patients who underwent either microlumbar disectomy (MLD), percutaneous endoscopic transforaminal lumbar discectomy (PELD) or microendoscopic lumbar discectomies (MED) were compared.
Results: Of the total sample of 75 cases, it was found that male population was affected more and the degenerative disc process was more prevalent among those over 40 years of age. The MED had the shortest operative time while MLD had the longest mean duration. A comparison of the intraoperative blood loss was negligible in PELD group and 42.80 ml in MED and 63.20 ml in MLD which was strongly significant with a $p<0.001$. Pain scores were comparable between the patients in the three surgery groups. We observed significantly higher ODI score for patients in MLD group at in the immediate post-operative, 3 months and 6 months post-operative period.
Conclusions: MLD is the gold standard for treatment for lumbar disc disease even today due to its familiarity among neurosurgeons; however, reduced tissue destruction and cosmetic demand with equally good results if not better, endoscopy could replace MLD as the first-line treatment for LDH until lesser invasive modality comes to light.

Keywords: Low backache, Lumbar disc herniation, Surgery, Minimally invasive

INTRODUCTION

Literature suggests that 60% of Indian population suffers from low back pain at some point in their lives.[1] It affects the population not only in terms of pain and disability but also in terms of number of lost working days, need for health care interventions with associated costs and lost productivity thereby having financial implications. Lumbar disc herniation (LDH) is the most common specific cause for low back pain (LBP).[2] It is a degenerative process causing annular tear with extrusion of the nucleus pulposus through posterolateral aspect of the disc leading to compression of the thecal sac and nerve roots with radicular symptoms. Surgery is reserved for only those who are refractory for nonsurgical management (5-8 weeks), need of stabilization and for conus and cauda lesions needing immediate attention. Many of the newer surgical techniques are minimally invasive and include microlumbar disectomy (MLD), percutaneous endoscopic transforaminal lumbar discectomy (PELD) and microendoscopic lumbar discectomies (MED).

The present study aimed to compare various intra-operative and post-operative outcomes between three

minimally invasive surgical modalities for treating lumbar disc herniation.

METHODS

Study design and sample population

This prospective observational study was conducted on patients who presented to our department with low back pain with radicular symptoms was conducted with a 3- and 6-months follow-up analysis from November 2018 till June 2020. We included patients over 18 years with a confirmed diagnosis of single level lumbar disc herniation with clinic-radiological correlation of the offending level who were refractory to conservative management for a period of 5-8 weeks. We excluded patients aged below 18 years, with multiple level discs, canal stenosis, lateral recess stenosis, pyogenic discitis, psychological disorders, neoplasms, symptomatic patients whose clinical and radiological assessment don't correlate, spondylolisthesis or those requiring stabilization, contraindication for general anesthesia and allergy to local anesthesia. During the study period, 75 patients were included. Three surgical techniques were compared, MLD, MED and PELD. Twenty-five consecutive patients undergoing these procedures were included in the final analysis. The study was approved by the Institutional Ethics Committee and written informed consent was obtained from the patients before enrolling for the study.

Surgical technique

All three surgical groups were performed in prone position. The MLD and MED groups were performed under general anesthesia (GA) while PELD was performed under local anesthesia (LA) (2% lignocaine with 0.25% bupivocaine adjusted for the weight of the patient). The surgical groups used intraoperative C-arm assistance for level confirmation.

MLD group

A longitudinal midline incision corresponding to the offending disc followed by subperiosteal paraspinal dissection was done. A hemilaminotomy with the medial end of the facet if needed was performed. Ligamentum flavum was cut and removed. The root, thecal sac and disc were noted. The thecal sac and root was medialized and the disc removed with a ring curette and a disc forceps and decompressed expanded thecal sac and root were noted (Figure 1).

PELD group

It uses the principle of working through safe corridors. The kambin's triangle was used as the safe triangle for entry. A paraspinal incision was marked 12-14 cm from the midline. The extruded portion of the disc was confirmed on discography by injecting 2-3 ml of urograffin dye with C- arm visualization. A guidewire was inserted and spinal needle was removed. With the guidewire in place, dilator was placed with a small stab incision if required for easy passage of the dilator. The working beveled channel was then passed over the dilator with the bevel facing upwards. This step was performed under sedation (fentanyl) as it the most painful part of the procedure when the channel had to be docked over the disc space with the help of a mallet. Under direct visualization through the microscope with continuous saline irrigation, a fragmentectomy was performed from the medial to the lateral aspect of the disc under vision with a rongeur. Decompression was done between the medial pedicular line and the foramen (Figure 2).

MED group

A 2nd generation METRx system was used. The surgeon stands on the side of the disc and a paramedian skin incision was marked 2 cm lateral to the midline. An incision was placed based on the size of the working trocar. The fascia is opened followed by serial dilation upto 18 mm which sweeps the muscles laterally and insertion of the working sheath. The sheath is docked over the bone. The lamina is exposed after removing remnant soft tissue. The ligamentum flavum is identified or exposed by further opening the interlaminar window with a karisson. A burr can also be used as an alternative. The ligament and epidural fat are removed. The dura and roots are identified. Fenestration is furthered till the lateral recess. The disc is identified via the extruding fragment and removed. Adequate decompression is confirmed by epidural bleeding (Figure 3).

Data collection and data analysis

Demographics of patients like age, gender, clinical profile, level of disc herniation were recorded. After a thorough clinical and neurological examination, an MRI of the lumbosacral spine (L-S spine) was done to confirm the level of herniation and establish clinic-radiological correlation. A dynamic X-rays of the L-S spine was done to rule out spondylolisthesis. The outcome was assessed using a subjective and an objective scale namely VAS and Oswestry Disability Index (ODI) scales respectively. ODI consists of 10 parameter system.[3] Each of these parameters has a 5 point system. no interference, mild interference, moderate interference, severe interference and inability to perform. The points are summed up and given a score in percentage out of a total of 100 points. Both these scales were used to evaluate the pain and functional status of the patient in the pre-op, post-op day 1 and during follow-up at 3 and 6 months. The patients were also assessed for blood loss, operative time, complications, and duration of hospital stay.

The data were compiled and analysed in Statistical package for social sciences (SPSS) software version 23.0 (IBM, NY). Quantitative data were describes as means and standard deviation, while qualitative data were described as frequency distribution. Means were compared between

the patients of the three surgical groups using one-way ANOVA. A p value of less than 0.05 was considered as statistically significant.

RESULTS

The demographic details of the 75 patients are as listed in the table 1. We observed that all patients presented with low backache along with radicular symptoms.

Table 1: Baseline characteristics of the patients included in the study.

Variable	N	%
Age groups		
≤40 years	22	29%
>40 years	53	71%
Gender		
Male	40	53%
Female	35	47%
Clinical presentation		
Low backache	75	100%
Radiculopathy	75	100%
Motor deficit	10	13%
Sensory deficit	10	13%
Bowel and bladder deficit	0	0%
Disc level		
L3/4	5	7%
L4/5	55	73%
L5/S1	15	20%
Surgery		
Microlumbar disectomy	25	33%
Percutaneous endoscopic transforaminal lumbar discectomy	25	33%
Microendoscopic lumbar discectomies	25	33%

The entire patient population included in the group as per the inclusion criteria had a positive SLR test (<70˚). None of the patients had evidence of bowel or bladder disturbances. 10 patients had history of motor weakness of which 5 had foot drop, 3 patients had weakness of toe dorsiflexion (extensor hallusis longus) and 2 had weakness of extension of at the knee joint. Post-surgery 3 patients had complete recovery in the foot drop while 2 patients had an improvement in the foot drop which achieved complete recovery at 3 months follow-up, both knee extension and toe dorsiflexion improved in the patients in the follow up period. Sensory disturbances showed 5 patients who had decreased sensation along the medial aspect of the leg, 3 with sensory deficit over the dorsum of foot and great toe and 2 patients who had decreased of sensation over the thigh. The sensory symptoms however showed immediate improvement in the postoperative period on evaluation on day 1 post-surgery. The commonest disc level affected was seen to be L4/5 with 55 cases this was followed by involvement of L5/S1 and L3/4 in that order. It was observed that the MED group had the shortest operative time while MLD group had the longest mean duration (Table 2). A comparison of the intraoperative blood loss was negligible in PELD group and 42.80 ml in MED and 63.20 ml in MLD which was strongly significant with a p<0.001. The duration of hospital stay was longest in MLD group with 6.84 days and 4.08 in PELD group which was seen to be the group with the shortest and 4.80 in the MED group.

The MLD group had 6 cases that had complications of which 2 patients had intra-operative dural tear which was dealt with by packing the rent with muscle and fascia and use of glue (Table 3). Two patients had CSF leak postoperatively one of whom was managed conservatively by regular dressings, nursing by strict bed rest with foot end elevation and Acetazolamide 250 mg BID. One underwent re-exploration and muscle fascia packing and glue application. One patient had superficial skin infection which was managed by regular dressings and antibiotics as per culture sensitivity reports. In the PELD group a total of 4 patients had complications with 1 patient having dural tear who needed intra-op conversion to an open approach to deal with the tear which was deemed rather large to be managed endoscopically the same patient had CSF leak which was managed conservatively in the post-operative period. One PELD procedure had to be abandoned due to intra-operative difficulty in continuing with the procedure and converted to an open procedure due to a high riding lilac crest. One patient had post-operative dysesthesia which was transient and improved over a 2 weeks period with use of steroid. The MED group had a total of 5 patients with complications dural tear which required abandoning the procedure and conversion to open surgery for primary closure with packing the rent. One patient had CSF leak who needed resurgery in the postoperative period to seal the rent. One patient had postoperative dysesthesia which was a temporary deficit and improved in the 3 months follow-up period.

Table 2: Comparing duration of surgery, blood loss and duration of hospital stay.

Variables	Type of surgery			Total	P value
	MLD	PELD	MED		
Duration of surgery (min)	67.16±13.46	61.08±12.29	57.64±11.81	61.96±12.99	0.030*
Blood loss (ml)	63.20±17.31	Negligible	42.80±20.61	35 ± 10.48	<0.001**
Duration of hospital stay (days)	6.84±3.23	4.08±2.21	4.80±2.02	5.24±2.77	<0.001**

MLD: Microlumbar disectomy; PELD: Percutaneous endoscopic transforaminal lumbar discectomy; MED: Microendoscopic lumbar discectomies

Table 3: Comparison of complication rate between patients undergoing different surgeries.

Complication (Yes/No)	Type of Surgery			Total
	MLD	PELD	MED	
No	19 (76%)	21 (84%)	20 (80%)	60 (80%)
Yes	6 (24%)	4 (16%)	5 (20%)	15 (20%)
Total	25 (100%)	25 (100%)	25 (100%)	75 (100%)

MLD: Microlumbar disectomy; PELD: Percutaneous endoscopic transforaminal lumbar discectomy; MED: Microendoscopic lumbar discectomies

Table 4: Comparison of VAS scores between the 3 surgical groups.

VAS	Type of surgery			Total	P value
	MLD	PELD	MED		
Pre-op	7.52±1.29	7.88±1.12	8.04±0.97	7.81±1.14	0.263
Post op	4.60±1.70	4.40±1.89	4.72±1.56	4.57±1.70	0.804
3-months Follow-up	2.88±1.30	2.64±1.11	2.40±0.81	2.64±1.09	0.307
6-months Follow-up	1.68±0.85	1.28±0.73	1.24±0.72	1.40±0.78	0.091+

MLD: Microlumbar disectomy; PELD: Percutaneous endoscopic transforaminal lumbar discectomy; MED: Microendoscopic lumbar discectomies

Table 5: Comparing oswestry disability index between the three surgical groups.

Variables	Type of Surgery			Total	P value
	MLD	PELD	MED		
Preop ODI (%)	62.2±14.29	65.60±09	64.00±12.58	63.93±13.23	0.668
Post op ODI (%)	48.40±13.67	37.20±15.48	44.20±7.02	43.26±13.26	0.009**
3 months Follow-up ODI (%)	38.20±10.49	21.00±9.35	21.80±5.37	27.00±11.71	<0.001**
6 months Follow-up ODI (%)	22.80±7.78	11.20±4.39	11.40±4.68	15.13±7.95	<0.001**

MLD: Microlumbar disectomy; PELD: Percutaneous endoscopic transforaminal lumbar discectomy; MED: Microendoscopic lumbar discectomies

We observed that the pain scores were similar in the immediate post-operative, 3 months and 6 months post-operative period (Table 4). We observed significantly higher ODI score for patients in MLD group at in the immediate post-operative, 3 months and 6 months post-operative period (Table 5).

DISCUSSION

Lumbar disc herniation is a common problem in today's population. Though the mainstay of treatment is pharmacological and interventional techniques; surgery is reserved for refractory case. Before the introduction of minimally invasive techniques, an open discectomy was the gold standard for disc herniations. To avoid/minimize complications of this approach; minimally invasive techniques were introduced. In the present study, MLD, PELD and MED were compared. A study conducted by Liang et al patient population, the study was divided into below and above the age of 40 years similar to our study, and it was observed that the patients above 40 years were more commonly affected similarly to the findings in our study.[4] This signifies that this is a degenerative process whose incidence increases with age similar to findings of Goda et al.[5] Various authors observed increased incidence in the young male population (<40 years) due to lack of physical activity and sedentary lifestyle.[6] A comparative study between interlaminar and microlumbar discectomy by Markovic et al of 570 patients showed that the commonest level affected was L4/5 followed by L5/S1 and L3/4 in that order as per our findings.[7]

A study comparing PELD and MED in lumbar disc herniation by Sinkemani et al showed an operative time of 93.89 mins in the former and 46.90 mins in the latter.[8] On comparing these observations to our own, it was noted that our study had a shorter operative time in the PELD group by 32.81 mins, but a longer operative time between the MED groups by 10.74 mins. In his study, the PELD took more time than the MED group which was similar to what we had observed in the analysis of our study population.

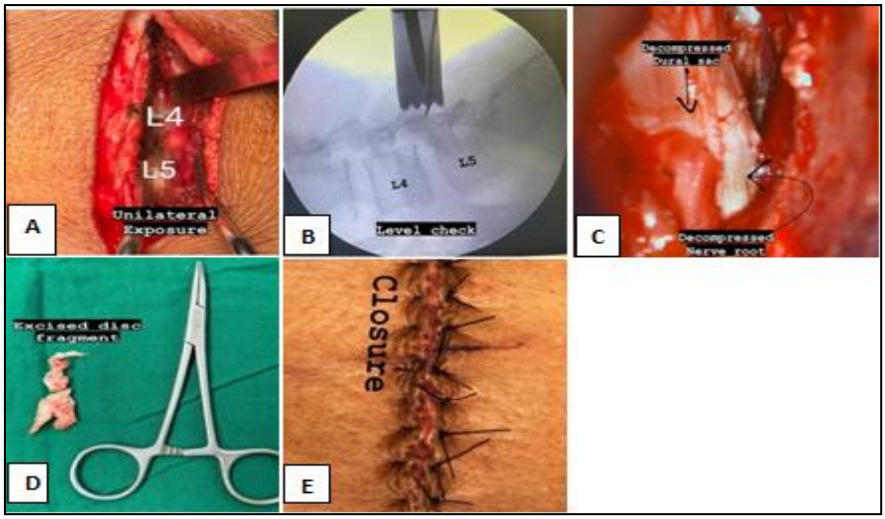

Figure 1: Microlumbar discectomy (MLD).

A: Lumbar L4/5 exposure. B: C-arm level check with retractor system in place. C: Decompressed thecal sac and root after hemilaminotomy. D: extruded disc fragment. E: Closure.

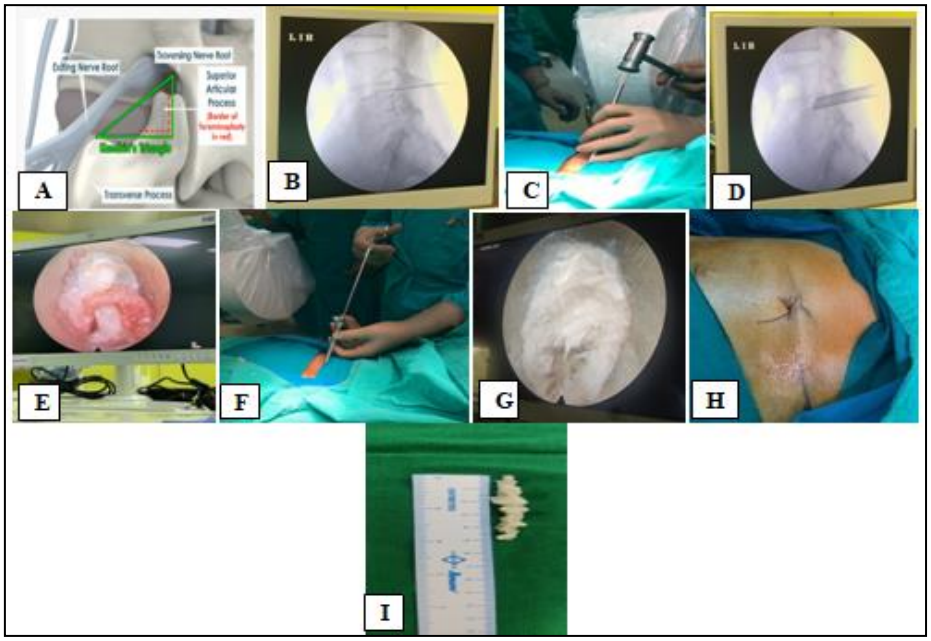

Figure 2: Percutaneous endoscopic interlaminar lumbar discectomy (PELD).

A: Kambin's triangle. B: Level localization with spinal needle. C: Insertion of working channel with a hammer. D: C- arm confirmation of working channel position. E: Videoscopy showing herniated disc segment. F: Removal the herniated disc with a disc forceps. G: Videoscopic evidence of annulus after extruded fragment is removed. H: Closure. I: Extruded disc fragment.

It also was coherent with the fact that the MED mean operative time was lesser than the PELD group. Both the endoscopic modalities were lower when compared to the MLD group in our study. The mean blood loss in our study between the 3 surgical groups was 63.20 ml in MLD, negligible in PELD, and 42.80 in the MED group. The p-value was <0.001 which was highly significant. These findings were compared to a study by Ruetten et al who also compared the 3 surgical methods.[9] He observed that the MLD group had a mean blood loss of 45 ml and the endoscopic groups had negligible blood loss. In comparison, it was noted that in both studies the MLD group had significantly more blood loss as compared to the endoscopic groups.

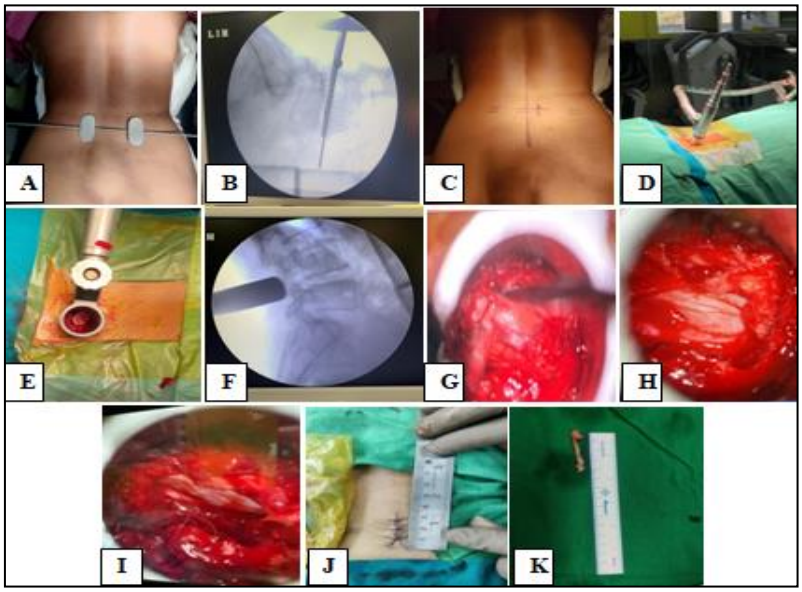

Figure 3: Micro-endoscopic discectomy with tubular retractor system (MED).

A: Level localization. B: C-arm confirmation of retractor system. C: Final skin marking. D: Serial dilator system. E: Tubular retractor system. F: C-Arm confirmation of retractor system at level. G: Compressed thecal sac and root. H: decompressed thecal sac I: Decompressed thecal sac and root. J: Closure. K: Extruded disc fragment.

In our study, the average duration of hospital stay was 6.84 days in MLD, 4.08 days in PELD, 4.80 in MED. The shortest duration was in PELD followed by MED and was highest in MLD. A study by Chen et al observed that the PELD group had a significantly shorter hospital stay than the MED group (8.2±4.2 days vs. 10.9±3.8 days) which was contrasting to our study and was longer than both PELD and MED in our study which had a hospital stay of 4.08 and 4.80 were comparable with interlaminar having a slightly shorter period than transforaminal.[10] In another study by Gibson et al duration of hospital stay was between 0-2 in the PELD group and 0-9 days in the MLD group which was similar to our findings.[11] Liu et al had a total of 11 complications which was comparable to our study.[12] Their endoscopic groups together had 11 and we had 6. The incidence of complication in our study was lesser than in Liu et al endoscopic groups. His endoscopic group also had more complications than our MLD group.[13] A positive observation was that the total number of complications in our group was lesser than that in Ruetten's group. They were also lesser in the MLD group and were comparable to the endoscopic groups when viewed individually. There are a few limitations of this study. First, the surgical technique would depend on the experience of the surgical team and would thus vary between different hospitals. As a result, our conclusions might not be generalizable to other surgical centres. Second, longer follow ups would be required to comment on the long-term clinical outcomes of the patients.

CONCLUSION

MLD is the gold standard for treatment for lumbar disc disease even today due to its familiarity among neurosurgeons; however, reduced tissue destruction and cosmetic demand with equally good results if not better, endoscopy could replace MLD as the first-line treatment for LDH until lesser invasive modality comes to light. In our study PELD had a better blood loss profile in being negligible, a shorter duration of hospital stay, and VAS and ODI profiles between pre-operative, post-operative, and in follow-up periods than MED.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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