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Endoscopic micro-discectomy v/s open discectomy in lumbar disc prolapse: which is better?

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Abstract

Objectives: To evaluate the results of micro-endoscopic discectomy and open discectomy in lumbar disc prolapse.
Methods: This study is a prospectively conducted study of 30 patients operated by a single surgeon with both modalities. The first modality is endoscopic discectomy using METRx system (Medtronic, Sofamor-Danek, Memphis, TN) using 22mm port and the second is open method of discectomy for lumbar disc herniation.
Results: The results were evaluated using ODI (Oswestry Disability Index) and VAS (visual analogue scale 0-10) for back pain and leg pain. Patients were followed up at an interval of 1 week, 2 week, 1 month, 6 months and 12 months post-operatively.
Conclusion: By limiting the tissue manipulation via small incisions and minimal muscle dissection, MED has reported to have better perioperative outcomes, including shorter hospital stay, less blood loss, less pain medicine requirement, decreased surgical site infection rate, quicker return to activities and Early discharge rate than open method. Although MED have some advantages over the open techniques in the perioperative factors, both the techniques are effective and provide similar pain relief and functional outcomes at the end of 2 years.

Keywords: Lumbar disc prolapse, micro-endoscopic discectomy, open discectomy.

Introduction

Humans have been plagued by back and leg pain since the beginning of recorded history. Low back pain is thought to occur in almost 80% of adults at some point in their life. Among chronic conditions, back problems are the most frequent cause of limitations of activity in persons less than 45 years of age [1].
Intervertebral disc disease and disc herniation are most prominent in otherwise healthy people in the 3rd and 4th decades of their life. It accounts for a majority of cases of low backache seen by an orthopaedician in clinical practice and is a major contributor of functional disability [1].
It is the responsibility of the orthopedic surgeon to diagnose and appropriately treat this ailment

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of which lumbar intervertebral disc prolapse is a very common cause.
Discectomy is a common procedure carried out for treatment of lumbar disc prolapse. In lumbar disc surgery pain is the most important indication, but neurologic symptoms and signs are also considered, although they are usually of far less functional consequence. Perhaps because they appear to be more objective than the pain related signs.
There are mainly two methods of discectomy. One is open technique and other one is minimally invasive micro endoscopic technique. There are very few long term studies which show results of these two techniques.
We have evaluated the results of discectomy by open technique as well as minimally invasive techniques like micro endoscopic discectomy utilizing tubular retractors.

Materials and Methodology

This study is a prospectively conducted study of 30 patients operated by a single surgeon with both modalities. The first modality is endoscopic discectomy using METRx system (Medtronic, Sofamor-Danek, Memphis, TN) using 22mm port and the second is open method of discectomy for lumbar disc herniation. The results were evaluated using ODI (Oswestry Disability Index) and VAS (visual analogue scale 0-10) for back pain and leg pain. Patients were followed up at an interval of 1 week, 2 week, 1 month, 6 months and 12 months post-operatively.

Inclusion criteria

1. Single level lumbar disc prolapse.
2. Patients with back pain/radicular pain with positive nerve root tension sign which showed no signs of improvement with conservative management of minimum of 6 weeks which consisted of rest, modification of activities, physiotherapy and analgesics and anti-inflammatory drugs.
3. MRI proved significant disc herniation, extrusion or sequestration.

Exclusion criteria

1. Presence of other associated spine pathology like tumour and infection.
2. Presence of gross spinal deformity.
3. Previous history of spine surgery.
4. Presence of instability.

All patients were assessed clinically. A detailed history was obtained and they were subjected to a thorough clinical examination. Radiological investigations like plain X-Ray: anteroposterior view and lateral flexion and extension view (to rule out instability) and MRI were carried out to confirm the diagnosis and know the level of lesion. Routine preoperative medical fitness and written and informed consent for surgery was obtained. The patients were assessed preoperatively and also postoperatively with the ODI and VAS score for back and leg pain.
All patients underwent either open discectomy or Micro-endoscopic discectomy (MED). Postoperatively the patients were followed up at 1 week, 2 week, 1 month, 6 months and 12 months.

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Intraoperative images: Micro-endoscopic discectomy

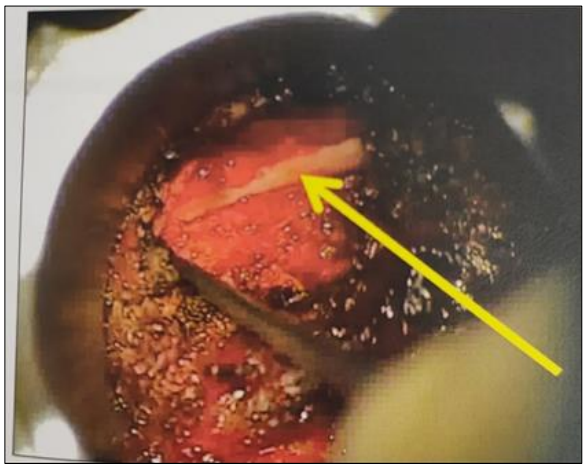

Fig 1: After fenestration nerve root is seen medially

Fig 2: Trying to deliver herniated disc with nerve hook

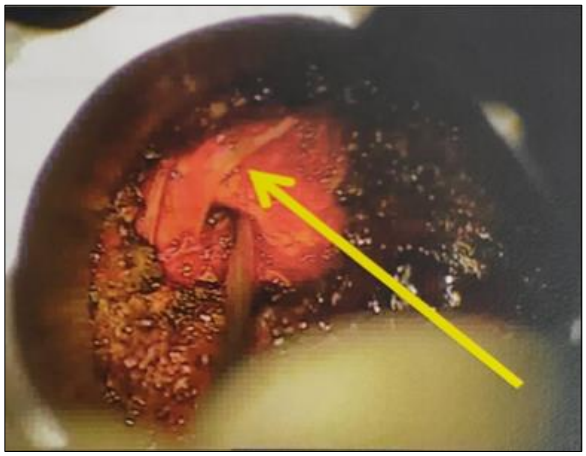

Fig 3: removal of disc herniation with pituitary rongeur

Fig 4: after discectomy nerve root can be observed free

Intraoperative Images: Open Discectomy

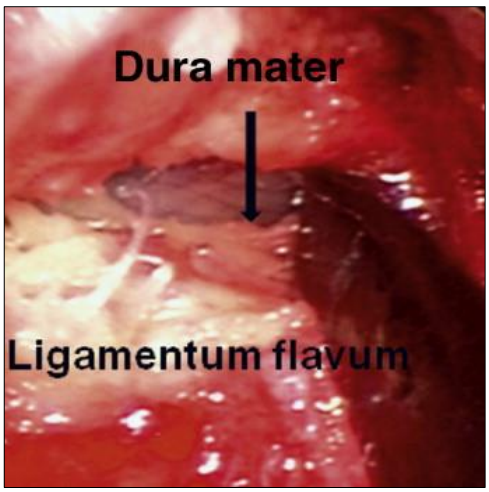

Fig 5: Incision of ligamentum flavum

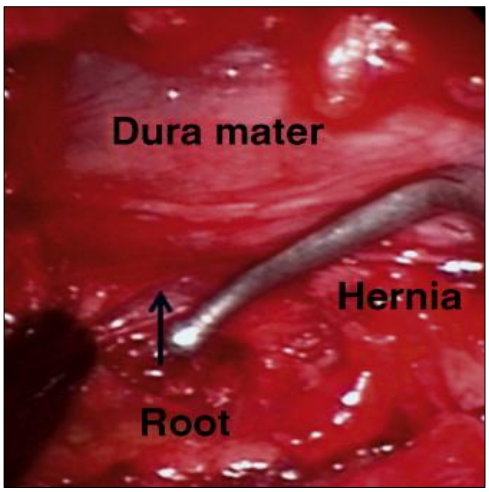

Fig 6: exposure of dura mater and nerve root

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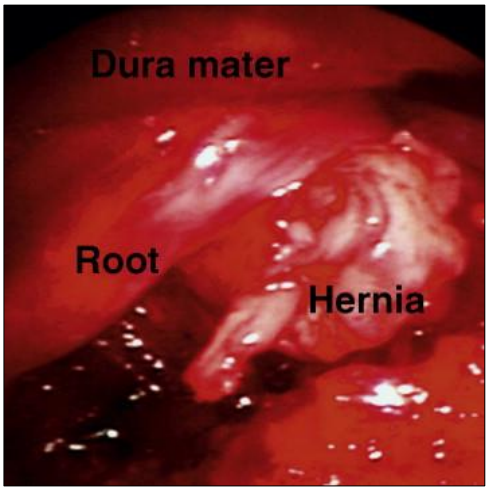

Fig 7: location of discal hernia

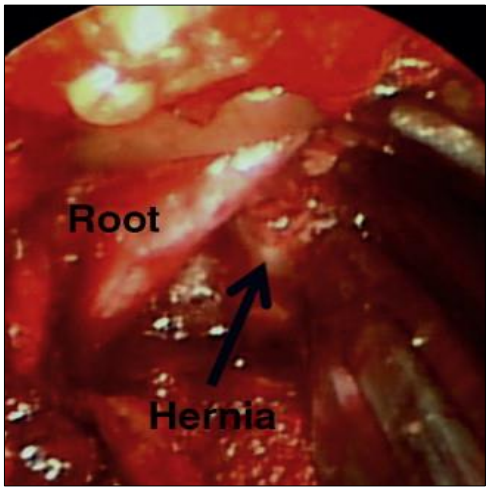

Fig 8: Incision of posterior with common vertebral ligament

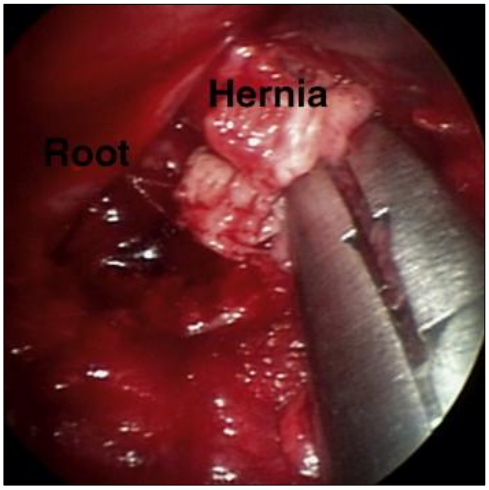

Fig 9: Disc excision

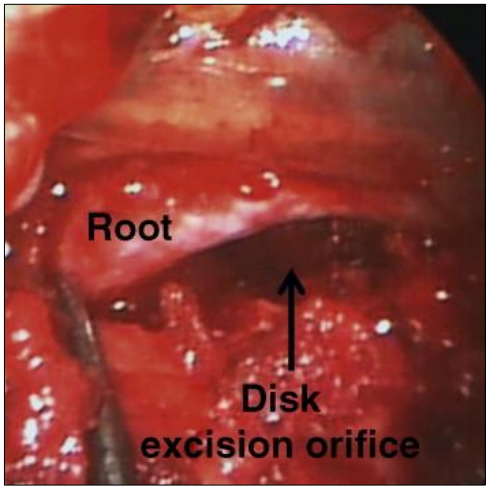

Fig 10: checking nerve root freedom

Results and Analysis

This study consists of 30 cases of lumbar disc prolapse treated by either open or Micro-endoscopic method of discectomy. Average follow-up was 23.13±3.13 months (Range 17-27 months).

Open discectomy

The age of these patients ranged from 28 to 54 years with an average of 48.86 years, female patients were aged between 34 to 48 years with an average of 43.2 years, males were aged between 28 to 54 years with an average of 36.7 years. 66.7% patients were male and 33.3 % were female. Events which precipitated the onset of pain were analyzed. History of lifting heavy weights was present in 5 cases (33.33%) and insidious onset was present in 8 (53.33%) and trauma in 2(13.33%) cases.5 patients (33.33%) out of 15 patients turned out to be labourers. This bodes well with the incidence of lumbar disc prolapse in heavy weight lifters. Other occupations include housewife (20%), driver (13.33%), businessman (13.33%), nurse (6.67%), carpenter (6.67%), student (6.67%) etc. Obesity was measured by visual BMI chart on follow up. In our study 20% patients were obese and 33.33% patients were smokers suggesting associated etiology of disc prolapse.

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Table 1: Distribution of symptoms

Symptoms	Pre-op cases	Pre-op (%)	Postop cases	Post op (%)
Radicular pain	15	100%	3	20%
Low backache	15	100%	4	26.67%
Paraesthesia	4	26.67%	1	6.67%
C/O motor weakness	2	13.33%	1	6.67%
Bowel/Bladder	0	0%	0	0%

Most common symptoms are radicular pain and low backache followed by sensory and motor involvement. All patients had received a trial of conservative treatment in form of bed rest and physiotherapy for minimum of 6 weeks with no significant improvement. Postoperatively there was a vast improvement in all indices with back pain and radiculopathy decreased by almost 74% and 80% respectively.

Table 2: Distribution of signs

Signs	Pre-op cases	Pre-op%	Postop Cases	Postop%
SLRT	15	100%	2	13.33%
Paraspinal muscle spasm	12	80%	1	6.67%
Restricted movement	11	73.33%	1	6.67%
Sensory deficits	6	40%	1	6.67%
Motor deficits	3	20%	0	0%
Absent knee jerk	0	0%	0	0%
Absent ankle jerk	1	6.67%	0	0%
B/B involvement	0	0%	0	0%

Most common sign observed in all patients is positive SLR, para spinal muscle spasm, restricted forward bending respectively. In 6 patients, 4 patients were having paresthesia over L4-L5 dermatomal region and 2 patients were having L5-S1 dermatomal paresthesia.20% patients having motor weakness in terms of weak ankle dorsiflexion and weak toes extension. Postoperatively all but 2 patients could perform SLR without any pain or restriction in normal range of motion. Incidence of muscle spasm also showed a significant reduction. Overall, there was improvement across all signs seen in patients on final follow up. The most common level of disc prolapse was L4-L5 disc followed by L5-S1 disc.

Average duration of onset of symptoms to time of surgery was 6.86 months (2 months-1 year). In our study 93.33% patients had forward bending up to toes in the postoperative period.

One patient who developed superficial infection was having uncontrolled diabetes. She was managed conservatively with regular dressings and antibiotics with control of diabetes. Her wound was healed in 3 weeks without any further sequelae. Patient with recurrent disc herniation was explained for revision operation; however, she refused for surgery and was managed conservatively with analgesic and pregabalin. Her pain was improved over a period of three months with physiotherapy and medications.

Table 3: Vas score for back pain

Pre OP Vas Score			Post OP VAS Score	
VAS Score	No. of Cases	Per%	No. of Cases	Per%
0-3	0	0%	12	80%
4-6	4	26.67%	3	20%
7-10	11	73.33%	0	0%

From the table, the VAS score improved significantly in the majority of the cases, where the preoperative mean VAS score of 73.33% patients was 7 or more, but in the postoperative period

80% patients had a mean VAS score of 3 or less.
The mean preoperative VAS score was 7.46±1.12 while the mean postoperative VAS score was 2.20± 1.20 on mean follow up of 23.13±3.13 months.

Table 4: Vas scale for radicular pain

Pre OP Vas Score			Post OP Vas Score	
VAS Score	**No. of Cases**	**Per%**	**No. of Cases**	**Per%**
0-3	2	13.33%	13	86.67%
4-6	11	73.33%	2	13.33%
7-10	2	13.33%	0	0%

The mean VAS score for leg pain also showed significant improvement with more than 85% patients having score of 4 or above, before surgery. In postoperative period almost 90% patients having mean score of 3 or less.
The mean preoperative VAS score for radiculopathy was 4.93±1.33 while the mean postoperative VAS score was 2.20±1.20 on mean follow up of 23.13±3.13 months.

Table 5: ODI Index

Pre OP ODI score			Post OP ODI score	
ODI Score	**No. of cases**	**Per%**	**No. of cases**	**Per%**
0-10	0	0%	9	60%
11-20	0	0%	5	33.33%
21-30	6	40%	1	6.67%
31-40	3	20%	0	0%
41-50	6	40%	0	0%

Initially, of the admitted patients, 40% had an ODI score of more than 40, with another 20% having ODI between 31-40. After surgery none of the patients had an ODI of above 30, with the vast majority having score below 20.
The mean preoperative ODI score was 36.60±8.02 while mean postoperative ODI score was 9.86±5.62 on mean follow-up of 23.13±3.13 months.

Microendoscopic discectomy

The age of these patients ranged from 22 to 60 years with an average of 43.73 years, female patients were aged between 22 to 60 years with an average of 43.5 years, males were aged between 34 to 55 years with an average of 44.2 years. 33.33% patients were male and 66.7 % were female. Events which precipitated the onset of pain were analyzed. History of lifting heavy weights was present in 6 cases (40%) and insidious onset was present in 7 (46.67%) and trauma in 2(13.33%) cases.6 patients (40%) out of 15 patients turned out to be laborers. This bodes well with the incidence of lumbar disc prolapse in heavy weight lifters. Other occupations include housewife (26.67%), mason (6.67%) etc. Obesity was measured by visual BMI chart on follow up. In our study 20% patients were obese and 33.33% patients were smokers suggesting associated etiology of disc prolapse.

Table 6: Distribution of symptoms

Symptoms	Pre op cases	Pre op (%)	Postop cases	Postop (%)
Radicular pain	15	100%	3	20%
Low backache	15	100%	4	26.67%
Paraesthesia	5	33.33%	1	6.67%

C/O motor weakness	1	6.67%	0	0%
Bowel/Bladder	0	0%	0	0%

Most common symptoms are radicular pain and low backache followed by sensory and motor involvement. All patients had received a trial of conservative treatment in form of bed rest and physiotherapy for minimum of 6 weeks with no significant improvement. Postoperatively there was a vast improvement in all indices with back pain and radiculopathy decreased by almost 74% and 80% respectively.

Table 7: Distribution of signs

Signs	Pre OP cases	Pre OP %	Post OP Cases	Post OP %
SLRT	15	100%	2	13.33%
Paraspinal muscle spasm	12	80%	2	13.33%
Restricted movement	11	73.33%	1	6.67%
Sensory deficits	6	40%	1	6.67%
Motor deficits	3	20%	0	0%
Absent knee jerk	0	0%	0	0%
Absent ankle jerk	1	6.67%	0	0%
B/B involvement	0	0%	0	0%

Most common sign observed in all patients is positive SLR, Para spinal muscle spasm, restricted forward bending respectively. In 6 patients, 4 patients were having paresthesia over L4-L5 dermatomal region and 2 patients were having L5-S1 dermatomal paresthesia.20% patients having motor weakness in terms of weak ankle dorsiflexion and weak toes extension. Postoperatively all but 2 patients could perform SLR without any pain or restriction in normal range of motion. Incidence of muscle spasm also showed a significant reduction. Overall there was improvement across all signs seen in patients on final follow up. The most common level of disc prolapse was L4-L5 disc followed by L5-S1 disc. Average duration of onset of symptoms to time of surgery was 6.46 months (2 months -1 year). 86.67% patients had forward bending up to toes in the postoperative period. Patient with recurrent disc herniation was explained for revision operation; however, she refused for surgery and was managed conservatively with analgesic and pregabalin. Her pain was improved over a period of 4 months with physiotherapy and medications.

Table 8: Vas score for back pain

Pre OP Vas Score			Post OP Vas Score	
VAS Score	No. of Cases	Per%	No. of Cases	Per%
0-3	0	0%	13	86.67%
4-6	3	26.67%	2	13.33%
7-10	12	73.33%	0	0%

From the table, the VAS score improved significantly in the majority of the cases, where the preoperative mean VAS score of 73.33% patients was 7 or more, but in the postoperative period 86.67% patients had a mean VAS score of 3 or less.
The mean preoperative VAS score was 7.53±1.06 while the mean postoperative VAS score was 2.40± 0.91 on mean follow up of 22.31±3.30 months.

Table 9: Vas scale for radicular pain

Pre op vas score			Post op vas score	
VAS SCORE	No. of Cases	Per%	No. of Cases	Per%
0-3	1	6.67%	14	93.33%
4-6	11	73.33%	1	6.67%
7-10	3	20%	0	0%

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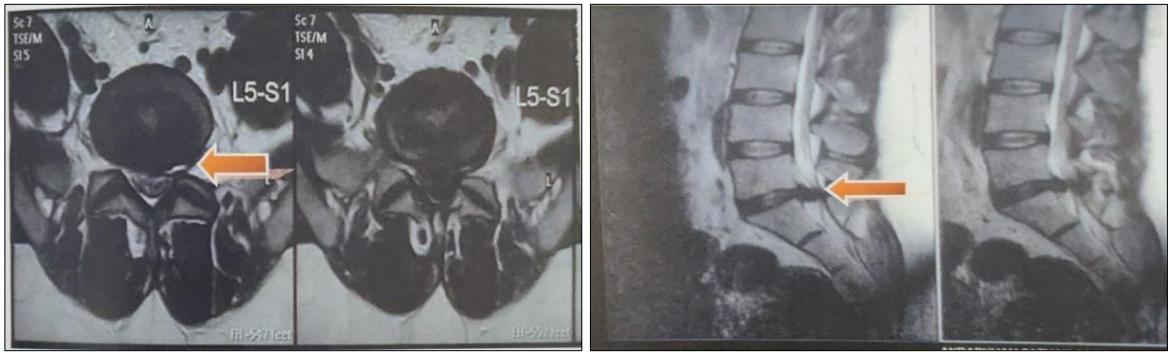
The mean VAS score for leg pain also showed significant improvement with more than 90% patients having a score of 4 or above, before surgery. In postoperative period almost 93% patients having mean score of 3 or less.
The mean preoperative VAS score for radiculopathy was 5.06±1.33 while the mean postoperative VAS score was 1.67±0.97 on mean follow up of 23.31±3.30 months.

Table 10: ODI Index

Preop ODI score			Postop ODI score	
ODI Score	**No. of cases**	**Per%**	**No. of cases**	**Per%**
0-10	0	0%	8	53.33%
11-20	0	0%	7	46.67%
21-30	4	26.67%	0	0%
31-40	6	40%	0	0%
41-50	5	33.33%	0	0%

Initially, n of the admitted patients 33% had an ODI score of more than 40, with another 40% having ODI between 31-40.After surgery none of the patients had an ODI of above 30,with the vast majority having score below 20.
The mean preoperative ODI score was 36.93±7.07 while mean postoperative ODI score was 9.93±4.23 on mean follow-up of 23.31±3.30 months.

Case 1-Endoscopic Discectomy
34 Year male l5-s1 disc prolapse with Right side radiculopathy
Pre-op vas score for back pain: 7.
Pre-op vas score for leg pain: 4.
Pre op ODI score: 36.
Pre op MRI:



Post op vas score for back pain: 3.
Post op vas score for leg pain: 1.
Post op ODI score: 8.
Final follow up at 18 months:

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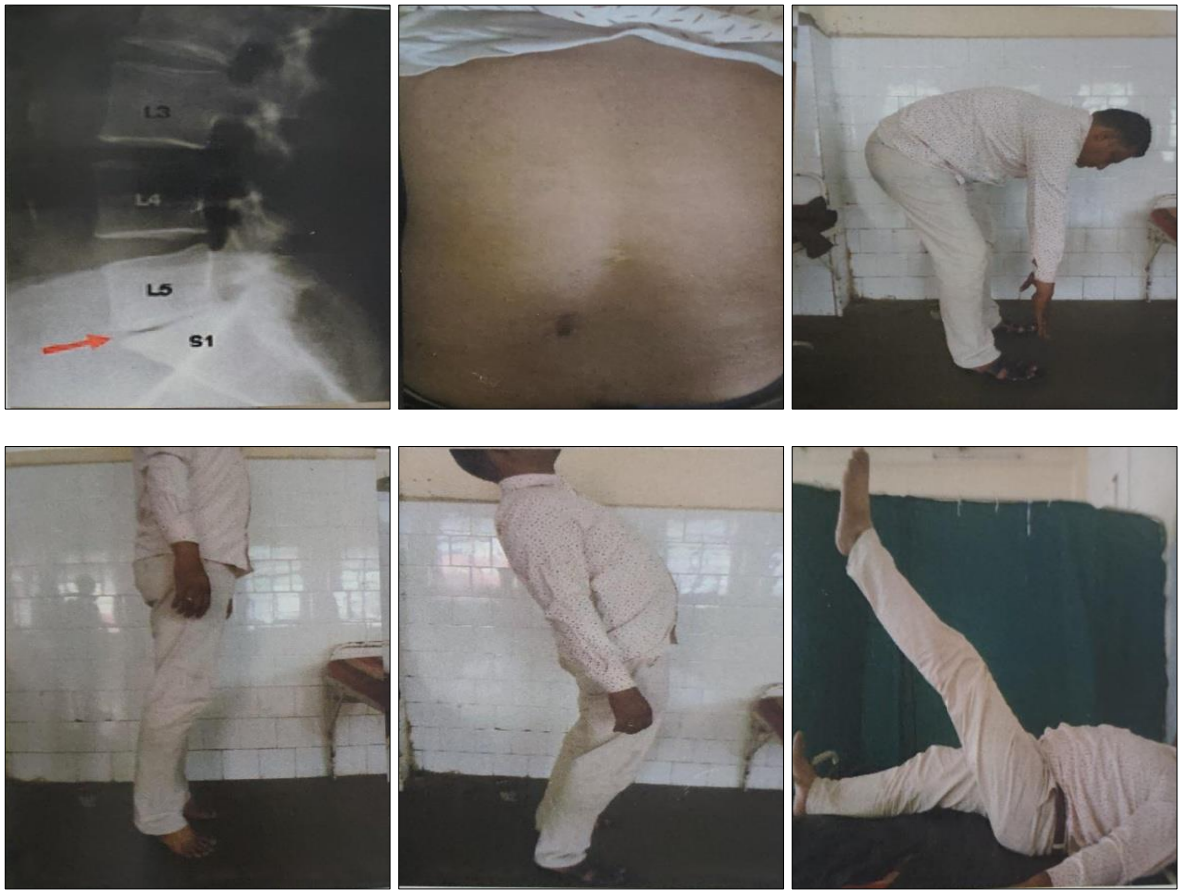
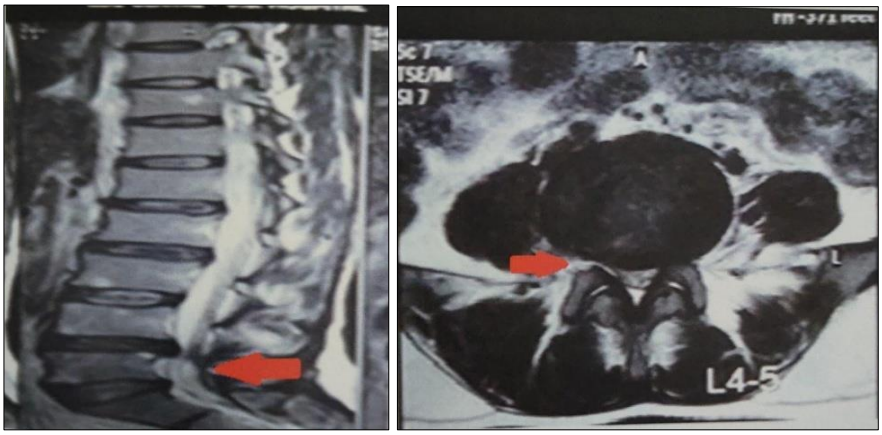


Case 2-endoscopic discectomy:
48 year old male with l4-l5 disc prolapse with Left >right leg radiculopathy
Pre op vas score for back pain: 7.
Pre op vas score for leg pain: 5.
Pre op ODI score: 37.
Pre op MRI l4-l5 disc prolapse.



Post op vas score for back pain: 3.
Post op vas score for leg pain: 3.
Follow up ODI score: 16.
Final follow up at 27 months.

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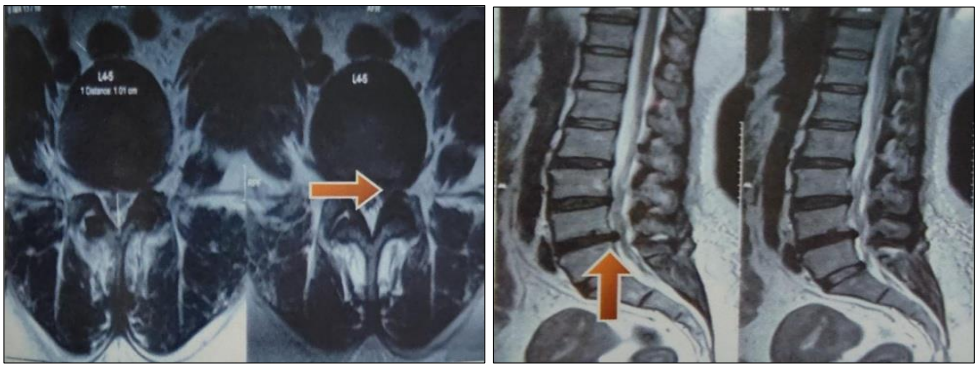
Case 3-open discectomy:
52 year male with rt l/l radiculopathy
Pre op vas score for back pain: 7.
Pre op vas score for leg pain: 5.
Pre op ODI score: 47.
Mri: l4-l5 disc bulge.



Post op vas score for back pain: 1.
Post op vas score for leg pain: 2
Follow up ODI score: 6.
Final follow up at 26 months.

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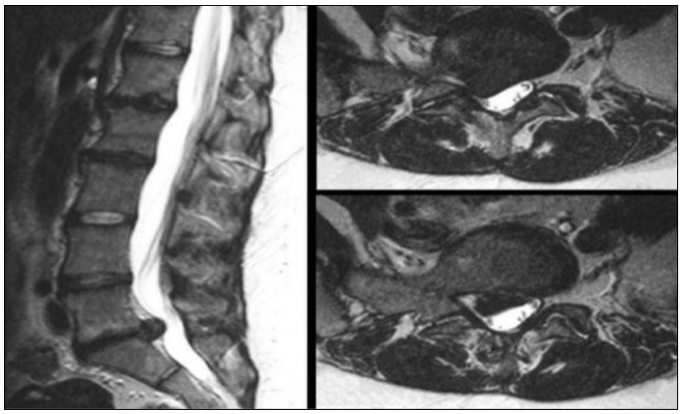
Case 4-open discectomy:
34 year female with rt l/l radiculopathy
Pre op vas score for back pain: 9.
Pre op vas score for leg pain: 6.
Pre op ODI score: 43.
MRI: l5-s1 disc bulge.



Post op vas score for back pain: 1.
Post op vas score for leg pain: 4.
Follow up ODI score: 4.
Final follow up at 19 months.

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Discussion

Low back disorders have become the most common musculo-skeletal Disorder, with a major impact on the costs of healthcare and are a major source of disability [18].

One must recognize that low back pain is a symptom that has many causes, the commonest being a protruded disc. The origins of disc related sciatica with its clear morphologic and clinical neurologic findings were not recognized until the 20th century. After Mixter and Barr in 1934 described disc protrusions and showed the effectiveness of surgery in its management, there has been an increasing enthusiasm to solve sciatica problems surgically by disc excision. Better investigative modalities (myelography/CT/MRI) have led to more accurate diagnosis of disc lesions. They have revolutionized the diagnosis of spinal disease by the accurate visualization of all structures within the neural canal. In addition, it offers the opportunity to outline the neural foraminal and extra foraminal areas and thus guides the surgeon in planning a precise surgical correction, preventing unnecessary exploration of uninvolved levels [19] Results of lumbar disc surgery are excellent when there is agreement between clinical presentation and imaging studies.

A proper surgical technique should lead to satisfactory outcomes, minimal morbidity and good cosmesis. It should be cost effective, able to adjust to patient factors like obesity, ethnicity, etc. The percutaneous systems such as chemonucleolysis [20] percutaneous lumbar discectomy (manual and automated") [8, 9], nucleoplasty and percutaneous laser-assisted discectomy [21] cannot deal with disc fragment extrusions and associated bony and ligamentous compression. The results of these procedures have been very variable and speculative ranging from 29% to 92% success rates [22].

Open discectomy (OD) and micro discectomy remain the current gold standard of surgical treatment [23, 24, 25] the overall results of standard discectomy range from 68% to 95% in different series. Though the results of standard discectomy are equally good, micro

discectomy introduced by Yarsargit and Caspar (1997) is considered gold standard. The results of micro discectomy also range from 88% to 98.5% [26, 27, 28]. Both the procedures are time tested procedures giving a good surgical result in patients having disc prolapse.
Katayama *et al*. [29] compared the results of macro discectomy versus micro discectomy. They concluded that there was no difference between the surgical outcomes of both of them but micro discectomy gave better vision. Magnification and therefore decreased length of incision and tissue invasion. They also found that micro discectomy allowed patients to return early to work with lesser use of postoperative narcotic analgesics. It is but natural that if both procedures have overall the same outcome than the procedure with lesser tissue invasion, lesser length of incision. Lesser use of postoperative analgesics with an early return to work is the procedure of choice.
MED introduced by Foley *et al*. [12], combines standard lumbar microsurgical techniques with an endoscope, enabling surgeons to successfully address and free fragment disc pathologic factors and lateral recess stenosis. The endoscopic approach allows even smaller incision and less tissue trauma.

Conclusion

This is a single center study from a tertiary care center. By limiting the tissue manipulation via small incisions and minimal muscle dissection, MED has reported to have better perioperative outcomes, including shorter hospital stay, less blood loss, less pain medicine requirement, decreased surgical site infection rate, quicker return to activities and Early discharge rate than open method. Although MED have some advantages over the open techniques in the perioperative factors, both the techniques are effective and provide similar pain relief and functional outcomes at the end of 2 years. The sample size of this study is small and more patients in future could be included for better comparison.

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