

ORIGINAL ARTICLE

Clinical Outcome of Fenestration as Minimally Invasive Surgery for Lumbar Disc Herniation: Successes and Obstacles

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ABSTRACT

Objective: To assess the clinical outcome of fenestration as minimally invasive surgery among patients with lumbar disc herniation undergoing microdiscectomy.

Methods: This retrospective observational study was conducted at the Neurosurgery Department of Jinnah Postgraduate Medical Centre (JPMC), Karachi from June 2015 to December 2019. Patients with single-level unilateral side lumbar disc herniation underwent microdiscectomy, age more than 18 years of either gender were consecutively included. The patients were observed for pre and post-surgical pain improvement using a visual analogue scale (VAS). The follow-up was conducted at 3rd months of treatment.

Results: A total of 247 cases were enrolled. The mean age was 47.57 ± 8.22 years. There were 152 (61.5%) males and 95 (38.5%) females. Back pain and radiating leg pain, i.e. 182 (73.7%) and 139 (56.3%) respectively were the most common complaints. Complications were reported in 19 (7.69%) cases. Of these 19 cases, 8 (42.10%) had discitis, 6 (31.57%) had superficial infection, and 5 (26.31%) had dual tear. The VAS score was markedly improved when compared among pre and post-operative cases (7.56 ± 1.01 vs. 2.46 ± 0.84, p-value < 0.001, 95% CI 4.94-5.25).

Conclusion: Our study shows that a microdiscectomy is an effective approach with removal for the unilateral disc with a small incision, early mobilization, low rate to morbidity and success rate based on VAS scoring system was 86.6% ranged from good to excellent.

Keywords: Microdiscectomy, Back Pain, Lumbar Disc Herniation, Fenestration, Visual Analogue Scale.

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INTRODUCTION

Nerve root compression or irritation symptomatically cause leg pain and neurological disturbance in the respective dermatome, numbness, and severe cases may lead to foot drop. It is reported that most of the time, these symptoms occur due to lumbar disc herniation, having a prevalence of 1–3%.¹ Multiple risk factors are identified for lower back pain have been recalled in studies which include body mass index (BMI), age, diabetes, gender, smoking, and weight lifting.²

Low back pain is one of the prominent issues faced by health care throughout the world, as the population ages with time it is observed that suffering from low back pain is also at rise.³ Although during examination, the patient has back tenderness associated with spasm, numbness of the leg, and limited straight leg raising movement cross leg test, femoral stretch test these examination findings are supported by imaging that commonly includes Flexion and extension x-ray of

the lumbar spine and magnetic resonance imaging (MRI) lumbosacral spine is considered reliable for making the diagnosis and help in verification of the lumbar spine degenerative disc level.^{4,5}

Patients who do not respond to conservative management up to 6 weeks minimal or having progress in neurological impairment they can be considered surgical intervention and this can be performed with different surgical approaches that may include endoscopic discectomy, percutaneous discectomy, open discectomy, and microdiscectomy.⁶ Surgeons have tried different methods towards discectomy, to make patient pain free as well as minimize the incidence of redo surgery.⁷

Discectomy-related complications can be as high as 20%, which may include injury to supporting structures or post-surgical back pain, lumbar instability, recurrent herniation, Dural injury, hematoma, and nerve root injury.^{8,9} The severity of the back pain associated with radiating pain to the leg is a disabling situation for the patient and affects not only quality of life but also the

mental health and self-esteem of the individual. The following study focuses on minimizing the pain, approach based on fenestration discectomy and addressing the response of this fenestration discectomy assessed on the visual analogue scale.

METHODS

This retrospective observational study was carried out at the Neurosurgery Department, Jinnah Postgraduate Medical Centre (JPMC) from June 2015 to December 2019. Ethical approval was obtained for conducting the study. The informed consent was also obtained from all study participants after explaining the pros and cons of the surgery. All the patients who had age above 18 years of either gender presented with unilateral lumbar disc with sciatica (diagnosis was supported by MRI of the lumbar spine findings), patient who had a history of failed conservative management were consecutively included in the study. While patients who had lumbar pain either due to lumbar stenosis, fractures of the spine, lumbar spinal tumors or associated nerve lesions or previously operated surgery, and patients having scoliosis or kyphosis were excluded. The MRI lumbosacral spine flexion and extension dynamic x-ray lumbar spine was done for diagnostic purposes. Visual analogue scale from 1-10 helped to assess the severity of pain after enrolment.

All patient's surgery was performed under general anesthesia and chest and pelvis had the support of pillows. All the patients were operated in the prone position. After draping was made, a midline 3cm incision was given, skin, subcutaneous tissue along with lumbar fascia was lateralized with fenestration was made through Ligamentum Flavum. A small part around one-third of superior and inferior lamina was removed to approach desired disc space level. Nerve root retracted medially and prolapsed/extruded disc was removed with the help of pituitary rongeur. Satisfied nerve root was cleared of any compression by disc, ligamentum flavum and osteophytes, after which muscle and skin were closed layer by layer. The closure of the skin was carried out with prolene-1. The post-surgery patient was mobilized very second day of surgery and patients were kept on follow-up for 3 months. The patient was admitted one day before surgery and remained admitted for 2 days post-surgery. SPSS version 24 was used for data analysis. Standard deviation and mean were computed for variables like age of the patients and visual analogue scale scores pre and postoperatively. Frequency and percentages were computed for qualitative variables like gender,

lumbar level, leg numbness, leg pain, back pain, leg weakness, and complications. Inferential statistics were explored using paired sample t-test. p-value ≤ 0.05 was considered significant.

RESULTS

Of 247 patients, the age ranges from 24 to 67 years while the mean age of the patients was 47.57 ± 8.22 years. There were 152 (61.5%) males and 95 (38.5%) females. Lumbar level involvement showed that L5-S1 was involved in the majority of the patients, i.e., 08 (43.7%) patients, followed by L4-L5 in 100 (40.5%), L3-L4 in 19 (7.7%), L2-L3 in 16 (6.5%) patients, and L1-L2 in 4 (1.6%) patients.

Back pain was reported in 182 (73.7%) patients, leg pain by 139 (56.3%), leg numbness by 23 (9.3%), while complications were reported by 19 (7.7%) patients. Of these 19 cases in which complications were observed, 8 (42.10%) had discitis, 6 (31.57%) had superficial infection, and 5 (26.31%) had a dural tear. The patient who had discitis were treated with conservative management, bed rest and antibiotics and analgesics, the patient who had dural tear the incision size was increased, laminectomy was performed and primary repair or fat patch was used to seal the dural tear.

The results showed the mean visual analogue scale score was significantly improved post-operatively as compared to pre-operative score (2.46 ± 0.84 vs. 7.56 ± 1.01 , p-value < 0.001 , 95% CI 4.94-5.25). (Table 1) Stratification concerning demographic and clinical characteristics also showed similar findings. (Table 2)



Figure 1: MRI lumbar spine sagittal image showing degenerative disc at L4 - L5 level Causing severe nerve pain.



Figure 2: Axial view showing that prolapsed disc causing compression

Table 1: Mean difference of VAS score pre- and post-operatively

VAS Score	mean ±SD	p-value	95% CI
Pre-Operative	7.56 ±1.01	<0.001	4.94-5.25
Post-Operative	2.46 ±0.84		

Paired t-test applied, pvalue <0.05 taken as significant

Table 2: VAS score pre and post operatively based on demographic and clinical characteristics (n=247) and associated symptomatology

Variables	VAS Score				
	n	PreOperative	PostOperative	p-value	95% CI
Age, years					
≤50	152	7.62 ±1.01	2.48 ±0.82	<0.001	4.935-34
>50	95	7.45 ±0.99	2.42 ±0.87	<0.001	4.765-29
Gender					
Male	152	7.57 ±1.01	2.43 ±0.87	<0.001	4.945-34
Female	95	7.53±1.01	2.52 ±0.78	<0.001	4.765-28
Lumbar Level					
L1-L2	4	7.50 ±1.29	2.50 ±1.00	0.012	2.097-91
L2-L3	16	7.50 ±1.03	2.37 ±0.72	<0.001	4.455-79
L3-L4	19	7.57 ±0.96	2.53 ±0.90	<0.001	4.465-64
L4-L5	100	7.67 ±0.99	2.58 ±0.82	<0.001	4.845-34
L5-S1	108	7.46 ±1.01	2.35 ±0.86	<0.001	4.865-36
Back Pain					
Present	182	7.54 ±1.02	2.42 ±0.78	<0.001	4.945-31
Absent	65	7.58 ±0.97	2.57 ±0.97	<0.001	4.685-35
Leg Pain					
Present	139	7.57 ±0.99	2.55 ±0.83	<0.001	4.845-23
Absent	108	7.54 ±1.02	2.34 ±0.84	<0.001	4.955-44
Leg Numbness					
Present	121	7.52 ±1.01	2.41 ±0.86	<0.001	4.885-35
Absent	126	7.59 ±1.01	2.52 ±0.82	<0.001	4.865-31
Leg Weakness					
Present	23	7.65 ±0.98	2.39 ±0.98	<0.001	4.675-84
Absent	224	7.54 ±2.47	2.47 ±0.83	<0.001	4.945-25
Complications					
present	19	7.68 ±1.15	2.47 ±0.90	<0.001	4.595-82
Absent	228	7.54 ±0.99	2.46 ±0.84	<0.001	4.925-25

Paired t-test applied, p-value ≤0.05 considered as significant

DISCUSSION

The findings of the current study has reported that the outcome based on visual analogue scale criteria revealed improvement at third month follow-up. In particular, results were better seen in aged more than fifty years with low morbidity than in above fifty years. Moreover, it was observed that majority of the patients were below fifty years that may be due to the workload during that period of age. While during the follow-up, we did not observe adjacent level degeneration may be due to short duration of follow-up in our study while in one of the studies based on adjacent level spinal disc degeneration without involving the fusion, this study showed the rate of reoperation up to four percent due to adjacent level disc degeneration, which was common for upper lumbar level then lower.¹⁰ While in another study, one of the studies based on large sample size showed decompression of disc at a single involved level in elder population had significant morbidity, but overall complications were low. Similarly in our study, morbidity was around seven percent based on the complication that we had during the procedure and recovery.¹¹

At our institute, we did not perform any redo surgery as no patient-reported for redo surgery of the spine that we had in our study while we had our share of complication, we had 19 cases in which complications were observed, majority had discitis, followed by superficial infection, and dural tear. The patient who had discitis were conservatively managed with bed rest, antibiotics and analgesics were used to give relief while the patient who had dural tear, the incision size was increased. Moreover, in these patients, laminectomy was performed and primary repair of dural tear or muscle patch were used. All patients showed smooth recovery post-operatively. However, another study showed that reoperations for single-level disc removal in long term follow-up of around four year study, it was around twelve percent and rate of progression to lumbar fusion following re-do surgery in a long duration of four years was around thirty eight percent.¹²

In our study, back pain was observed in majority of the patients, followed by radiating leg pain, leg numbness and leg weakness. Around seven percent complications among patients improved significantly. Similar to the current study findings, there was a marked improvement in motor weakness, neurogenic claudication, radiculopathy, sensory deficit and back pain following lumbar laminectomy in a previous study.¹³ It is also reported that individuals who had a

microdiscectomy/open discectomy improved less low back pain, pain in their legs but no significant difference was between them. A second surgery was likely, in terms of complication no vast difference was seen in both studies plus the functional outcome was similar.¹⁴ In the current study, results have shown marked improvement in back pain, radiating pain, and numbness which affected the quality of life of the patients as well as daily living of the patient. This study showed a better outcome based on visual analuge scale scoring system. Similarly, other study showed that microlaminectomy as a safe procedure and gave better results on Japanese orthopaedic association scale system compared to extensive procedure laminectomy and discectomy.¹⁵

According to the current study finding, L5-S1 and L4-L5 were most affected levels. However, in a previous study, L4-5 was the most commonly involved level.¹⁶ It is also reported that a considerbale number of patients improvement in their study.¹⁶

In the current study, less operative time, less blood loss and minimize tissue was reported. In a previous study, it was reported that outcome between an endoscopic lumbar discectomy and open micro lumbar discectomy had been similar in functional outcome with some differences in endoscopic which had decrease blood loss.¹⁷ The procedure of minimally invasive surgery was also seen in another study that showed a comparison between minimally invasive and endoscopic surgery and concluded that later one was more time consuming. While for a hospital stay for minimal, they had two to five days and two patients minimally invasive spine procedure had epidural haematoma.¹⁸ In another study it was reported that open method had more chances of a cerebrospinal leak than compared to minimal invasive one.¹⁹

According to another study finding, good functional recovery has been noted after surgical procedure of fenestration discectomy.²⁰ The better outcome was found in females. The study showed better result in the age group less than thirty years and those who were employed to lighter work. Simialrly, in another study, it was also reported that due to increasing number of cases, the lumbar surgery should be performed after thorough workup and proper planning to minimize the chances of failed back syndrome which can act as morbidity for patients. While in our study, the main bulk was of patients who were less than fifty years. This may be due to laborious working age and middle class presented to us while similar to the study female patient had low rate of complication.

The finding of the current study could be highlighted in

the light of limitation that this was a single centre study and due to retrospective nature, a short follow-up duration was reported. Though, a reasonable literature on surgical approach for the lumbar spine surgery is present and multiple surgical options are available. The best choice could be made according to an institutional protocol for patients. This also emphasized that lumbar spine surgeries are one of the most common problem encountered by the neurosurgeon.

CONCLUSION

Our study shows that microdiscectomy is an effective approach with removal for the unilateral disc with a small incision, early mobilization, low rate to morbidity, and success rate based on visual analogue scale scoring system that was ranged from good to excellent in pain relieve which affects the quality of life.

AUTHORS' CONTRIBUTION:

AK & FJ: Proposed topics and contributed in manuscript writing & data collection.

ASP & SH: Contributed in data analysis and manuscript writing.

LR: Assisted in manuscript writing and critical review of manuscript.

ETHICAL APPROVAL: Ethical approval was obtained from Institutional Ethics Review Board of Jinnah Sindh Postgraduate Medical Centre Karachi (No. F.2-81/2020-GEN/26812/JPMC)

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