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Evaluation of Fenestration and Discectomy for Prolapsed Lumbar Intervertebral Disc by Minimally Invasive Procedure

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Abstract

Background: Prolapsed lumbar intervertebral disc is one of the most common problems encountered in medical practice. In orthopaedic practice patients having lesions of lumbosacral region causing low back pain with sciatica are not uncommon since the begdatainning of recorded history. To evaluate the fenestration and discectomy for prolapsed lumbar intervertebral disc by minimally invasive procedure. **Material & Methods:** This prospective observational study was conducted at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh during July 2015 to June 2017. A total of 31 patients with prolapsed lumbar intervertebral disc were included for the study. A 3cm incision was made in midline on back centering the desired space of the spine. The analysis was done according to the standard statistical analysis system. Prior to commencement of this study, the research protocol was approved by the Institutional Review Board of ethics of National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR). **Results:** Mean age was (35.98 ± 8.50) years with the range from 17 to 50 years. Out of 31 patients, 26 (83.87%) patients were male and 05(16.12%) were female. Out of 31 patients 01(03.22 %) had prolapse at the level of L3-L4, 23(74.19%) had at the level of L4-L5 and 07(22.58%) had at the level of L5-S1. In this series the most common causes of muscle weakness in EHL. Out of 31 patients, 22 (70.96 %) patients had weakness in EHL. 08 (25.80%) cases had weakness in FHL and both muscle weakness in 01 (3.22%). Out of 31 patients, 30 (96.78%) patients had preoperative sensory deficit and 03(09.67%) patients had postoperative sensory deficit, which is statistically significant. In preoperative period, moderate pain in 27(83.87%) patients, severe pain in 04(12.90%) patients. In postoperative period had no pain in 22(70.96%) patients, mild pain was noted in 08(25.08%) patients, moderate pain in 01(03.22%) patient. 20(64.51%) patients had para spinal muscle spasm in the preoperative period. Postoperative mean SLR was 81.94 ± 4.774 degree and range was 70^0 -90^0 , which was significantly improved. 29 (93.54%) patients had normal spine movement and 02 (06.45%) patients had restricted movement after 3 months of follow up. The minimum period of duration for follow up was 3 months and maximum duration of follow up was 12 months.. **Conclusions:** By considering all aspects fenestration and discectomy is a better technique in the context of our country with the advantage of less tissue injury, good spinal function, smooth patient recovery, improve working status with early rehabilitation and maintain clinical efficacy.

Keywords:- Fenestration, Discectomy, Invasive, Prolapsed Lumbar Intervertebral Disc.

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INTRODUCTION

Prolapsed lumbar intervertebral disc is one of the most common problems encountered in medical practice.[1] In orthopaedic practice patients having lesions of lumbosacral region causing low back pain with sciatica are not uncommon since the beginning of recorded history. Hippocrates (460-370 BC) was probable the first to mention sciatica and low-back pain. A.G. Smith was the first to perform a successful laminectomy in 1829 in the United States.[2] Majority of cases the backache is associated with degeneration of the intervertebral discs in the lower lumbar spine. This is an age-related phenomenon that occurs in over 80 percent of people who live for more than 50 years and in most cases it is asymptomatic. Overall, degeneration of the lumbosacral discs correlates closely with age. This process begins surprisingly early in life and increases gradually with age.[3] Approximately 20% of teens aged 11-16 years will begin to have mild signs on imaging, whereas 10% of 50-year-olds and 60% of 70-year-olds will have signs of severe degeneration. Back pain is second only to the common cold as a cause of work loss and results in more loss of productivity than any other medical condition. It has been estimated to result in 175.8 million days of restricted activity annually in the United States. Prolapse of disc occur primarily in the second through the fifth decades of life and have a slight male preponderance. Disc prolapse at the L4-5 level has been shown to be the most commonly herniated disc, resulting in L5 radiculopathy and at L5-S1 level is second in frequency of herniation.[4] Approximately 70% - 80% people have experienced low back pain at some point in their life.[5] Prolapsed lumbar intervertebral disc is one of the most important causes of low back pain. The disease itself run through periods of remission and recurrence, and significantly influenced by level and type of activity and work status. In earlier stages, the symptoms can be controlled and treated adequately by rest, analgesics, co-analgesics, exercises, physiotherapy and by other conservative means. Data suggest that aggressive treatment between 4 weeks and 6 months is necessary for patients with low back pain.[6] But after failed conservative treatment or having a neurological deficit or significant loss of daily activities urges the need for surgical decompression of compressed nerve root.[7,8] The concept of mini-incision came forward in the field of minimally invasive surgery which concentrates towards cosmesis, less tissue damage keeping optimal neurological outcome. The minimally invasive procedure can be categorized as percutaneous, endoscopic and minimal access (open) technique.[9,10] The minimally invasive procedure needs special theatre set up and advanced equipment and in open technique it is done by using an operating loupe or operating microscope. In our context of economic and social status, in this series minimally invasive discectomy was done by minimal access (open) technique in direct vision without using the special advanced equipment.

MATERIAL AND METHODS

This prospective observational study was conducted at National Institute of Traumatology and Orthopedic Rehabilitation (NITOR), Dhaka, Bangladesh during July 2015 to June 2017. A total of 31 patients with prolapsed lumbar intervertebral disc were included for the study according to following

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inclusion and exclusion criteria. Aim of the study was to evaluate the fenestration and discectomy for prolapsed lumbar intervertebral disc by minimally invasive procedure. Follow up visits has been carried out at 15 days, 1 month, 3 months, 6 months, 9 months and 12 months postoperatively. A 3cm incision was made in midline on back centering the desired space of the spine. Skin and subcutaneous tissue were incised along the line of skin incision. Deep fascia and supraspinatus ligaments were cut by unipolar diathermy. The Para spinal muscles were dissected subperiosteally from spinous process and lamina at the desired level and side to be explored. The muscles were then retracted by self-retaining retractor from the midline. Data was collected, compiled and tabulated according to key variables and functional assessment scoring system. The analysis was done according to the standard statistical analysis system. Paired t-test for quantitative data and wilcoxon signed-ranked test for qualitative data were done for significance test, and P value < 0.05 was regarded as statistically significant. Prior to commencement of this study, the research protocol was approved by the Institutional Review Board of ethics of National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR).

Inclusion Criteria

- Traumatic and degenerative cause of prolapsed lumbar intervertebral disc.
- Single level of disc involvement
- Positive radiology and imaging – MRI or CT scan.
- Patient of both sex – male and female.
- Age – between 16 - 55 years.

Exclusion Criteria

- Disc herniation from tumour and infection.
- Two or more level of disc involvement.
- Age below 16 years and above 55 years.
- Uncontrolled comorbidity – such as uncontrolled hypertension, uncontrolled diabetes mellitus.
- Patient having previous single or more level discectomy.

RESULTS

Out of 31 patients 3 patients (09.67%) were aged below 25 years, 11 (35.48%) aged 26-35 years, 13 (41.93%) aged 36-45 years and 4 (12.90%) aged 46-55 years. Mean age was 35.98 ± 8.50 years with the range from 17 to 50 years [Table 1]. Out of 31 patients, 26 (83.87%) patients were male and 05 (16.12%) were female [Figure 1]. Out of 31patients 06 (19.35%) were heavy worker, 09 (29.03%) farmer, 11 (35.48%) sedentary worker and 05 (16.12%) house wife [Table 2] Out of 31 patients 01 (03.22 %) had prolapse at the level of L3-L4, 23 (74.19%) had at the level of L4-L5 and 07 (22.58%) had at the level of L5-S1 [Figure 2]. On X-ray all patients had obliteration of lumbar lordosis, 17 (54.83%) patients had reduced disc space at the level of prolapse and 15 (48.38%) patients had marginal osteophyte formation [Table 3]. In this series the most common causes of muscle weakness in EHL. Out of 31 patients, 22 (70.96 %) patients had weakness in EHL. 08 (25.80%) cases had weakness in FHL and both muscle weakness in 01 (3.22%). All patients had muscle weakness at affected level but postoperatively 04 (12.89%) patients had muscle weakness ($p < 0.05$) [Table 4]. The distribution of patients having most of 17(54.83%) patients had the sensory deficit at L5. Sensory deficit at the level of L4 was 02(06.45%) and that of S1 was

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08(25.80%). Sensory deficit at the level of both L5 &S1 was 03(09.67%) and 01 (03.22%) patient had no sensory deficit. Out of 31 patients, 30(96.78%) patients had preoperative sensory deficit and 03(09.67%) patients had postoperative sensory deficit, which is statistically significant [Table 5]. In preoperative period, moderate pain in 27(83.87%) patients, severe pain in 04(12.90%) patients. In postoperative period had no pain in 22(70.96%) patients, mild pain was noted in 08(25.08%) patients, moderate pain in 01(03.22%) patient. Statistical paired t-test value was significant; P value was < 0.05 [Table 6]. In this study, 20(64.51%) patients had para spinal muscle spasm in the preoperative period, whereas no patient had any spasm in 3 months postoperatively. The success rate was 100% and the result was statistically significant [Table 7]. Mean SLR in preoperative period was 45.97 ± 11.137 degree with the range from 30^0 -60^0 . Postoperative mean SLR was 81.94 ± 4.774 degree and range was 70^0 -90^0 , result was significantly improved after 3 months of follow up. Statistical paired t-test value was significant and P value was < 0.05 [Table 8]. In this study, 20(64.51%) patients had restricted spine movement preoperatively, but 29(93.54%)patients had normal spine movement and 02(06.45%) patients had restricted movement after 3 months of follow up, the success rate was 90% and the result was statistically significant [Table 9]. In our study, 01(03.22%) of patient had per operative excess haemorrhage and there was 1(03.22%) case had dural tear [Table 10]. In this study, 02(06.45%) were followed up upto 12 months, 18(58.06%) were up to 9 months and 11(35.48%) followed up upto 6 months. The minimum period of duration for follow up was 3 months and maximum duration of follow up was 12 months [Table 11].

Table 1: Frequency of the patients by age (n=31)

Age (years)	**Frequency**	**Percentage**
16-25	3	09.67
26-35	11	35.48
36-45	13	41.93
46-55	4	12.90
Total	31	100
Mean ± SD (range)	35.98 ± 8.50(17-50 years)	

Table 2: Frequency of the patients by occupation (n=31)

Occupation	**Frequency**	**Percentage**
Farmer	09	29.03
Heavy worker	06	19.35
Sedentary worker	11	35.48
Housewife	05	16.12
Total	31	100

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Table 3: Frequency of the patients by investigation findings (n=31)

SL. No.	Investigations		No. of patients	Percentage(%)
1	Plain Xray of lumbosacral spine			
	Loss of lumbar lordosis		31	100
	Diminished disc space		17	54.83
	Osteophytes		15	48.38
2	MRI of lumbosacral spine			
	Side of disc prolapsed			
	Posterolateral	Right	12	38.70
		Left	11	35.48
	Central		08	25.80

Table 4: Comparison of motor weakness in before and after operation(n=31)

Muscle power	Preoperative		Postoperative		P value	
	No. of patient	Percentage	No. of patient	Percentage		
EHL	22	70.96	02	6.45		
FHL	08	25.80	01	3.22		
Both EHL & FHL	01	3.22	01	3.22	< 0.05	
Total	31	100	04	12.89		

N.B.: EHL – Extensor Hallucis Longus.
FHL – Flexor Hallucis Longus.
Significance test was done using paired t-test.

Table 5: Comparison of preoperative and postoperative sensory deficit(n=31)

Level of sensory deficit	Preoperative		Postoperative		P value
	No. of patient	Percentage	No. of patient	Percentage	
L4	02	06.45	00	00	
L5	17	54.83	01	3.22	
S1	08	25.80	01	3.22	
L5 & S1	03	09.67	01	3.22	< 0.05
None	01	03.22	28	90.32	
Total	31	100	31	100	

Significance test was done using Wilcoxon signed-ranked test.

Table 6: Comparison of pain score in before and after operation (n=31).

Sl. No.	Preoperative VAS Score (mm)	Postoperative VAS Score (mm)	P value	Sl. No.	Preoperative VAS Score (mm)	Postoperative VAS Score (mm)	P value
1	50	0		17	80	30	
2	50	0		18	60	0	
3	60	0		19	70	20	
4	50	30		20	70	0	

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5	60	0	< 0.05	21	60	0	< 0.05
6	50	20		22	70	0	
7	50	0		23	60	20	
8	60	0		24	70	0	
9	50	0		25	70	0	
10	50	0		26	60	0	
11	55	0		27	60	0	
12	60	0		28	70	30	
13	60	40		29	70	50	
14	70	0		30	50	0	
15	80	0		31	60	0	
16	90	0					

VAS scale	**Preoperative**		**Postoperative**		**P value**
	Frequency	**%**	**Frequency**	**%**	
No pain	00	00	22	70.96	
Mild	00	00	08	25.08	
Moderate	27	83.87	01	03.22	< 0.05
Severe	04	12.90	00	00	
Total	31	100	31	100	
Mean ± SD	63.258 ± 8.32		11.306 ± 11.48		

(N.B.: VAS – Visual Analog Scale
Significance test was done using paired t-test).

Table 7: Comparison of preoperative and postoperative muscle spasm (n=31).

Spasm	**Preoperative**		**Postoperative**		**P value**
	Frequency	**%**	**Frequency**	**%**	
Absent	11	35.48	31	100	
Present	20	64.51	00	00	< 0.05
Total	31	100	31	100	

Table 8: Comparison of preoperative and postoperative straight leg raising test finding (n=31).

SLR	**Preoperative**	**Postoperative**	**P value**
Mean ± SD	45.97 ± 11.137	81.94 ± 4.774	
Range	30^0 -60^0	70^0 -90^0	< 0.05

Table 9: Comparison of preoperative and postoperative spine mobility (n=31).

Mobility	**Preoperative**		**Postoperative**		**P value**
	Frequency	**%**	**Frequency**	**%**	
Normal	11	35.48	29	93.54	
Restricted	20	64.51	02	06.45	< 0.05
Total	31	100	31	100	

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Table 10: Frequency of the patients by peroperative complications (n=31).

Complications	Frequency	%
Haemorrhage	01	03.22
dural tear	01	03.22
Total	02	06.45

Table 11: Frequency of the patients by postoperative follow-up duration.

Range of duration	Frequency	Percentage
3 months-6 months	11	35.48
6 months-9 months	18	58.06
9months-12 months	02	06.45
Total	31	100
Mean ± SD (range)	6.629 ± 1.76 (3-12 months)	

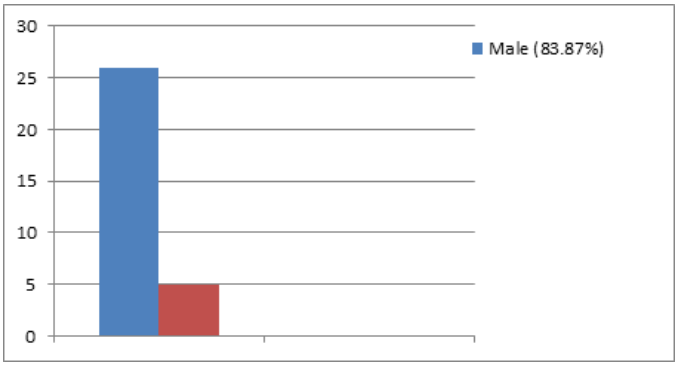

Figure 1: Frequency of the patients by sex(n=31)

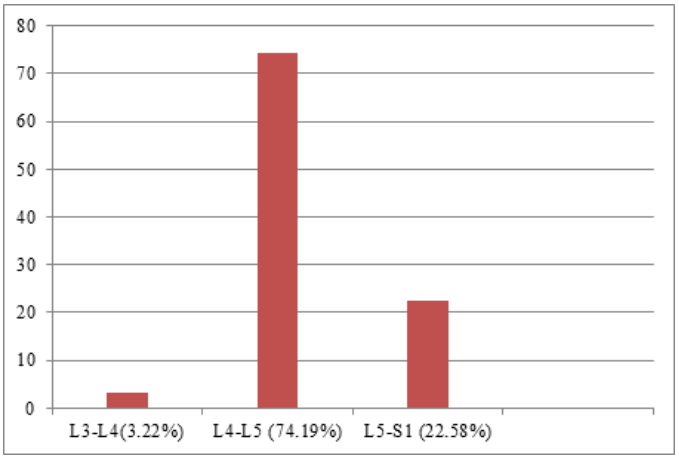

Figure 2: Frequency of patients by level of disc prolapse (n=31)

DISCUSSION

Lumbar intervertebral disc prolapse usually occurs in the active age group of the population, most frequently from 30-50 years. In Nabi et al series all the 13 cases were between 30-60 years.[11] In our present series, mean age was 35.98 ± 8.50 years with the range from 17 to 50 years. Lumbar disc prolapse more commonly occurs in male than in the female. In Nabi et al series all patients were male.[11] In Mariconda et al series out of 180 patients, 128 were men and 52 were women.[12] In this series, out of 31 patients, 26 (83.87%) patients were male. In Nabi et al series showed all patients have definite history of trauma.[11] In this series, out of 31patients, 06 (19.35%) were heavy worker, 09 (29.03%) farmer, 11 (35.48%) sedentary worker and 05 (16.12%) house wife. In our series, most of the cases prolapse occur at L4-L5 level followed by L5-S1 level. Shapiro reported that 64.28% had prolapse at the L4-L5 level, 21.42% had prolapse at the L5-S1 level, 14.28% had prolapse at L3-L4 level.[13] Nabi et al series narrow disc space only in 38.57% of cases.[11] In present series, all cases were specifically diagnosed by MRI findings. On X-ray all

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patients had obliteration of lumbar lordosis, 17 (54.83%) patients had reduced disc space at the level of prolapse and 15 (48.38%) patients had marginal osteophyte formation. In this series, out of 31 patients, 22 (70.96 %) patients had weakness in EHL. 08 (25.80%) cases had weakness in FHL and another group was both muscle weakness in 01(3.22%). All patients had muscle weakness at affected level but weakness 01postoperatively 04 (12.89%) patients had muscle weakness and result was statistically significant (P value < 0.05). Out of 31 patients, 30 (96.78%) patients had preoperative sensory deficit and 03 (09.67%) patients had postoperative sensory deficit, which is statistically significant. Postoperatively pain, muscle spasm, gait, deformity of the spine, SLR, muscle power, spine movement, sensory status was assessed. All patients were followed up at least for 3 visits. Pain was evaluated by using visual analog scale (VAS). Chakrabarty reported postoperative VAS score was 2.96 ± 1.02.[14] In this series, preoperatively pain was present in all cases, but after 3 months of operation pain was absent in 22 cases, mild pain was in 8 cases, moderate pain was in 1 case.[14] Preoperatively pain score was 63.258 ± 8.32 and postoperatively it was 11.306 ± 11.48 which was statistically significant (P < 0.05). Mean SLR in preoperative period was 45.97 ± 11.137 degrees and postoperatively it was 81.94 ± 4.774 degree and ranged 70°-90°, which was significantly improved. Statistical significance is measured by paired t-test and P value was < 0.05. Postoperatively spinal movement and muscle spasm were improved significantly (P < 0.05). Majority of reports suggests the incidence of recurrent disc herniation is 6-13%.[15] In my study period, no patient had recurrent herniation. Regarding complication, most striking is per-operative bleeding, dural tear, wrong level selection, anaesthetic problems, postoperative wound infection, discitis and failed back syndrome.[15,16] O'Connell reported wound infection in 3% of cases, haematoma formation in 2% of cases, pulmonary embolism in 1% of cases, operative pain in back in 1.6% of cases. German et al reported postoperative hospital stay was 1.446±0.09 days. Postoperative hospital stays in my study 11ranging from 2-7 days with mean ± SD value was 2.29 ± 1.18 days. Out of 09 cases of delayed discharge 01 case had urinary retention, 01 case was kept due to peroperative dural tear and other 07 cases had moderate pain. Minimum follow up duration was 3 months and maximum follow up duration was 12 months with 35.48% cases between 3-6 months, 58.06 % cases between 6-9 months, 06.45% cases between 9-12 months with about 64.51 % of patients having at least 6 months follow up.[17]

Limitations of the study

OT set up and the operative facility was not good enough. No monitoring system for assessing nerve root function was available during the procedure. Lack of advanced facilities such as operating loupe and microscope. No post-operative CT or MRI could be done due to socio-economic condition of the patients. Pre-operative hospital stay was long.

CONCLUSIONS

This method will enhance neurological recovery, reduce pain and improve working status with early rehabilitation. Neurological recovery was better in operative patients. Post-operative hospital stay was minimal, lower in intensity of pain, lesser complications and early

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return to activity. By considering all aspects fenestration and discectomy by mini-incision is a better technique in the context of our country with the advantage of less tissue injury, good spinal function, smooth patient recovery, improve working status with early rehabilitation and maintain clinical efficacy.

Recommendations

The study should be conducted with a large sample size. The study should be conducted with long-term follow up. Patients with single level prolapsed lumbar intervertebral disc should be operated by fenestration and discectomy through mini-incision in indicated cases. The operation should be performed after proper patient selection. Operating microscope & loupe facility should be included.

REFERENCES

1. Bajpai J, Saini S, Singh R. Clinical correlation of magnetic resonance imaging with symptom complex in prolapsed intervertebral disc disease: A cross-sectional double blind analysis. J Craniovertebr Junction Spine. 2013;4(1):16-20. doi: 10.4103/0974-8237.121619.
2. Castro Id, Santos DP, Christoph Dde H, Landeiro JA. The history of spinal surgery for disc disease: an illustrated timeline. Arq Neuropsiquiatr. 2005;63(3A):701-6. doi: 10.1590/s0004-282x2005000400030.
3. Gruber P, Böni T. Ischias. Von der Säftelehre zur Pathomorphologie. Unfallchirurg. 2015;118 Suppl 1:43-52. German. doi: 10.1007/s00113-015-0100-1.
4. Stienen MN, Surbeck W, Tröhler U, Hildebrandt G. Little-known Swiss contributions to the description, diagnosis, and surgery of lumbar disc disease before the Mixter and Barr era. J Neurosurg Spine. 2013;19(6):767-73. doi: 10.3171/2013.8.SPINE121008.
5. Wankhade UG, Umashankar MK, Reddy BS. Functional Outcome of Lumbar Discectomy by Fenestration Technique in Lumbar Disc Prolapse - Return to Work and Relief of Pain. J Clin Diagn Res. 2016;10(3):RC09-13. doi: 10.7860/JCDR/2016/16607.7512.
6. Zheng CJ, Chen J. Disc degeneration implies low back pain. Theor Biol Med Model. 2015;12:24. doi: 10.1186/s12976-015-0020-3.
7. Ropper AH, Zafonte RD. Sciatica. N Engl J Med. 2015;372(13):1240-8. doi: 10.1056/NEJMra1410151.
8. Deyo RA, Weinstein JN. Low back pain. N Engl J Med. 2001;344(5):363-70. doi: 10.1056/NEJM200102013440508.
9. O'Toole JE. The future of minimally invasive spine surgery. Neurosurgery. 2013;60 Suppl 1:13-9. doi: 10.1227/01.neu.0000430305.33208.96.
10. Wankhade UG, Umashankar MK, Reddy BS. Functional Outcome of Lumbar Discectomy by Fenestration Technique in Lumbar Disc Prolapse - Return to Work and Relief of Pain. J Clin Diagn Res. 2016;10(3):RC09-13. doi: 10.7860/JCDR/2016/16607.7512.
11. Lawal YZ, Maitama MI, Ejagwulu FS, Lawal A. Open Laminectomy for Lumbar Spinal Canal Stenosis due to Prolapsed Lumbar Intervertebral Discs. West Afr J Med. 2019;36(1):83-87.
12. Mariconda M, Galasso O, Secondulfo V, Cozzolino A, Milano C. The functional relevance of neurological recovery after lumbar discectomy: a follow-up of more than 20 years. J Bone Joint Surg Br. 2008;90(5):622-8. doi: 10.1302/0301-620X.90B5.20182.
13. Shapiro S. Cauda equina syndrome secondary to lumbar disc herniation. Neurosurgery. 1993;32(5):743-6; discussion 746-7. doi: 10.1227/00006123-199305000-00007.
14. Wankhade UG, Umashankar MK, Reddy BS. Functional Outcome of Lumbar Discectomy by Fenestration Technique in Lumbar Disc Prolapse - Return to Work and Relief of Pain. J Clin Diagn Res. 2016;10(3):RC09-13. doi: 10.7860/JCDR/2016/16607.7512.

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15. Ambrossi GL, McGirt MJ, Sciubba DM, Witham TF, Wolinsky JP, Gokaslan ZL, Long DM. Recurrent lumbar disc herniation after single-level lumbar discectomy: incidence and health care cost analysis. Neurosurgery. 2009;65(3):574-8. doi: 10.1227/01.NEU.0000350224.36213.F9.
16. Daffner SD, Hymanson HJ, Wang JC. Cost and use of conservative management of lumbar disc herniation before surgical discectomy. Spine J. 2010;10(6):463-8. doi: 10.1016/j.spinee.2010.02.005.
17. German JW, Adamo MA, Hoppenot RG, Blossom JH, Nagle HA. Perioperative results following lumbar discectomy: comparison of minimally invasive discectomy and standard microdiscectomy. Neurosurg Focus. 2008;25(2):E20. doi: 10.3171/FOC/2008/25/8/E20.

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