Comparative study between laminectomy and fenestration surgery in lumbar prolapsed intervertebral disc (PIVD)

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Abstract

Background: Comparative study between laminectomy and fenestration surgery in lumbar prolapsed intervertebral disc (PIVD).
Material and method: In this study, 44 cases of Lumbar Prolapsed Intervertebral Disc (PIVD) were admitted and divided into two procedure groups, i.e; laminectomy and fenestration and operated via either of the procedure and the outcome after the surgery was assessed by the Oswestry Disability index (ODI).
Results: In Present study, the fenestration group's ODI score was significantly decreased post-operatively after one month and after 6-12 months with $p<0.05$ with ODI values pre-operatively, post- operatively after one month and after 6-12 months with mean 28.05±4.03, 4.68±2.42 and 3.50±4.11, respectively. In present study, the laminectomy group's ODI score was Significantly decreased post-operatively after one month and after 6-12 months with $p<0.05$ with ODI score values pre- operatively, post-operatively after one month and after 6-12 months with mean 30.05±4.01, 6.27±3.27 and 5.14±5.51 respectively.

Conclusion: No significant difference was found in post-operative after one month and post operative 6-12 months ODI scores between both study groups laminectomy and fenestration with $p>0.05$. Fenestration is advantageous over Laminectomy in perioperative parameters, i.e; less soft tissue injury, less blood loss, less duration of surgery, good spinal function, smooth patient recovery, early rehabilitation
Keywords: Laminectomy, Fenestration, Oswestry Disability index

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Introduction

Low back pain is a very common condition. About 90% of people suffer from it at some point in their lives.[1] It is the second leading cause of medical consultation in the primary care setting and the leading cause of disability worldwide.[2] 80-90% of patients with low back pain usually recover fully within 3 months.[3,4] Among the remaining 10-20%, however, less than 50% return to work, [3,5] but when symptoms persist more than 2 years, the probability of returning to work drops to almost zero.[3,5] Intervertebral disc (IVD) degeneration is the most common cause of chronic back pain.[6-9] PIVD usually occurs dorsally or dorsolaterally in the back, between the fourth and fifth lumbar vertebrae, or between the fifth vertebra and the sacrum.[10]

A laminectomy is a surgical procedure in which the entire posterior (posterior) part of the spinous bone, called the lamina, and/or sometimes the attached ligaments and part of the spinous process is removed to allow visualization of the underlying nerve elements (spinal cord and/or nerve roots emerging from it branches) and intervertebral disc. It is often performed to relieve pressure (compression) on a nerve root or spinal cord that is causing

radiating pain and weakness, as a potential disadvantage of a lumbar laminectomy is that by removing parts of the ligaments and joints, it could lead to lumbar instability that may require a lumbar fusion in the future. [11]

Fenestration with disc excision is quite a reasonable method for surgical treatment of indicated cases of herniated disc. Fenestration offers complete visualization of the nerve root and complete removal of the problematic disc. This procedure does not require much know-how, expertise in instrumentation and techniques.

Love described the extradural herniated disc and invented the interlaminar fenestration for the treatment of lumbar disc prolapse.[12] It is a very safe, effective and reliable surgical technique for the treatment of properly selected patients with a herniated disc. This approach is free of the spinal instability and membrane formation resulting from laminectomy. Disc excision through fenestrations is a procedure that most neurosurgeons and orthopedic surgeons can perform even in small peripheral centers. Thus, this study was conducted to compare the results of laminectomy and fenestration for lumbar PIVD.

Material and method

The study was conducted in the department of orthopaedics of R.D Gardi Medical College and associated C.R.G.H, Ujjain during the year August 2020 to July 2022. In this study, 44 cases of Lumbar Prolapsed Intervertebral Disc (PIVD) were admitted and divided into two procedure groups, i.e; Laminectomy and Fenestration and operated via either of the procedure and the outcome after the surgery was assessed by the Oswestry Disability index (ODI).

Inclusion criteria was patients who opt for surgical treatment of back pain with radiculopathy (MRI proved PIVD with significant compression on either/ both nerve roots), patients not responding to conservative treatment for 6 weeks, all patients of PIVD > 18 years and both sex involved and patients with PIVD associated with neurological deficit.

Exclusion criteria was age < 18 years, patient unwilling for surgery and post-surgery lifestyle modifications, patient medically unfit for surgery, patient with dynamic instability, patients with infection and bleeding disorders and patient who needed revision surgery.

Results

In present study mean age of the cases was 46.75±12.15 years, median age 46.50 years, minimum age 18 year and maximum age was 70 years. Out of 44 cases, 24 were males and 20 were females. Out of 44 cases majority of 18 cases presented L4-L5 segment involved, 11(25.0) with L4-L5, L5-S1, 6 (13.6%) with L5-S1, 5 (11.4%) with L3-L4,L4-L5 respectively and remaining minority at other lumbar levels. Out of 44 cases 7 cases had neurological deficit. Out of 44 cases, 14 cases needed bone graft.

Table 1

SEGMENT INVOLVED	**Group**		**Total**
	LAMINECTOMY	**FENESTRATION**	
L2-L3,L3-4, L4-L5	1	0	1
	4.5%	0.0%	2.3%
L3-L4	2	0	2
	9.1%	0.0%	4.5%
L3-L4,L4-L5	4	1	5
	18.2%	4.5%	11.4%
L4-L5	5	13	18
	22.7%	59.1%	40.9%
L4-L5,L3-L4	1	0	1
	4.5%	0.0%	2.3%
L4-L5,L5-S1	8	3	11
	36.4%	13.6%	25.0%
L5-S1	1	5	6
	4.5%	22.7%	13.6%
Total	**22**	**22**	**44**
	100.0%	**100.0%**	**100.0%**
Chi-square= 14.295, p= 0.027			

There was significant association in segment involved of the cases between fenestration and laminectomy discectomy groups with p<0.05.

There was significant association in using bone graft among the cases between fenestration and laminectomy discectomy groups with p<0.05. In laminectomy group 14 cases used bone graft and no cases in fenestration group. There was significant association in skin incision among the cases between fenestration and laminectomy discectomy groups with p<0.05. In laminectomy group 22 (100.0%) cases had

more than 5 cm skin incision and 1 (4.5%) case in fenestration group with more than 5 cm skin incision.

There was significant association in complication of the cases between fenestration and laminectomy discectomy groups with p<0.05. In laminectomy group 6 (27.39%) cases had complications and 3(13.6%) case in fenestration group had complications.

In present study ODI score for all cases there was significantly decreased ODI score post-operatively after one month and after 6-12 months with p<0.05 in both the groups. There was no significant difference found in between both study groups with p>0.05.

In laminectomy group, According to ODI, post operative ODI after one month 10 (55.6%) had mild disability who had severe disability pre-operatively and after 6-12 month ODI score 2 (9.1%) had moderate disability and 5 (22.7%) had mild disability. In fenestration group, according to ODI, post operative ODI after one month 6 (27.3%) had mild disability pre-operatively who had severe disability and after 6-12 month ODI score 1 (4.5%) had moderate disability pre-operatively who had severe disability.

Discussion

In present study mean age of the cases was 46.75±12.15 years, median age 46.50 years, minimum age 18 year and maximum age was 70 years. Hence the outcomes of both groups were comparable. Similar findings were observed in, **Parisa Azimi et al. (2015)** [13] showed that mean age of the cases was 52.1 years, in fenestration groups cases mean age was 51.9 years and male cases were 46.6% and female 53.4%, in laminectomy groups cases mean age was 52.7 years and male cases were 44.4% and female 55.6%. **Dennis Antony (2016)**[14]revealed that, Majority (80%) of the patients were males. The mean age of the participants was 40.6 years. The mean age of the male patients was 40.75 years (range 32 - 54 years). The female patients had a mean age of 40 years (range 28 - 58 years).

In our study, out of 44 cases, 16 (36.4%) were home maker, 15 (34.1%) were farmer and 13 (29.5%) were laborer. There was no significant association in occupation of the cases between fenestration and laminectomy discectomy groups with p>0.05. In laminectomy group 6 (27.3%) cases were laborer, 8 (36.4%) were farmer and 8 (36.4%) cases were home maker, fenestration group 7 (31.8%) cases were laborer, 7 (31.8%) were farmer and 8 (36.4%) cases were home maker. Findings of other studies similar to our study **Dennis Antony (2016)** [14] revealed that, 56% of the patients were engaged in strenuous work. **Deepak C D et al. (2014) [15]** showed that 30% cases were engaged in heavy work, 25% were farmer, 25% cases were house wife, 10% were merchant and 10% were clerk/office work.

In our study. out of 44 cases majority, i.e; 18 (40.9%) cases presented L4-L5 segment involved, 11 (25.0) with L4-L5, L5-S1, 6 (13.6%) with L5-S1 respectively and remaining at the other lumbar levels. There was significant association in segment involved of the cases between fenestration and laminectomy discectomy groups with p<0.05. **Mohammad Aslam et al. (2015) [16]** showed that, the most common level of involvement was L4-L5 followed by L5-S1. On MRI, disc protrusion was commonest finding followed by disc bulge, disc sequestration and disc extrusion.

There was no significant association in neurological deficit of the cases between fenestration and laminectomy discectomy groups with p>0.05. In laminectomy group 4 (18.2%) cases had neurological deficit and 18 (81.8%) cases had no neurological deficit, in fenestration group 3 (13.6%) cases had neurological deficit and 19(86.4%) cases had no neurological deficit. **Deepak C D et al. (2014) [15]** showed that 16 (80%) patients had neurological deficits. L4-5 disc prolapse was the commonest in this study with 95% of the prolapse occurred at this level.

In our study, out of 44 cases, 24 (54.5%) cases had 101-150 ml blood loss, 14 (31.8%) cases had less than 100 ml blood loss and 6 (13.6%) had more than 150 ml blood loss. There was significant association in blood loss among the cases between fenestration and laminectomy discectomy groups with p<0.05. In laminectomy group 5(22.7%) cases had more than 150 ml blood loss and 1(4.5%) case in

fenestration group with more than 150 ml blood loss. Similar finding observed in **Nagi et al.** [17] fenestration had the added advantages of less intraoperative blood loss as compare to laminectomy. On comparing fenestration with laminectomy as described by **Nahar et al(2013) [18]** fenestration had the added advantages of less intraoperative blood loss.

In our study, out of 44 cases 24 (54.5%) cases operated in more than 120 min and 20(45.5%) in less than 120 min. There was significant association in duration of the surgery of the cases between fenestration and laminectomy discectomy groups with $p<0.05$. In laminectomy group 20 (90.9%) cases had more than 120 min duration of surgery and 4 (18.2%) case in fenestration group with more than 120 min duration of surgery. **Nagi et al. [17]** said fenestration had the added advantages of less operative time as compare to laminectomy. On comparing fenestration with laminectomy as described by **Nahar et al(2013) [18]** fenestration had the added advantages of less operative time.

In Present study ODI score for all cases there was significantly decreased pre- operatively, post-operatively after one month and after 6-12 months with $p<0.05$. ODI score was significantly decreased pre-operatively, post-operatively after one month and after 6-12 months with mean 29.05±4.10, 5.48±2.95 and 4.32±4.87 respectively. Present study in laminectomy group ODI score was significantly decreased pre-operatively, post-operatively after one month and after 6-12 months with $p<0.05$. ODI score was significantly decreased pre-operatively, post-operatively after one month and after 6-12 months with mean 30.05±4.01, 6.27±3.27 and 5.14±5.51, respectively. Present study in fenestration group ODI score was significantly decreased pre-operatively, post-operatively after one month and after 6-12 months with $p<0.05$. ODI score was significantly decreased pre-operatively, post- operatively after one month and after 6-12 months with mean 28.05±4.03, 4.68±2.42 and 3.50±4.11 respectively.

There was no significant difference was found in pre-operative ODI category between both study groups with $p>0.05$. In our study, there was no significant difference was found in post-operative after one-month ODI category between both study groups laminectomy and fenestration with $p>0.05$. These results are consistent with our findings in both groups. There was no significant difference was found in post-operative after 6- 12 months ODI category between both study groups laminectomy and fenestration with $p>0.05$. In laminectomy group, According to ODI post operative ODI after one month 10 (55.6%) had mild disability who had severe disability pre-operatively. No disability after 6-12 month was seen in 15 (68.2%), mild disability in 5 (22.5%) and moderate in 2(9.5%)

Figure1: Fenestration

Figure2: Laminectomy

Table 2: Comparison of laminectomy outcome

Studies	Good	Fair	Poor
Ganz et al. [19]	86%	14%	0
Herron et al. [20]	82%	18%	0
Present study	68.2%	22.7%	9.1%

In fenestration group, According to ODI, post operative ODI after one month 6 (27.3%) had mild disability pre-operatively who had severe disability. According to ODI post operative ODI after 6-12 months 1 (4.5%) had moderate disability pre-operatively who had severe disability. No disability after 6-12 month was seen in 20 (90.9%), mild disability in 1 (4.5%) and moderate in 1 (4.5%)

Table 3: Comparison of Fenestration outcome

Studies	Good	Fair	Poor
Richard davis et al [21]	89%	7.7%	3.3%
Pappas et al[22]	77.3%	15.5%	6.6%
Kumaravel.S[23]	86.7%	13.3%	0.0%

Present study	90.9%	4.5%	4.5%

Conclusion

There was no significant difference found in post-operative after one-month ODI category between both study groups laminectomy and fenestration with p>0.05. There was no significant difference was found in post-operative after 6-12 months ODI category between both study groups laminectomy and fenestration with p>0.05.

Fenestration is advantageous over laminectomy in perioperative parameters,i.e; less soft tissue injury, less blood loss, less duration of surgery, good spinal function, smooth patient recovery, early rehabilitation

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