



Outcome of Fenestration versus Laminectomy Discectomy in Patients of Lumbar Disc Herniation

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Abstract

Introduction: Low back pain, affecting nearly 80% of adults at some point, poses significant challenges and limitations, particularly in the younger population. Lumbar disc herniation (LDH) is a common cause, prompting surgical interventions like discectomy. However, the optimal surgical approach remains unclear. This study compares the outcomes of fenestration versus laminectomy discectomy in LDH patients.

Material and Methods: This prospective observational study conducted at a Tertiary Care Centre inclusive of 100 patients with persistent radiculopathy and positive tension signs. Patients underwent either fenestration or laminectomy discectomy. Surgical procedures were performed according to standard protocols. Outcome measures included the Core Outcome Measures Index (COMI) questionnaire and the Oswestry Disability Index (ODI) questionnaire. Statistical analyses were conducted to compare outcomes between the two surgical approaches.

Result: Of the 100 patients, 38% underwent fenestration discectomy and 62% underwent laminectomy discectomy. Both procedures resulted in significant improvements in COMI and ODI scores postoperatively. There were no significant differences in outcomes between fenestration and laminectomy discectomy. Additionally, there was a positive correlation between postoperative COMI and ODI scores for both procedures. However, the study had limitations such as a relatively small sample size and lack of blinding.

Conclusion: Both fenestration and laminectomy discectomy showed significant improvements in outcomes for LDH patients, with no significant difference between the two approaches. These findings underscore the effectiveness of both surgical techniques in treating LDH. However, larger studies with longer follow-up periods are warranted to further validate these results and address existing limitations.

Keywords: Laminectomy Discectomy; Low back pain; intervertebral disc; Spinal Cord; Oswestry Disability

Abbreviations

LDH: Lumbar disc herniation; COMI: Core Outcome Measures Index; ODI: Oswestry Disability Index.

Introduction

Low back pain is the most common type of back pain [1] occurs in almost 80% of adults in some point in their life. Among all chronic conditions, backache problems are the most frequent cause of limitations of activity in persons less than 45-50 years. Only routine examination post-operative checkups and upper respiratory tract symptoms surpass back problems as a cause of visits for consultations. It is a liability upon the Neurosurgeons to diagnose and appropriately cure this ailment of which lumbar intervertebral disc prolapse is a very common cause [2].

Discectomy is a common procedure done for the treatment of lumbar disc prolapse. In lumbar disc surgery pain is the most important indication, but other neurologic symptoms and signs are also kept in mind, although they are usually of far less functional relevance. Perhaps they appear to be more objective than the pain related signs [3].

The surgical options for the management of LDH are the most ambiguous topic in the spine literature, as to whether surgical management should be attempted and if so which surgical approach is optimal. Open discectomy fenestration and laminectomy discectomy is the standard procedure for symptomatic LDH and it involves excision of the portion of the intervertebral disc compressing the nerve root or spinal cord (or both). The big question is if there are any differences in the methods of approach as per their surgical outcomes.

Mostly reported post-operative improvement in neurological signs and functional restoration and recovery from pain has shown striking change. These variations may be governed by several factors, including variability in patient selection and examination methods, but this is difficult to determine because methodological details are rarely provided. The reproducibility of neurologic indicators is moderate and values on the value of neurologic signs are divergent [3].

Material and Methods

Study site: Tertiary Care Centre, New Delhi.

Study Design: A prospective Observational Study.

Inclusion Criteria

Patients who had persistent radiculopathy and positive tension signs in straight- leg raising test have been included. There were no restrictions on patient selection with regard

to types of LDH, age or other characteristics.

Exclusion Criteria

Patients who had previous surgery for LDH, severe degenerative narrowing of the disc space or cauda equina syndrome were excluded.

Methodology

This is a study of cases of LDH, between May 2019 to May 2022 who were attended at the neurosurgery clinic of Tertiary care Hospital, delhi and were selected to undergo fenestration discectomy or laminectomy discectomy. The fenestration discectomy or laminotomy discectomy was performed in a standard fashion, by surgeons with National Board certification and senior resident in the presence of professors. Fenestration was performed for patients with lateral disc and with or without extruded fragments and laminectomy was performed for patients with large central or paracentral disc herniations. Patients were assessed pre- and postoperatively at last follow-up based on COMI and ODI measures. The fenestration discectomy or laminotomy discectomy groups were compared

Surgical Procedures

Open discectomy, fenestration and laminotomy discectomy is the standard surgical modality for symptomatic LDH and removal of the portion of the intervertebral disc compressing the nerve root or spinal cord (or both) is done [4]. In laminectomy discectomy, the whole of the lamina was removed along with overlying ligaments. In fenestration, the lamina was removed partially whenever needed, and the herniated fragment was removed after retracting the nerve roots. The remaining nucleus in the disc space was preserved as much as possible. Free fat grafts were sited over the root and the dura at the end of each method to prevent excessive adhesion.

The Core Outcome Measures Index (COMI) Questionnaire

In 1998 the Core Outcome Measures Index (COMI) was designed by an international group to assess pain, function, well-being, disability, and satisfaction for evaluating the treatment for low back pain [5]. It has been validated as an outcome tool in low back pain in Iran [6]. It is a short, self-administered and multidimensional outcome instrument. It consists of 5 subscales including 7 questions that evaluate pain (2items), function (1 item), well-being (1 item), disability (2 items) and satisfaction (1items). The pain score (the highest value out of leg pain and back pain; already scored 0-10) was calculated. For the other items, that scored

1-5 [function, symptom-specific well-being, general well-being, disability (average of social and work disability)] were first re-scored on a 0-10 scale (raw score -1, multiplied by 2.5). The COMI summary score, ranging from 0 (best health status) to 10 (worst health status) is then calculated by averaging the values for the 5 subscales (worst pain, function, symptom-specific well-being, general well-being, and disability). The satisfaction subscale was computed for assessment of treatment outcome.

The Oswestry Disability Index (ODI) Questionnaire

The Iranian version of Oswestry Disability Index (ODI): This is a measure of functionality and contains 10 items. The possible score on the ODI ranges from 0 to 50, with higher scores indicating worst conditions. The psychometric properties of Iranian version of questionnaire are well documented.

Statistical Analysis

For parameters describing the patient population, continuous variables are compared. Since the data is normally distributed T-test is used. Categorical variables are compared using Pearson Chi-square test. In addition, Pearson coefficient test is used for calculating the correlation between ODI and COMI in patients with LDH. Statistical analysis performed where Statistical significance assumed as $p < 0.05$.

This protocol design, tool for data collection, consent forms and patient information sheets will be reviewed by the Institutional Ethics Committee as a part of procedure involved for all researches that require Human protocol studies. Appropriate consent form has been designed for seeking written consent which would be approved by IEC at Indraprastha Apollo Hospital. The participants will be explained the procedure risk involved and the requirements of the study in details with special reference to technical aspect of scientific /medical terms used, only after clarity of the procedure is attained to the satisfaction of participant will he /she be requested to sign the consent form for study. If the patient does not understand English, it will be interoperated in desired language and explained and signed.

Patient confidentiality will be maintained in full. Patient will be given Patient's ID for further reference in any respect. Any data, forms or reports will be identified by PIDs only. All data entries will also be made using PIDs. The data collected on paper and all the data entry shall stay with the researcher and will be filled regularly by the researcher to be kept under safety. All computer entries will also stay with the researcher.

Result

A total of 100 patients were included in the study. Out of this 35% of the patients were female and 65 % were male. Mean \pm SD of age (Years)in female was 50.11 ± 16.46 and male was 50.98 ± 14.10 .

On Charting the number of patients both male and female, having LDH ,showed 3 patients in 10 to 20 years of age (all 3 females), 9 patients in 21 to 30 years of age (6 males, 3 females), 18 patients in 31 to 40 years of age (12males, 13 females), 22 patients in 41 to 50 years of age (17 males, 5 females), 25 patients in 51 to 60 years of age (12 males, 13 females), 10 patients in 61 to 70 years of age (7 males, 3 females), 11 patients in 71 to 80 years of age (7 males, 4 females) and 2 patients in 81 to 90 years of age (2 males, 0 females). (Figure 1)

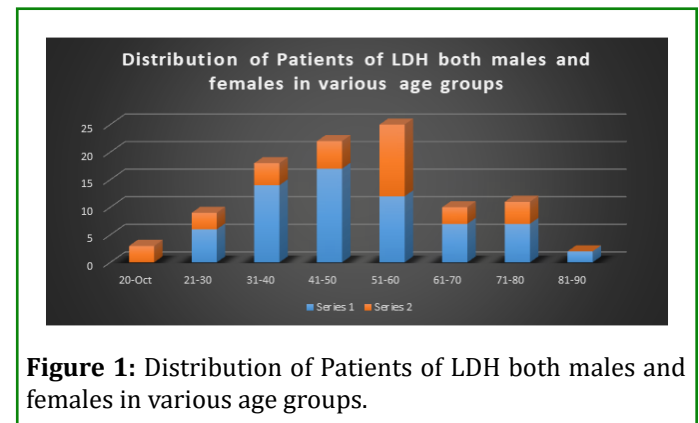


Figure 1: Distribution of Patients of LDH both males and females in various age groups.

Of the studied 100 patients of LDH 38% of these underwent fenestration discectomy and 62% underwent laminectomy discectomy. Out of the patients who underwent either of the discectomy procedures fenestration or laminectomy, 15% of the patients were operated at L3-4 level, 57% of the patients were operated at L4-5 level and 28% of the patients were operated at L5-S1 level. So, it is obvious that maximum number of patients underwent discectomy procedure at L5-S1 followed by L5-S1 and then L4-L5.

Comparison of duration of follow up mean \pm standard deviation of all studied patients was found to be 157.23 ± 40.36 days (155.79 ± 40.28 days for fenestration and 158.11 ± 40.71 days for laminectomy), Median values for total duration of follow up was 150 days (151 days for fenestration and 150 days for laminectomy). Range of follow up was from 94 days to 239 days (94 days to 239 days for fenestration and 96 days to 244 days for laminectomy). T-Test performed, p value was found to be > 0.05 (0.78). On comparison of duration of procedures, mean \pm standard deviation of all studied patients was found to be 55.06 ± 9.40 min (54.21 ± 8.26 min for fenestration and 55.60 ± 10.06 min for laminectomy),

Median values for total duration of follow up was 54 days (54 min for fenestration and 54.5 min for laminectomy) .Range of follow up was from 40 min to 77 min (40 min to 71 min for fenestration and 40 min to 77 min for laminectomy) .T-Test performed ,p value was found to be > 0.05 (0.45)

Comparison components of COMI score pre-operatively and post operatively for both fenestration and laminectomy

discectomies has been depicted in Table 1. Independent T Test applied and p values calculated for COMI scores and individual components of the scores for both the surgical procedures. p values for COMI scores of both surgical procedures is found to be 0.75972716 (p values for individual components: pain-0.66677803, functions-0.9471726, symptoms-0.99289916, general well-being-0.50699604, disability-0.48476213).

S.no	Components of COMI Score (Mean±SD)	Fenestration Discectomy			Laminectomy Discectomy		
		pre-operative	Post-operative	P value Paired t test	preoperative	Postoperative	P value Paired t test
1	Pain	5.21±1.42	3.13±1.07	<0.0001	5.42±1.6 9	3.03±1.19	<0.0001
2	Functions	4.79±1.54	3.08±1.10	<0.0001	4.41±1.38	3.06±0.97	<0.0001
3	Symptoms	5.63±1.58	3.08±0.94	<0.0001	4.76±1.46	3.08±0.89	<0.0001
4	General Well being	5.29±1.41	3.03±0.85	<0.0001	5.43±1.44	3.15±0.88	<0.0001
5	Disability	5.21±1.53	2.82±0.95	<0.0001	4.89±1.25	2.95±0.91	<0.0001
C O M I Score (Post-operative)		5.16±0.78	3.03±0.44	<0.0001	4.98±0.76	3.05±0.46	<0.0001

Table 1: Comparison of COMI score and its components pre-operatively and post operatively after discectomy fenestration and laminectomy discectomies.

Comparative study of individual components of Oswestry Disability Score and the overall score for both the procedures, fenestration and laminectomies is depicted in Table 2. Paired t test applied between the pre-operative and post-operative component scores and overall Oswestry Disability Score and p values were calculated which was found to be significant

(<0.0001) for Pain intensity, Personal Care, Lifting, Walking, Sitting Standing, Sleeping, Social life and Travelling. However, p value calculated for sex life in fenestration discectomy was 0.20 (>0.05) which was insignificant while it was significant, 0.008 (<0.05) for laminectomy discectomy.

S. no	Components of Oswestry Disability Score (Mean±SD)	Fenestration Discectomy			Laminectomy Discectomy		
		Pre-operative	Post-operative	P value Paired t test	Pre-operative	Post-operative	P value Paired t test
1	Pain intensity	3.82±1.16	1.84±0.87	<0.0001	3.77±1.16	1.84±0.87	<0.0001
2	Personal Care	3.76±1.17	1.50±0.70	<0.0001	3.69±1.06	1.50±0.70	<0.0001
3	Lifting	3.53±1.25	1.48±0.86	<0.0001	3.45±1.15	1.48±0.86	<0.0001
4	Walking	3.37±1.30	0.97±0.90	<0.0001	3.11±1.16	0.97±0.90	<0.0001
5	Sitting	3.55±0.92	1.42±0.92	<0.0001	3.61±1.06	1.42±0.92	<0.0001
6	Standing	3.29±1.39	1.37±0.85	<0.0001	3.31±1.29	1.37±0.85	<0.0001
7	Sleeping	3.66±1.21	1.40±0.90	<0.0001	3.34±1.21	1.40±0.90	<0.0001
8	Sex Life	1.55±0.89	1.35±0.89	0.2	1.79±1.04	1.35±0.89	0.008
9	Social life	3.11±1.08	1.21±0.68.	<0.0001	2.90±1.25	1.21±0.68.	<0.0001
10	Travelling	3.26±0.95	1.32±0.86	<0.0001	3.00±1.04	1.32±0.86	<0.0001
Oswestry Disability Score		32.89±4.20	14.29±3.08	<0.0001	31.98±4.96	13.87±2.92	<0.0001

Table 2: Comparison of and Oswestry Disability Score its components pre-operatively and post operatively after discectomy fenestration and laminectomy discectomies.

A correlation between the surgical outcome as indicated by the post-operative COMI scores and Oswestry Disability scores for the Fenestration Discectomy and Laminectomy Discectomy can be established. Pearson's coefficient of correlation was calculated for the same between the post-

operative COMI Scores and Oswestry Disability Scores. Pearson's coefficient of correlation (r) for fenestration discectomy was found to be 0.28331034 and the same was 0.1636143 for laminectomy discectomy. (Table 3)

S. no	Procedures	Post-operative Score Indicative of surgical outcome		Pearson's coefficient of correlation
		COMI Score (Mean±SD)	Oswestry Disability Score (Mean±SD)	
1	Fenestration Discectomy	3.03±0.44	14.29±3.08	0.28331034
2	Laminectomy Discectomy	3.05±0.46	13.87±2.92	0.1636143

Table 3: Correlation between the post-operative COMI Scores and Ostwestry Disability Scores using Pearson's coefficient of correlation (r) for both fenestration and laminectomy discectomy procedures.

Discussion

In the present study, 100 patients of low backache due to lumbar disc herniation were studied at the department of Neurosurgery at Tertiary care Hospital, New Delhi.

On inspecting the distribution of the complaint among the sex, male and female, it is indicative of a higher prevalence of low backache due to lumbar disc herniation in males. This finding is consistent with the findings of study by M.Teraguchi, N.Yoshimura, H.Hashizume, S.Muraki, H.Yamada, A.Minamide which suggested 69.1% men having disc herniation at l4-l5 level [7].

On the comparison of Mean±SD ages it was found to be 50.68 ± 15.45 years for all the studied patients (50.11±16.46 years in females and 50.98±14.10 years in males). Median value of age for the entire studied patient population was 51.50 years, 52 years for females and 49 years in males. This corroborates closely well with the study by Jungindro Singh Ningthoujam, Ajit Singh Naorem, Shugeta Devi Ningthoukhongjam wherein studied females were having mean age of 52.49 (±13.34) years and median age of 52 years [8].

In order to study the demographic distribution of LDH among the various age groups in the studied patient population, frequency of patients was plotted against various age groups and it showed a bell curve suggestive of normal distribution where the top of the curve indicated the age group having maximum probability of including the patients in a studied population which here is 51-60 years age group. All the other occurrences are symmetrically distributed around the mean, creating a downward sloping curve on each side. This finding was consistent with the study by Jungindro Singh Ningthoujam, Ajit Singh Naorem, Shugeta Devi

Ningthoukhongjam. 38% of the studied patients underwent fenestration discectomy while 62% underwent laminectomy discectomy [8].

Discectomy, fenestration or laminectomy was performed most commonly at L4-L5 level (57% in the present study) which is concordant with the study by Yi-Xiang J Wang, MD,1, James F Griffith, MD,1 Xian-Jun Zeng, MD,1,2 Min Deng, MD while only 15% underwent surgery for lumbar disc herniation at L3-L4 level which was minimum [9].

On making a comparison for the mean values of duration of follow up for both the discectomy procedures, no significant difference was noted (p value-0.781). Similarly mean values of the duration surgery for both the procedures showed no significant difference (p value-0.456) which is a finding concordant to that in the study by Azimi P, Mohammadi H, Nayeb-Aghaei [10]. Most of the studies on microdiscectomies had a surgical duration of 40 to 120 minutes which is more or less consistent with the findings in the present study.

The success rate of lumbar discectomy is about 70 to 90% [11,12]. An estimation of surgical outcome for laminectomy discectomy and fenestration discectomy was done by calculating preoperative and post-operative scores like COMI score and Oswestry Disability Score for patients who underwent the respective procedures. There was a significant improvement in the COMI SCORES of patients including significant change in the values of individual components of the score that is pain, function, symptoms specific, well-being quality of life, disability for both the procedures, fenestration discectomy as well as laminectomy discectomy.

On similar lines significant improvement in the Oswestry Disability Scores of patients including significant change in the values of individual components of the score that are for Pain

intensity, Personal Care, Lifting, Walking, Sitting Standing, Sleeping, Social life and Travelling for both the procedures, fenestration discectomy as well as laminectomy discectomy. An exception to this trend of significant improvements of individual components of Oswestry Disability Scores was noted in case of sexual life. Improvement in sex life score in fenestration discectomy was insignificant (p value- 0.20) while it was significant (p value- 0.008) for laminectomy discectomy.

Precisely we can infer that in the present study both COMI score as well as the Oswestry Disability Score showed significant improvement, or in other words, the surgical outcome was found to be significantly better for either of the discectomy procedures, fenestration and laminectomy. Both techniques relieved the symptoms of low backache by relieving the tension on the nerve root by the herniated disc. The finding is again found to be consistent with the study by Azimi P, Mohammadi H, Nayeb-Aghaei H [10].

Postoperative COMI SCORE and Oswestry Disability Score were correlated using Pearson's coefficient of correlation and surgical outcome as determined by the post-operative scores were found to be correlated affirmatively. This positive correlation was indicated by positive values of Pearson's coefficient of correlation (r) which was found to be 0.28331034 for fenestration discectomy and 0.1636143 for laminectomy discectomy. The change in the ODI good correlated with change in the COMI as in the study by Lozano-Álvarez et al (r=0.73; P<0.01), and Deyo et al. (r = 0.60; P<0.01) (3). The mortality rate for lumbar laminectomy is between 0.8% and 1% [13]. However, in this study no mortality rate was observed.

The present study has some limitations. First being, a relatively smaller sample size for the purpose, a larger study population is very essential. In addition, larger groups of patients and longer follow-up are essential to confirm these results. The study wasn't double blind but a prospective randomized study, so future endeavors are recommended to consider these issues.

Another unaddressed issue, job and literacy level for filling questionnaires and physical status in two groups if similar could make the results more acceptable and further studies are required to assess this issue. Medical responses as back pain and radicular pain cannot be studied as separate entities. Other associated diseases such as diabetes mellitus were not assessed, and also days of hospitalization in two groups were not evaluated.

Conclusion

- Low backache due to lumbar disc herniation is more prevalent in males compared to females.

- Maximum number of patients were operated at L4-L5 level followed by L5-S1 and L3-L4 respectively.
- Surgical Outcome was significantly good for both fenestration and laminectomy discectomy.
- However, no significant difference was noted between the surgical outcome of fenestration or laminectomy discectomy.

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