Functionality Status and Surgical Outcome of Fenestration versus Laminotomy Discectomy in Patients with Lumbar Disc Herniation

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Abstract

Background & Aim: To assess functionality status and surgical outcome of fenestration versus laminotomy technique based on Core Outcome Measures Index (COMI) in patients with lumbar disc hernia (LDH).

Methods & Materials/Patients: A cross-sectional study was performed between January 2007 and April 2012. A total of 108 patients with a single-level disc herniation were asked to respond to the Oswestry Disabiltiy Index (ODI) and COMI at two points in time: pre- and post-operative assessments. The ODI and COMI were assessed comparing patients' pre- and postoperative scores to determine the functionality status and surgical outcome.

Results: The mean age of patients was 52.4 (SD=10.1) years who underwent fenestration (n=45) or laminotomy discectomy (n=63). The mean clinical follow-up was 27.8 (SD=3.6) months (range 24 - 37 months). Regarding COMI scores, all subgroup values showed statistical significance pre- and postoperative indicating improvements on the outcomes and functionality. The change in the ODI after surgery was strongly correlated with change in the COMI, (r=0.79; P<0.001). The ODI score also was found to be statistically different between the groups in pre-and postoperative (P<0.001) assessment. However, the functionality status rate was similar in both groups.

Conclusion: The findings suggest that fenestration or laminotomy discectomy is an efficacious procedure for treatment of LDH. However, both methods are equally effective in surgical outcome.

Keywords: Functional; Pain; COMI; Lumbar disc hernia

Introduction

Low back pain is the most common type of back pain (1), mainly caused by lumbar disc herniation (LDH). The term LDH refers to the nucleus in the center of the disc pushes out of its normal space (2). Symptoms for LDH include back and leg pain, which may spread out into the hand (3). There are several tools for measuring the performance status or functionality in patients with low back pain that it can be judged to make appropriate informed clinical decisions. In 1998 an international group designed the Core Outcome Measures Index (COMI) to assess pain, function, well-being, disability, and satisfaction for evaluating the treatment for low back pain (4). It has been validated as an outcome tool in low back pain in Iran (5).

The treatment of LDH is the most controversial topic in the spine literature, as to whether surgical treatment should be attempted and if so which surgical approach is optimal (6). Open discectomy as fenestration and laminotomy discectomy is the standard procedure for symptomatic LDH and it involves removal of the portion of the intervertebral disc compressing the nerve root or spinal cord (or both) (7). The question is whether there are any differences in the methods of approach according to surgery outcomes. Thus, the aim of this study was to compare the outcomes of fenestration discectomy versus laminotomy discectomy for LDH based on COMI and ODI over at least 2 year follow-up.

Methods and Materials

Patients and Data Collection

This was retrospective and cross-sectional study. Between January 2007 and April 2012, patients with a single-level disc herniation were attended to the neurosurgery clinic of Imam-Hossain Hospital a large teaching hospital in Tehran, Iran and were selected to undergo fenestration discectomy or laminotomy discectomy. After at least 6 weeks of conservative

therapy, patients who had persistent radiculopathy and positive tension signs in both straight- and crossed- leg raising tests with absence of correlative neurological deficits were included. There were no restrictions on patient selection with regard to types of LDH, age or other characteristics. Patients who had lateral or central stenosis of spinal canal, previous surgery, drug dependency, severe degenerative narrowing of the disc space at the index level, and cauda equina syndrome were excluded. The fenestration discectomy or laminotomy discectomy was performed in a standard fashion (7), by five 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 laminotomy was performed for patients with large central or paracentral disc herniations. Patients were assessed pre- and post-operatively at last follow-up based on COMI and ODI measures and and ODI measures and the fenestration discectomy (n=45) or laminotomy discectomy (n=63) groups were compared. The MacNab scale was used to determine the clinical outcome after surgery (8). The state of satisfaction was graded as excellent, good, fair or poor.

Surgical Procedures

In laminotomy discectomy, the whole or half portion of the lamina was removed respectively 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 (7). In all 39 of 108 cases, the microscope was applied for discectomy.

The Core Outcome Measures Index (COMI) questionnaire

The Core Outcome Measures Index (COMI) is a short, self-administered and multidimensional outcome instrument. It consists of 5 subscale including 7 questions that evaluate pain (2 items), 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 (Table 1) (4, 9).

Table 1. Core Measures Outcome Index

Pain					
1) a. How severe was your back pain in the last week?	0 1 2 3 4 5 6 7 8 9 10 No pain — Worst pain possible				
1) b. How severe was your leg pain in the last week?	0 1 2 3 4 5 6 7 8 9 10 No pain — Worst pain possible				
	1	2	3	4	5
Function					
2) Duration the past week, how much did pain interfere with your normal work (including both work outside the home and housework)	Not at all	A little bit	Moderately	Quite a bit	Extremely
Symptom-specific Well-being					
3) If you had to spend the rest of your life with the symptoms you have right now, how would you feel about it?	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied
General Well-being					
4) How would you rate your quality of life?	very bad	bad	average	good	very good

Disability					
5) During the past 4 weeks, about how many days did you cut down on the things you usually do for more than half the day because of back pain or leg pain (sciatica)	None	Between 1 to 7 days	Between 8 to 14 days	Between 15 to 21 days	More than 21 days
6) During the past 4 weeks, how many days did low back pain or leg pain (sciatica) keep you from going to work or school?	None	Between 1 to 7 days	Between 8 to 14 days	Between 15 to 21 days	More than 21 days
Satisfaction					
7) Over the course of treatment for your low back pain or leg pain (sciatica) how satisfied were you with your overall medical care?	Very dissatisfied	Somewhat dissatisfied	Neither satisfied nor dissatisfied	Somewhat satisfied	Very satisfied

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 (10).

Statistical Analysis

For parameters describing the patient population, continuous variables were compared. Since the data were normally distributed T-test was used. Categorical variables were compared using Pearson Chi-square test.

In addition, Pearson coefficient test was used for calculating the correlation between ODI and COMI in patients with LDH. Statistical analysis was performed by SPSS for windows, ver. 18.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was assumed as p<0.05.

Ethics

The Ethics Committee of Shahid Beheshti University of Medical Sciences approved the study.

Results

In all, 108 patients completed the study. The characteristics of patients and their scores on the COMI, the ODI and affected levels are shown in Table 2.

The demographic distribution of both groups was similar. The mean clinical follow-up was 27.8 (SD=3.6) months (ranging from 24 to 37 months). The demographic distribution of both groups was similar. There was no significant difference in the operation time and blood loss between fenestration and laminotomy discectomy groups. In addition, no significant difference was observed between two groups based on involvement levels (Table 2).

There was no significant difference in preoperative COMI score and the ODI between fenestration and laminotomy discectomy groups. However, in all instances the COMI was able to detect changes after intervention (surgery) indicating improvements in all subscales. The results are shown in Table 3.

The ODI score also was found to be statistically different between the groups in pre-and postoperative (P<0.0001). The change in the ODI correlated strongly with change in the COMI lending support to its good convergent validity (r=0.79; P<0.001) for patients with LDH.

Based on Macnab's criteria, "Excellent", "Good", "Fair" and "Poor" outcome were seen in 32 (71.1%), 10 (22.2%), 2 (4.4%), and in 1 case (2.2%) for fenestration and 43 (68.3%), 14 (22.2%), 4 (6.3%) and in 2 cases (3.1%) for laminotomy discectomy, respectively.

Two patients (3.2%) within laminotomy group had recurrent disk herniations and underwent reoperation; however, it was not observed in fenestration group. No case was observed with missed level surgery. Cauda-equina syndrome occurred in 1 case (0.9%) in laminotomy group; however, it was not observed in fenestration group. In 1 case (1.6%) within laminotomy group dural laceration occurred during surgery which were repaired and no one showed CSF leakage or meningitis. No mortality rate was observed due to surgery.

Table 2. Demographic Data and Postoperative Status of 108 Patients with Lumbar Disc Herniation*

Parameter	Total	Surgery Approach		P-Value
		Fenestration	*Laminotomy*	
No. of patients	108 (100)	45 (41.7)	63 (58.3)	0.2
Mean age in yrs	52.4 ±10.1	51.9 ±9.9	52.7 ±10.2	0.9
Range	22-83	22-78	25-83	
Gender				
Male	49 (45.37)	21(46.6)	28(44.4)	0.7
Female	59 (54.6)	24(53.3)	35(55.5)	0.8
Levels of LDH				
L3–4	8 (7.4)	3 (6.6)	5 (7.9)	0.2
L4–5	61 (56.5)	27 (60.0)	34 (53.9)	0.6
L5–S1	39 (36.1)	15 (33.3)	24 (38.1)	0.1
Operation time (min)		51.4 ± 4.5	56.4 ± 5.1	0.1
Follow-up (months)	27.8 ± 3.6	28.3 ± 3.2	27.4 ± 4.1	0.9
mean ODI				
Preoperative	31.4 ±10.7	31.6 ±10.8	31.2 ±10.6	0.8
Range	20-50	20-50	22-50	
*Postoperative**	13.8 ±11.1	13.4 ±11.1	14.1 ±11.2	0.8
Range	0-23	0-23	0-23	
Mean COMI				
Preoperative				
Pain	4.03 ±0.83	4.07 ±0.81	3.99 ±0.84	0.6
Function	3.82 ±1.3	3.85 ±1.4	3.79 ±1.2	0.6
Symptom-specific well-being	4.5 ±0.36	4.45 ±0.35	4.59 ±0.37	0.3
General well-being	4.4 ±0.36	4.44 ±0.34	4.58 ±0.36	0.3
Disability	3.35 ±1.4	3.37 ±1.38	3.33 ±1.44	0.8
Satisfaction	2.8 ±1.2	2.77 ±1.1	2.83 ±1.2	0.7
COMI	5.86 ±1.3	5.82 ±1.4	5.91 ±1.3	0.8
Range of COMI	3.1-8.6	3.1-8.6	3.2-7.9	
*Postoperative**				
Pain	2.47±1.3	2.38±1.2	2.49±1.3	0.6
Function	2.63 ±1.3	2.58 ±1.3	2.67 ±1.3	0.6
Symptom-specific well-being	3.24 ±1.2	3.21 ±1.2	3.26 ±1.2	0.8
General well-being	3.23 ±1.2	3.21 ±1.2	3.25 ±1.2	0.8
Disability	1.82 ±1.1	1.81 ±1.1	1.83 ±1.1	0.8
Satisfaction	1.9 ±1.0	1.89 ±1.0	1.91 ±1.0	0.8
COMI	3.42 ±1.1	3.41 ±1.1	3.43 ±1.2	0.8
Range of COMI	0.6-4.3	0.6-4.6	0.9-4.3	
COMI	3.42 ±1.1	3.41 ±1.1	3.43 ±1.2	0.839

* Values are the number of patients (%) unless indicated otherwise. Mean values are presented as the mean ± SD. The T-test and Pearson chi-square test with Bonferroni correction were used to test for significant differences between groups. ODI=Oswestry Disabiltiy Index. COMI=Core Outcome Measures Index
** Postoperative at last follow-up

Table 3. Responsiveness to Change for Lumbar Disc Herniation

	Preoperative	Postoperative	
	Mean (SD)	Mean (SD)	P-Value
Pain	4.03 ±0.83	2.47±1.3	< 0.0001
Function	3.82 ±1.3	2.63 ±1.3	< 0.0001
Symptom-specific well-being	4.5 ±0.36	3.24 ±1.2	< 0.0001
General well-being	4.4 ±0.36	3.23 ±1.2	< 0.0001
Disability	3.35 ±1.4	1.82 ±1.1	< 0.0001
Satisfaction	2.8 ±1.2	1.9 ±1.0	< 0.0001
COMI	5.86 ±1.3	3.42 ±1.1	< 0.0001

Discussion

This is the first study about open discectomy outcomes based on the COMI in the literature over at least 2 year follow-up. The improvement in the COMI and ODI scores in both groups were significant. Both techniques were equally effective in surgical outcomes by reducing the tension on the nerve root caused by the herniated disc. The success rate of lumbar discectomy is about 70 to 90% (11,12). Most studies on microdiscectomy and percutaneous discectomies report a surgical time of 40 to 120 minutes (13-15). These results are consistent with our findings in both groups. 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) (16), and Deyo et al. (r = 0.60; P<0.01) (3). In this study also this issue was observed. In addition, the ODI improved in two groups after surgery in last follow-up. The mortality rate for a lumbar laminectomy is between 0.8% and 1% (17). However, in this study no mortality rate was observed. The results of the current study showed that no statistical difference between two methods based on outcomes. However, best outcome were reported after fenestration with other studies (17,18). Albeit, different assessment tools are not standardized, which makes it difficult to compare results of studies. The COMI can assess pain, function, well-being, disability, and satisfaction that may be a comprehensive tool for evaluating the treatment in low back pain. In addition, it is a quick and effective alternative in daily clinical practice to evaluate the condition of patients (5). However, it seems that a more comprehensive tool is required.

This study has some limitations. Firstly, the most common method of pain evaluation is visual analogue score (VAS) that we did not use it. Secondly, the sample size was small and a larger study population is very essential. In addition, larger groups of patients with longer follow-up are needed to confirm these results. Thirdly, the study was not double blind and a prospective randomized study, so future studies are recommended to consider these issues. Fourthly, job and literacy level for filling questionnaires and similar physical status in two groups could make the results more acceptable and future studies are required to assess this issue. Fifthly, we cannot study medical responses as back pain and radicular pain separately. Sixthly, other associated diseases such as diabetes mellitus were not assessed, and also days of hospitalization in two groups were not evaluated.
Finally, we cannot study primary outcomes as 1. Sciatica-specific outcomes: the Sciatica Bothersomeness Index (SBI) and the Sciatica Frequency Index (SFI) (19); 2. Remained/

persisted neurological deficit of lower extremity or bowel/urinary incontinence; 3. Functional outcome including, daily activity and return to work; and secondary outcomes as 1. The following common complications of surgery: i) Thromboembolic complications; ii) Procedure-related complications; iii) Re-hospitalization due to other causes except recurrence of discopathy; iv) Surgical re-intervention; and 2. Opioid use.

Conclusions

The findings suggest that fenestration or laminotomy discectomy are an efficacious procedure for treatment of LDH. However, both methods are equally effective in surgical outcome and functionality status.

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Conflicts of Interest

The authors declare that they have no competing interests.

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Comments

Azimi et al. have reported their valuable experience about two different methods of surgery and validation of Core Outcome Measures Index (COMI) as a comprehensive means to assess quality of life after surgery of lumbar herniated disc disease (1).

They verified the validated COMI index (2) and found it to be as effective as Oswestry Disability Index (ODI) in predicting the surgical outcomes of lumbar herniated disc disease. Meanwhile, they found fenestration and laminotomy discectomy (3) equally effective to treat these patients. Although, due to its retrospective nature; the method of this research seemed to be prone to various confounding factors, the authors tried their best to match the groups and nicely mentioned the possible limitations of the study at the end.

Relatively small sample size, necessity of including VAS score as a standard mean to assess pain, ignoring the presence of significant comorbidities, and the importance of distinguishing back pain from radiculopathy are some of the limitations that were nicely reminded by the authors.

I would like to add that the following considerations which I believe are also noteworthy for the future studies: A. assessment of clinical and radiological signs of instability is also very useful and crucial to compare the outcome of these two methods of surgery. B. A similar and homogenous time of follow up for all the cases will help the researchers to reach a more reliable result. C. The surgical procedures are recommended to be performed by a single surgeon to minimize the specific bias related to the skill of the interventionist. D. One of the most important problems here is that each surgery was used for its own indications. As a result, we can only conclude that the surgeries are as effective as each other when specifically used with the described indications and in the patients with the mentioned inclusion criteria. E. I believe that the presence of concomitant listhesis, significant cognitive or personality problems, proved potential for litigation, and important focal neurological deficits due to previous neurologic problems such as cerebrovascular accidents should also prompt exclusion from the future studies.

In conclusion; this study has provided primary data, although poor due to the level III classification of evidence but still valuable, about the utility and value of COMI in evaluation of the patients with lumbar disc disease in the postoperative period and the equal effectiveness of fenestration versus laminotomy discectomies in these cases. As the authors emphasized, future studies with an optimal design providing superior level of evidence are needed to further evaluate the results.

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