

Effectivity of open discectomy in lumbar prolapsed intervertebral disease in terms of pain relief: A prospective analysis

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Abstract:

Background: Nearly 80% of the population suffers from low-back-pain (LBP) during their lifetime. Within the vast differential of LBP, the most common source is intervertebral degeneration leading to degenerative disc disease and lumbar disc herniation (LDH).

Objective: The objective is to determine the effectiveness in terms of frequency of pain relief of open surgical excision in the treatment of herniated lumbar intervertebral disc.

Material and Methods: A case series was conducted at GTTH, Lahore where 68 patients were studied over a period of 6 months i.e. 02-June-2021 to 02-December-2021. A thorough history and clinical evaluation was done at the time of admissions, and Magnetic resonance imaging (MRI) was ordered. All Patients were followed up at 3 months for the evaluation of relief in pain as per VAS score.

Results: Mean age of the sample was 39.76 ± 7.99 years, mean BMI was $27.26 \pm 5.49 \text{ kg/m}^2$ and mean duration of symptoms was 14.40 ± 20.21 months. Out of 68 patients, 75.0% were male and 25.0% were female. Distribution of level of disc herniation was 7.4% in L1-L2, 8.8% in L2-L3, 19.1% were in L3-L4 and 64.7% were in L4-L5. Majority (52.9%) had left side complaints, 41.2% had right side affected area and 5.9% had pain in both sides. Pre-op VAS score 7.81 ± 1.26 and it improved to 2.62 ± 1.05 at 3 months post-operatively.

Conclusion: We found that in out of 68 patients, 83.8% (n=57) had a pain (VAS) score ≤ 3 , thus the intervention was effective. Hence open surgical excision is an effective treatment option for of herniated lumbar intervertebral disc.

Keywords: Symptomatic relief, lower back pain, herniated lumbar intervertebral disc, sciatica.

Received

Date: 1st January, 2022

Accepted

Date: 20th July, 2022

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Introduction:

Low back pain affects every population and is one of the world's foremost debilitating conditions. Low back pain is a common musculoskeletal disorder and a global burden. Approximately 70% to 80% of people have experienced low back pain at some point in their life. The annual prevalence of low back pain ranges from 15% to 45% but is largely dependent on the population being studied and surveillance methods.¹ The main explanation for low back pain, which in the entire world contributes to extreme morbidity, is lumbar prolapsed intervertebral disc (PIVD). Some authors reported a lifetime incidence of low back pain of 50- 70%, including 40% sci-

atica. However, only 4-6% have clinically serious radiculopathy that requires treatment. Due to several factors, disc degeneration leads to the proliferation of the intervertebral disc, particularly in L4-L5 and L5-S1 levels. Most of the prolapse is taken up by the L3-L4 and L2-L3. Since the findings are based on many factors such as patient treatment, clinical history, and comprehensive medical examination and radiological tests, disclaiming other causes of low back pain and sciatica are beneficial physical examination assisted by radiology.²⁻³

Surgical removal of the offending disc provides an easy and efficient approach to treating extreme sciatica pain. It has set its place in the majority of

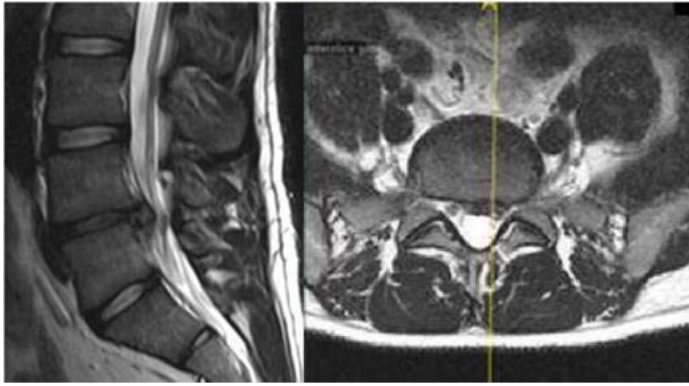


Figure 1: A sagittal (left) and axial (right) slice of T2 weight MRI image showing L4-5 prolapsed inter-vertebral disc

patients as a relatively secure procedure with acceptable results. The fenestration procedure for extracting the offensive disc is widely used for years as it has many advantages over laminectomy. Traditional extensive laminectomy and discectomy are reputed for extensive disorders of posterior stabilization and later complications in the spine.³ Shah et al. investigated the effectiveness of disc excision in the treatment of herniated lumbar intervertebral disc, and this study, effectiveness was found. 52(85%) patients as no pain, 8(12%) patients had mild pain while only two patients had moderate pain.⁴ The procedure of fenestration discectomy is believed to be less time consuming, with lesser blood loss, with few post-operative complications, and it does not affect the stability of the spine than laminectomy due to the minimally invasive nature of the operation.⁵ Herniated lumbar intervertebral disc is radiologically defined as a displacement of disc material (nucleus pulposus or annulus fibrosis) beyond the intervertebral disc space.

On radiological examination: Magnetic resonance imaging (MRI), narrowed disc space, loss of lumbar lordosis, complementary scoliosis can be observed at level L1-S1.⁶ MRI usually provides the most accurate assessment of the lumbar spine area, showing where a herniation has occurred and which nerves are affected (figure 1).⁶ The pain caused by PIVD has been previously assessed as per visual analog scale (VAS) to gauge effectivity of the procedure.^{7,8} Effectiveness: was measured in terms of pain relief using the VAS score at 3 months post-operatively. Pain

relief was assessed by a visual analog pain scale (VAS). On this Scale, 0 (No pain), 1-3 (Mild Pain), 4-6 (Moderate Pain), 7-10 (Severe Pain). Thus, patients having VAS score equal to or less than 3 at 12 weeks were considered as pain-free and thus procedure can be gauged as effective. However, patients having VAS score > 03 at 12 weeks were considered as painful and hence and hence the procedure is considered to be not effective. This assessment of the effectivity of various management modality in PIVD is essential as this disease alone is a huge economic burden on the healthcare all around the globe.⁹

There is a wide variability of outcome in patients operated for lumbar disc herniation for which the reasons are still unknown. This research will show the effectiveness among patients with lumbar disc prolapse to provides evidence of faster relief from pain than conservative treatment. Also, there is scarcity of literature from our part of world, so this study will help us to generate a piece of evidence-based medicine from our population. Following this study, we will better able to decide about best method to use for lumbar disc herniation.

Objective of the study is to determine the effectiveness of open surgical excision in terms of pain relief for the management of herniated lumbar intervertebral disc.

Material and Methods:

A case series was conducted at Orthopedic department of Ghurki Trust Teaching Hospital, Lahore. Where 68 patients were studied over a period of 6 months i.e. 02-June-2021 to 02-December-2021. The sample size of 68 was calculated by taking 95% confidence level, 8.5% margins of error, and taking effectiveness (no pain) after open surgical excision as 85%.³ In this study, with non-convenient consecutive sampling all the patient with LBP for more than 3 months that failed conservative management were considered. Both genders were considered and PIVD of any of the level from L1 to S1 were evaluated. All these patients underwent MRI assessment before undergoing open disc excision via fenestration technique.

Table 1: Distribution of quantitative variable of study sample

Variable	Mean	SD
Age (yrs.)	39.76	7.99
BMI (kg/m ²)	27.26	5.49
Duration of symptoms (months)	14.40	20.21
Pre-op pain (VAS)	7.81	1.26
Post-op pain (VAS)	2.62	1.05

Table 2: Distribution of categorical variables of study sample

variable	sub-categories	Frequency	Percent
Gender	Male	51	75
	female	17	25
Level of PIVD	L1-2	5	7.4
	L2-3	6	8.8
	L3-4	13	19.1
	L4-5	44	64.7
Radiculopathy	Right	28	41.2
	Left	36	52.9
	Both	4	5.9

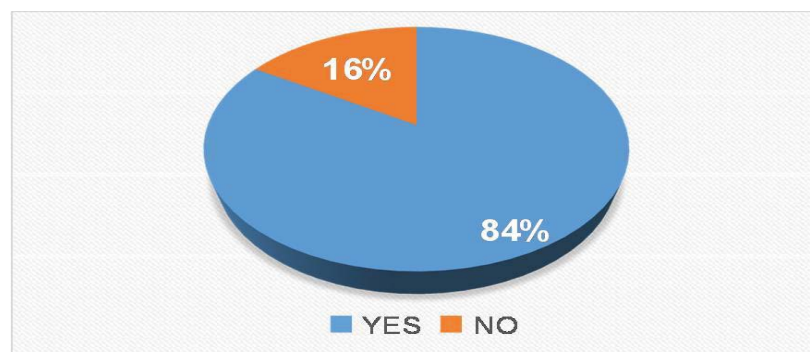


Figure 2: Effective pain relief by discectomy

Table 3: Factors affecting effectiveness of the procedure in terms of pain relief

Variable	Effective pain relief	Non-Effective pain relief	P-value
Age groups (20-35/36-50) yrs.	16/41	3/8	0.957
Gender (male/female)	41/16	10/1	0.183
BMI (17-25/>25) Kg/m ²	16/41	4/7	0.58
Duration of symptoms (1-24/>24) months	50/7	9/2	0.597
Level of PIVD (11-2/12-3/13-4/14-5)	5/5/11/36	0/1/2/8	0.776
Radiculopathy (right/left/both)	21/32/4/57	7/4/0/11	0.216

Chi-square test was applied to determine statistical significance at 95% confidence interval

Exclusionary criteria included patients with traumatic pain, deformity or history of any previous spine surgery. Those patients who underwent laminectomy, spinal fixation, discectomy or foraminotomy were not included. Similarly,

the patients that were lost to follow-up before completion of 3-month follow-up were removed from the sample.

In all these cases a detailed history was taken, followed by a thorough clinical evaluation at the time of admissions. All patients were subjected to Magnetic resonance imaging (MRI). Fenestration discectomy were performed by the consultant orthopedic surgeon (with at least 3 years of post-fellowship experience) in all these cases.

All Patients were followed up at 3 months for the evaluation of relief in pain (effectiveness). Postoperatively, effectiveness was taken in terms of relief in pain. Effectiveness was assessed by improvement in the VAS score (pain). Immediate post-operative pain score was assessed after 2nd week, but the pain relief (effectiveness) was assessed at 3rd month. All this information (age, gender, symptoms at the time of presentation, level of disc herniation, side effected) and effectiveness (as described in the operational definition) were noted through pre-designed proforma (attached at the end).

Data analysis procedure:

The data collected was entered and analyzed using statistical software SPSS version 25. The mean and the standard deviation were calculated for age, BMI, duration of symptoms, and pre- and post-op VAS score. Frequency and percentage were calculated for gender, level of disc herniation, the side affected, and effectiveness. Inferential analysis was derived via application of chi square test for each effect modifiers like age, gender, BMI, duration of symptoms, level of disc herniation, the side affected diagnosis. At a confidence interval of 95%, p-value ≤ 0.05 was taken as statistically significant.

Results:

A total of 68 patients fulfilling inclusion and exclusion criteria were selected to determine the effectiveness in terms of pain relief of open surgical excision for lumbar PIVD. Age distribution of the patients was done, it showed that out of 68 patients, 27.9 % (n=19) were in age group of 20-35 years and 72.1 % (n=49) were in age

group 36-50 years. Mean age was 39.76 ± 7.99 years. Distribution of BMI was $27.26 \pm 5.49 \text{ kg/m}^2$, duration of symptoms 14.40 ± 20.21 months, Pre-op VAS score 7.81 ± 1.26 and post-op VAS score 2.62 ± 1.05 . Gender distribution of the patients was done which showed that out of 68 patients 75.0 % (n=51) were male and 25.0 % (n=17) were female. Distribution of level of disc herniation was 7.4% (n=5) in L1-L2, 8.8% (n=6) in L2-L3, 19.1% (n=13) were in L3-L4 and 64.7 % (n=44) were in L4- L5. Distribution of affected side was done according to which 41.2 % (n=28) had in right side, 52.9% (n=36) had in left side and 5.9% (n=4) had pain in both sides. This descriptive statistic is illustrated in tables 1 and 2.

According to the pain relief gauged at 6 months postop, 83.8% (n=57) got effective pain relief: at postop 6-month follow-up pain was ≤ 3 on VAS (Figure 2). All the studied variables were considered in inferential analysis to figure out whether or not any of these factors play a role in determining effectivity of the procedure in terms of pain relief. Chi-square results of the analysis is illustrated in table 3. The results show that none of the variables among age group, gender, BMI, duration of symptoms, level of disc herniation and affected side were had significant role in degerring the effectivity of the procedure

Discussion:

LDH almost always occurs by the degeneration of the nucleus pulposus and annulus fibrosus from the intervertebral disc, especially when they compress on the nerve root, which is the major cause for lower back pain. The MED is an approach of choice for the compressed nerve root and the herniated disc. It is less traumatizing to the paravertebral muscles, results in less fibrosis inside the canal and less morbidity, shorter hospital stay, better VAS, and ODI score and greater overall patient satisfaction.¹⁰(80) In current study, out of 68 patients, 27.9% (n=19) were in age group of 20-35 years and 72.1% (n=49) were in age group 36-50 years. Mean age was 39.76 ± 7.99 years. Distribution of BMI was $27.26 \pm 5.49 \text{ kg/m}^2$, duration of symptoms 14.40 ± 20.21 months, Pre-op VAS score

7.81 ± 1.26 and post-op VAS score 2.62 ± 1.05 . Out of 68 patients 75.0 % (n=51) were male and 25.0 % (n=17) were female.

Distribution of level of disc herniation was 7.4% (n=5) in L1-L2, 8.8% (n=6) in L2-L3, 19.1% (n=13) were in L3-L4 and 64.7 % (n=44) were in L4-L5. Out of 68 patients, 41.2 % (n=28) had right side affected area, 52.9% (n=36) had left side and 5.9% (n=4) had pain in both sides. Distribution of effectiveness was 83.8% (n=57). Thus, showing that open discectomy with fenestration approach is effective at pain relief. Literature states that the conventional surgical methods are open discectomy and lamellar fenestration. The effect is better with these methods than with open surgery.¹¹ Decompression is thorough and suitable for patients with different types of single-segment lumbar disc herniation.¹² In addition, surgery provides excellent vision and a wide range of exploration in the spinal canal. It can avoid the omission of free nucleus pulposus, reduce damage to the nerve root and dura mater during surgery, and expand the nerve root and lateral crypt more conveniently.

However, surgery can cause greater trauma to the body and cause massive bleeding during the operation. The long bed-rest period after surgery can also easily induce low back pain, lumbar instability and recurrence. In addition, open discectomy can cause hyperplasia and adhesion of scar tissue, can cause nerve root adhesion and spinal stenosis, and can reduce patient prognosis. This is not ideal, and there are certain limitations in its clinical application.¹³

In a study done by Pang et.al, 48 patients undergoing lumbar discectomy and nuclear enucleation in the observation group and 48 patients undergoing open discectomy and nuclear enucleation in the control group were followed for 6 months. The excellent and good recovery rate in the observation group was 93.75% and the rate in the control group was 91.67%, and there was no significant difference between the two groups ($p > 0.05$). The two surgical methods achieved the same degree of recovery. The reason for this is that both surgical methods were performed

directly. Both methods completely removed the nucleus pulposus and reduced the pressure on the nerve roots; thus, the symptoms associated with movement disorders, gait, and lower back pain were significantly reduced, resulting in good recovery.¹³ In the study of Pang, et.al, compared with the control group, the observation group had a shorter bed-rest time and hospital stay, less blood loss during surgery, and shorter incision lengths. In terms of the postoperative VAS pain scores at 1 day, 3 day, 1 month, and 6 month, the scores were low, and the differences between the two groups were statistically significant ($p < 0.05$). Lumbar discectomy achieved a higher quality of surgery, had faster healing and reduced pain more quickly after surgery. In addition, the rate of complications in this group was 6.25%, which was lower than the rate of 22.92% in the control group. The difference between the two groups was statistically significant ($p < 0.05$). The application of a lumbar discoscope can reduce various complications during and after surgery.¹⁴

In a study done by Yadav et.al, the VAS and ODI scores were used for clinical effectiveness assessment. There are significant differences between the VAS and ODI scores of the 2 groups on day first post-operatively which is clinically and statistically significant ($p < .05$). In comparison the score at 6th weeks and 6th months post-operatively in both groups, the result was clinical improvement significant in each group but statistically not significant ($p > .05$). Time mean Oswestry score micro endoscopic discectomy and open discectomy Preop* 15.33:15.00 Postop 1st post-operative day 12.00:13.00, 6-week 10.26:10.40, 6th months 10.60:10.46. Whereas, time mean VAS score micro endoscopic discectomy and open discectomy Preop* 5.73:5.93, Postop 1st post-operative day, 3.73:4.00, 6 weeks 0.06:0.40, 6th months 0.066:0.066. Which shows that there was improvement in Oswestry and ODI score in MED and OLD in both groups as well.¹⁵ Kulkarni et al¹⁶ reported a prospective study of 188 consecutive patients who underwent surgery for herniated disc using the tubular retractors between April 2007 and 2012. All patients had a preoperative MRI

(Magnetic Resonance Imaging) and were operated by a single surgeon with the METRx system (Medtronic, Sofamor- Danek, Memphis, TN) using 18- and 16-mm ports. All patients were mobilized as soon as pain subsided and discharged within 24 to 48 hours post-surgery. The results were evaluated by using VAS (Visual Analog Scale 0–5) for back and leg pain and ODI (Oswestry Disability Index). Patients were followed up at intervals of 1 week, 6 weeks, 3 months, 6 months, 12 months, and 2 years. In his study result was found that the mean age of patients was 46 years (range 16–78 years) and the sex ratio was 1.5 males to 1 female. The mean follow-up was 22 months (range 8–69 months). The mean VAS scale for leg pain improved from 4.14 to 0.76. ($P < .05$) and the mean VAS scale for back pain improved from 4.1 to 0.9 ($P < .05$). The mean ODI changed from 59.5 to 22.6 ($P < .05$). The mean operative time per level was about 50 minutes (range 20–90 minutes). Dural punctures occurred in 11 (5%) cases. Average blood loss was 30 ml (range 10–500 ml).¹⁵

Since long it has been established that surgical and conservative treatments had long-term beneficial effects on sciatica symptoms in patients with lumbar disc herniation. Compared with conservative treatment, surgical treatment relieved back pain faster. Surgical treatment may thus be attractive to patients with debilitating pain symptoms who seek quick relief, or who did not experience satisfactory improvement with conservative treatment.

Study limitations: This was a unicentric case series with limited number of study subjects. A multicentric study with a study design that provides higher level of evidence would add more to the subject. Furthermore, since many a surgical technique of discectomy including microscope- as well as endoscopic-assisted are now being used nowadays; a comparative analysis would help determine best practice guidelines for the surgical intervention as well.

Conclusion:

In current study we determine the effectiveness in terms of frequency of pain relief of open surgi-

cal excision in the treatment of herniated lumbar intervertebral disc. We found that out of 68 patients, 83.8% (n=57) got effectiveness. Hence, we concluded that open surgical excision is an effective treatment option for of herniated lumbar intervertebral disc

Conflict of interest: None

Funding source: None

Role and contribution of authors:

Muhammad Naveed, collected the data, references and did the initial writeup.

Imtiaz Muhammad, helped in collecting the data and also helped in introduction writing.

Atif Ali, helped in collecting the references and also helped in abstract writing.

Zain Muhammad, helped in collecting the data and also helped in discussion writing.

Zeeshan Faisal, helped in collecting the data and references.

Rizwan Akram, critically review the article and made final changes.

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