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Functional Outcome of Open Conventional Discectomy of Patients with Prolapse Lumbar Intervertebral Disc – A Prospective Observational Study

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Abstract **Original Research Article**

***Introduction*:** Low back pain is one of the most common complaints in clinical practice with life time prevalence ranging from 65-80%. The annual prevalence of low back pain ranges from 15% to 45% but is largely dependent on population. Major cause of low back pain leading to severe morbidity throughout the world affecting mainly the young population is lumbar disc prolapse. Prolapsed intervertebral disc is an important cause of spondylogenic backache. Conservative treatment is often preferred for LDH, but patients who fail to respond to this are treated with surgery. Surgical treatment aims to remove the herniated nucleus pulposus to the largest extent possible to relieve nerve compression while minimizing spinal instability. ***Aim of the Study*:** The aim of this study was to assess the functional Outcome of open conventional discectomy among patients with prolapse lumbar intervertebral disc or lumbar herniated disk. ***Methods*:** This was a prospective observational study and was conducted in the Department of Orthopaedics Surgery, Square Hospitals Ltd, Dhaka, Bangladesh during the period from January 2008 to December 2020. We included 300 patients with prolapse lumbar intervertebral disc undergoing open conventional discectomy in our study. ***Result*:** In our study we found majority (36%) of our patients was aged 41-50 years and most of our study patients were male (70%) compared to female (30%). We found the mean age was 44.73 ± 8.9 years. Among all patients 78% had lower lumber problem & 22% had upper lumber problem. Most of our patients (44.5%) had L4-L5 level, followed by 31.5% had L5-S1 level. We found the mean vas score for leg pain and back pain in preoperative period significantly reduced at postoperative 2nd week, 3rd month, 6th month and 1st year. The mean ODI score was 56.24 ± 4.18 in preoperative period. At postoperative 1st year follow up the mean score significantly reduced to 3.26 ± 2.64 in our study. Majority (37%) of our patients had good outcome, followed by 28%, 24% & 11% had fair, excellent & poor outcome respectively. ***Conclusion*:** In our study, we found no major complications after open conventional discectomy on PLID patients. We also found mechanical factors like level of disc herniation do not influence the functional outcome in patients with prolapsed lumbar disc after discectomy. After discectomy of prolapsed intervertebral disc at different levels in the lumbar spine we found no significant difference in the end result and functional outcome of the patients.

Keywords: PLID, Open conventional discectomy, VAS, ODI.

INTRODUCTION

Low back pain is one of the most common complaints in clinical practice with life time prevalence ranging from 65-80% [1]. The annual prevalence of low back pain ranges from 15% to 45% but is largely dependent on population being studied and surveillance methods [1]. Major cause of low back pain leading to severe morbidity throughout the world affecting mainly the young working class population is lumbar disc prolapse. Authors have mentioned lifetime incidence of low back pain in range of 50-70% including sciatica among 40%, but clinically significant sciatica requiring special attention accounts for only 4-6% cases. Degeneration of disc due to various factors leads to prolapse of intervertebral disc into intervertebral foramina especially into L4-L5 and L5-S1 level. The L3-L4 & L2-L3 account for the majority of remaining prolapse [2]. Prolapsed intervertebral disc is an important cause of spondylogenic backache. Although back pain is common from the second decade of life, intervertebral disc disease and disc herniation are most prominent in otherwise healthy people in third and fourth decades of life. Ninety five percent of lumbar

disc herniation occurs at either L4-L5 or L5-S1 level [3]. The posterior longitudinal ligament affords only weak re-enforcement especially at L4-L5 and L5- S1 level where it is a midline narrow unimportant structure attached to annulus [4]. The L4- L5 and L5-S1 articulations have the greatest motion in the lumbar spine [5]. 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 [6]. Disc prolapse at the L4-5 level has been shown to be the most commonly herniated disc, resulting in L5 radiculopathy and atL5-S1 level is second in frequency of herniation [7].

Conservative treatment is often preferred for LDH, but patients who fail to respond to this are treated with surgery [8]. Surgical treatment aims to remove the herniated nucleus pulposus to the largest extent possible to relieve nerve compression while minimizing spinal instability [9]. Interlaminar fenestration discectomy (IFD) is the most commonly performed surgical procedure for treating LDH and is considered the gold standard [10]. Although the herniated nucleus pulposus can be completely removed to relieve nerve compression, it will affect spinal stability, as it requires partial removal of the posterior portion of the spine [11, 12]. Surgical removal of offending disc offers a simple and effective solution in management of severe sciatic pain and this method has established its position as reasonably safe procedure with satisfactory results in most of patients. Technique of fenestration for removal of offending disc has been used extensively for years since it has certain advantages over commonly employed laminectomy technique. The traditional extensive laminectomy and discectomy went into disrepute because of extensive disruption of posterior stabilizing structures of spine and its later complications [13]. More often, surgery is done to provide more rapid pain relief and disability in those patients whose recovery is unacceptably low with non-operative treatment. There are various studies which show favourable outcome of lumbar discectomy for leg pain but only few studies regarding improvement in back pain. One of the earliest descriptions of lumbar discectomy was that reported by Mixter and Barr in 1932, in which an L2 to S1 exploratory laminectomy led to the removal of a "mass one centimetre in diameter" [14]. As an essential component of minimally invasive spine surgery, endoscopic spine surgery (ESS) has continuously evolved and has been accepted as a practical procedure by the worldwide spine community. Especially for lumbar disc herniation (LDH), the percutaneous endoscopic or full-endoscopic discectomy technique has been scientifically proven through randomized controlled trials and meta-analyses to be a good alternative to open discectomy [15]. A Visual Analog Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured [16]. For example, the amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain. The Modified Oswestry Disability Index (ODI) is an extremely important tool that researchers used to measure patient's functional disability due to low back pain. The test is considered as gold standard of low back functional outcome tools. The ODI is a valid and vigorous measure and has been a worthwhile outcome measure. It consists of questionnaire which has been designed to give us information as to know how the back pain has affected patient's ability to manage in everyday life. It categories the patient as having minimal, moderate or severe disability due to back pain [14, 17].

In this study we assessed the functional outcome regarding leg pain and back pain following Open conventional discectomy surgery in our patients.

OBJECTIVE OF THE STUDY

The main objective of the study was to assess the functional outcome of open conventional discectomy among patients with prolapse lumbar intervertebral disc or lumbar herniated disk.

METHODOLOGY & MATERIALS

This was a prospective observational study and was conducted in the Department of Orthopaedics Surgery, Square Hospitals Ltd, Dhaka, Bangladesh during the period from January 2008 to December 2020.

We included 300 patients with prolapse lumbar intervertebral disc undergoing open conventional discectomy in our study.

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged more than 20 years old; b)Patients with prolapse lumbar intervertebral disc; c) Patients suffering from pain due to herniated disk; d) Patients with severe discogenic/radiating pain with radiological correlation; e) Patients who were willing to participate were included in the study And a) Patients with recurrent disc disease & multiple level disc herniation; b) Patients with Spondylodiscitis; c) Patients with previous surgical history; d) Patients with known allergy to anesthetic drugs; e) Patients with any history acute illness (e.g., renal or pancreatic diseases, ischemic heart disease etc.) were excluded from our study.

Operative Technique

All patients were randomly placed in the prone position under general & spinal anaesthesia. A 4–6 cm

posterior midline incision was made with the deteriorating segment positioned in the centre. The lumbar fascia was exposed, and the attachment of the spinalis muscle was cut near the spinous process so that the supraspinous and interspinous ligaments were preserved. The soft tissue behind the laminae was stripped to reveal the intervertebral space, upper and lower lamina and small joints. A laminar rongeur was used to remove the ligamentum avum between the lamina and small portions of the upper and lower lamina adjacent to the deteriorating segment; thus, interlaminar fenestration was performed. A neuroexfoliator was used to separate and gently retract the nerve root, revealing the intervertebral disc. The brous ring was cut, and the nucleus pulposus was removed with dedicated forceps. The incision was closed [18, 19].

Evaluation Measures

Patients were asked to use the Visual Analogue Scale (VAS) to rate the severity of the pain in their lower back and legs before surgery, 1 month after and at the nal follow-up appointment. A score of 0 points corresponded to no pain; 1 to 3 points, to slight pain; 4 to 6 points, to obvious pain that affected sleep but was still tolerable and 7 to 10 points, to intense, unbearable pain [20]. Functional changes were evaluated using the ODI, which has 10 questions on the severity of pain, ability to perform self-care, lifting objects, walking, sitting, standing, sleeping, social life and travel. There are six response options for each question, and the highest score for each question is 5 points. The lower the score was, the better the postoperative recovery [21].

Statistical Analysis

All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Square Hospitals Ltd, Dhaka, Bangladesh.

RESULT

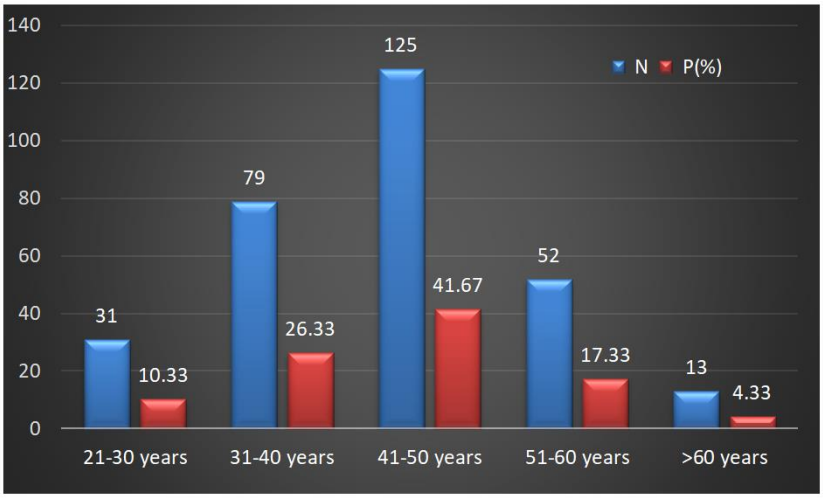

Figure 1: Age distribution of our study patients

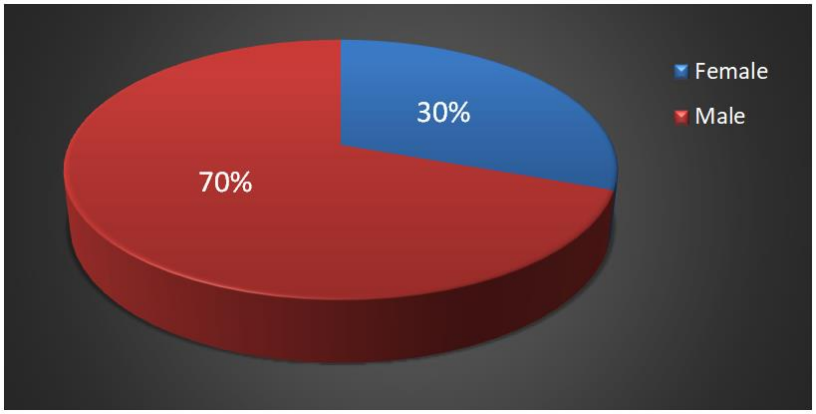

Figure 2: Gender distribution of our study participants

Table 1: Demographic characteristics of our study subjects

Baseline	**N**	**P (%)**	**P-value**
Mean age (years)	44.73 ± 8.9		0.186
Education			
Illiterate	37	12.33	0.412
Primary education	94	31.33	0.214
Secondary education	124	41.33	0.318
Higher above	45	15.00	
Lumber level			
Upper	89	29.7	0.169
Lower	211	70.3	0.241
Level			
L2 -L3	34	11.3	0.412
L3 -L4	50	16.7	0.612
L4 -L5	119	39.7	0.236
L5 -S1	97	32.3	0.147
Surgery duration (min)	67.54±4.24		0.014
Intraoperative blood loss (ml)	86 ± 17		0.021
Length of hospital stay (days)	7.24 ± 0.78		0.041
Bed rest duration (days)	3.24 ± 0.69		0.052
Co-morbidities			
DM	74	24.67	0.149
HTN	89	29.67	0.215
Hypotension	43	14.33	0.124
Asthma	52	17.33	0.241
Anaemia	44	14.67	0.124

Table 2: Comparison of VAS scores for leg pain in preoperative & postoperative

VAS for leg pain	**Mean ±SD**	**P-value**
Preoperative	9.4 ± 0.89	0.186
At 2nd week	3.4 ± 1.81	0.749
At 3rd month	1.4 ± 0.72	0.682
At 6th month	0.74 ± 0.29	0.514
At 1st year	0.18 ± 0.36	0.041

Table 3: Comparison of VAS scores for back pain in preoperative & postoperative

VAS for back pain	**Mean ±SD**	**P-value**
Preoperative	6.24 ± 1.18	0.518
At 2nd week	1.34 ± 0.72	0.054
At 3rd month	0.87 ± 0.74	0.032
At 6th month	0.39 ± 0.27	0.018
At 1st year	0.28 ± 0.34	0.048

Table 4: Comparison of Oswesty score among our study patients

Oswesty score	**Mean ±SD**	**P-value**
Preoperative	56.24 ± 4.18	0.218
Postoperative		
At 2nd week	16.78 ± 2.36	0.024
At 3rd month	8.39 ± 2.27	0.018
At 6th month	5.28 ± 1.34	0.054
At 1st year	3.26 ± 2.64	0.021

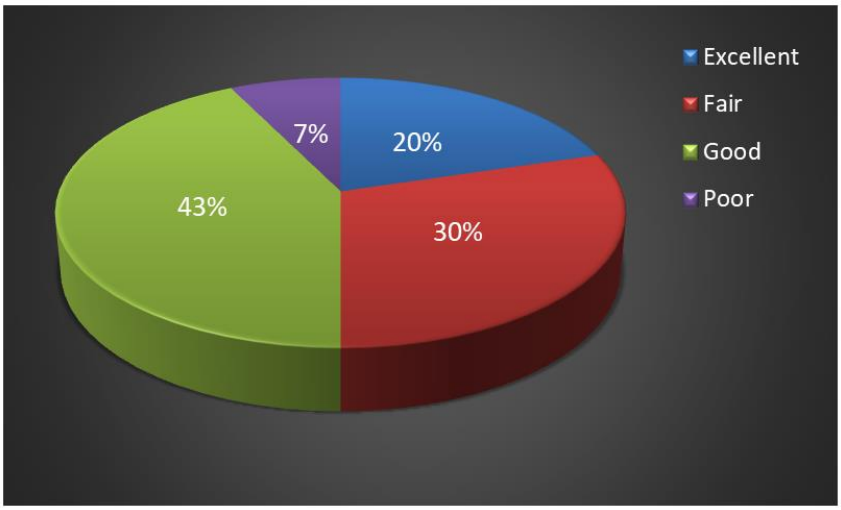

Figure 3: Functional final outcome of our study patients

Figure 1 shows that majority (41.67%) of our patients were aged 41-50 years, followed by 26.33% & 17.33% were aged 31-40 & 51-60 years old respectively. Then there were 10.33% patients in 21-30 years age group and only 4.33% patients were aged more than 60 years old.

Figure 2 shows gender distribution of our study. Most of our study patients were male (70%) compared to female (30%).

Table 1 shows the demographic characteristics of patients. We found the mean age was 44.73 ± 8.9 years. Majority (41.33%) of our patients got secondary education. Among all patients 70.3% had lower lumber problem & 29.7% had upper lumber problem. Most of our patients (39.7%) had L4-L5 level, followed by 32.3% had L5-S1 level. Among all patients, 24.67% had DM, 29.67% had hypertension, 17.33% had asthma, 14.67% had anaemia.

Table 2 compares the pain of before and after operation by VAS scores. We found the mean vas score was 9.4 ± 0.89 which significantly reduced to 0.18 ± 0.36 at postoperative 1st year follow up period.

In table 3 we found the mean vas score in preoperative period significantly reduced at postoperative 2nd week, 3rd month, 6th month and 1st year.

Table 4 shows the mean oswesty score was 56.24 ± 4.18 in preoperative period. At postoperative 1st year follow up the mean score significantly reduced to 3.26 ± 2.64 in our study.

Figure 4 shows the functional final outcome of our patients. Majority (43%) of our patients had good outcome, followed by 30%, 20% & 7% had fair, excellent & poor outcome respectively.

DISCUSSION

We prospectively followed 300 patients with PLID at L2-L3, L3-L4, L4-L5 or L5-S1 levels after open conventional discectomy. In our study majority (41.67%) of our patients were aged 41-50 years and the mean age was 44.73 ± 8.9 years. The mean age of patients in the group 1 was 55.21 years (SD± 6.10) while in the group 2, mean age being 42.28 years (SD=± 10.80) [22]. In the study done by Saberi *et al.*, the mean age of patients with upper lumbar disc herniation and lower lumbar disc herniation were 45.7 years (23-70) and 41.2 years (20-63) [23]. Similarly, in SPORT trial by Lurie *et al.*, case study the level of herniation varied directly with age, as patients with upper level herniation were significantly older, the L4-L5 group was of an intermediate age, and the L5-S1 group was the youngest [24].

In this study most of our study patients were male (70%) compared to female (30%). Out of all the patients in the study a total of 36 (72%) were males and 14 (28%) were females [22]. Similarly, in the study acne by Lurie *et al.*, the majority of the study population (57%) was male [24]. Also in study done by Saberi *et al.*, male to female ratio was 1.08 and 1.14 in the upper and lower lumbar disc herniation respectively [23].

In this study, among all patients 70.3% had lower lumber problem & 29.7% had upper lumber problem. Most of our patients (39.7%) had L4-L5 level, followed by 32.3% had L5-S1 level. A total of 50 patients which were included in a study done by Xin *et al.*, found only 4 (8%) patients had disc prolapse at L2-L3 level while 10 (20%) patients had disc prolapse at L3-L4 level who are referred as Group 1. L2-L3 and L3-L4 levels constitutes so called upper lumbar disc herniation group. 22 (44%) patients had prolapsed intervertebral disc at L4-L5 level and 14 (28%) at L5-S1 level, who are referred as Group 2 [25]. L4-L5 and L5-S1 levels constitutes so called lower lumbar disc

herniation group. According to literature, the majority of lumbar herniation occurs at the L4-L5 and L5-S1 intervertebral disc levels, affect the L5 and S1 roots, and result in sciatica. Upper level herniation (levels L2-L3 or L3-L4) are less common, may affect the L2, L3, and L4 nerve roots and cause a femoral radiculopathy [26-29].

In our study we found the mean vas score for leg pain & back pain was 9.4 ± 0.89 & 6.24 ± 1.18 respectively before operation which significantly reduced at postoperative 2nd week, 3rd month, 6th month and 1st year. In a study done by Yadav *et al.*, found the preoperative VAS leg pain and back pain was 7.31±1.14 and 7.29±1.13 respectively and significant improvement was seen in VAS at 2weeks, 3 months and six months [30]. Postoperatively at the end of 6 months VAS score was 0.45±0.57 for leg pain and 0.48±0.57 for back pain which is similar to the study done by Ahsan M *et al.,* Ahsan K *et al.,* and Tomoaki *et al.,* [31-33].

In our study the mean ODI score was 56.24 ± 4.18 in preoperative period. At 1st year follow up the mean score significantly reduced to 3.26 ± 2.64 after operation. Yadav *et al.,* found that improvement was significant at 3 months and six months durations post operatively. The preoperative ODI score was 53.28±12.88 and changed to 23.15±8.02 at 3 months and 9.15±5.0 at six months ($p<0.001$). There was around 50 % improvement in symptoms at around 3 months which improved more at 6 months. This outcome was seen consistent with the study done by Ahsan M *et al.,* and Ahsan K *et al.,* [31, 32]. In a study done by Arja Hakkinen *et al.,* there was 88% improvement in females and 80 % improvement in males in Oswestry Disability Index (ODI) during the initial 6 weeks, there after the changes were minor [34]. Weber found that the short term outcome after discectomy is better than the conservative therapy alone. In his controlled prospective randomized trial, he found statistically significant improvement in pain at one year in which surgery was performed but at a longer follow up of 4-10 years it had no significant difference [35]. Our study also had similar short term outcome after discectomy.

In the present study majority (43%) of our patients had good outcome, followed by 30%, 20% & 7% had fair, excellent & poor outcome respectively. According to Modified Macnab's Criteria , Yadav *et al.,* found results were excellent in 13 cases(41.9%),good in 16 cases (51.6%),fair in 2 cases(6.5%) and none had poor results, which is similar to the findings of the study by Ahsan M *et al.,* [31] In a similar retrospective study done in the Chinese population in 2019 by Ren Z *et al.,* 93.8% (92/98) of the patients showed excellent or good results, and 3.1% (3/98) fair [36]. Three (3.1%) patients were rated poor because they required subsequent fusion surgery within the 5-year follow-up period [36]. In a retrospective observational study conducted by Bakhsh A reviewed medical records of 68 patients who underwent lumbar disc surgery for sciatic pain during the period 1995–2004. Lumbar disc surgery yielded complete pain relief in 79.41% of the cases. In 14.7% of the cases surgery failed to give any pain relief and in 5.88% it yielded partial pain relief. At up to 10 years postoperatively, 27.77% of patients remained absolutely pain free. They concluded that surgery provided immediate pain relief in 79.41% of cases, but the long-term outcome of lumbar disc surgery was not satisfactory [37]. In the series by Devkota *et al.,* 98.33 % of patients had an improvement in the radicular pain and at 6 months, 97.5% had good to excellent (grade 4, or 5) results reaching the premorbid states in the Prolo Functional and Economic Scale. They reported that as per the rates of complication, long term rates of reoperation and outcome assessment, their results were on a par with the results of Maroon's series of microlumbar discectomy cases [38, 39]. In another series on patients who underwent microdiscectomy, and performed by Shrestha D *et al.,* found disc at L4-L5 were significantly associated with better ODI at final follow up after. For ODI score interpretation, gender, presence of leg pain as a predominant symptom were statistically significant factors whereas smoking and drinking habit, level of education, occupation, back pain and numbness as predominant preoperative symptom, types of disc in MRI were significantly related to Mcnab outcome [40].

Limitations of the Study

Our study was a single centre study. We took a small sample size due to our short study period & limited resources. There is more clinical & radiological outcome of open conventional discectomy in PLID patients need to be evaluated. After evaluating once those patients we had a follow-up only for one year and have not known other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In our study, we found no major complications after open conventional discectomy on PLID patients. We also found mechanical factors like level of disc herniation do not influence the functional outcome in patients with prolapsed lumbar disc after discectomy. After discectomy of prolapsed intervertebral disc at different levels in the lumbar spine we found no significant difference in the end result and functional outcome of the patients.

So, further study with a prospective and longitudinal study design including larger sample size needs to be done to identify advantages and disadvantages of open conventional discectomy among PLID patients.

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