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Research Paper

Comparative Study between Transforamenal Lumbar Interbody Fusion (TLIF) and Traditional Discectomy in Treatment of Patients with Massive Lumbar Disc Prolapse

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ABSTRACT:

BACKGROUND:

Disc prolapse is thought to cause one-third of all back pain, in which the spongy interior matrix of an intervertebral disc in the spine is drying out compressing the thecal sac and nerve roots. Traditional discectomy involves removing a portion of an intervertebral disc. TLIF is atechnique that is used to achive disc resection, decompression and circumferential arthrodesis in the lumbar spine; it fuses the anterior and posterior sections through a posterior unilateral approach.

OBJECTIVE:

In this study, we aim to review cases of massive single level lumber disc prolapse treated surgically either with traditional discectomy or (TLIF) and compared their outcomes regarding pain, deficits, instability, complications, blood loss, hospitalization and cost.

PATIENTS AND METHODS:

Study included 43 patients presented with symptomatic, single level, massive lumbar disc prolapse at different levels were designed in to 2 groups: (Group A: 23 patients were treated with open TLIF) and (Group B: 20 patients were treated traditional discectomy).

RESULTS:

The outcomes of 43 patients were assessed and followed up at 12 months postoperatively. The results was appeared to be significantly better in open TLIF than traditional discectomy in a term of both low back and radicular leg pain and mechanical instability, while significantly better in traditional discectomy than open TLIF in a term of intraoperative complications and blood loss, hospitalization stay and cost, there was no significant difference between the two types of surgery in the term of neurological deficits. The overall success rate in open TLIF was (91.3%), while (70%) in traditional discectomy.

CONCLUSION:

Both open TLIF and traditional discectomy were effective in treatment of patients with massive single level lumber disc prolapse.

KEYWORDS: lumbar disc prolapse, transforamenal lumber interbody fusion (TLIF), traditional discectomy.

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Iraqi Postgraduate Medical Journal, 2024; Vol. 23(3): 320-325
DOI: 10.52573/ipmj.2024.138121 *Received: February 20, 2023,* *Accepted: March 14, 2023*

INTRODUCTION:

The intervertebral (disc) joints is a fibrocartilaginous joints found at each level except C1-C2, the sacrum, and the coccyx. Composed of outer anulus fibrosus and inner nucleus pulposus. Disc herniation is an injury to the cushioning and connective tissue between vertebrae, usually caused by excessive strain or trauma to the spine. It may result in back pain, pain in different parts of the body, and physical disability. When a tear in the outer, fibrous ring of an intervertebral disc allows the soft, central portion to bulge out beyond the damaged outer rings, the disc is said to be herniated. [1]

Disc protrusion, in which the outermost layers of the annulus fibrosus are still intact, but can bulge when the disc is under pressure. In contrast to a herniation, none of the central portion escapes beyond the outer layers. Disc herniation can occur in any disc in the spine. The majority of spinal disc herniations occur in the lumbar spine (95% at L4–L5 or L5–S1). The second most common site is the cervical region (C5–C6, C6–C7). The thoracic region account for only 1-2% of the cases.

In the majority of cases spinal disc herniation can be treated successfully conservatively, without surgical removal of the herniated material. Surgery may be useful when a herniated disc is causing significant pain radiating into the leg, significant leg weakness, bladder problems or loss of bowel control. Surgical options include discectomy alone (without fusion) including traditional discectomy, Endoscopic discectomy and microdiscectomy and discectomy along with fusion (lumbar interbody

fusion) including Posterior lumbar interbody fusion (PLIF), Transforaminal lumbar interbody fusion (TLIF), Lateral lumbar interbody fusion (LLIF) and Anterior lumbar interbody fusion (ALIF) [2].

PATIENTS AND METHODS:

1. **Study design:** A retrospective randomized comparative study.
2. **Setting:** The study was conducted at the Department of Neurosurgery, Ghazy Alhariri hospital for surgical specialities in Baghdad, Iraq from June to December 2020, and we followed them after 12 months from June to December 2021.
3. **Patients:** This study included 43 patients (20 males, 23 females; mean age at diagnosis is 48.5 years; at range of 31–76 years) presented with symptomatic, single level and massive lumbar disc prolapse at different levels and designed in to 2 groups:
   A. **Group A:** 23 patients were treated with open TLIF surgery.
   B. **Group B:** 20 patients were treated with traditional discectomy.
4. **Surgical technique:** The surgery for all patients was done under general anesthesia with prone position and midline posterior lumbar incision.

1. **Preoperative baseline characteristics:**

For (group A) open TLIF patients, bilateral dissection, trans-pedicular screws were inserted. On the symptomatic side, a hemifacetectomy performed at the level of the spinal segment to be fused. Nearly complete discectomy and end-plate decortication were performed. Intervertebral disc space spreaders were then inserted and rotated to restore the normal disc space height. The anterior two-third of the disc space was packed with cancellous bone. A single cage packed with bone was inserted posterolaterally and oriented anteromedially.

For group B discectomy patients, the dissection was just lateral to lamina bilaterally, laminectomy was done, exploration of thecal sac and nerve root, thecal sac retraction with pinfield dissector and the nucleus polposus was removed totally with disc rongeurs.

5. **Follow-up:** At 12 months postoperatively, clinical and radiological features were assessed. The verbal rating scale (VRS) was used for assessment of both back and radicular pain. The muscle power scale was used for assessment of motor weakness. For stability assessment, AP and lateral X-rays with flexion and extension was done at 12 months for each patient. Blood loss was calculated by calculation of the numbers of pints of blood that were transfused to each patient.
6. **Statistical analysis:** The analysis of the reported study was performed using Statistical Packages (SPSS-25) in which the significance of different means was tested through the chi-square test. Unpaired student T-Test evaluated for groups with different means. The non parametric tests performed using one sample kolmogorov-smirnov test. The statistical significance level of p-value was evaluated at a **0.05** level.

RESULTS:

Table 1: Baseline characteristics of the included patients.

Characteristics	Group A	Group B	P value
Total number (%)	23 (100)	20 (100)	0.1
Age/yr: median (range)	48.2 (32-68)	48.7 (31-76)	٠.٨٧٣٧
Gender: male, number (%)	11 (47.8)	9 (45)	0.1
Side: right, number (%)	12 (52.1)	11 (55)	0.1

2. Clinical outcomes:

Table 2: Clinical outcomes acording to parameters.

Parameters	Group A [total 23/100%]			Group B [total 20/100%]			p value of Difference
	Pre op	Post op	P value	Pre op	Post op	P value	
Low back pain	23 (100%)	1 (4.3%)	0.00001	20(100%)	6 (30%)	0.014	٠.٠٠٠٠٣٤
Radicular leg pain	23 (100%)	0 (0%)	<0.00001	20 (100%)	3 (15%)	0.0001	٠.٠٠٠٧٣٨
Motor deficit	7 (30.4%)	1 (4.3%)	<0.00001	6 (30%)	3 (15%)	0.00001	0.022376
Sphincter disturbance	2 (8.6%)	0 (0%)	<0.00001	1 (5%)	0 (0%)	<0.00001	0.69627
Sensory deficit	15 (65.2%)	0 (0%)	<0.00001	13 (65%)	4 (20%)	0.0001	0.000093
Instability	8 (34.7%)	0 (0%)	<0.00001	0 (0%)	2 (10%)	<0.00001	0.00001

Preoperatively, all patients had discogenic low back and radicular leg pain, 7 patients in Group A and 6 patients in Group B had distal lower limb weakness, 2 cases in Group A and 1case in Group B were have urinary problems, 15 cases in Group A and 13 cases in Group B were have unilateral or bilateral numbness and tingling sensation in the lower limbs, 8 cases in Group A and no one in Group B were have lumber spinal instaibility. After surgery, 1 patient in Group A and 6 patients in Group B remained with low back pain, no patient in Geroup A and 3 patients in Group B remained with radicular leg pain, 1 patient in Group A and 3 patients in Group B were remaind with lower limb weakness, all cases that had urinary problems were improved in both groups, no one in Group A and 4 cases in Group B remained with numpness and tingling sensation, no case was detected to have mechanical instability in Group A while 2 cases developed it in Group B.

3 Perioperative outcomes:

The mean operation time in Group A (180.975 ± 37.70 minutes) and in Group B (120.143 ± 24.40 minutes). The mean intraoperative blood loss in Group A (2 ± 1 pints) and in Group B (1 ± 1 pints). The hospital stay in Group A (5 ± 1 days) and in Group B (3 ± 1 days). Intraoperative complications were noted in 5 (21.7%) cases of Group A (4 of them had iatrogenic durotomy and 1 of them had pedicular fracture) and in Group B (1 [5%] case had iatrogenic durotomy) (**Table 3**).

Table 3: Summary of perioperative outcomes.

Parameter	Group A	Group B	P value
Operation time, min	180.975 ± 37.70	120.143 ± 24.40	0.00172
Blood loss, pint	2 ± 1	1 ± 1	<0.00001
Hospital stay, day	5 ± 1	3 ± 1	<0.00001
Complication, number (%)	5 (21.7)	1 (5)	0.000435

4 The overall success rate: In Group A, 21 (91.3%) patients were returned to narmal daily performance after 1 year follow up after surgery.In Group B 14 (70%) patients were returned to narmal daily life after 1 year follow up after surgery.

Table 4: The overall success rate in both groups.

Group	Total	Overall success rate	P value	P value of Difference
Group A	23(100%)	21 (91.3%)	<0.00001	0.217215
Group B	20(100%)	14 (70%)	0.0001	

DISCUSSION:

1. Success rate: all the functional scores were significantly improved postoperatively compared with those in preoperative stage in either Group A or Group B. That means both types of surgery were significantly effective in treating disc prolapse. The results were slightly better in group A (91.3%) than in group B (70%) in the term of overall success rate.

This was consistent with study in china of (Yi *et al*., 2020) [3], they concluded that there was no significant difference of the clinical outcome over time between microdiscectomy and minimally invasive TLIF.

2. Clinical outcomes:

Regarding discogenic low back pain, all cases were have low back pain before surgery and only 1 in Group A and 6 cases in Group B

remained suffering from this type of pain after surgery. So both open TLIF (**P value = 0.00001**) and traditional discectomy (**P value = 0.014**) were significantly effective in releaving this type of pain. Open TLIF was significantly more effective in releaving low back pain (**P value = 0.000034**). This was in a greement with many studies like (DePalma *et al*., 2012) [4] they concluded that discogenic low back pain is the most common cause of low back pain after surgical discectomy. Also a study of (Satoh *et al*., 2006) [5] they clearly mentioned massive disc herniation as one of the indications of fusion.

Regarding radicular leg pain, all cases were have radicular leg pain before surgery and no patient in Group A and 3 patients in Group B remained suffering from this type of pain after surgery. So both open TLIF (**P value < 0.00001**) and traditional discectomy (**P value < 0.00001**) were significantly effective in releaving this type of pain. Open TLIF was significantly more effective in releaving radicular leg pain (**P value = 0.000738**). Different results were observed in a study of (Gupta *et al*., 2021) [6] they found no procedure is found to be superior to the other. Also in a study of (Cao *et al*., 2014) [7] they concloded simple discectomy can relieve radicular leg pain as efficient as PLIF. (Hunt *et al*., 2007) [8] concluded that TLIF can cause post-operative contralateral radiculopathy with no implant malpositioning. (HT *et al*., 2018) [9] mentioned a contralateral radiculopathy is an avoidable complication of TLIF and careful intraoperative manipulation is needed to avoid it**.**

Regarding neurological deficit, 7 cases in Group A and 6 cases in Group B were have distal lower limb weakness in pre operative period and only 1 case in Group A and 3 cases in Group B were remained with weakness after surgery. So both open TLIF (**P value < 0.00001**) and traditional discectomy (**P value = 0.00001**) were significantly effective in improving this type of deficit. There was low significant difference between the 2 groups in the term of motor deficit (**P value = 0.022376**).

Regarding sphincter disturbance, 2 cases in Group A and 1 in Group B were have urinary problems pre operatively and all were improved after surgery. Both open TLIF (**P value < 0.00001)** and traditional discectomy (**P value < 0.00001**) were significantly effective in improving urinary problem and no surgery was superior to other (**P value =0.69627**).

Regarding sensory deficit, 15 cases in Group A and 13 cases in Group B were have numpness and tingling in pre operative period and no one in Group A but 4 cases in Group B remained with it after surgery. Both open TLIF (**P value <0.00001)** and traditional discectomy (**P value = 0.0001**) were significantly effective, but open TLIF was significantly more effective in improving sensory deficit (**P value = 0.000093**). Different results were observed in a study of (Nixon *et al*., 2014) [10] they reoprted that TLIF surgery can cause a new neurological deficit, it is prone to stretch injury. Also in the study of (Kwon *et al*., 2003) [11] they concluded that there is a risk of neural damage during retraction.

Regarding mechanical instability, 8 cases in Group A were have lumber spinal instaibility in preoperative phase and no case was detected to have mechanical instability after surgery, these results exhibited that open TLIF was significantly effective in maintaining spinal stability (**P value <0.00001**). In group B, no one were have instaibility before surgery and 2 cases (10%) develope it after surgery, these results exhibited that traditional discectomy was significantly cause mechanical instaibility (**P value <0.00001**). So, open TLIF was better than traditional discectomy in restoring and maintaining spinal stability (**P value = 0.00001**). This was in agreement with many studies like the study of (Kwon *et al*., 2003) [11] they concluded that interbody fusion enables neural decompression, stabilisation and reconstruction of the disc height. And in a study of (Ebara *et al*.,1992) [12] they found that extensive laminectomy in the treatment of spinal stenosis had been well documented to increase spinal instability.

4.3 Perioperative outcomes:

Intraoperative complications were noted in 5 cases of Group A, which were significantly higher than that of Group B, which was noted in 1case (**P value = 0.000435**). This was in consistence with a study of (Potter *et al*., 2005) [13] they mentioned iatrogenic durotomy as a complication of TLIF. While different results were appeared in a study of (Hedtmann *et al*., 1992) [14] they mentioned discectomy alone for disc prolapse can lead to intraoperative neural injury or cauda equina syndrome. The **mean operation time** in Group A (180.975 ± 37.70 minutes) was significantly longer than that in Group B (120.143 ± 24.40 minutes) (**P value = 0.00172**). The **mean intraoperative blood loss** in Group A (2 ± 1 pints) was significantly greater than that of Group B (1 ± 1 pints) (**P value < 0.00001**). The **hospital stay** in Group A (5 ± 1 days) was significantly longer than that in Group B (3 ± 1 days) (**P value < 0.00001**).

These results meaning that open TLIF was more time and blood consuming and required more hospital stay and more expensive.This was in agreement with a study of (Ahsan *et al*., 2021) [15] they concluded that instrumented fusion with revision discectomy and TLIF in patients with RLDH improves the postoperative low back pain and radicular pain, decreases the nerve root damage, the postoperative incidence of mechanical instability, and re-recurrence but requires more blood transfusion, longer operation time, longer hospital stay, and significantly higher total cost of the procedure compared to revision discectomy alone. Also was consistent with study in china of (Yi *et al*., 2020)[3], they compared between microdiscectomy and minimally invasive TLIF and concluded that, the advantages of microdiscectomy in shorter hospital stay, shorter operation time, less intraoperative blood loss, and less cost over minimally invasive TLIF.

CONCLUSION:

Both open TLIF and traditional discectomy are effective in treatment of patients with massive lumbar disc prolapse. Both types of surgery can improve the low back and radicular pain and neurological deficits. Open TLIF surgery is better in improving the low back pain, radicular pain and decreases the postoperative incidence of mechanical instability, but has higher rate of intraoperative complications and requires more blood transfusion, longer operation time, longer hospital stay, and higher cost of the procedure than traditional discectomy.

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