

Outcome of Transforaminal Lumbar Interbody Fusion versus Posterolateral Lumbar Fusion with Instrumentation in Treatment of Degenerative Lumbar Disorders

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ABSTRACT

Background Data: Degenerative lumbar spine disorders are common pathologies that usually affect females in their sixth decade or older. Patients usually present with various symptoms, including back pain, radiculopathy, or neurogenic claudication, among other less common presentations. Different fusion procedures are available to manage these problems.

Purpose: This study was designed to evaluate the clinical and radiological outcome of transforaminal lumbar interbody fusion (TLIF) and posterolateral fusion (PLF) in managing degenerative lumbar disorders.

Study Design: A prospective study.

Patients and Methods: This study was conducted on patients with degenerative lumbar spondylolisthesis and degenerative lumbar spinal stenosis who underwent lumbar spine fixation with either TLIF or PLF. Patients were randomized into two groups according to the operative procedure: Group A (20 patients) underwent TLIF and Group B (20 patients) underwent PLF. Patients were followed up and assessed for back and leg pain, functional disability, and spinal fusion.

Results: We found that both TLIF and PLF improve disability and pain in patients with degenerative lumbar disorders. TLIF was found to be superior to PLF as regards achieving radiographic outcomes. We did not find strong evidence to support the use of interbody fusion along with transpedicular fixation compared to traditional posterolateral fusion in the treatment of degenerative lumbar disorders, taking into consideration the higher material costs added with interbody fusion.

Conclusion: The reported data in the present study suggest that both TLIF and PLF provide improvement of disability and pain in patients with degenerative lumbar disorders. They also suggest that TLIF is superior to PLF when comparing the achievement of radiographic fusion. However, there is no significant clinical outcome difference to recommend using TLIF over traditional PLF in treating degenerative lumbar disorders, especially with the higher treatment costs related to the use of interbody fusion. (2020ESJ217)

Keywords: Transforaminal lumbar interbody fusion, Posterolateral lumbar fusion, Degenerative lumbar disc disease, Spondylolisthesis.

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INTRODUCTION

Low back pain has a higher incidence in developed countries, affecting more than 50% of adults at some point during their lifetime. It has also been associated with significant economic impact due to elevated cost of healthcare and decreased productivity.⁴ Degenerative lumbar spine disorders are common pathologies that typically affect females more in their sixth decade or older. Patients typically present with a spectrum of symptoms, including back pain, radicular manifestations, and neurogenic claudication.¹⁶

As long as there are no progressive neurological deficits or symptoms of cauda equina syndrome, management usually starts with conservative measures encompassing physical therapy, nonsteroidal anti-inflammatory medications, and/or epidural injections.¹⁶

Spondylolisthesis is defined as an anterior displacement of a vertebral body compared to the one below it. This may occur as a result of degenerative disc disease, and similar to disc degeneration, it may also lead to narrowing of the spinal canal and stenosis, causing radicular symptoms in addition to back pain.⁷ Spine stability is of utmost importance in the management of spine patients. Maintaining the stability of the spinal column by minimizing the extreme or repetitive movement is the foundation for many commonly used treatments. Spinal degenerative cascade is a principal concept related to the model of spine stability and was originally explained in 1970 by Kirkaldy-Willis.²⁰

Spine fusion has been described in the literature for almost 100 years, starting with the management of Pott's disease using tibial grafts. This was followed by Chandler using spine fusion to manage sciatica in 1929 and Barr managing low back pain and sciatica by discectomy and fusion. Then, lumbar interbody fusion was developed for treating various degenerative diseases, neoplasms, and infections of the spine. Several techniques can achieve fusion, including posterior lumbar

interbody fusion (PLIF), transforaminal (TLIF), anterior (ALIF), posterolateral (PLF), and lateral lumbar interbody fusion (LLIF).^{21,18}

As transpedicular fixation has advantages of initial stability, good radiological fusion rates, and relatively lower cost, it has been commonly used to treat degenerative lumbar disease.¹⁵ In PLF, bone graft is placed in the posterolateral gutter to promote fusion across the transverse processes. This circumvents possible stenosis, which can be caused by a direct posterior fusion approach.²¹ Since it had been demonstrated by Harms and Rolinger in 1982, TLIF has gained wide acceptance as a surgical technique for providing 360-degree arthrodesis from a posterior approach alone. Alleged advantages of the TLIF procedure include interbody graft placement through a unilateral approach preserving the posterior tension bands and limiting manipulation of the neurological tissues.¹⁹

This study aims to prospectively compare the clinical and radiological outcomes of TLIF and PLF in treating degenerative lumbar disorders.

PATIENTS AND METHODS

This prospective study was conducted on patients with degenerative lumbar spondylolisthesis and herniated lumbar disc who were admitted to the Department of Neurosurgery of Ain Shams University Hospital and treated with either TLIF or PLF between 2017 and 2019.

The patients were randomized into two groups according to the operative procedure done for each group: Group A (20 patients) included patients who underwent TLIF; Group B (20 patients) included patients who underwent PLF.

The study included patients who met the following criteria: degenerated lumbar disc, low-grade degenerative spondylolisthesis, aged between 40 and 60 years, complaining of low back pain or sciatic pain, and failure of a trial of conservative therapy for at least three months. However, patients requiring more than single-level

fusions, with high-grade spondylolisthesis grade, with spinal deformities, and with osteoporosis (as documented by bone densitometry studies done for all patients) were excluded.

Clinical preoperative assessment included the following: (1) personal history: name, age, sex, occupation, and special habits; (2) complaint: low back pain or sciatic pain or both; (3) history of present illness: duration of symptom, onset, and precipitating and relieving factors; (4) evaluation of intensity back and leg pain using the SPAASMS scorecard (score of pain, physical activity, additional pain medication, additional emergency room (ER) visit, sleep, mood, and side effects); (5) medication; (6) history of chronic medical diseases. The examination included general examination and full neurological examination including motor power, sensory, tone, and reflexes assessment and disability assessment using the Oswestry Disability Index (ODI) questionnaire.

Routine preoperative investigations were full preoperative laboratory tests and imaging studies, including lumbosacral spine noncontrast MRI and static (anterior-posterior and lateral), dynamic (flexion-extension), and oblique (right and left) lumbosacral spine plain X-rays.

Operative Technique:

Group A: Patients underwent TLIF using a midline lumbar incision followed by fluoroscopy-assisted pedicle localization and screw insertion. All screws used were titanium polyaxial screws. This was followed by decompression of the thecal sac and nerve roots, where facetectomy on the side of predominant symptoms was performed. The cages used were all made of polyetheretherketone (PEEK) material and were filled with local bone graft material harvested from the laminae and facet during decompression, and the cage was inserted from the side of the facetectomy (Figure 1).

Group B: Patients underwent PLF through the same posterior midline lumbar incision and exposure of the facets joints transverse processes bilaterally. Decortication of the transverse processes was done on both sides using a high-speed drill,

followed by fluoroscopy-assisted screw insertion for localization and orientation of the screw direction. This was followed by decompression of the thecal sac and roots on both sides, including bilateral foraminotomies. Bone graft harvested during the laminectomy is then carefully packed into the lateral gutters to promote fusion across the transverse processes bilaterally (Figure 2).

Follow-Up:

Patients were followed up and reassessed immediately postoperatively and 6 and 12 months after surgery by clinical and functional evaluation using SPAASMS scorecard and ODI. Radiological follow-up by plain X-rays was done during the follow-up visits to evaluate fusion and degree of spondylolisthesis. The reduction was assessed by manually measuring and comparing the degree of slippage on the lateral film of plain radiographs. Final fusion assessment was done according to Bridwell criteria (Table 1).¹¹

Statistical Analysis:

The data have been analyzed using SPSS (statistical package for social science) version 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive and analytic statistics were done. Analytic statistics included the Chi-square test (χ^2) used to study the association between two qualitative variables and Fisher's exact test used as a statistical significance test. A *t*-test was used as a test of significance for comparing two groups normally distributed having quantitative variables. The Wilcoxon signed-rank test was used when comparing two related samples, matched samples, or repeated measurements on a single sample to assess whether their population mean ranks differ. A *p* value of <0.05 was considered statistically significant.

RESULTS

Demographic data showed that age for Group A (n = 20) was 54.55 ± 4.26 (range, 48–60) years, 40% (n = 8) of which were males. In Group B (n = 20), the age was 54.15 ± 4.17 (range, 42–60) years; 45% (n = 9) were males. There were no

statistically significant differences between the two groups regarding both age and gender. Clinical evaluation of the patients showed no statistical differences between the two groups regarding the mean SPAASMS of back or leg pain ($p > 0.05$). All the studied patients had no reported sensory or neurological deficits (Table 2).

The mean operative time in Group A (141.0 ± 23.15 min) was longer than that of Group B (135.0 ± 35.03 min); however, it does not reach a statistical difference ($p > 0.05$). The mean amount of blood loss in Group A (502.5 ± 138.1 ml) is statistically more than that in Group B (335.0 ± 89.0 ml) with $p < 0.05$. There were no significant differences between the two groups regarding the mean days of hospital stay ($p > 0.05$) or postoperative leg SPAASMS of pain or percentage of slippage (Table 3).

Group A:

Comparing the preoperative, 6-month, and 12-month follow-up outcome parameters of Group A revealed the following results.

Leg SPAASMS:

The mean leg SPAASMS has dramatically improved from 3.9 ± 1.2 preoperatively to 0.45 ± 0.60 at 6 months, then scored 0.10 ± 0.31 at 12-month follow-up. The mean SPAASMS improvement is 88.5% after 6 months and 97.4% at 12-months follow-up [SPAASMS improvement% = (preoperative score – postoperative score)/preop. score x 100]. The Wilcoxon signed test results indicate that there are statistically significant differences in leg SPAASMS across the three time points alternatively (preoperatively and at six-month and twelve-month follow-up after TLIF) ($p < 0.05$).

Back SPAASMS:

The mean back SPAASMS has also improved from 7.0 ± 0.9 preoperatively to 1.65 ± 0.99 after 6 months and then scored 0.45 ± 0.51 at 12-month follow-up. The mean SPAASMS improvement is 76.4% after 6 months and 97.4% at 12-month follow-up. Wilcoxon signed test results indicate statistically significant differences in back SPAASMS across the three time points

alternatively (preoperatively and at six- and twelve-month follow-up after TLIF) ($p < 0.05$).

ODI:

The mean ODI score before treatment was 55.45 ± 8.07 , then dropped to 13.55 ± 10.16 after six months, then to 7.40 ± 3.35 at 12-month follow-up. ODI reduction is statistically significant ($p < 0.05$). ODI improvements were 75.6% after 6 months and 86.7% after one year.

Slip Reduction:

The mean preoperative percentage of slippage was $25.25 \pm 10.19\%$, then decreased to $8.25 \pm 5.91\%$ postoperatively. The difference in spondylolisthesis grade is statistically significant ($p < 0.05$) (Wilcoxon signed ranked test). The percentage of reduction was 59.4% (Table 4).

Fusion:

In Group A, the fusion achieved according to Bridwell's fusion criteria at the 6-month follow-up was 1.4 and at the end of 1-year follow-up, it reached 1.3 (range 1–4).

Group B:

Comparing the preoperative and 6-month and 12-month follow-up outcome parameters of Group B showed the following.

Leg SPAASMS:

The mean leg SPAASMS has dramatically improved from 4.0 ± 1.0 preoperatively to 0.45 ± 0.51 at 6 months, then scored 0.30 ± 0.47 at 12-month follow-up. The mean SPAASMS improvement is 71% after 6 months and 92.5% at 12-month follow-up. The Wilcoxon signed test results indicate statistically significant differences in leg SPAASMS across the three time points alternatively (preoperatively and at six- and twelve-month follow-up) ($p < 0.05$).

Back SPAASMS:

The mean back SPAASMS has also improved from 6.6 ± 1.0 preoperatively to 1.65 ± 0.75 after 6 months, then scored 0.90 ± 0.64 at 12-month follow-up. The mean VAS improvement is 86.4% after 6 months and 75% at 12-month follow-up. Wilcoxon signed ranks test results indicate statistically significant differences in back SPAASMS across the three time points

alternatively (preoperatively and at six- and twelve-month follow-up after TLIF) ($p < 0.05$). (Table 5)

ODI:

The mean ODI score prior to treatment was 55.05 ± 8.63 , then dropped to 13.25 ± 3.23 after 6 months, then to 7.65 ± 2.08 at 12-month follow-up. ODI reduction is statistically significant ($p < 0.05$). ODI improvements were 75.9% after 6 months and 86.8% after one year.

Slip Reduction:

The mean preoperative percentage of slippage was $23.75 \pm 9.30\%$, then decreased to $9.25 \pm 4.66\%$ postoperatively. The difference in spondylolisthesis grade is statistically significant ($p < 0.05$) (Wilcoxon signed-rank test). The percentage of reduction was 61.1%.

Fusion:

In Group B, the fusion achieved according to Bridwell's fusion criteria at the 6-month follow-up was 1.8 and at the end of the 1-year follow-up, it reached 1.6 (range 1–3). Although the mean was higher than in that Group A, the maximum grade was 3 compared to 4 in Group A.

Comparing Both Groups:

There were no statistical differences between the two groups after 6-month follow-up regarding leg and back SPAASMS of pain, ODI, and percentage of slippage ($p > 0.05$). The grade of fusion in Group A was statistically better than Group B ($p < 0.05$). Also, there were no statistical differences between the two groups at 12-month follow-up regarding leg and back SPAASMS of pain, ODI, and percentage of slippage ($p > 0.05$). The grade of fusion in Group A was statistically better than that of Group B ($p < 0.05$). Fusion assessed according

to Bridwell fusion criteria showed that fusion was higher at 6-month and 12-month assessments for Group A than that in Group B and the results were statistically significant in both instances (Table 6).

Complications:

Intraoperative complications included dural tear in 2 patients in Group B. The tears were repaired intraoperatively by dural stitches and fat graft, no postoperative lumbar drain was needed, a suction drain was placed superior to the fascia for 5 days and then removed, and stitch was taken at its site. After that, the patient was followed up for 2 weeks for any cerebrospinal fluid leakage or collection, which did not occur. No dural tears occurred in Group A.

Postoperative posterior cage migration was reported in one case of Group A after 1 month. The patient presented with severe right lower limb sciatic pain; plain X-ray and CT scan showed posterior cage migration. The patient underwent surgical revision, and the cage was removed and replaced with another one larger in size. Postoperatively, sciatic pain improved, and the patient was discharged after the third day postoperatively and continued follow-up (clinically and radiologically) for 3 consecutive months after revision.

Superficial wound infection occurred only in one patient of Group A. After intravenous injection of antibiotics and daily dressing, the infection was completely controlled. No infection occurred in Group B. None of the 40 patients in both groups in the study had postoperative neurological symptoms relating to screw malposition and hence no screw revision was necessary.

Table 1. Bridwell grading criteria for spinal fusion.

Interbody fusion grades	
Grade 1	Fused with remodeling and trabeculae
Grade 2	Graft intact, not fully remodeled or incorporated, though no lucency
Grade 3	Graft intact, but definite lucency at the top or bottom of the graft
Grade 4	Definitely not fused with resorption of the graft and with collapse
Posterolateral fusion grades	
Grade 1	Solid trabeculated transverse process and facet fusion bilaterally
Grade 2	Thick fusion mass on one side, difficult to visualize on the other side
Grade 3	Suspected lucency or defect in fusion mass
Grade 4	Definite resorption of graft with fatigue of instrumentation

Table 2. Preoperative clinical data between the studied groups.

Parameters	Group A (n = 20)	Group B (n = 20)	t-/u-test	p value
SPAASMS (leg)	3.9 ± 1.2 (1–6)	4.0 ± 1.0 (3–6)	0.43	0.67
SPAASMS (back)	7.0 ± 0.9 (6–8)	6.6 ± 1.0 (5–8)	1.36	0.18
ODI	55.45 ± 8.07 (43–67)	55.05 ± 8.63 (39–68)	0.15	0.88
Slippage %	25.25 ± 10.19 (10–40)	23.75 ± 9.30 (10–35)	0.51	0.61

Table 3. Operative data between the studied groups.

Parameters	Group A (n = 20)		Group B (n = 20)		t-/u-test	p value
Operative time/min	141.0 ± 23.15 (100–180)		135.0 ± 35.03 (100–180)		0.79	0.43
Blood loss/ml	502.5 ± 138.1 (250–700)		335.0 ± 89.0 (200–450)		4.56	<0.001
Hospital stay/day	3.05 ± 1.10 (2–6)		3.15 ± 0.75 (2–6)		1.24	0.21
Complications	No	%	No	%	Fisher's	
Dual tear	0	0	2	10	0.36	1.0
Cage Migration	1	5	0	0		
Infection	1	5	0	0		

Table 4. Comparison of follow-up data and baseline data in Group A.

Parameters	Baseline	6 months	12 months	W Test	p value
SPAASMS (leg)	3.9 ± 1.2 (1–6)	0.45 ± 0.60 (0–2)	0.10 ± 0.31 (0–1)	3.89 3.96	<0.001 ¹ <0.001 ²
SPAASMS (back)	7.0 ± 0.9 (6–8)	1.65 ± 0.99 (0–5)	0.45 ± 0.51 (0–1)	3.96 3.96	<0.001 ¹ <0.001 ²
ODI	55.45 ± 8.07 (43–67)	13.55 ± 10.16 (5–55)	7.40 ± 3.35 (5–20)	3.82 3.93	<0.001 ¹ <0.001 ²
Slippage %	25.25 ± 10.19 (10–40)	8.25 ± 5.91 (0–15)	8.25 ± 5.91 (0–15)	3.95 3.95	<0.001 ¹ <0.001 ²
Grade of fusion	NA	1.40 ± 0.75 (1–4)	1.30 ± 0.73 (1–4)	1.41	0.15 ³

W = Wilcoxon signed test.

1 = comparing baseline data and 6-month follow-up data.

2 = comparing baseline data and 12-month follow-up data.

Table 5. Comparison of follow-up data and baseline data among Group B patients.

Parameters	Baseline	6 months	12 months	W test	P value
SPAASMS (leg)	4.0 ± 1.0 (3–6)	0.45 ± 0.51 (0–1)	0.30 ± 0.47 (0–1)	3.97 3.97	<0.001 ¹ <0.001 ²
SPAASMS (back)	6.6 ± 1.0 (5–8)	1.65 ± 0.75 (0–3)	0.90 ± 0.64 (0–2)	3.96 3.96	<0.001 ¹ <0.001 ²
ODI	55.05 ± 8.63 (39–68)	13.2.5 ± 3.23 (7–19)	7.65 ± 2.08 (5–13)	3.92 3.92	<0.001 ¹ <0.001 ²
Slippage %	23.75 ± 9.30 (10–35)	9.25 ± 4.66 (0–15)	9.25 ± 4.67 (0–15)	3.94 3.94	<0.001 ¹ <0.001 ²
Grade of fusion	NA	1.85 ± 0.81 (1–3)	1.60 ± 0.60 (1–3)	2.23	0.02 ³

W = Wilcoxon signed test.

1 = comparing baseline data and 6-month follow-up data.

2 = comparing baseline data and 12-month follow-up data.

Table 6. Comparing outcome parameters in both study groups.

6-month outcome parameters				
Parameters	Group A (n = 20)	Group B (n = 20)	u-test	p value
SPAASMS (leg)	0.45 ± 0.60 (0–2)	0.45 ± 0.51 (0–1)	0.17	0.86
SPAASMS (back)	1.65 ± 0.99 (0–5)	1.65 ± 0.75 (0–3)	0.40	0.69
ODI	13.55 ± 10.16 (5–55)	13.25 ± 3.23 (7–19)	1.48	0.14
Grade of fusion	1.40 ± 0.75 (1–4)	1.85 ± 0.81 (1–3)	2.01	0.045
Slippage %	8.25 ± 5.91 (0–15)	9.25 ± 4.66 (0–15)	0.42	0.67
12-month outcome parameters				
SPAASMS (leg)	0.10 ± 0.31 (0–1)	0.30 ± 0.47 (0–1)	1.24	0.21
SPAASMS (back)	0.45 ± 0.51 (0–1)	0.90 ± 0.64 (0–2)	1.26	0.21
ODI	7.40 ± 3.35 (5–20)	7.65 ± 2.08 (5–13)	0.42	0.67
Grade of fusion	1.30 ± 0.73 (1–4)	1.60 ± 0.60 (1–3)	2.10	0.04
Slippage %	8.25 ± 5.91 (0–15)	9.25 ± 4.67 (0–15)	0.42	0.67



Figure 1. MRI sagittal (A), axial (B), and plain radiograph (C) showing L4-L5 degenerative lumbar disc disease and degenerative facet arthropathy with degenerative spondylolisthesis grade 1. Immediately postoperative (D) and 6-month (E) and 12-month (F) postoperative plain X-rays, lateral views showing L4-L5 interbody cage augmented with pedicle-screw fixation and depicting stable construct with ongoing and sound interbody fusion at the last follow-up.

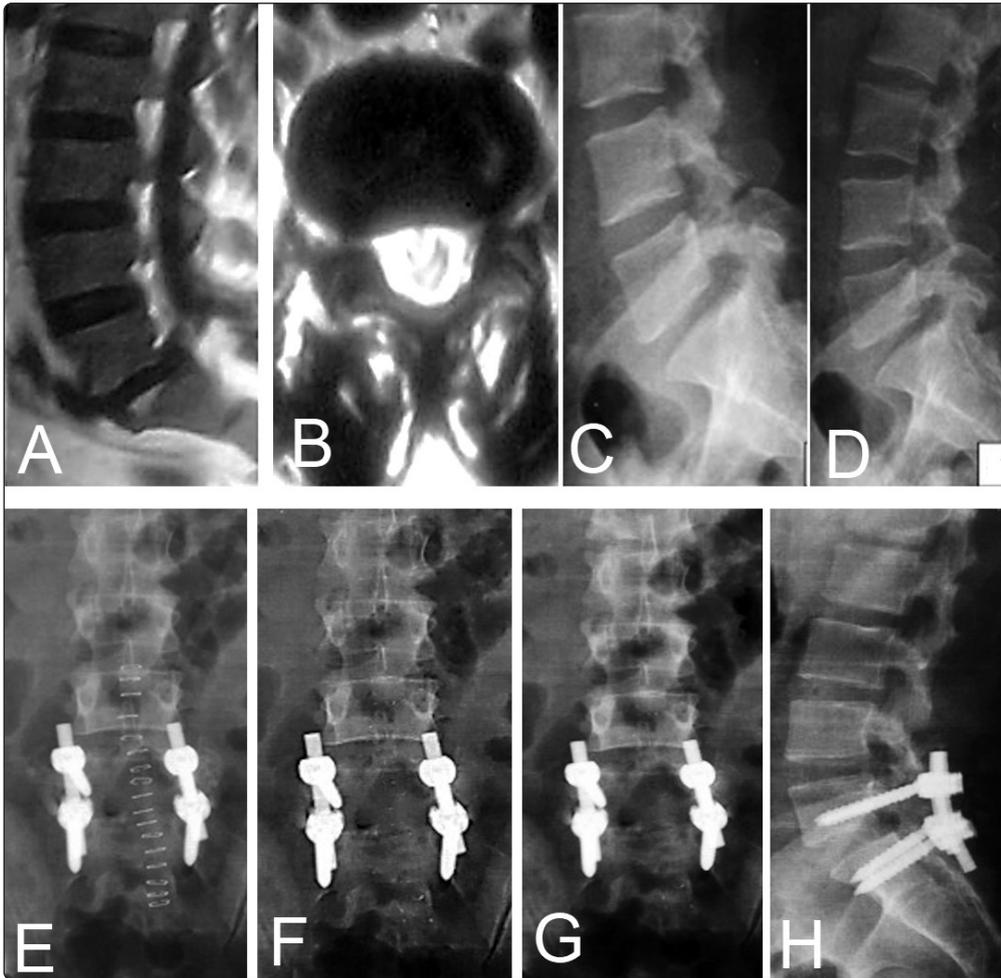


Figure 2. MRI sagittal (A), axial (B), and plain radiograph lateral view in flexion (C) and extension (D) showing L5-S1 degenerative lumbar disc disease and degenerative spondylolisthesis grade 1. AP view X-ray of lumbosacral spine immediately postoperatively (E); 6 months postoperatively (F); 12 months postoperatively (G). Lateral view (H) showing L5-S1 pedicle-screw fixation with posterolateral fusion and depicting stable construct with ongoing and sound posterolateral fusion at the last follow-up.

DISCUSSION

Surgical options for spondylolisthesis have been discussed in previous literature and pointed to good results achieved with decompression alone without any fusion in cases with mild degrees of degenerative spondylolisthesis. Nevertheless, this can probably be a sustainable option for older patients with multiple comorbidities and low functional activity.²² Nonetheless, more recent and elaborate studies demonstrate that better and more long-lasting results can be achieved when arthrodesis is performed in addition to decompression. This is emphasized in the North American Spine Society (NASS) clinical guideline for degenerative spondylolisthesis and canal stenosis, where a stronger recommendation has

been made for both decompression and arthrodesis rather than decompression alone.³

In the present study, fusion was performed by transpedicular screws fixation based on data suggesting it can improve fusion rates. Twenty patients with degenerative lumbar stenosis and spondylolisthesis underwent lumbar decompression, transpedicular fixation, and TLIF (Group A). Another group, with the same number of patients, underwent lumbar decompression, transpedicular fixation, and posterolateral fusion (Group B).

Epidemiologic Findings:

In our study, the mean age at presentation in Group A was 54.55 ± 4.26 (range, 48–60) and in Group B was 54.15 ± 4.17 (range, 45–60) years. There was no significant difference between the two groups regarding the age of presentation.

The number of female patients was slightly larger than that of male patients. The female patients represented 60% and 55% of studied patients in Groups A and B, respectively.

Most studies investigating the prevalence of degenerative spondylolisthesis and canal stenosis showed female predominance. Jacobsen et al.¹⁴ reported the prevalence of degenerative lumbar spinal stenosis was 2.7% for males and 8.4% for females, with a F:M ratio of 6.4:1. Wang et al.²⁴ showed that the prevalence of degenerative lumbar spondylolisthesis is quite gender-specific and age-specific. Few women and men have degenerative lumbar spondylolisthesis before the sixth decade and after the age of fifty, both sexes start to develop degenerative changes, especially in the lumbar spine. The most common affected level in all the studied patients was L4-L5, accounting for 55% (22 patients). This finding coincides with the results obtained by Wang et al.²⁴ in their study. They noted that the most affected level was L4-L5, followed by L5-S1 and L3-L4.

Operative Data:

The average amount of blood loss in Group A (502.5 ± 138.1 ml) was significantly higher than that for Group B (335.0 ± 89.0 ml) ($p < 0.001$). Similarly, Challier et al.⁵, in their randomized controlled trial (RCT), showed higher mean blood loss in the TLIF group (364 mL) compared to the PLF group (271 mL); however, this result failed to show statistical significance ($p = .08$). Abou-Madawi et al.'s study in 2020 on patients with spondylolisthesis compared the outcomes of those who underwent TLIF augmented with a locally harvested autograft to those augmented with iliac crest bone graft. They recorded a mean blood loss of 377 ml between the two groups, which is less than that recorded in our TLIF group. They also recorded mean hospital stay of 1.7 and 1.9 days in the groups, which is less than that recorded in our study, reaching more than 3 days for either group.¹ The mean operative time in our study was recorded at 141 minutes and 135 minutes for Groups A and B, respectively. This is comparable to results from a similar study by Farid et al. in 2018, where

they recorded 123.25 minutes of mean operative time for PLF patients and 185 minutes for TLIF patients.⁸

Clinical and Functional Outcomes:

Comparing the clinical outcome between the two groups, we found that SPAASMS of leg and back pain improved in the two groups, but there were no statistically significant differences comparing the two groups whether after six or twelve months of follow-up. This agrees with Høy et al.¹³ in their randomized trial where there was no evidence of any superiority of the procedure as regards to function and back pain in a 2-year prospective follow-up. We could not prove that there are any significant differences in radicular pain between TLIF and PLF groups. A retrospective study done by Ghasemi et al.¹² studied the data of 145 consecutive patients with degenerative spondylolisthesis who underwent lumbar fusion by the two different modalities. Eighty patients underwent TLIF, whereas 65 were included in the PLF with transpedicular screws group. They found no statistically significant difference between the two groups considering the SPAASMS for leg pain in follow-up results. Nevertheless, there was a significant difference between the groups concerning SPAASMS for back pain in favor of the TLIF group. In our study, ODI decreased in the two groups without significant differences between the two groups at either six- or twelve-month follow-up. Similarly, the RCT by Challier et al.⁵ was concluded an ODI improvement of 19 in the PLF compared with 28 in the TLIF group; however, this difference did not achieve statistical significance ($p = .080$). The improvement of ODI in our TLIF group from the preoperative mean of 55.45 to 7.4 in the last follow-up at 12 months can be compared to Abou-Madawi et al.'s series of 108 patients where the improvement recorded was from a mean of 41.4 to 12.3 in the local autograft group and from a mean of 39 to 13 in the iliac crest bone graft group.

Radiological Outcome:

It is of utmost significance to note that any radiologic assessment of lumbar spine fusion

would not be complete unless the correlation between clinical outcome and the radiologic outcome is made relevant. It is always imperative to remember that patients who show the technical success of fusion on radiologic assessment may not show a matching clinical improvement and vice versa.²³

In the present study, the TLIF group shows a high grade of fusion according to Bridwell grading criteria for spinal fusion and significantly better than the PLF group of patients at either six-month follow-up ($p = 0.045$) or twelve-month follow-up ($p = 0.04$).

These results are consistent with the RCT results of Challier et al.⁵, who reported a more successful fusion rate of 96.7% in their TLIF group that was statistically significant when compared to the 56.7% in the PLF group ($p < 0.001$). Høy et al.¹³ found that the fusion rate after 2 years was 94% in their interbody fusion group compared to 88 % in the PLF group.

Theoretically, interbody fusion results in high fusion rates. It provides large vascularized bed for fusion. Interbody grafting and pedicular screw augmentation subject the graft to compressive loads. Additionally, Proper endplate preparations and well-positioned interbody spacers optimize the fusion environment. Furthermore, synthetic bone substitutes enrich the biological media for fusion.²

Although some articles in the literature reported that TLIF was superior to PLF in improving back pain; however, several other studies showed that both techniques reached quite similar outcomes.¹³

In this present study, we used X-ray for the evaluation of either posterolateral fusion or interbody fusion. In the previous studies, there have been some debates concerning which modality of radiography would best assess and follow up spine fusion. In a study by Fogel et al.⁹, plain X-ray and spiral computed tomography demonstrated equal accuracy after PLIF confirmed by surgical

exploration. The authors proposed that whether the plain X-ray shows good evidence of fusion or pseudarthrosis, computed tomography will be unlikely to add any further useful findings.

Complications:

We found low complication rates in our study. Two cases in Group B had a dural tear and none in Group A. No cases were reported with postoperative neurological deficits. No cases of the adjacent level disease were encountered in the follow-up period. One case of cage migration was reported in Group A. These results are nearly matching or less than others reviewed in the literature. Pooswamy et al.¹⁷ demonstrated a 9.5% (2/21) infection rate in the PLF group and a 5.2% (1/19) infection rate in the TLIF group. Ghasemi et al.¹² reported a 3.1% (2/65) infection rate in the PLF group and a 3.7% (3/ 80) infection rate in the TLIF group. Fujimori et al.¹⁰ did not report any infection cases in either the PLF group (0/32) or TLIF group (0/24). A recent study conducted by Chang C-W et al.⁶ analyzed data from 4923 patients who had undergone TLIF with cage and pedicle-screw fixation for spondylolisthesis. Of those 4923 patients in the study, 32 (0.65%) developed infection affecting the interbody cage. They concluded that the most important factor contributing to TLIF cage retention failure was epidural fibrosis of the previous transforaminal route and biofilm adhesion on interbody devices affecting infection clearance. Thus, they recommended a combined anterior and posterior approach for radical debridement with cage removal to reach better clinical outcomes.

Limitations:

Our study has certain limitations, including the small number of patients, the short-term follow-up period, and the usage of only X-ray in the evaluation of fusion. We believe that our results should be interpreted taking into considerations all these limitations. Based on that, we recommend more studies to overcome these limitations.

CONCLUSION

The reported data in the present study suggest that both TLIF and PLF provide improvement of disability and pain in patients with degenerative lumbar disorders. It also suggests that TLIF is superior to PLF when comparing the achievement of radiographic fusion. However, there is no significant clinical outcome difference to recommend using TLIF over traditional PLF in the treatment of degenerative lumbar disorders, especially with the higher treatment costs with the use of interbody fusion.

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الملخص العربي

نتائج الإلتحام الفقاري الأمامي من خلال مخارج الأعصاب والإلتحام الفقاري الخلفي الجانبي بواسطة مثبتات لعلاج التغيرات الإنتكاسية للفقرات القطنية

البيانات الخلفية: يعد انزلاق الغضروف القطني، والتزحزح الفقاري القطني وضيق القناة الشوكية القطنية هي اسباب شائعة جدا وتؤثر علي الملايين من الناس. ولعلاج امراض العمود الفقري القطنية التنكسية فاننا قد نحتاج في كثير من الاحيان الي تدخل جراحي عندما يفشل العلاج التحفظي في تخفيف الالم وكذلك في حالات وجود عجز عصبي حسي او حركي وكذلك اضطرابات التحكم في الإخراج.

الغرض: هو مقارنة النتائج الاكلينيكية والاشعاعية للإلتحام القطني من خلال مخارج الأعصاب والإلتحام الفقاري الخلفي الجانبي في حالات ضيق القناة القطنية وحالات التزحزح الفقاري التنكسي.

تصميم الدراسة: هذه دراسة أجريت علي المرضى الذين يعانون من ضيق القناة القطنية والتزحزح الفقاري القطني الذين خضعوا لتثبيت الفقرات القطنية مع عمل اما الإلتحام الفقاري من خلال مخارج الاعصاب أو الإلتحام الفقاري الخلفي الجانبي من 2015 إلى 2019.

المرضى والطرق: تم تقسيم المرضى إلى مجموعتين: الأولى تضم 20 مريضا وهم الذين تم اجراء التحام فقاري قطني من خلال مخارج الاعصاب والثانية تضم 20 مريضا وهم الذين تم اجراء التحام فقاري قطني خلفي جانبي. تم تقييم المرضى عقب اجراء الجراحة عن طريق قياس شدة الالم وفق المقياس البصري لشدة الألم وكذلك النشاط الوظيفي للمرضي بعد الجراحة مباشرة وبعد ستة اشهر وبعد سنة ومقارنة تلك النتائج بمثيلاتها قبل اجراء الجراحة. وكذلك تم تقييم نتائج الجراحة بالاشعاع عن طريق عمل اشعة عادية عقب اجراء الجراحة مباشرة وبعد ستة اشهر وبعد سنة من اجراء الجراحة.

النتائج: كل من الطريقتين أدى إلى تحسن الألم وكذلك تحسن النشاط الوظيفي. ولكن أظهر البحث أن الإلتحام الفقاري القطني من خلال مخارج الاعصاب أدى إلى نتائج أفضل في الإلتحام الفقاري وهذا ما أثبتته نتائج الأشعة العادية أثناء متابعة المرضى.

الخلاصة: من الدراسة الحالية وغيرها من الدراسات، وجد انه في حالات ضيق القناة القطنية والتزحزح الفقاري يقوم كلا من الإلتحام الفقاري القطني من خلال مخارج الاعصاب والإلتحام الفقاري الخلفي الجانبي بتحسين درجة الالم وتقليل نسبة العجز للمرضي. الا ان الإلتحام الفقاري القطني من خلال مخارج الاعصاب متفوق علي الإلتحام الفقاري الخلفي الجانبي من ناحية درجة الإلتحام. لا توجد أدله قويه تدعم استخدام احدهما علي الاخر في علاج امراض العمود الفقري القطني.