Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2024.234154.2873 Volume 30, Issue 9, December. 2024
Manuscript ID: ZUMJ-2409-3560
DOI 10.21608/zumj.2024.318187.3560

ORIGINAL ARTICLE

Transforaminal Lumbar Interbody Fusion in the Management of Single Level Low Grade Lumbar Degenerative Spondylolisthesis

Mohamed Fathy Abdallah Abdeldaim*, Omar Abdel-Wahab Kelany, Mohamed Hussein Elsayed, Elsayed Mohamed Selim Ali

Orthopedic Surgery departement, Faculty of Medicine, Zagazig University, Egypt

Corresponding author*:
Mohamed Fathy Abdallah Abdeldaim

Email:
drtoha172@gmail.com

Submit Date: 04-09-2024
Revise Date : 29-09-2024
Accept Date : 03-10-2024

ABSTRACT:

Background: Surgical procedures like transforaminal lumbar interbody fusion (TLIF) are becoming more common for treating degenerative spondylolisthesis (DS). This work aimed to evaluate the functional and radiographic outcomes of TLIF in the management of low-grade DS.

Methods: thirty-six patients who had low grade degenerative spondylolisthesis with axial low back pain and/or leg pain refractory to medical treatment were involved in this retrospective-prospective cohort study with follow up period of two years. Assessment was done in terms of Oswestry Disability Index (ODI), neurogenic symptoms, and visual analogue scale scores (VAS) for back and leg pain. Anteroposterior, lateral and dynamic views radiology of the lumbosacral area to assess the degree of spondylolisthesis, lumbar lordosis together with measuring the spinopelvic parameters. Finally, computed tomography was done post operatively to evaluate the degree of fusion.

Results: Comparing preoperative, 6 months postoperative and final outcome (2 years) VAS of back pain, VAS of leg pain and ODI among the operated patients (N=36), there was high significant change among them with follow up (P<0.001).The mean pelvic tilt (PT) decreased from 32.22(17-48) to 22.38 (12-39), with highly significant difference (p value <0.001). The sacral slope (SS) increased from 31.72(18-51) to 41.55(24-63), with highly significant difference (p value <0.001). The lumbar lordosis (LL) increased also from 52.50 (6-85) to 62.55 (36-101), with highly significant difference (p value <0.001). L4-S1 segmental lordosis increased from 32.27(16-55) to 37.11 (2-61), with significant difference (P value 0.003). PI-LL mismatch decreased to less than 10, with highly significant difference (p value <0.001).

Conclusions: Low-grade degenerative spondylolisthesis can be effectively managed using TLIF, which has been shown to significantly improve the clinical and the radiological outcomes. It has the ability to preserve and restore healthy spinopelvic balance.

Keywords: TLIF; Low Grade; Lumbar; Degenerative Spondylolisthesis

INTRODUCTION

When one vertebra is displaced forward over an adjacent one but the spinal arch remains intact, this condition is called degenerative lumbar spondylolisthesis [1]. The intervertebral discs and ligaments degenerate or wear and tear, making degenerative spondylolisthesis (DS) more common after the age of 50, particularly in women. Instability and sliding can also be caused by osteoarthritis of the facet joints. The most common levels affected are L4/L5, then L3/L4 [2].

Low back and leg pain are common symptoms of Lumbar DS, which is a leading cause of spinal canal stenosis. Back pain is the primary symptom experienced by persons with DS. Leg pain that moves from side to side has been a common symptom for many years, and it has often been episodic. Neurogenic claudication is another associated type of pain of these patients [3].

Temporary bed rest, anti-inflammatory drugs, physical therapy, and spinal bracing are the main components of treatment for most patients of low-grade DS (Grades I and II). Surgical intervention may be beneficial for patients experiencing symptoms of low-grade degenerative spondylolisthesis who have not responded to non-operative treatment for a minimum of six months [4].

Surgery options for DS include decompression and fusion with or without instrumentation, or decompression alone. Spinal slippage progression and back pain complaints increased after decompression without instrumentation [5].

The two most common fusion techniques for treating lumbar spondylolisthesis are posterolateral fusion (PLF) and lumbar interbody fusion (LIF). Furthermore, when compared to other methods, interbody fusion offers certain benefits in restoring disc height and maintaining lumbar lordosis [6].

Bilateral pedicle screw instrumentation provides firm fixation during transforaminal lumbar interbody fusion (TLIF). When interbody fusion and posterior decompression are necessary, TLIF is typically advised for low-grade spondylolisthesis. With TLIF, patients can get a straightforward, safe, and successful treatment that greatly improves their quality of life after surgery [7].

So, the current research aimed to evaluate the functional and radiographic outcomes of TLIF in the management of low-grade DS with relation to the spinopelvic parameters.

METHODS

This Retrospective-prospective cohort study was conducted on thirty-six patients who had low grade degenerative spondylolisthesis with axial low back pain and/or leg pain refractory to medical treatment in the spine unit of orthopedic department Zagazig university hospital from April 2022 to April 2024 with follow up period of at least 2 years.

After institutional review board approval of IRB (ZU-IRB #1050412.3. 2023), written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

We included patients who had low grade degenerative spondylolisthesis with axial low back pain and/or leg pain refractory to medical treatment for at least one year. We excluded patients with high grade spondylolisthesis, severe osteoporosis, patients with previous spinal surgeries, spinal trauma, tumor and infections.

Preoperative assessment:

Every patient's demographic information, such as age, sex, occupation, smoking, and body mass index (BMI), was gathered. Every patient underwent a neurological, local, and general evaluation. Lateral Standing X-ray films displaying both femoral heads were collected prior to the procedure. The following parameters were measured: the pelvic tilt (PT), which indicates the angle between a vertical line that passes through the center of the femur and a line that connects the femur center to the sacral endplate midpoint, Sacral slope (SS) represents the angle between the S1 endplate and the horizontal plane , Pelvic incidence (PI) represents the angle between a line perpendicular to the middle of the sacral plate and another line connecting the previous point to the center of the femoral axis; Segmental lordosis (SL) of the affected segment represents the angle between the upper endplate of the slipped vertebrae and the upper endplate of the lower one. Lumbar lordosis (LL), L1–L4 angle and L4–S1 angle as well as Meyerding slip grades.

Every patient included in the study received both an MRI and dynamic films. Prior to surgery, Oswestry Disability Index (ODI) and Visual Analogue Scale (VAS) scores for leg and back pain were collected. Surgi-map Spine was used to measure spinopelvic parameters. All measurement were done by two trained independent spine surgeons[8,9].

Operative technique:

The patients were placed prone on radiolucent table on firm rolls to support the iliac crest, rib cage and the clavicle, keeping the hip extended. For the L3–S1 levels, a single midline skin incision was done. Blunt dissection was used to split the para-spinous muscle down to the base of the transverse process. Spinous processes and laminae from a level above and below the disease level were recognizable. Pedicle screws were inserted under c-arm before decompression after completing the exposure.

Following the performance of the surgical procedure to expose the transforaminal zone, a nerve root retractor was inserted medially to protect the thecal sac. Minimal retraction was done to prevent incidental durotomy during the annulotomy. The discectomy was initiated using a pituitary rongeur and curettes once the annulotomy was finished.

The distraction was maintained by applying a temporary rod on the contralateral pedicle screws. A thorough discectomy and endplate preparation were essential. Adequate preparation of the host graft site and removal of the cartilaginous endplates were done to ensure successful fusion.

Radiolucent Straight PEEK (Polyetheretherketone) cages were used to enhance spinal fusion and reduce stress shielding because of their lower elastic modulus and visualize bone formation on radiographs after implantation. Care was made to tamp the trial Implant properly medially and anteriorly after dilatation to the optimum size. After implant trialing, the cage should be bone grafted with the graft material from removed lamina and facet joint. the graft-containing cage is positioned using tamps to guide the cage medially and anteriorly.

Post-operative stage:

The patients were followed up at two weeks, 2 months, 6 months and then every 6 months till fusion. Clinical Assessment in terms of Oswestry Disability Index (ODI), neurogenic symptoms, and visual analogue scale scores (VAS) for back and leg pain.Radiologically;anteroposterior and lateral views to evaluate the degree of fusion. CT scan was used to assess the final fusion. The researchers employed the modified Bridwell fusion criteria. I and II fusion grades were considered satisfactory [10]. The results were analyzed statistically.

Outcome Measures were conducted on a regular basis (six months and two years after surgery) using the same clinical and radiological measurements as before the procedure.Patient's satisfaction index (PSI): The Patient Satisfaction Index was used as a measure to assess patients' experiences and satisfaction with the care they received. PSI involves 4 grades [11].

Statistical analysis

Excel 2010 (Microsoft Corp., Redmond, WA, USA) and SPSS 22.0 (IBM Inc., Chicago, IL, USA) were used for data collection, tabulation, and statistical analysis. Categorical data were represented as a percentage, whereas continuous variables were shown as the mean ± SD and median (range). The Shapiro-Wilk test was used to ensure that the continuous variables were normal. Three sets of dependent variables that did not follow a normal distribution were compared using the Friedman test. Two sets of dependent variables, neither of which had a normal distribution, were compared using the Wilcoxon signed ranks test. For paired categorical data, McNemar's test was utilized. If your square table has more than two rows or columns, you can use the Stuart-Maxwell test—a distinct version of the McNemar test—to see if there is marginal homogeneity. The tests were all bi-directional. Statistical significance (S) was denoted by a p-value less than 0.05, highly statistical significance (HS) by a p-value less than 0.001, and statistical insignificance (NS) by a p-value greater than or equal to 0.05.

RESULTS

The study included 36 patients in the spine unit of orthopedic department Zagazig university hospital with a mean age of 47.16 ± 8.24. The mean of Body Mass Index (BMI) was 32.16 ± 6.26. 88.9% of the patients had spondylolisthesis at level L4-L5 with 72.2% of the patients had spondylolisthesis grade 1 according to Meyrding classification. 55.5% of the patient had normal PI-LL mismatch (<10). **(Table 1).**

The cases showed blood loss with a mean of 198.33 ± 69.30 cc. On the whole cases, a blood transfusion was never required during the perioperative period. About post-operative results four patients had complication, two patient had superficial wound infection that was managed with repeated dressing and systemic antibiotics. two patients needed revision for a mal-directed screw. The duration of hospital stay for all patients was a mean of 3.33 ±1.64 days Regarding fusion level, after 1 year, 26 (72.3%) patients had fusion grade 1, 6 (16.7%) patients had fusion grade 2, 2 (5.5%) patients had fusion grade 3 and 2 (5.5%) patients had fusion grade 4 **(Table 2).**

About our VAS for back deceased from 7.44 preoperative to 1.38 and VAS for leg pain from 7.22 to 1.38 at final outcome. The ODI also decreased from severe disability (54.16%) to minimal disability post-operative and continue like that till our final outcome measures (10.88%). There was a statistically significant difference in VAS for back pain, leg pain and ODI, $\chi2$ (2) = 35.521, 35.086 and 33.718 respectively, p <0.001. Post hoc analysis with Wilcoxon signed-rank tests was conducted. Median VAS for back pain for the preoperative, 6 months postoperative, and final follow up were 7 (5 to 10), 2 (2 to 4), 1 (1 to 3), respectively. Median VAS for leg pain for the preoperative, 6 months postoperative, and final follow up were 7 (5 to 9), 2 (1 to 4), 1 (1 to 3), respectively. Median ODI for the preoperative, 6 months postoperative and final follow up were 50 (35 to 80), 16.5 (8 to 35), 10 (4 to 25), respectively. There were high significant differences in between the preoperative and postoperative VAS for back pain, leg pain and ODI **(Table 3).**

At the final follow-up 88.9% had mild disability and 11.1% had moderate disability as measured using the ODI. Comparing preoperative, 6 months postoperative and final outcome VAS of back pain, VAS of leg pain and ODI among the operated patients, there was high significant change among them with follow up. According to **Hardacre's criteria** of the cases in the study, 83.3% were excellent, and 16.7% were good. Regarding PSI, 24 (66.7%) patients had PSI grade 1, 8 (16.7%) patients had PSI grade 2, 2 (5.5%) patient had PSI grade 3 and 2 (5.5%) patient had PSI grade 4. **(Table 4).**

The pelvic incidence did not change throughout the follow up as it was a constant value, there were highly significant differences between pre and post PT, SS, LL (with p<0.001), L4-S1 (P value 0.003), and PI-LL mismatch (p value <0.001) **(Table 5).**

Table (1): Patient demographics, and Clinical Data among the operated patients (N=36).

Patient demographics	**The operated patients (N=36)**	
	No.	**%**
Sex		
• Male	12	33.3%
• Female	24	66.7%
Age (years)		
• Mean±SD	47.16 ± 8.24	
• Median (Range)	46.50 (34 – 60)	
BMI (kg/m^2)		
• Mean±SD	32.16 ± 6.26	
• Median (Range)	33 (21 – 42)	
Co-morbidities		
• Absent	18	50%
• Diabetes mellitus	8	22.2%
• Hypertension	10	27.8%
Smoking		
• Non-smoker	26	72.2%
• Current smoker	10	27.8%
Occupation		
• Non work	24	66.7%
• Worker	12	33.3%
Level of spondylolisthesis		
• L4-L5	32	88.9%
• L5-S1	4	11.1%
Grade of spondylolisthesis		
• Grade 1	26	72.2%
• Grade 2	10	27.8%
Mismatch		
• Normal	20	55.5%
• Abnormal	16	45.5%

Categorical variables were expressed as number (percentage).
Continuous variables were expressed as mean ± SD & median (range).

Table (2): Operative, Postoperative, and Fusion level data among the operated patients (N=36).

Operative data	**The operated patients (N=36)**	
Operative time (min.) • Mean±SD • Median (Range)	124.16 ± 22.70 120 (90 – 180)	
Blood loss • Mean±SD • Median (Range)	198.33 ± 69.30 180 (100 – 400)	
Post-operative data	**The operated patients (N=36)**	
	No.	**%**
Complications • Absent • Superficial wound infection • Screw maldirection& revision	32 2 2	88.9% 5.6% 5.6%
Mobilization • Mean ± SD • Median (Range)	12 ± 0 12 (12 – 12)	
Hospital stay (days) • Mean ± SD • Median (Range)	3.33 ± 1.64 3 (2-7)	
Fusion grade	**The operated patients (N=36)**	
	No.	**%**
6 months postoperatively: • 1 • 2 • 3 • 4	0 12 20 4	0% 33.3% 55.7% 11%
2 years postoperatively: • 1 • 2 • 3 • 4	26 6 2 2	72.3% 16.7% 5.5% 5.5%

Continuous variables were expressed as mean ± SD & median (range).

Table (3): Post hoc test for functional outcome (as quantitative variables) among the operated patients (N=36).

Functional outcome	**Preoperative Vs 6 months**	**Preoperative Vs Final (2years)**	**6 months Vs Final (2years)**
VAS for Back pain • Test b • p-value (Sig.)	-3.773 <0.001 (HS)	-3.771 <0.001 (HS)	-3.787 <0.001 (HS)
VAS for Leg pain • Test b • p-value (Sig.)	-3.803 <0.001 (HS)	-3.785 <0.001 (HS)	-3.755 <0.001 (HS)
ODI (%) • Test b • p-value (Sig.)	-3.730 <0.001 (HS)	-3.749 <0.001 (HS)	-3.562 <0.001 (HS)

Continuous variables were expressed as mean ± SD & median (range); b: Wilcoxon signed ranks test; Sig.: Significance; p-value< 0.05 is significant.

Table (4): Functional outcome (as qualitative variables), and Patients satisfaction index (PSI) among the operated patients (N=36).

Functional outcome	Preoperative (N=36)		Postoperative 6 months (N=36)		Postoperative Final (N=36)		Test[a]	p-value (Sig.)
	No.	%	No.	%	No.	%		
VAS for Back pain							34.000	<0.001 (HS)
• Mild	2	5.6%	36	100%	36	100%		
• Moderate	2	5.6%	0	0%	0	0%		
• Severe	32	88.9%	0	0%	0	0%		
VAS for Sciatic pain							36.000	<0.001 (HS)
• Mild	0	0%	36	100%	36	100%		
• Moderate	6	16.7%	0	0%	0	0%		
• Severe	30	83.3%	0	0%	0	0%		
ODI							32.893	<0.001 (HS)
• Mild disability	0	0%	30	83.3%	32	88.9%		
• Moderate disability	6	16.7%	6	16.7%	4	11.1%		
• Severe disability	22	61.1%	0	0%	0	0%		
• Crippled	8	22.2%	0	0%	0	0%		

Patient Satisfaction Index (PSI)	The operated patients (N=36) No.	%
• 1	24	66.7%
• 2	8	22.3%
• 3	2	5.5%
• 4	2	5.5%

Categorical variables were expressed as number (percentage); a: Friedman test; Sig.: Significance; p-value< 0.05 is significant.

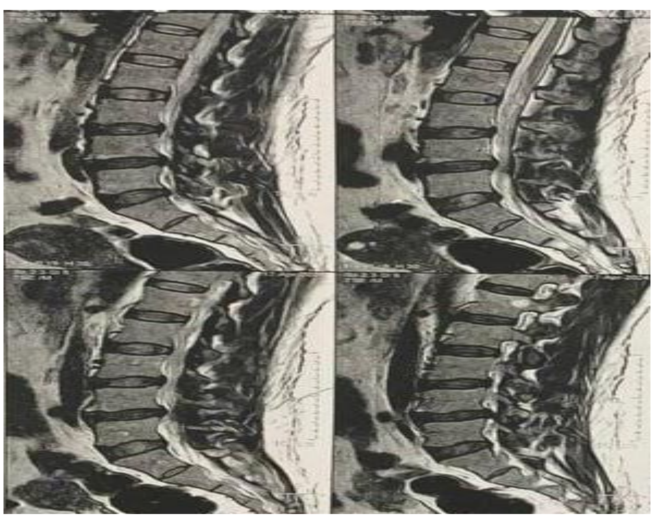
Table (5): Radiological outcome among the operated patients (N=36).

Radiological outcome	Preoperative (N=36)	Final (N=36)	Test[b]	p-value (Sig.)
PI • Mean ± SD • Median (Range)	63.94 ± 13.50 65 (40 – 87)	63.94 ± 13.50 65 (40 – 87)	0.000	1.000 (NS)
PT • Mean ± SD • Median (Range)	32.22 ± 9.93 32 (17 – 48)	22.38 ± 6.50 21 (12 – 39)	- 3.726	<0.001 (HS)
SS • Mean ± SD • Median (Range)	31.72 ± 9.50 28 (18 – 51)	41.55 ± 13.12 38.50 (24 – 63)	-3.726	<0.001 (HS)
LL • Mean ± SD • Median (Range)	52.50 ± 19.84 57 (6 – 85)	62.55 ± 16.91 62 (36 – 101)	-3.662	<0.001 (HS)
L1-L4 • Mean±SD • Median (Range)	31.94 ± 12.01 36 (13 – 50)	27.72 ± 14.19 27 (9 – 54)	-1.199	0.230 (NS)
L4-S1				

Radiological outcome	Preoperative (N=36)	Final (N=36)	Test[b]	p-value (Sig.)
• Mean±SD • Median (Range)	32.27 ± 11.56 31.50 (16 – 55)	37.11 ± 13.86 39 (2 – 61)	-2.948	0.003 (S)
PI-LL • Mean±SD • Median (Range)	8.66 ± 9.09 7 (-4 – 24)	1.38 ± 10.58 4.50 (-16 – 18)	-3.641	<0.001 (HS)

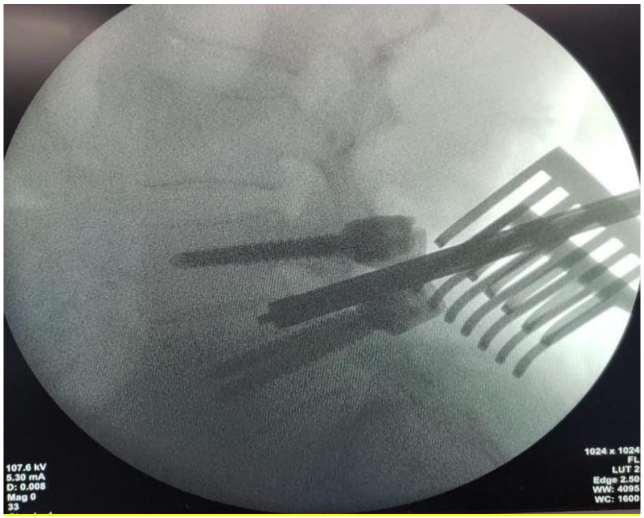
Continuous variables were expressed as mean ± SD & median (range); b: Wilcoxon signed ranks test; Sig.: Significance; p-value< 0.05 is significant

(A)

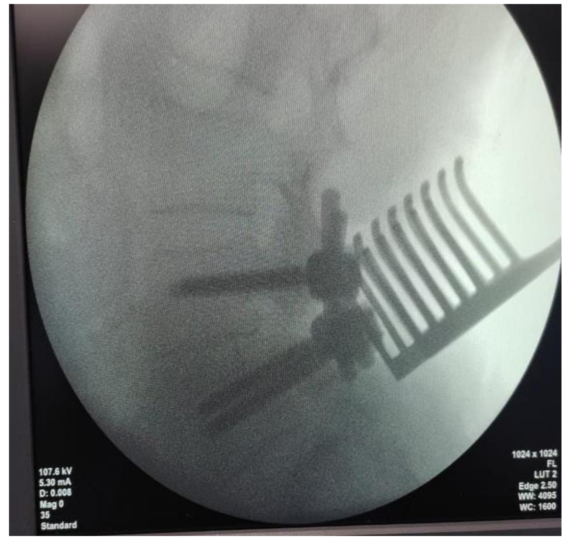


(B)

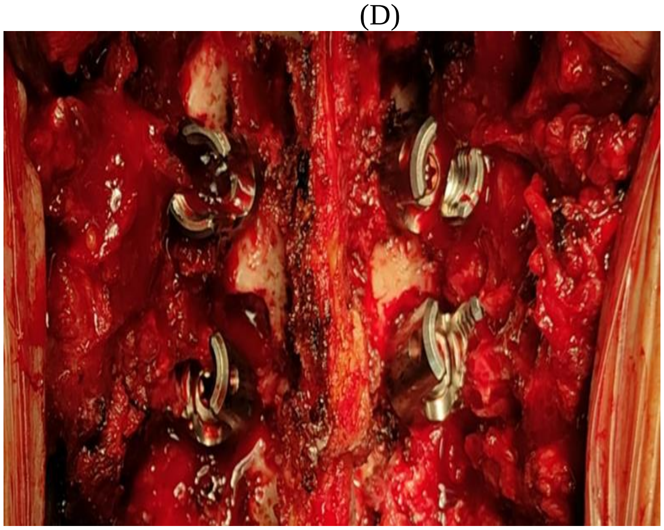
(C)


107.6 kV
5.30 mA
D: 0.008
Mag 0
33
1024 x 1024
FL
LUT 2
Edge 2.50
WW: 4095
WC: 1600

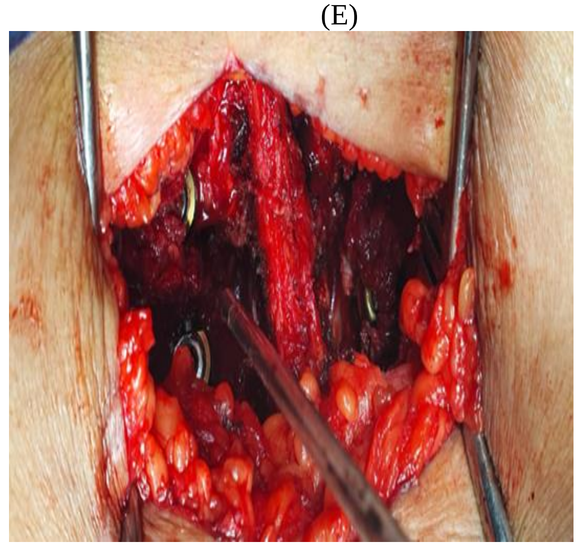
(D)


107.6 kV
5.30 mA
D: 0.008
Mag 0
35
Standard
1024 x 1024
FL
LUT 2
Edge 2.50
WW: 4095
WC: 1600

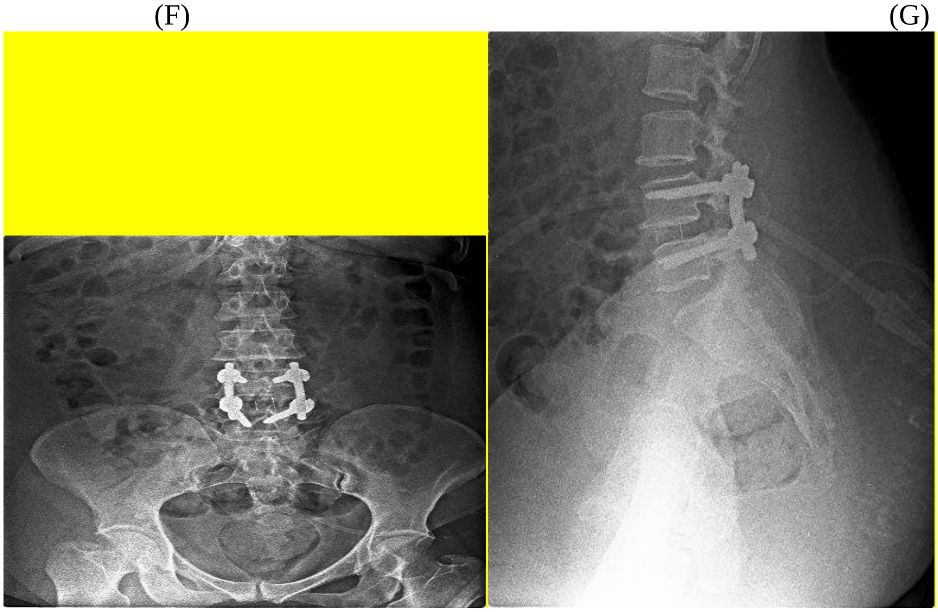
(E)



(F)



(G)



(H)

Figure 1: (A) Preoperative plain x ray dynamic standing views of the patient with slipped level L4_L5, (B,C) Preoperative sagittal and axial MRI lumbosacral spine showing slipped L4 L5 level, (D) Intraoperative fluoroscopic image lateral view after insertion of screw and the trial cage, (E) Intraoperative fluoroscopic image after insertion of screws and rods, (F) Intraoperative photo of A TLIF with the spinous process in the midline and the osteotomy of the facet of L4 to reach the intervertebral foramen, (G) Intraoperative photo showing a pointer marking the window for the cage entry, (H) postoperative x ray AP and Lateral views .

DISCUSSION

A condition known as degenerative spondylolisthesis (DS) results in one vertebral body slipping over the other because of degenerative alterations in the spine. Because it requires less retraction of the thecal sac, the TLIF approach has received positive reviews [12]. Adjusting the spinopelvic parameters has become crucial in spondylolisthesis surgery [13]. Our objectives were to assess the contribution of TLIF to improve the functional and radiological outcome in patients with low-grade degenerative spondylolisthesis and to look into the significance of assessing spinopelvic parameters.

Improvement in VAS and ODI scores suggests a successful course of treatment. These scores are important predictors of the functional outcome in patients with lumbar spine issues [14]. The current study showed significant improvement in terms of visual analogue scale (leg pain and back pain), Oswestry disability index and patient satisfaction index, among the operated patients, there was high significant change among them with follow up. We observed a considerable decline in ODI scores, which went from severe disability to mild disability. Our findings are in line with the finding of Kazim et al. [15], who reported that the average ODI before surgery was 61.65±11.380, with a range of 42–80; after 1 year of surgery, it decreased dramatically to 35.35±11.417. The baseline VAS score varied from 4 to 9, with an average of 6.80±1.609, and after 1 year of surgery, it decreased dramatically to 0.75±0.910.

According to the current study, the mean operative time for the patients under study was determined to be 124.16 ± 22.70 minutes, with 180 minutes being the longest and 90 minutes being the shortest. Our work's mean operational blood loss was determined to be 198.33 ± 69.30 cc. According to Zhang et al. [16], who reported an operating time of 257 minutes and a mean blood loss of 246 ml, the maximum blood loss was 400 cc, and the minimum was 100 cc. For single level fusion, Lee et al. [17] also employed an open TLIF technique; their patients' mean operative time (181.8 min) and mean blood loss (447.4 ml) were comparable to our findings. To prevent excessive blood loss, we carefully used sub-periosteal dissection and electrocautery as well as using a controlled hypotensive anesthesia that lowers blood pressure during the procedure.

The current study found that the average length of hospital stay for the patients under study was 3.33±16.4 days after surgery. The maximum hospital stay duration was 7 days, and the shortest was 2 days. These results were almost identical to those of Kazim et al. [15] whose mean hospital stay duration was 4–7 days and 5.95±1.146. Also Zhang et al.'s study [16] took 3.7 days.

Out of the 36 patients in this study, two patient (5.5%) had a superficial wound infection and another two patient had L5 nerve root irritation because a maldirected screw and needed revision surgery. Hee et al. [18] had one patient died from a severe infection. Rosenberg and Mummaneni [19] study had two patients (9%) with neurological insult, one patient had brachial neuralgia due to positioning, while the other had L5 motor impairment due to a mal-directed screw.

The pelvic incidence did not change throughout the follow up as it was a constant value; the mean value for PI was 63.94 ± 13.50 before and after operation. In the final follow-up, the PT value decreased significantly from 32.22 ± 9.93 to 22.38 ± 6.50. One possible explanation for TLIF's potential to alleviate low back pain in patients with degenerative spondylolisthesis is the enhancement and preservation of PT within physiological parameters. Surgeons are advised to carefully attain sagittal spinopelvic alignment and to steer clear of postoperative PI-LL mismatch. Patients with lumbar pathologies should be able to adapt better after PT decrease. Furthermore, a decrease in it is linked to a decrease in pain, which explains why our study's PT reduction improved ODI and VAS scores [20,21]. We noted a significant postoperative improvement toward more normal values for PT and SS in relation to PI, as well as considerably higher mean values of SS and LL ($p < 0.001$). In line with our research. The sacral slope also increased from 31.72(18-51) to 41.55(24-63), Ali et al. [13] found that fusion led to a considerable drop in PT values as a result of loss of the no more needed compensation of the pelvis.

The postoperative LL in our sample improved from 52.50 ± 19.84 to 62.55 ± 16.91, (p value<0.001). These modifications were thought to be related to compressing the pedicle screws posteriorly against the anteriorly situated interbody cage, and with the preservation of the posterior tension band created by the posterior ligament complex. L1-L4 segmental lordosis changed from 31.94 (13-50) to 27.72 (9-54), there was significant difference between pre and post L4-S1 (P value 0.003) as a result of the spontaneous restoration of lordosis at the unfused lumbar levels as demonstrated by Jagannathan et al. [22].

By treating the localized kyphotic deformity, TLIF in those patients led to the restoration and/or maintenance of spinopelvic harmony in the current investigation with a normal PI-LL matching in all patients postoperatively less than 10. Disregarding a mismatched PI-LL may result in less favorable surgical results, as patients with a high PI are at a higher risk because they try to keep their posture comfortable by having more LL and retroverting their pelvis to increase PT compensation. These intensive compensatory strategies deteriorate Health related quality of life and cause agonizing pain in their daily life [23,24].

Out of all the patients in this study, regarding fusion grade, after 2 years, 13 (72.3%) patients had fusion grade 1, 3 (16.7%) patients had fusion grade 2, 1 (5.5%) patient had fusion grade 3 and 1 (5.5%) patient had fusion grade 4. A similar finding was observed by Lee et al. [17] who reported that in their cases, the fusion rate increased from 52.2% at the 6-month mark to 98.5% after a two-year follow-up. According to multiple investigations, the fusion rates were 93% by Potter et al. [25], 96.2% by Wang et al. [26], 89% by Hackenberg et al. [27] and 94.8% by Lauber et al. [28]. Our results were better than those of Faundez et al. [24] who had a fusion rate of 76.9%, 15 out of 65 patients developed pseudoarthrosis and 12 of them needed revision surgery. Lowe et al. [29] stated that 95% of cases had radiological fusion. 90% of patients had a fusion, and 90% reported an improvement in their clinical symptoms, according to research by Mohammad et al. [30].

The current study results about patient satisfaction index were similar to those of Salehi et al. [31] who reported that 71% of their 17 patients rated the procedure as meeting their expectations (grade I), Three patients (12.5%) of the total, expressed satisfaction with the surgery but were uncertain about whether or not they would have the same procedure again (grade II), Three more patients (12.5%) expressed dissatisfaction with the surgery (grade III), and one patient was lost during the follow-up period. The findings of this study were more favorable compared to the study conducted by Potter et al. [23], In their study 75% of patients expressed satisfaction (Grade 1.2) with the surgical outcomes, 10% into grade III, and 12% into grade IV. In our present study, out of all the patients, 5.56% reported that the operation had a positive effect on him. However, they expressed that he would not want to undergo the same procedure again if it resulted in the same outcome (grade III). Additionally, two patients experienced no improvement or even a worsening of their condition compared to before the surgery (grade IV).

There are several restrictions on our investigation. First, the study's findings may not be broadly applicable given the small sample size, which only included cases of degenerative spondylolisthesis not other types of spondylolistheses. Secondly, the duration of the follow-up periods was insufficient to evaluate the long-term effectiveness and complications of the procedure. Finally, the study done at single medical center. In the future, research with a larger patient population and extended follow-up times is therefore necessary to validate these results in relation to other degenerative diseases and comparing TLIF with other fusion surgeries.

CONCLUSION

Low-grade degenerative spondylolisthesis can be effectively managed using TLIF, which has been shown to significantly improve the clinical and the radiological outcomes. It has the ability to preserve and restore healthy spinopelvic balance.

Conflict of Interest : None
Financial disclosure: None

REFERENCES

1. Akkawi I, Zmerly H. Degenerative Spondylolisthesis: A Narrative Review. Acta Biomed. 2022; 92(6):e2021313.
2. Zukowski LA, Falsetti AB, Tillman MD. The influence of sex, age and BMI on the degeneration of the lumbar spine. J Anat. 2012; 220(1):57-66.
3. Bydon M, Alvi MA, Goyal A. Degenerative Lumbar Spondylolisthesis: Definition, Natural History, Conservative Management, and Surgical Treatment. Neurosurg Clin N Am. 2019;30 (3):299-304.

4. Boyd ED, Mundluru SN, Feldman DS. Outcome of Conservative Management in the Treatment of Symptomatic Spondylolysis and Grade I Spondylolisthesis. Bull Hosp Jt Dis (2013). 2019; 77(3):172-82.
5. Hirase T, Ling JF, Haghshenas V, Weiner BK. Instrumented Versus Noninstrumented Spinal Fusion for Degenerative Lumbar Spondylolisthesis: A Systematic Review. Clin Spine Surg. 2022; 35(5):213-21.
6. Koenig S, Jauregui JJ, Shasti M, Jazini E, Koh EY, Banagan KE, et al. Decompression Versus Fusion for Grade I Degenerative Spondylolisthesis: A Meta-Analysis. Global Spine J. 2019; 9(2):155-61.
7. Levin JM, Tanenbaum JE, Steinmetz MP, Mroz TE, Overley SC. Posterolateral fusion (PLF) versus transforaminal lumbar interbody fusion (TLIF) for spondylolisthesis: a systematic review and meta-analysis. Spine J. 2018; 18(6):1088-98.
8. Zanoli G, Strömqvist B, Jönsson B. Visual analog scales for interpretation of back and leg pain intensity in patients operated for degenerative lumbar spine disorders. Spine (Phila Pa 1976). 2001; 26(21):2375-80.
9. Fritz JM, Irrgang JJ. A comparison of a modified Oswestry Low Back Pain Disability Questionnaire and the Quebec Back Pain Disability Scale [published correction appears in Phys Ther. 2008 Jan; 88(1):138-9]. Phys Ther. 2001; 81(2):776-88.
10. Poh SY, Yue WM, Chen LT, Guo CM, Yeo W, Tan SB. Two-year outcomes of transforaminal lumbar interbody fusion. J Orthop Surg (Hong Kong). 2011; 19(2):135-40.
11. Vanhorn TA, Knio ZO, O'Gara TJ. Defining a Minimum Clinically Important Difference in Patient-Reported Outcome Measures in Lumbar Tubular Microdecompression Patients. Int J Spine Surg. 2020; 14(4):538-43.
12. Le Huec JC, Faundez A, Dominguez D, Hoffmeyer P, Aunoble S. Evidence showing the relationship between sagittal balance and clinical outcomes in surgical treatment of degenerative spinal diseases: a literature review. Int Orthop. 2015;39(1):87-95.
13. Ali EMS, El-Hewala TA, Eladawy AM, Sheta RA. Does minimally invasive transforaminal lumbar interbody fusion (MIS-TLIF) influence functional outcomes and spinopelvic parameters in isthmic spondylolisthesis?.J Orthop Surg Res. 2022;17(1):272.
14. Khalid Saleh M, Elhewala TA. Sublaminar decompression and fusion versus transforaminal lumbar interbody fusion in management of lumbar degenerative disorders: a retrospective cohort study. Curr OrthopPract. 2020; 31(5):448-56.
15. Kazim G, Ali A, El Karamany M, Mohammed M. Transforaminal Lumbar Interbody Fusion (TLIF) Technique for the Treatment of Degenerative Lumbar Disease. BJAS, 5(4) (2)), 311-7.
16. Zhang W, Li X, Shang X, Xu X, Hu Y, He R, et al. Modified minimally invasive transforaminal lumbar interbody fusion using a trans-multifidus approach: a safe and effective alternative to open-TLIF. J Orthop Surg Res. 2015; 10:93.
17. Lee SH, Kim YB, Kim TS, Lee ST, Lee SY, Keum JS, et al. Transforaminal Lumbar Interbody Fusion for the Treatment of Nonunion after Posterolateral Lumbar Fusion. J Korean Soc Spine Surg. 2004; 11(4):223-30.
18. Hee HT, Castro FP Jr, Majd ME, Holt RT, Myers L. Anterior/posterior lumbar fusion versus transforaminal lumbar interbody fusion: analysis of complications and predictive factors. J Spinal Disord. 2001; 14(6):533-40.
19. Rosenberg WS, Mummaneni PV. Transforaminal lumbar interbody fusion: technique, complications, and early results. Neurosurgery. 2001; 48(3):569-75.
20. Bhosale S, Pinto D, Srivastava S, Purohit S, Gautham S, Marathe N. Measurement of spinopelvic parameters in healthy adults of Indian origin – A cross sectional study. J Clin Orthop Trauma. 2020; 11(5):883-8.
21. Wang Z, Wang B, Yin B. The relationship between spinopelvic parameters and clinical symptoms of severe isthmic spondylolisthesis : a prospective study of 64 patients. Published online 2014:560-8.
22. Jagannathan J, Sansur CA, Oskouian RJ Jr, Fu KM, Shaffrey CI. Radiographic restoration of lumbar alignment after transforaminal lumbar interbody fusion. Neurosurgery. 2009; 64(5):955-64.
23. Aoki Y, Nakajima A, Takahashi H, et al. Influence of pelvic incidence-lumbar lordosis mismatch on surgical outcomes of short-segment transforaminal lumbar interbody fusion. BMC Musculoskelet Disord. 2015; 16(1):213.

24. Cheng X, Zhang K, Sun X, Zhao C, Li H, Zhao J. Analysis of compensatory mechanisms in the pelvis and lower extremities in patients with pelvic incidence and lumbar lordosis mismatch. Gait Posture. 2017; 56:14-8..
25. Potter BK, Freedman BA, Verwiebe EG, Hall JM, Polly DW Jr, Kuklo TR. Transforaminal lumbar interbody fusion: clinical and radiographic results and complications in 100 consecutive patients. J Spinal Disord Tech. 2005; 18(4):337-46.
26. Wang J, Zhou Y, Zhang ZF, Li CQ, Zheng WJ, Liu J. Minimally invasive or open transforaminal lumbar interbody fusion as revision surgery for patients previously treated by open discectomy and decompression of the lumbar spine. Eur Spine J. 2011; 20(4):623-8.
27. Hackenberg L, Halm H, Bullmann V, Vieth V, Schneider M, Liljenqvist U. Transforaminal lumbar interbody fusion: a safe technique with satisfactory three to five year results. Eur Spine J. 2005; 14(6):551-8.
28. Lauber S, Schulte TL, Liljenqvist U, Halm H, Hackenberg L. Clinical and radiologic 2-4-year results of transforaminal lumbar interbody fusion in degenerative and isthmic spondylolisthesis grades 1 and 2. Spine (Phila Pa 1976). 2006; 31(15):1693-8.
29. Lowe TG, Tahernia AD. Unilateral transforaminal posterior lumbar interbody fusion. Clin OrthopRelat Res. 2002;(394):64-72.
30. Mohammad Hassaan M, Ali Nassar I, Abd Al-Aleem Alsebaie A, Ibrahim Khamiss A, Ibrahim Akar A. Transformational Lumbar Interbody Fusion in Management of Degenarative Lumbar Spine Disorders. AMJ, 2016, 45(1), 161-70.
31. Salehi SA, Tawk R, Ganju A, LaMarca F, Liu JC, Ondra SL. Transforaminal lumbar interbody fusion: surgical technique and results in 24 patients. Neurosurgery. 2004; 54(2):368-74.

Citation

Abdeldaim, M., Kelany, O., Elsayed, M., Ali, E. Transforaminal Lumbar Interbody Fusion in the Management of Single Level Low Grade Lumbar Degenerative Spondylolisthesis. *Zagazig University Medical Journal*, 2024; (4428-4439): -. doi: 10.21608/zumj.2024.318187.3560