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Research Article

Transpedicular screws with posterolateral fusion versus with posterior lumbar interbody fusion in lumbar spondylolisthesis

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Abstract

Background: When one vertebral body moves anteriorly in relation to its caudal vertebral body, this condition is known as spondylolisthesis. The best surgical procedure is still debatable. Some neurosurgery surgeons prefer posterior lumbar interbody fusion (PLIF) but others prefer posterolateral fusion (PLF).(1) **Aim**: The aim of the work is to compare the prognosis and outcome between PLIF with transpedicular screws versus PLF with transpedicular screws in spondylolisthesis and prognosis of each one. **Patient and Methods**: This is a prospective study which was conducted on **forty patients** with spondylolisthesis who were admitted to **Minya university hospital** between March 2020 and September 2021, and were randomly assigned in to 2 groups: the first group included 20 patients who underwent PLIF and the second group included 20 patients who underwent PLF. **Results:** In PLIF group the mean age was 47.85 (27-61 years). And in PLF group a mean age of was 46.7 (28-63 years), all patients were presented with low back pain while radicular pain was present in 65% and 75% in both groups respectively, 85% of patients had a single level spondylolisthesis either L4-5 or L5-S1 and 15% had double level spondylolisthesis in the PLIF group these percentages were nearly the same in the PLF group with 80% for single level spondylolisthesis and 20% percent with double level spondylolisthesis. The back pain and leg pain improved significantly in both groups with no significant difference between them. The outcome in the two groups was excellent in 65% and 50% respectively, good in 20% in both groups , fair in 10% and 25% respectively and poor in only 5% of each group. Complication rates were low and varied between incidental durotomy , infection and cage subsidence. **Conclusions:** PLIF had advantages in fusion rates, reduction of back pain with no other significant difference regarding other points of comparison.

Keywords: PLIF, PLF, intervertebral herniated disc, spondylolisthesis

Introduction

Each vertebral body should remain aligned with the vertebral bodies above and below in the lumbar spine's sagittal plane. When one vertebral body moves anteriorly in relation to its caudal vertebral body, this condition is known as spondylolisthesis.(2)

Most often, spondylolisthesis symptoms manifest as chronic back pain, sometimes accompanied by leg pain. Acute neurological examination impairments in patients with traumatic or metastatic tumors may include a loss of bowel and bladder function.(3)

Spondylolisthesis can have a variety of reasons, including those that are congenital, degenerative, traumatic, pathologic, iatrogenic, and isthmic. Isthmic spondylolisthesis is a term used to describe a pars interarticularis deficiency that eventually leads to anterior subluxation, most frequently at L5-S1 and then

L4-5. Back pain, central canal stenosis, and lateral recess or foraminal stenosis can all develop from the accompanying anterior subluxation.[4]

Spondylolisthesis frequently occurs without any symptoms. However, low back discomfort is the most typical presentation. Patients may also experience neurogenic claudication symptoms as low back pain, leg pain, and discomfort while standing or walking.[5][1][6]

Acute spondylolisthesis patients occasionally exhibit paralysis, loss of bowel and bladder control, and specific pain-related weakness of the lower limbs. Patients with persistent spondylolisthesis typically do not initially exhibit severe motor weakness. [1]

Since L5-S1 is the level that is most frequently affected, an L5-S1 isthmic spondylolisthesis would typically result in radicular symptoms including weakness in ankle dorsiflexion and hallux extension. [5][1][7][6]

Plain x-rays, such as oblique and lateral flexion-extension views, can be used to examine the lumbar spine's bone structure, alignment, and any dynamic instability. The lateral x-ray is the best tool for determining the degree of slippage. The lumbar spine's oblique view x-ray is a useful tool for evaluating the pars deformity. [5][1][7][6]

The reliable investigation to determine the pars defect is a CT scan of the lumbar spine. The preferred method for evaluating soft tissue structures in the lumbar spine, such as the conus medullaris, ligamentum flavum, nerve roots, and intervertebral discs, is magnetic resonance imaging (MRI). Patients who have tried conservative therapy without success and are considering surgery require an MRI.[1]

Low back discomfort associated with spondylolisthesis should initially be treated conservatively. Surgery is recommended if the problem is progressing, the radicular symptoms are incapacitating and interfere with daily activities, or if there is a substantial neurological deficiency.[6]

The best surgical procedure is still debatable. Some neurosurgery surgeons prefer posterior lumbar interbody fusion (PLIF) but others prefer posterolateral fusion (PLF).[1]

We will compare between posterior lumbar interbody fusion with transpedicular screws using polyetheretherketone (PEEK) cages as intersomatic spacers due to the complications of impacted bone grafts collapsing into the disc space versus posterolateral fusion with autografting or artificial bone in spondylolisthesis and prognosis of each one.[7]

Patients and Methods

This is a prospective study conducted on **forty patients** with spondylolisthesis who were admitted to **Minia university hospital between March 2020 and September 2021.**

Retrospectively, patients were randomly assigned to two groups.

A) twenty of them were operated on with transpedicular screws fixation and posterior lumbar inter body fusion by auto grafting (PLIF) (PEEK cages insertion).
B) twenty were operated on with transpedicular screws fixation and posterolateral fusion by autografting (PLF)

Among all cases presented with spondylolisthesis patients who fulfilled the following criteria were selected: those with L4-5 and L5-S1 spondylolisthesis or both levels together (congenital, degenerative, traumatic, pathologic, iatrogenic, and isthmic), age between 20 and 70, low back discomfort with or without radicular pain, Patients who developed post-laminectomy spondylolisthesis, patient who afford the cost of the cage and patient medically fit for surgery. Those with the following conditions were excluded: patients presented with spinal infection, patients who are medically not fit for surgery and patients refusing surgery.

All patients were subjected to full history, general and neurological examination. Plain radiographs, computerized tomography scans and MR images of the Lumbosacral spine were obtained in all patients.

In plain X-ray AP and lateral views were taken. Disc space height was measured and the degree of slippage was calculated using Taillard's method.CT images provides detailed bony anatomy and any bone pathology , while MR images. In some patients with traumatic spondylolisthesis who need information on ligamentous and spinal cord integrity, MRI offers complementary imaging.

Patients were followed up at regular interval at 2 weeks, 1month and 6 months for clinical assessment and radiological assessment, to evaluate correction of slippage angle, disc space height and fusion by the following criteria:

- **a- Definitive fusion**: appearance of trabecular bridging pattern of dense cortical bone across graft host interface, no motion less than (3º) in flexion extension radiograph, no gap at interface.
- **b- Probable fusion**: no trabecular bridging but no detectable motion and no identifiable gap at interface.
- **c- Possible pseudoarthrosis**: no trabecular bone crossing or movement but identifiable gap at interface.
- **d- Definitive pseudoarthrosis**: no traversing trabecular pattern, definitive gap, or movement more than 3 mm.

The Kirkaldy-Willis criteria (KWC) was used to evaluate the functional outcome and is as follows,

(a) Excellent. Patient returned to normal work and other activities with little or no complaint

(b) Good. Patient returned to normal work but may have some restriction in other activities and may -on occasion after heavy work- have recurrent back pain requiring a few days' rest

(c) Fair. Patient work capacity was reduced, necessitating a lighter job, or working part time, and may occasionally have pain recurrent requiring absence from work for one or two weeks once or twice a year

(d) Poor. Patient does not return to work.

The Oswestry Disability Index was used and is considered the "gold standard" of low back functional outcome.

An informed written consent was taken from each patient prior to the operation. This consent was done according to the guidelines of Faculty of Medicine Research Ethics Committee (FMREC), Minia University, El-Minia, Egypt.

Surgical procedure

The procedure is done with the patient under general or spinal anaesthesia. A prophylactic antibiotic is given just prior to beginning surgery. The patient is placed in the prone position on the operating table. After sterilization and draping, a midline incision down to the thoracolumbar fascia incorporating three spinous processes is done, centred on the spinous process of the upper vertebrae of the segment to be fused (i.e., L4, in the case of an L4–5 fusion). The fascia is then opened, and a bilateral subperiosteal dissection of the muscles is performed showing the spinous processes, laminae, facets of the levels to be fused

Insertion of pedicle screws: The projection of the lumbar pedicle will determine the entry points for pedicle fixation, the following landmarks should be recognized for proper identification of the pedicle:

The midline of the transverse process corresponding to the middle of the pedicle, the zygapophyseal joint line, the mamillary process of the lumbar vertebra or the lateral side of the superior articular facet.

We use a rongeur to decorticate the bone over, Insertion of awl into the pedicle, and advance it through the pedicle; monitor the path of the probe with posteroanterior and lateral C-arm images.

Removing the probe after the vertebral body is entered and confirmation of the continuity of the pedicle wall with a small ball-tipped probe, probe the pedicle in all four quadrants to ensure that it in the pedicle, and insert a pedicle screw with a poly axial head.

Transverse pedicle angle in the coronal plane was 0º at T12 from T12 down one should aim 5 degrees for each level. At the L5 level the orientation must be 15 to 30 degrees. Bilateral transpedicular screws are placed in the rostral and caudal vertebrae. After appropriate rods have been placed, gentle distraction can be applied across the segment before provisional tightening.

The decompression is performed at this time. we prefer an extensive decompression with bilateral laminectomy of the uppermost vertebrae, complete bilateral facetectomy, and at a minimum, removal of the rostral half of the lamina below. Thus, at L4–5, the thecal sac will be exposed in its entirety, both L4 nerve roots will be exposed from a point just medial to the L4 pedicles all the way out the foramina, and both L5 nerve roots will be exposed from their axillae to a point just medial to the L5 pedicles bilaterally.

The thecal sac is then retracted, the disc space opened with a scalpel and discectomy is performed with a rounger, All accessible disc material is then removed.
In the PLIF group typically shavers or dilators of increasing size are serially introduced into the disc space and rotated Lateral fluoroscopy can be helpful in determining the proper depth of penetration into the disc space.

After endplate preparation, Insertion of an obliquely placed rectangular PEEK cage upside down vertically then rotate it to be easily passed in front thecal sac and nerve root to be impacted into upper and lower end plate of involved segment.

Implant position should be confirmed with AP and lateral fluoroscopy during insertion.
while in the PLF group, the autologous bone may be augmented from bone of lamina or facet after laminectomy and medial facetectomy. Curette of transverse process to expose cancellous bone for better fusion, the graft material is initially placed directly on the transverse processes and then in the intertransverse space.
Closure in layers is done with a vacuum drain for at least 24 hrs.

Statistical-Analysis
Data were prepared and coded to facilitate data handling and entered into Microsoft Access and data analysis was achieved using Statistical Package of Social Science **(SPSS)** software version 20 in windows 10.

Results
(Table 1, 2, 3, 4, 5) The mean patient age was 47 years (range 25-61years) in the PLIF group while it was 46 years in the PLF group (range 28-63 years), there were 6 men and 14 women in the first group while the second group involved 5 males and 15 females with a male to female ratio of one to three.
In PLIF group all our patients presented with low back pain, radicular pain was evident in 13 patients (65%), 7 with Rt sciatica (35%) and 5 with Lt sciatica (25%) and 1 patient with bilateral sciatica (5%),however in PLF group all our patients presented with low back pain, radicular pain was evident in 15 patients (75%), 3 with Rt sciatica (15%),9 with Lt sciatica (45%) and 3 patient with bilateral sciatica (15%).

In PLIF group: The involved level was L4-5 in 5 patients (25%), L5-S1 in 12 patients (60%) and double level (L4-5 and L5-S1) in 3 patients (15%) while In PLF group the involved level was L4-5 in 5 patients (25%), L5-S1 in 11 patients (55%) and double level (L4-5 and L5-S1) in 4 patients (20%).

In PLIF group the Mean operative time was 2.10(range 1.45–2.30 h), while In PLF group the Mean operative time was 1. ٤٥(range 1.30–2.15 h).
The mean estimated blood loss was insignificantly higher in the PLIF group with a mean of 372 ml while it was 287 ml in the second group.

Back pain and leg pain were evaluated using the VAS pain score, The mean VAS score of low back pain improved from 7.4 preoperatively to 1.85 after 6 months follow up postoperatively in the PLIF group and the mean VAS score of low back pain improved from 7.85 preoperatively to 2.95 after 6 months follow up postoperatively in the PLF group, with no significant difference between the two groups.

Regarding leg pain in PLIF and PLF groups the mean VAS score of radicular pain improved from 4.75 and 5.85 preoperatively to 1.15 and 1.2 postoperatively respectively in both groups.

Table (1): Pre and post operative back pain score of the two compared groups (PLIF & PLF)

• Radicular pain score	PLIF (PLIF (Group A) (n=20)		PLF (Group B) (n=20)		p value
	Range	Mean	Range	mean	
Preoperative pain score	1 – 9	4.75	1 – 10	5.85	**0.256**
Immediate Post operative score	1 – 2	1.15	1 – 2	1.2	**0.681**
p value	**0.001***		**0.001***		

Table (2): Pre and post operative radicular pain score of the two compared groups

Fusion rate	PLIF (Group A) (n=20)	PLF (Group B) (n=20)	p value
• **Fused**	• ١٧(85%)	• ١3 (65%)	**0.038***
• **Not fused**	• 3 (15%)	• 7 (35%)	

Regarding fusion rates evaluated with Lee's criteria after 6 months there were 17 (85%) patients with definitive fusion while 3 with probable fusion in the PLIF group while there were 13(65%) patients definitive fusion and 7 (35%) with probable fusion in the PLF group with significant improvement in the 1st group than the second.

Table (3): Fusion rate of the two compared groups (PLIF & PLF).

Back pain score	PLIF (Group A) (n=20)		PLF (Group B) (n=20)		p value
	Range	**Mean**	**Range**	**Mean**	
Preoperative back pain score	5 – 10	7.95	6 - 10	7.85	**0.33**
Postoperative score after 6month	1 – 7	1.85	1 - 7	2.95	**0.004***
p value	**< 0.0001***		**< 0.0001***		

The mean preoperative slippage angle was 21.2, 17.7 degree and mean post operative slippage angle decreased to 18.8, 17.1 degree respect-tively in both groups.

Evaluation of results according to Disc space height showed the in PLIF the Mean pre-operative DSH was 6.88 mm, mean post-operative DSH after 6 months increased to 7.45 mm, while in PLF group the Mean preoperative DSH was 7.39 mm, mean post-operative DSH after 6 months increased to 7.51 mm with no significant difference between both groups.

The functional outcome of back pain results assessed by Oswestery disability index (ODI) showed a mean ODI value changed from a mean of 72.5% pre-operatively to 13% at 6 months post-operatively in PLIF while in the PLF group it showed a mean ODI value changed from a mean of 75.7% pre-operatively to 18.7% at 6 months post-operatively with a significant difference in favour of the first group.

Table (4): ODI of the two compared groups (PLIF & PLF).

ODI	PLIF (Group A) (n=20)		PLF (Group B) (n=20)		p value
	Range	Mean	Range	Mean	
Pre operative ODI	50% - 85%	72.5	60%-85%	75.7	**0.393**
6m post operative ODI	5% - 50%	13	5% - 50%	18.7	**0.046***
p value	**< 0.0001***		**< 0.0001***		

In our study, the functional outcome according to KWC Based on the Kirkaldy–Willis functional outcomes criteria was 65% excellent outcome,20% good outcome,10% fair outcome and 5%poor outcome in PLIF group, and it was 50% excellent outcome, 20% good outcome, 25% fair outcome and 5%poor outcome in PLF group.

PLIF shows superiority over PLF in functional outcome but there was no significant statistical difference between the two groups

Regarding complications in PLIF group one case developed wound infection which required repeated dressing and antibiotics, one case had dural tear, two cases developed urine retention which corrected after 2 days and one developed cage subsidence after 2 months of the operation while in PLF group two cases developed wound infection which required repeated dressing, one case had dural tear, one had malposition of transpedicular screws and one cases developed urine retention which corrected after 2 days.

Table (5): Complications of the two compared groups (PLIF & PLF).

Complications	PLIF (Group A) (n=20)	PLF (Group B) (n=20)	p value
• **Free** • **Infection** • **Durotomy** • **Malposition of screws** • **Urine retention** • **Cage subsidence**	15 (75%) 1 (5%) 1 (5%) -- 2 (10%) 1 (5%)	15 (75%) 2 (10%) 1 (5%) 1 (5%) 1 (5%) --	**0.751**

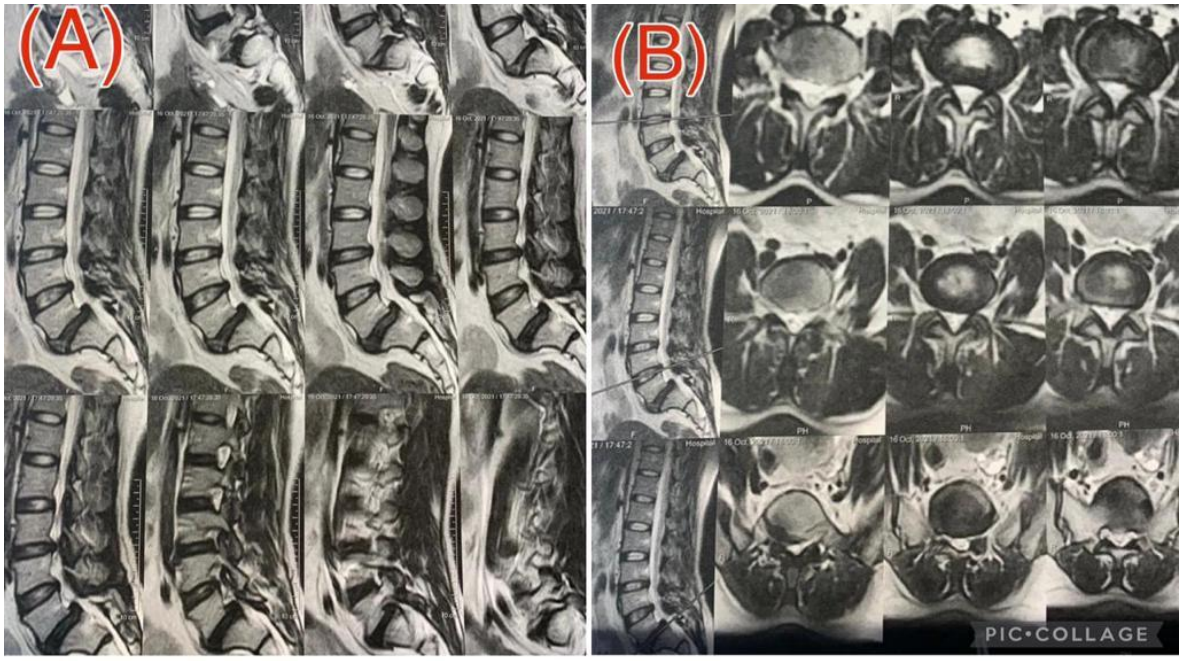

Figure (1): Preoperative unenhanced T2-weighted magnetic resonance image (MRI). (A) Midline sagittal image. (B)Axial section thorough L5-S1 disc space.

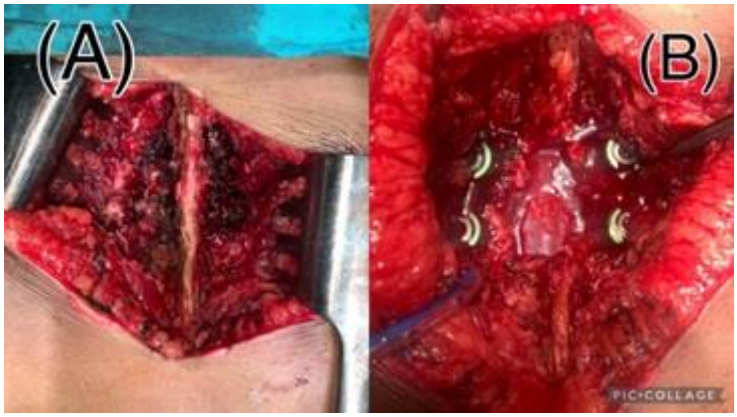

Figure (2): intraoperative picture (A) showing muscle separation and facet joint preparation for fixation.(B) showing intraoperative transpedicular screws fixation of L5-S1 vertebrae with 4 screws and 2 plates, posterior decompression of L5 vertebrae,

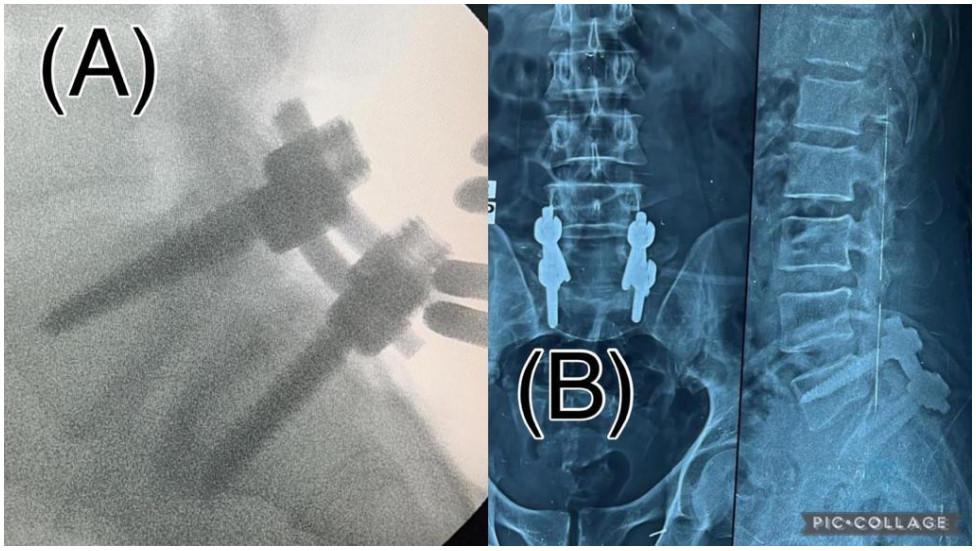

Figure (3) (A) immediately Postoperative x-rays demonstrating pedicle screw fixation with 4 screws and 2 plates Lateral view (B) 6 month Postoperative follow up x-rays demonstrating pedicle screw fixation with 4 screws and 2 plates and posterolateral

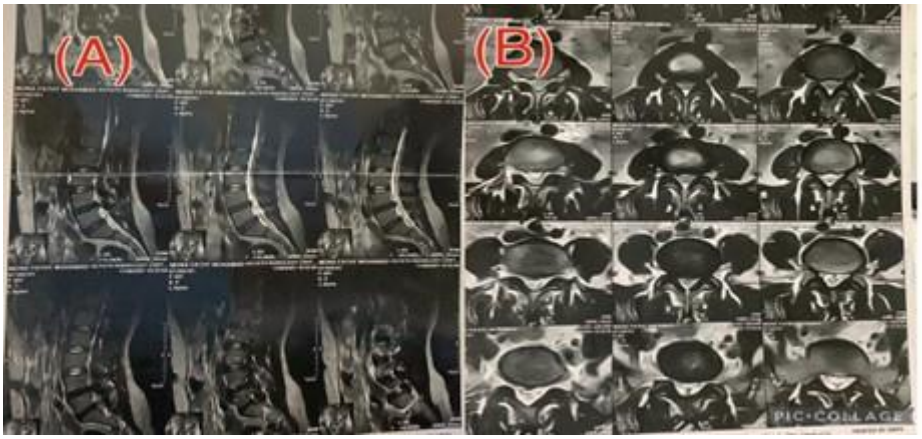

Figure (4): Preoperative unenhanced T2-weighted magnetic resonance image (MRI). (A) Midline sagittal image. (B)Axial section thorough L4-L5 disc space.

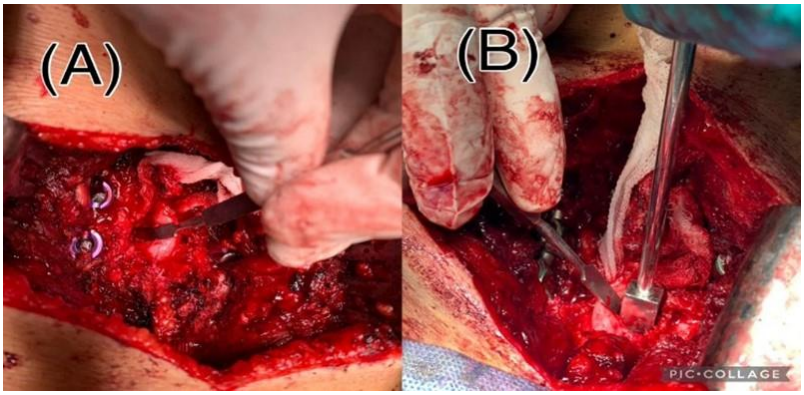

Figure (5): A-intraoperative picture showing discectomy and disc space preparation for cage insertion.

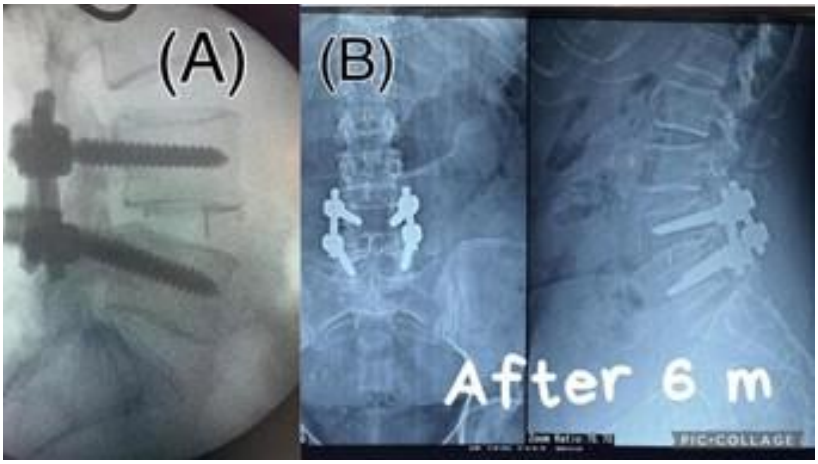

Figure (6): A- Postoperative x-rays demonstrating pedicle screw fixation with Polyether ether ketone (PEEK) interbody cage Lateral view. B- Postoperative follow up x-rays after 6 months demonstrating pedicle screw fixation with Polyether ether ketone

Illustrative cases [fig1-6]

Case I: The patient was a 49-year-old woman with a 3-year history of low back pain. Over the last 3 months she had developed right leg pain which increased by exercise and not responding to medical treatment and physiotherapy. Her past medical history was positive for diabetes only. She had high body mass index (BMI over 25) and not performing any regular exercise. She was housewife.
On examination she was full motor power, positive leg raising test in right lower limb, intact sensations and no sphincteric problems were detected.

Lumbosacral Xray was done, and it demonstrate a grade one L5–S1 spondylolisthesis with right L5 pars defect, non-contrasted magnetic resonance imaging (MRI) study in addition to assessing for nerve compression after x-rays have been completed.it demonstrating grade one L5–S1 spondylolisthesis with right pseudo disc herniation. [fig1]

- After preoperative fitness was done patient entered operative room under general anesthesia for fixation of L5-S1 with transpedicular screws and posterolateral fusion with autologous bone graft. [fig 2]

- Pt was admitted to the ward postoperatively and IV antibiotics, analgesia were started, Patient was full motor power, intact sensations and Right sciatica was relieved, patient was discharged after 2 days after removal of the drain with no complications and showed good improvement in Follow up visits, stitches were removed after 14 days. X-ray lumbosacral was done 6 months postoperatively and showed appearance of fusion mass. Fig [3]

Case 2: The patient is a 43-year-old woman with a 1-year history of low back pain and bilateral leg pain which increase by exercise and doesn't respond to medical treatment and physiotherapy. Her past medical history was negative for any chronic diseases. She had high body mass index (BMI over 25) and not performing any regular exercise. She was farmer.
On examination she was full motor power, positive leg raising test in both lower limb, intact sensations and no sphincteric problems were detected.

Lumbosacral Xray was done and it demonstrate a grade one L4–l5 spondylolisthesis. non-contrasted MRI study in addition to assessing for nerve compression after x-rays had been completed.it demonstrating grade one L4–L5 spondylolisthesis with demonstrating severe bilateral facet arthropathy at L4–L5 with resultant lateral recess stenosis. Fig [4]

- After preoperative fitness was done patient entered operative room under general anesthesia for fixation of L4-L5 level with transpedicular screws and interbody fusion with PEEK cage.
B- intraoperative picture showing choosing of proper size of PEEK cage.[fig 5]
Postoperatively Patient was full motor power, intact sensations and bilateral sciatica was relieved.
patient was discharged 2 days after removal of the drain with no complications and showed good improvement in Follow up visits, stitches were removed after 15 days.
X-ray lumbosacral was done 6 months postoperative and showed appearance of fusion mass. [fig 6]

Discussion

In our study, regarding the age of patients in PLIF group the mean age was 47.85ys (27-61 years) and in PLF group the mean age was 46.7ys (28-63years), This agrees with (Farrokhi 2012)[8] the mean age was 50 years in PLIF group and it was 49 years in PLF group.

Regarding operative time in our thesis, in PLIF group the mean operative time was 2.10 (range 1.45–2.30 h) and in PLF group the mean operative time was 1.45 (range 1.30–2.15 h).
The operation time was significantly higher in PLIF compared to PLF (value 0.0001*) this may be due to time taken by cage insertion.

This goes in agreement with (Wu et al., 2011)[9] where the mean operative time was 135 minutes for PLIF patients and 120 minutes for PLF, (Lee et al., 2014)[10] in which the mean operative time was 2.6 hours for PLIF patients and 2.1 hours for PLF
Regarding the estimated blood loss, in PLIF group the mean estimated blood loss was 372.5 ml (range 250 – 550 mL) and in PLF group the mean estimated blood loss was 287.٥ ml (range 150 – 400 mL), this significant difference in blood loss is due to the difference in time taken in both procedures.

This agrees with (Wu et al., 2011)[9] the mean estimated blood loss was 950 ml and in PLF group the mean estimated blood loss was 850ml, (lee et al., 2014)(Lee et al., 2014) study showed estimated blood loss was 360 ml and 350 ml in PLIF and PLF respectively and (luo et al., 2017)[11] estimated blood loss was 873 ml and 747 ml in PLIF and PLF respectively, we think this variation in blood loss depends on surgeon skills, type of anaesthesia, position of the patient and other circumstances related to the patient.

The mean VAS scores for lower back pain in our study indicated that 6-month postoperative pain levels were significantly lower than preoperative levels for each group with superiority for PLIF over PLF group. (P value 0.004*).

These results accord with Li et al., 2020[12]who found that Vas score improved from 7.6 to 1.1 and from 7.6 to 2.3 in PLIF and PLF respectively.

But against Guppy et al., 2021[13]in which pain index improved from 68 to 26 and from 67 to 29 in PLIF and PLF respectively. In our study there was no significant difference in the improvement in radicular pain immediately after the operation in the two groups, the mean VAS score of radicular pain improved from 4.75 preoperatively to 1.15 immediate postoperatively and from 5.85 preoperatively to 1.2 immediate postoperatively in PLIF and PLF group respectively group.

These results goes in agreement with (luo et al., 2017)[11] who reported that the improvement in radicular pain was 82% in the PLF group and 85.5% in the PLIF group, no statistically significant difference was found between the two groups. But in contrast with Guppy et al., 2021[13] reported that PLF with posterior instrumentation provides more improvement in radicular pain than PLIF with posterior instrumentation, they explained that because of the performed discectomy, curettage of annulus and increased risk of more extensive epidural fibrosis formation.

PLIF has been introduced to solve the disadvantages of PLF by replacing the disc with interbody cages. Posterior interbody fusion with

pedicle screw fixation realizes the stabilization of 3 columns, significantly increases stability and fusion rate and improves clinical satisfaction and postoperative function.

Our study confirmed that PLIF can increase the fusion rate compared with PLF, fusion rate was 85% and 65% after postoperative follow up of 6 month duration for PLIF and PLF respectively.
This goes in aggrement with (Liu et al., 2014)[14] found that fusion rate was 93% and 84.5% in PLIF and PLF respectively, Agrawal et al., 2020[15]Who found that the successful fusion was more among the PLIF group patients 81.25%, than the PLF group patients, i.e., 67.30%, although there was no statistically significant difference among the two groups and Said et al., 2022.[16]

PLIF and PLF maintain the intervertebral disc height according to our thesis, mean pre-operative DSH was 6.88 mm and 7.39 mm and increased to 7.45mm and 7.51mm post-operatively in PLIF and PLF respectively after 6 months follow up the difference between the groups was statistically not significant.

The disc space can be both emptied and distracted by interbody fusion. Distraction makes it possible for the neural foramen to widen, removing any foraminal stenosis that might be present due to degenerative loss of disc height

These results accord with (Dehoux et al., 2004)[17] in which PLIF provided a significant increase in the disc height but they observed a deterioration of the result with respect to rest sciatica (paraesthesias) at follow-up this seems to be the result of vascular problems, they used bipolar coagulation to prevent bleeding from the peridural veins around the root during the surgical procedure, relative ischemia could possibly explain the postoperative paraesthesias, Guppy et al., 2021[13] who reported that PLIF is superior to PLF in disc space height maintenance disc height increased by 0.5 mm in the PLF group and by 3.0 mm in the PLIF group; the difference between the groups was statistically significant, this explained by interbody fusion maintains the stabilization of the anterior column in addition to the posterior column stabilizes all 3 columns, enhances the fusion rate, maintains disc height, and corrects sagittal alignment

Both procedures lead to decrease the degree of slippage, mean preoperative slippage angle was 21.2 degree decreased to 18.8 degree postoperatively in PLIF and it decreased from 17.7 preoperatively to 17.1 postoperatively but the difference in both studies was not statically significant.

These findings go in agreement with Guppy et al., 2021[13] who reported that the degree of slip decreased by 5.1% ± 11.0% in the PLF group and by 3.7% ± 9.8% in the PLIF group; the difference between the groups was not statistically significant.

According to Oswestery disability index (ODI) the mean ODI value changed from a mean of 72.5% pre-operatively to 13% at 6 months post-operatively In PLIF group and from a mean of 75.7% pre-operatively to 18.7% at 6 months post-operatively in PLF group.

These results agrees with what have been previously reported by Li et al,.2020 [12] in which the mean ODI decreased from 53.2% pre-operatively to 25.6% postoperatively in PLIF group and from a mean of 52.1% pre-operatively to 24.5% post-operatively in PLF group, These results come in contrast with (Farrokhi et al., 2012)[8] and Farrokhi et al., 2021[18] who reported that PLF with posterior instrumentation is recommended for patients with Spondylolisthesis due to better clinical outcomes.

In our study, the functional outcome according to KWC Based on the Kirkaldy–Willis functional outcomes criteria was 65% excellent outcome, 20% good outcome, 10% fair out-come and 5%poor outcome in PLIF group, and it was 50% excellent outcome, 20% good out-come, 25% fair outcome and 5% poor outcome in PLF group.

PLIF shows superiority over PLF in functional outcome but there was no significant statistical difference between the two groups
This agrees with Guppy et al., 2021[13] who found that KWC outcome was 53.7% excellent outcome, 38.8% good outcome,6.1% fair

outcome and 1.4%poor outcome in PLIF group and it was 50.7% excellent outcome,36.9% good outcome, 9.3% fair outcome and 3.1% poor outcome in PLF group.

But against Plantz et al., 2020[19] showed that clinical outcome was good in 81% of patients who underwent PLF with posterior instrumentation, and 69.5% of patients who underwent PLIF with posterior instrumentation, (Farrokhi et al., 2012)[8] and Farrokhi et al., 2021[18] who reported that Patients with spondylolisthesis are advised to undergo PLF with posterior instrumentation since the operation is straightforward, results in better clinical outcomes, and causes less neurological damage and blood loss.

Regarding complications in our study, in PLIF group, one case developed wound infection which required repeated dressing and IV antibiotics according to culture and sensitivity, one case had dural tear, two cases developed urine retention which corrected after 48 hours postoperatively and one developed cage subsidence after 2 months of the operation, in PLF group, two cases developed wound infection which required repeated dressing and IV antibiotics according to culture and sensitivity, one case had dural tear, one had malposition of transpedicular screws that needed revision and one cases developed urine retention which corrected after 48 hours. Only 5% in both groups needed reoperation, there was no significant difference between both groups in post-operative complications.

These results agree with Plantz et al., 2020[19] who reported CSF leak in one patient and there was one patient with a deep vein thrombosis in the PLF group, there was one patient with deep wound infection in the PLIF group,(Brodano et al., 2010)[20] who reported postoperative complications near to our results complications requiring revision surgery occurred in one in the PLIF group (3.6%) and four in the PLF group (9.3%).

Conclusions

The best surgical procedure is still debatable, some neurosurgery surgeons prefer posterior lumbar interbody fusion (PLIF) but others prefer posterolateral fusion (PLF). There is no statistically significant difference was found in postoperative immediate VAS leg and back pain score, blood loss, complication rate and postoperative ODI. PLIF had advantages in reduction of follow up postoperative low back pain after 6 months as well as improvement of patient clinical and functional satisfaction postoperatively. Compared with PLF, the fusion rate and operation time were significant higher in PLIF.

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