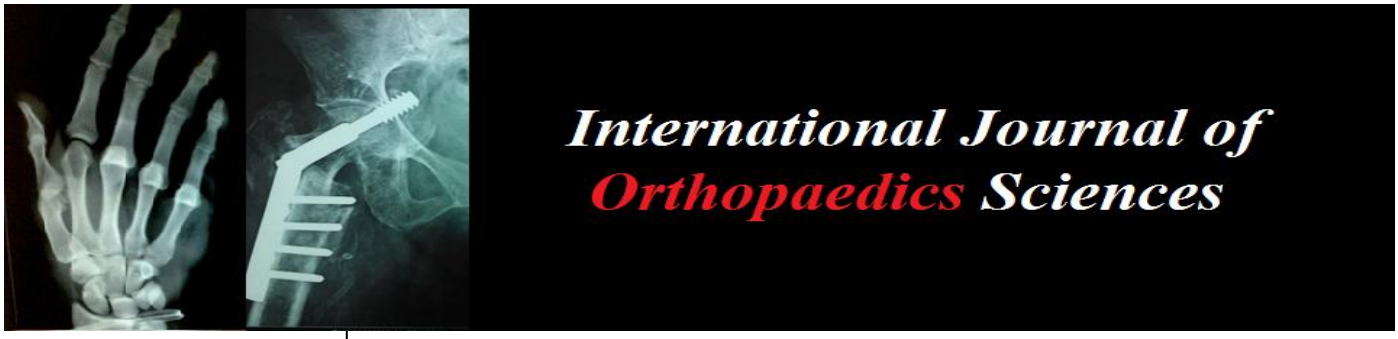

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Functional outcome of posterior decompression and stabilization with PLIF in degenerative lumbar instability

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Abstract
Spondylolisthesis, primarily caused by spondylolysis, often presents as acute low back pain and can lead to conditions such as disc bulging and sciatica. Since Kilian's initial report in 1854, surgical methods, especially vertebral fusion techniques like Posterior Lumbar Interbody Fusion (PLIF), have evolved to treat these conditions effectively. PLIF, introduced by Briggs and Milligan in 1944 and later refined by Cloward, became popular in the 1990s due to advancements in interbody implants. Despite its high fusion rates, PLIF has complications, including graft extrusion and neurological damage. A recent study evaluated the functional outcomes of posterior decompression and PLIF in patients with degenerative lumbar instability. This prospective observational study involved 32 patients and demonstrated significant improvements in pain relief and quality of life post-surgery. The study underscores the importance of PLIF in managing lumbar instability but also highlights the need for further research to validate these findings and explore long-term outcomes.

Keywords: Spondylolisthesis, PLIF, lumbar instability, vertebral fusion, degenerative conditions, surgical outcomes.

Introduction
The most prevalent cause of spondylolisthesis in young adults is thought to be a deficiency in the pars interarticularis, or spondylolysis [1]. Spondylolisthesis was first reported by Kilian in 1854 [1]. Spondylolisthesis's primary symptom is acute low back discomfort. Prolonged low back discomfort might be caused by ligamentous strain resulting from instability at the slip level. Both disc bulging and sciatica may be predisposed to by traction and strain on the nerve roots [2].

Numerous surgical methods have been developed over time, the most widely used of which is vertebral fusion, either with or without instrumentation [1]. PLIF is among the most widely used fusion and instrumentation techniques used in the treatment of these disorders [3].

Briggs and Milligan created Posterior Lumbar Interbody Fusion (PLIF) in 1944. They used bone chips obtained from laminectomy as an Interbody graft. However, after Cloward started using iliac crest bone transplants, PLIF's acceptance grew [4]. Although PLIF was associated with over 85% fusion rates, it was beset by problems such extrusion of the graft, arachnoiditis, and neurological damage [4]. The popularity of PLIF increased only in the 1990s due to the development of Interbody implants and how simple it was to insert them [4]. In order to stabilise the vertebral end plates and preserve the inter-discal height, synthetic cages and pre-milled allografts are now a part of PLIF [4].

Although there are numerous surgical options available for treating degenerative lumbar illness, decompression and fusion surgery (also known as posterior lumbar interbody fusion, or PLIF) is one of the most popular and widely accepted forms of treatment. One Nevertheless, a number of drawbacks and complications associated with fusion surgery have been identified in the management of lumbar spine degenerative conditions. These include pain at the donor site, pseudoarthrosis, nonunion, screw loosening, instrumentation failure, infection, adjacent segment disease (ASDis), and degeneration. Research has been conducted on therapies that could prevent these unintended consequences. [5, 6].

In 2009, the USA approved the Dubois and Graf-designed dynamic neutralisation device to treat radiculopathy, degenerative spondylolisthesis, spinal stenosis, and other stenosing lesions in patients requiring spine alignment and stabilisation [7]. To stabilise the functional spinal unit and maintain the adjacent motion following surgeries, this system consists of pedicle screws, polyethylene terephthalate cables, and polycarbonate urethane spacers. Several in vitro and biomechanical investigations have demonstrated that this system can limit the degree of flexibility by using polycarbonate urethane spacers and polyethylene terephthalate cables. This method may preserve more lumbar mobility than PLIF because it is intended to stabilise the operated segment while permitting some mobility, as opposed to PLIF, which could result in a stiff connection of the operational level [8-10].

Therefore, present study was conducted to assess functional outcome of posterior decompression and stabilization with PLIF in degenerative lumbar instability.

Aims and Objectives

To assess the quality of life of patients after the procedure. To study final outcome and complications after posterior decompression and stabilization.

Methodology

A Prospective Observational study was conducted among 32 Patients who were undergoing surgical management for Spondylolysthesis of lumbar spine in Sri Lakshmi Narayana institute of medical science, Pondicherry.

Inclusion Criteria

- Patients with degenerative lumbar instability conditions.
- Spondylolisthesis (degenerative) with Angular instability and Intractable pain more than 6 weeks.
- Failed conservative management even after 6 months.
- Patient willing to give consent for surgery.
- Age group between 18 and 70 years of age.
- MRI proved cases of lumbar intervertebral disc prolapse (single level, two levels or three levels) with instability demonstrated in stress X-rays.

Exclusion Criteria

- Patient with comorbid conditions and not fit for surgery.
- Patient not willing to participate.
- Patients associated with spinal Trauma, Tumor, Infection
- Associated with b/l hip, sacro iliac joint problem
- Age less than 18 years and above 70 years.
- Patients who have undergone surgery in the Spine earlieru.

Ethical Consideration

This institute's Institutional Ethical Committee gave its approval to this study. Prior to the trial, each participant's written informed consent was obtained.

Data collection and analysis

Data was collected by case record form and entered into MS excel 2016. Data analysis was done in SPSS Software version 26. Detailed history and complete physical examination with neurological assessment was done. Basic investigations to rule out any other comorbid conditions which includes complete blood count, random blood sugar, renal function tests and hepatitis HIV serology was done. Plain x-ray of lumbosacral spine Anteroposterior, lateral and special views including flexion and extension views to assess instability and Magnetic resonance imaging of lumbosacral spine with whole spine survey including sagittal. Coronal and axial views Both T1 and T2 weighted images are taken.

Results

Table 1: Age wise distribution

Age group (in years)	Frequency	Percentages
31-40	2	6.25
41-50	10	31.25
51-60	12	37.5
61-70	8	25

The mean age of study participants was 53.8 ± 8.4 years of total, 12 cases were belonged to 51-60 years of age followed by 10 cases were aged of 41-50 years [Table 1].

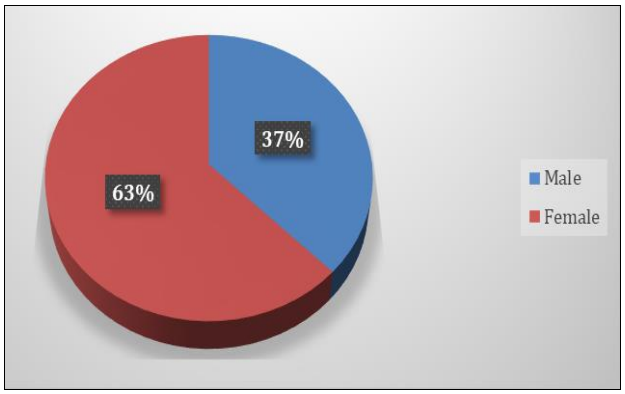

Fig 1: Gender wise distribution

Among the study participants, 20(63%) cases were females and 12(37%) cases were males [Figure 1].

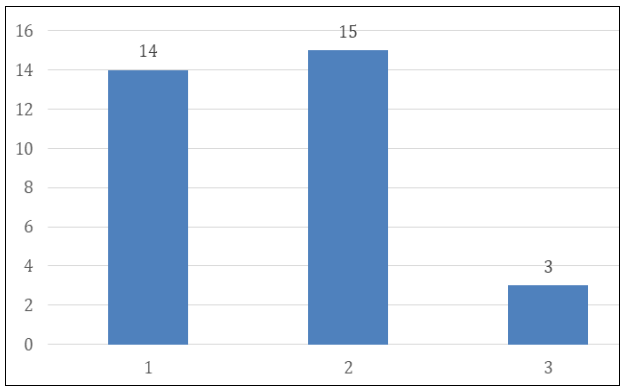

Fig 2: Show Grade

Total 15 cases had grade II, 14 cases had grade I and remaining 3 cases had grade III, Figure 2.

Table 2: Side of Radiculopathy

Side of Radiculopathy	Frequency	Percentages
Right	7	21.9
Left	11	34.4
Bilateral	14	43.8

Among the study participants, 14 cases had bilateral side of radiculopathy, 11 cases affected on left side and 7 cases had affected on right side, Table 2.

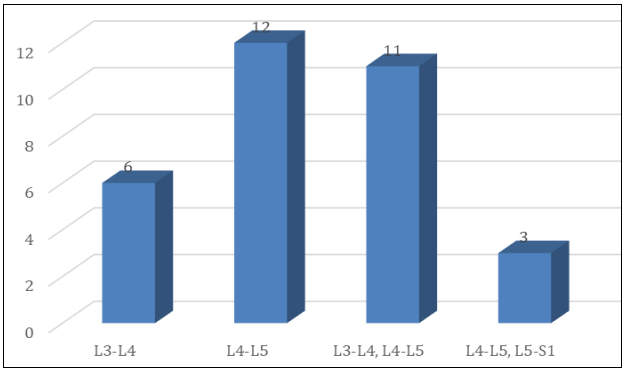

Fig 3: Show segment involvement

Total, 11 cases had affected on L3-L4 and L4-L5 segment. Only 3 cases were affected on L4-L5 &L5-S1 segment. [Figure 3].

Table 3: Mean duration of surgery and Blood loss

Variables	Mean	SD
Duration of surgery (in hours)	2.5	0.6
Blood Loss (in ml)	277.5	69.1

The mean duration of surgery was 2.5 hours and the mean blood loss was 277.5 ml. [Table 3]

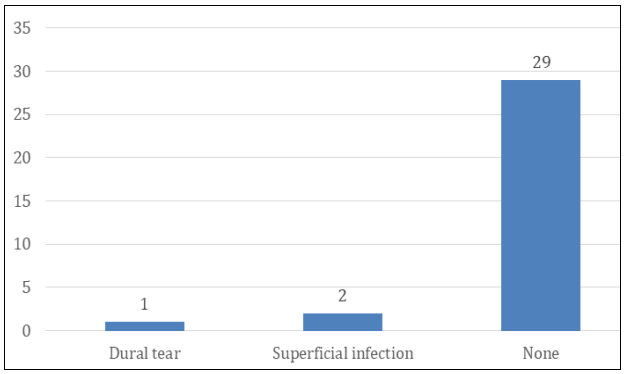

Fig 4: Show complications

Total, 1 cases had Dural tear and another 2 cases had superficial infection as a postoperative complication, Figure 4.

Table 4: Comparison of VAS score

VAS score		ANOVA Test (P-Value)
Preoperative	8.13±0.7	0.0001
Post-operative 1 month	5.31±0.4	
Post-operative 3 month	3.16±0.71	
Post-operative 6 month	1.34±0.48	

There was a statistically significant difference found between preoperative and postoperative duration VAS score, Table 4.

Table 5: Comparison of ODI score

ODI score		ANOVA Test (P-Value)
Preoperative	71.7±7.46	0.0001
Post-operative 1 month	41.5±4.8	
Post-operative 3 month	28.6±4.12	
Post-operative 6 month	17.9±3.2	

There was a statistically significant difference found between preoperative and postoperative duration ODI score, Table 5.

Discussion

Surgery is recommended for patients with unbearable pain who do not respond to conservative therapy, because an improvement in LBP and functional ODI is crucial in patients with LSS and degenerative instability. The two most popular methods for treating LSS and degenerative instability surgically are instrument-assisted PLF and instrument-assisted PLIF. Other minimally invasive fusion techniques include transformational lumbar Interbody fusion, extreme lateral Interbody fusion/direct lateral Interbody fusion, and others are also frequently utilised. However, there is a startling lack of research comparing the results of PLF and PLIF to determine which surgical technique reduces pain and disability more. Since this technique was initially established, PLIF has been extensively utilised in the treatment of lumbar degenerative illness [11].

The mean age of study participants was 53.8 ± 8.4 years. Of total, 12 cases were belonged to 51-60 years of age followed by 10 cases were aged of 41-50 years. Elmorsy SE *et al.* [12] mean age was 48.9 years, in study of Jambukeswaran PS *et al.* [13] mean age was 43.2 years and in research of Angachekar D *et al.* [14] mean age was 45.7 years.Among the study participants, 20(63%) cases were females and 12(37%) cases were males. In study of Elmorsy SE *et al.* [12], Jambukeswaran PS *et al.* [13], and Angachekar D *et al.* [14] female preponderance was more compared to males.

Out of total, 53% cases had low back pain since more than 1 year. In study of Elmorsy SE *et al.* [12], Jambukeswaran PS *et al.* [13], and Angachekar D *et al.* [14] more than half of participants had complained of low back pain from more than 1 year. Total 15 cases had grade II, 14 cases had grade I and remaining 3 cases had grade III. Among the study participants, 14 cases had bilateral side of radiculopathy, 11 cases affected on left side and 7 cases had affected on right side of total, 11 cases had affected on L3-L4 and L4-L5 segment. Only 3 cases were affected on L4-L5 & L5-S1 segment. Similar findings were seen in study of Elmorsy SE *et al.* [12], Jambukeswaran PS *et al.* [13], and Angachekar D *et al.* [14] The mean duration of surgery was 2.5 hours and the mean blood loss was 277.5 ml of total, 1 cases had dural tear and another 2 cases had superficial infection as a postoperative complication. In study of Elmorsy SE *et al.* [12] 3 cases had superficial infection.

There was a statistically significant difference found between preoperative and postoperative duration VAS score. There was a statistically significant difference found between preoperative and postoperative duration ODI score. In research of Noordeen S *et al.* [15] there was mean pre-operative ODI score of 54±5.4 decreased to 10.64±4.96 at the final follow-up (p<0.001). The VAS pain scores improved from a mean of 7.86±0.7 to 1.4±0.7 (p<0.001).

Conclusion

The results of this investigation confirm that posterior stabilisation and fusion surgical therapy is beneficial in treating degenerative lumbar instability. The favorable effects of this surgical method are demonstrated by the notable increases in functional outcomes, pain alleviation, and quality of life assessments. To validate these results, more investigation is necessary; in particular, prospective studies with bigger sample sizes and longer follow-up times are needed. Additionally, in the therapy of degenerative lumbar instability, assessing long-term results and potential consequences will aid in guiding treatment options and

optimising patient care.

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