

## To Study the Posterior Lumbar Interbody Fusion in the management of Spondylolisthesis

\*Dr. Shah P. D., \*\*Dr. Thipse J. D.

\*P.G. Resident, \*\*Professor

**Corresponding Author :** Dr. Thipse J. D

**Mail id** - jayant.thipse@yahoo.com

**Mobile No.** - 9820130737

**Address :** Department of Orthopedics, Dr. Vithalrao Vikhe Patil Foundation's Medical College, Ahmednagar (MS) - 414111

### Abstract :

**Background:** Spondylolisthesis historically was treated conservatively; however operative stabilization and fixation has revolutionized its treatment outcome.

**Aim:** It is to study the effectiveness of posterior lumbar inter-body fusion in the management of Meyerding grade 2 or more spondylolisthesis. **Objectives :** To evaluate the outcome of posterior lumbar inter-body fusion performed for spondylolisthesis both clinically and radiologically. **Study design:** Prospective longitudinal observational study. **Result :** The study comprised of 44 patients with the mean age of 47.2 years, with 27 females and 17 male patients. It was a lumbar decompression procedure combined with a fusion procedure for 36 patients and isolated PLIF for 8 patients while 32 patients had single level instrumentation and 12 patients had two level instrumentation. Satisfactory outcome in terms of pain relief was obtained in 40 of the 44 patients. One patient had superficial skin infection, 3 had recurrence of symptomatology while 6 patients were lost to follow-up (which were excluded from the study). None of the cases developed any iatrogenic neuro-deficit and there were no mortalities.

**Key words :** Spondylolisthesis, Lumbar, Inter-body, Fusion.

**Introduction:** Spondylolisthesis is defined as displacement / subluxation of one vertebral body over another in the sagittal plane. It is a mechanism of intervertebral instability<sup>[1]</sup>. Interbody fusion has been considered by many to be the treatment of choice for instability.<sup>[2]</sup> PLIF allows for spinal canal decompression, reconstruction of the anterior column, foraminal stenosis decompression and reduction of sagittal slip using a single posterior approach.<sup>[3]</sup> Posterior lumbar interbody fusion (PLIF) has been found to be equivocal to Trans-foraminal lumbar interbody fusion (TLIF) in regards to good outcome in the post-operative evaluation.<sup>[4]</sup>

Lumbar interbody fusion is one of the most reliable fusion technique currently available for the lumbar spine as these constructs offer greater biomechanical strength, better axial support with less graft subsidence or collapse comparing to those with posterolateral arthrodesis, and produce a better biologic fusion in lordotic alignment.<sup>[5,6]</sup>

Open posterior approach is marred with disadvantages such as the morbidity of increased muscle dissection, increased post-operative wound pain, slower mobilization post-operatively, as well as increased intra-operative blood loss. Alternatively, a minimally invasive method may be opted by use of percutaneous pedicle screws in combination with a minimally invasive bilateral laminotomy and PLIF. However, this method is compromised by longer operating times and higher complication rates.<sup>[7]</sup>

**Historical Aspect :** The first description of Spondylolisthesis was given by Belgian Obstetrician Herbinaux<sup>[8]</sup> and the terminology was coined by Killian.<sup>[9]</sup>

The bilateral posterior lumbar interbody fusion (PLIF) procedure was first introduced by Cloward for lumbar interbody fusion and neural decompression.<sup>[10]</sup>

**Materials and Methods :** The present work was conducted in the department of Orthopaedics, DVVPP's Medical College and Hospital, Ahmednagar from January 2015 to August 2016 with a minimum follow up period of 6 months upto December 2016.

A total of 44 cases were studied from admission to rehabilitation upto 6 months post-operative using the following criteria-

### Inclusion criteria:

- Low back ache more than leg pain
- Age between 25-65 years
- Patients with degenerative, isthmic or congenital spondylolisthesis
- Grade 2,3 or 4 listhesis according to Meyerdig grading system

### Exclusion criteria:

- Traumatic spondylolisthesis
- Pathologic spondylolisthesis
- Tandem stenosis
- Bleeding/ clotting disorder Recent history of infection



**Figure 1: Pre-op lateral view radiograph of patient K.A. showing L4-L5 spondylolisthesis**

**Procedure :** Patients with complaints of low back pain more than leg pain were evaluated by performing radiographs of the lumbar spine in lateral projection, i.e. flexion-extension views as well as A.P radiographs. Listhesis was graded using the Meyerding grading criteria.<sup>[11]</sup> Out of the initially screened patients, 110 patients were found to be having spondylolisthesis of which 40 patients had satisfactory pain relief with the 6-week course of conservative treatment, 20 patients had grade 1 listhesis and remaining 50 patients had grade 2 or more of listhesis. We did not come across any patients with spondyloptosis. A detailed neurological evaluation was carried out pre-operatively and a pre-op MRI was performed on all patients. 12 of the 50 patients had grade 3 or 4 power in one of more muscle groups at the time of presentation while 2 patients had grade 2 power in at least one muscle group. MRI evaluation showed presence of concomitant lumbar canal stenosis or prolapsed inter-vertebral disc in 12 patients.

After full pre-operative work-up and anaesthesia fitness, all patients meeting inclusion and exclusion

criteria admitted to this hospital and consenting to the procedure and the research proposal were operated under general anaesthesia by expert team of orthopaedic surgeons with the help of image intensifier. Patient was pre-operatively catheterized. The procedures were done in major O.T as first case under full aseptic precautions. The procedure comprised of posterior approach to lumbar spine with laminectomy and lumbar decompression with/ without discectomy and inter-body fusion using pedicle screws and connecting rods with/ without PLIF cage. The bone graft for the fusion was morselized from the excised spinous process. Injection triamcinolone acetate was infiltrated in most of the cases at the time of closure after keeping a drain in the muscular space.

**Immediate Post-op:** The patients were kept in Surgical ICU for 3 days. Turning in bed was started from post-operative day 1 and patients were mobilized out of bed by 3rd to 5th post-operative day with the help of lumbo-sacral corset prepared by the orthotics department of the hospital with measurements having been taken pre-operatively. Catheter was removed by 5th post-operative day.



**Figure 2: 5 day post-operative clinical photos taken showing an ambulatory patient with Lumbo-sacral corset**

**Late Post-op:** Drain removal and sterile dressing was done on post-operative day 3 or drain collection less than 45ml whichever was later. Suture removal was done on day 14-16 post-operatively.

**Follow-up:** Patients were followed-up with serial x-rays taken every monthly up to 6 months. The longest follow-up was that of the first case for up to 18 months.

**Parameters of Evaluation:**

**1) Clinical:**

- Pain (Visual analogue scale and Stauffer and Coventry evaluation criteria<sup>[12]</sup>)
- Neurological deficit (Medical research council grading)

**2) Radiological:**

- Evidence of bony fusion



**Figure 7, 8:** Post-op lateral and A.P. view radiographs of patient D. L showing L2 - L4 PLIF

**Results:**

- The study comprised of 44 patients (excluding 6 patient lost to follow-up)
- The mean age of patients was 47.2 years with the youngest being 32 years and eldest being 65 years of age.
- There were 27 females and 17 males in the study.
- Spondylolisthesis was found at the L5-S1 level in 30 patients and L4-L5 level in 14 patients.
- It was a lumbar decompression with fusion procedure for 36 patients while an isolated PLIF for 8 patients. 32 patients had single level instrumentation while 12 patients were operated for two level instrumentation.
- Satisfactory outcome was obtained in 40 out of the 44 patients.
- 1 patient had a superficial skin infection which was treated promptly using debridement, re-suturing and intravenous antibiotics for a period of 10 days followed by oral medications for another 11 days. 3 patients had recurrence of symptomatology mainly in the form of back pain out of which one patient had flat-back. Recurrent pain was managed conservatively.
- Dural tear occurred in 2 patients. However, both patients had an insignificant post-operative period except for mild headache in one patient lasting less than 3 days.

The most common post-operative complication was that of paralytic ileus noted in 12 patients lasting from 3 to 7 days. One patient had frequent diarrhea which required meticulous management under the care of internal medicine specialist.



**Figure 3, 4:** Immediate post-op lateral and A.P. view radiograph of patient K.A. showing PLIF done using pedicle screws and PLIF cage

**Figure 5, 6:** Post-op lateral and A.P. view radiographs of patient G.N. showing L4-L5 PLIF

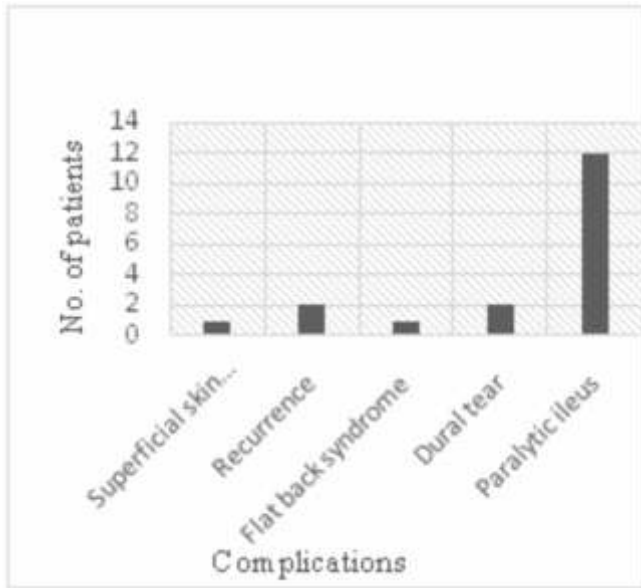


Figure 9: Complications

- There were no iatrogenic neurological deficit and no mortalities.
- Recovery from neurological deficit was recorded by 1 grade in 6 patients while 8 patients had persistence of weakness.
- In terms of the Stauffer and Coventry evaluation criteria<sup>12</sup>, 37 patients had good results, 3 patients belonged to fair group and 4 cases had poor outcome.

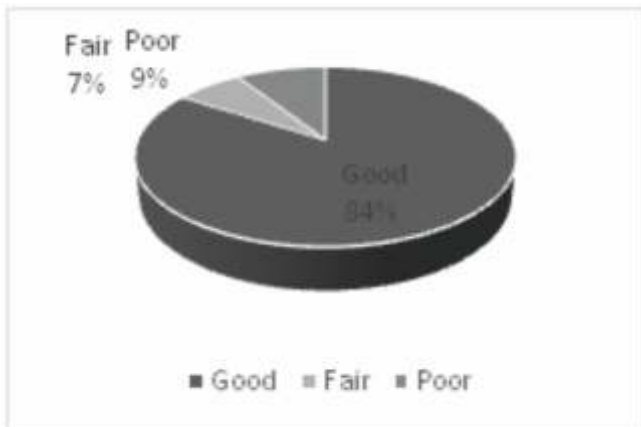


Figure 10: Patient outcome in terms of Stauffer Coventry evaluation criteria

- There was radiological evidence of bony union by 9-12 months in 40 patients while 4 patients had pseudo-arthritis according to the criteria proposed by Fishgrund.<sup>[13]</sup>

**Discussion:** Management options for treatment of spondylolisthesis is varied. The goals of surgical

**management comprise of :** Decompression of neural structures, restoration of the inter-vertebral height, facilitating sagittal and rotational plane alignment and stabilization of the motion segment.<sup>[14]</sup> PLIF was a technique that was initially described by Cloward and later fine-tuned by Lin.<sup>[15]</sup> Fusion procedures have obvious mechanical advantages and produce a biomechanically stable spine.<sup>[16,17]</sup>

In our study, union was seen in 90.90% of the patients according to the criteria proposed by Fishgrund. Kai<sup>18</sup> reported 92.9% fusion, Dantas<sup>[1]</sup> reported 96% union rate in his PLIF group. Overall outcome was analysed using the criteria proposed by Stauffer and Coventry<sup>12</sup> based on relief of back and leg pain, return of employment, restriction of physical activities and use of analgesics for lumbar spine fusion. In our study 84% patients got good results, 7% patients had fair outcome and 9% patients had poor results. Stauffer got 81% good results with satisfactory clinical outcome which is comparable with our results. PLIF, thus, is a definitive treatment modality in the management of spondylolisthesis as it provides stable spine with less risk of complications and overall good outcome.

**Conclusion :** Posterior lumbar inter-body fusion is a technically demanding procedure requiring high level of precision. However the results of its use in the management of spondylolisthesis have been impressive. Our study, though limited in terms of the number of patients and duration of follow-up has found PLIF to be the go-to procedure when it comes to surgical intervention in spondylolisthesis. However, more detailed and exhaustive randomized trials can substantiate the effectiveness of this versatile procedure.

**Acknowledgements:**

**We would like to thank:**

- Department of Anaesthesia for patience in these marathon procedures.
- Department of Radiology for co-operating for several position adjusted serial x-ray shoots.
- Department of Orthotics for providing Lumbo-sacral corset on a timely basis and at affordable rates.

## References:

1. Dantas FL, Prandini MN, Ferreira MA. Comparison between posterior lumbar fusion with pedicle screws and posterior lumbar interbody fusion with pedicle screws in adult spondylolisthesis. *ArqNeuropsiquiatr.* 2007; 65 (3B): 764-70.
2. Suk SI, Lee CK, Kim WJ, Lee JH, Cho KJ, Kim HG. Adding posterior lumbar interbody fusion to pedicle screw fixation and posterolateral fusion after decompression in spondylolytic spondylolisthesis. *Spine (Phila Pa 1976)* 1997;22:210-9.
3. Sudo H, Oda I, Abumi K, Ito M, Kotani Y, Minami A. Biomechanical study on the effect of five different lumbar reconstruction techniques on adjacent-level intradiscal pressure and lamina strain. *J Neuro Surg Spine* 2006;5:150-5.
4. Yan DL, Pei FX, Li J, Soo CL (2008) Comparative study of PILF and TLIF treatment in adult degenerative spondylolisthesis. *Eur Spine J* 17: 1311-1316.
5. Enker P, Steffee AD. Interbody fusion and instrumentation. *ClinOrthopRelatReser* 1994; 300: 90-1.
6. Evans JH. Biomechanics of lumbar fusion. *ClinOrthopRelatReser* 1985; 193: 38-46
7. Park Y, Ha JW (2007) Comparison of one-level posterior lumbar interbody fusion performed with a minimally invasive approach or a traditional open approach. *Spine (Phila Pa 1976)* 32: 537-543.
8. Herbinaux G. *Traite sur divers accouchemens labprieux, et sur polypes de la matrice.* Brussels; JL Deboubers, 1782
9. Johnson JR, Kirwan EO. The long-term results of fusion in situ for severe spondylolisthesis. *J of Bone and Joint Surgery* 1983; 65(B) 1: 43-46.
10. Cloward R. The treatment of ruptured intervertebral discs by vertebral body fusion. Indications, operation technique after care. *J Neurosurg* 1953; 10: 154-68.
11. Meyrding HW. *Spondylolisthesis.* *SurgGynecolObstet* 1932; 54: 371-7.
12. R. N. Stauffer and M. B. Coventry. Posterolateral lumbar-spine fusion. Analysis of Mayo Clinic series. *Journal of Bone and Joint Surgery* 1972; 54 (6): 1195–1204.
13. Fishgrund JS, Mackay M, Merkowitz HN, Brower R, Montgomery DM, Kurtz LT. Degenerative lumbar spondylolisthesis with spinal stenosis: a prospective randomized study comparing decompressive laminectomy and arthrodesis with and without spinal instrumentation. *Spine* 1997; 22: 2807-12.
14. Yan DL, Pei FX, Li J, Soo CL. Comparative study of PLIF and TLIF treatment in adult degenerative spondylolisthesis. *Eur Spine J* 2008; 17: 1311-6.
15. Lin PM. A technical modification of Cloward's posterior lumbar interbody fusion. *Neurosurg* 1977; 1: 118-24.
16. Huang KF, Chen TY. Clinical Results of a Single Central Interbody Fusion Cage and Transpedicle Screws Fixation for Recurrent Herniated Lumbar Disc and Low-Grade Spondylolisthesis. *Chang Gung Med J* 2003; 26: 170-6.
17. Voor MJ, Mehta S, Wang M. Biomechanical evaluation of posterior and anterior lumbar interbody fusion techniques. *J Spinal Dis* 1998; 11: 328-34.
18. Kai Y, Oyama M, Morooka M. Posterior lumbar interbody fusion using local facet joint autograft and pedicle screw fixation. *Spine (Phila Pa 1976)* 2004; 29: 41-6.