IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 8 Ver. 8 (August. 2018), PP 35-38
www.iosrjournals.org

Outcome of Posterior Lumbar Underbody Fusion (Pilaf) For Degenerative Spondylolisthesis.

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Abstract: *Spondylolysis may lead to instability of the spinal column that causes listhesis. Even in the absence of symptoms from the pars defects themselves, spondylolisthesis may lead to clinically significant radiculopathy and progressive neurologic deficits secondary to nerve root impingement. Both conditions vary in their presentations and require judicious application of conservative and surgical treatment strategies. The advent of improved anaesthetic management, the introduction of image intensifier, and advanced instrumentation helped the orthopaedic surgeons greatly in the management of spondylolisthesis. We aim to study the symptomatic and neurological improvement, the stability of fixation and complications in patients who underwent posterior lumbar interbody fusion for degenerative spondylolisthesis.*

Date of Submission: 06-08-2018 Date Of Acceptance: 20-08-2018

I. Introduction

Spondylolysis may lead to instability of the spinal column that causes listhesis. Even in the absence of symptoms from the pars defects themselves, spondylolisthesis may lead to clinically significant radiculopathy and progressive neurologic deficits secondary to nerve root impingement.Both conditions vary in their presentations and require judicious application of conservative and surgical treatment strategies. The clinical syndrome of spondylolisthesis was first described in 1782 by the Belgian obstetrician Herbiniaux, [1] before an understanding of its pathophysiology.

The care of patient with spondylolisthesis with or without neurological deficit has evolved dramatically over the past 30 years with the emergence of more effective spinal instrumentation and anaesthesia techniques, despite these advances the majority of patients with spondylolisthesis are treated non-operatively with physiotherapy, lumbar brace and NSAIDS. More aggressive treatment is guided by the use of classification system that detail the mechanism of spondylolisthesis , the degree of slippage of vertebra and the potential for late mechanical instability or neurological deficit. The goal of treatment remains attainment of spinal stability with protection or improvement of the patient neurological status, allowing rapid and maximal functional recovery. The advent of improved anaesthetic management, the introduction of image intensifier, and advanced instrumentation helped the orthopaedic surgeons greatly in the management of spondylolisthesis. We aim to study the symptomatic and neurological improvement, the stability of fixation and complications in patients who underwent posterior lumbar interbody fusion for degenerative spondylolisthesis

Type	Description
I	Congenital dysplastic
II	Isthmic—defect at pars interarticularis
IIA	Spondylolytic—stress fracture of pars interarticularis
IIB	Elongation of pars interarticularis
IIC	Acute or traumatic fracture of pars interarticularis
III	Degenerative—long-standing intersegmental instability
IV	Post-traumatic—defects of posterior elements (aside from pars interarticularis)
V	Pathologic

Table 1: *Wiltse Classification for Spondylolisthesis*

II. Methodology

All the patients with age range 20-65 years, with Type III Degenerative spondylolisthesis {Table 1 : Wiltse Classification [2]} and whose symptoms were not relieved even after conservative management for 6 months or patients who had severe slip of varied etiology who underwent PLIF during 2013-2015 at our institution were included in the study. Patients aged more than 65 years and with significant comorbidities were excluded from the study. Radiological evaluation including Lumbosacral spine AP view, flexion & extension lateral and oblique views were done. MRI was done to evaluate spinal canal, nerve root compression and status of intevertebral disc - that would necessitate decompression. In plain radiographs the degree of displacement evaluated by MEYERDINGS grading[3]. All the patients included in the study underwent PLIF. All patients were followed at regular intervals i.e, 6 weeks, 12 weeks, 24 weeks, and prospectively. In all follow ups patients were examined clinically for symptomatic improvement, SLRT, recovery from neurological deficits and radiologically for maintenance stability of fixation, and complications. Functional outcome was assessed by Kim and Kim`s criteria[4] {table 2}.

TABLE 2. Criteria for Measuring Improvement of Clinical Results – Kim and Kim`s Criteria [4]

Excellent	Complete relief of pain in back and lower limbs No limitation of physical activity Analgesic not used Able to squat on the floor
Good	Relief of most pain in back and lower limbs Able to return to accustomed employment Physical activities slightly limited Analgesic used only infrequently Able to squat on the floor
Fair	Partial relief of pain in back and lower limbs Able to return to accustomed employment with limitation or return to lighter work
Poor	Physical activities definitely limited Mild analgesic medication used frequently Mild limitation to squat on the floor Little or no relief of pain in back and lower limbs Physical activities greatly limited Unable to return to accustomed employment Analgesics medication used frequently Unable to squat on the floor without support

III. Results

In our study 60 patients were included with the average age of 39.5 years (Range 21-62 years). 75% (n=45) had pars interarticularis defect and 25% (n=15) had no defect. 80 % of the patients had Grade I (40%) and Grade II (40%) listhesis and did not respond to conservative management. {Table 3}

MEYERDING GRADE	NO. OF PATIENTS	PERCENTAGE
GRADE I	24	40%
GRADE II	24	40%
GRADE III	6	10%
GRADE IV	6	10%

Table 3: Pre-operative Distribution of the study group as per Meyerding Grading for Spondylolisthesis

Complications(Table 4) : Screw Malposition was noted in one patient for whom, repositioning was done on 3 Post operative day. The same patient had superficial wound infection that healed in 3 weeks of time by treating with antibiotics as per culture and sensitivity. Two cases had EHL weakness residually even in post-operative period even at 2 years of follow up. Four patients had persistent low back pain with partial relief of pre-operative symptoms and are treated symptomatically even at 2 years of follow up. One patient had implant failure with back out of screw at 4th month follow up, who required implant removal and redo fixation of longer spinal segments.

Intra-operative Complications	
Dural Tear	2 (3.3%)
Screw Malposition	2 (3.3%)
Post-Operative Complications	
Superficial Infection	2 (3.3%)
Deep Infections	Nill
Implant Failure	1(1.6%)
Persistent Low back pain	4 (6.66%)
Neurological deficits	2 (3.3%)

Table 4 : Complications in the study group.

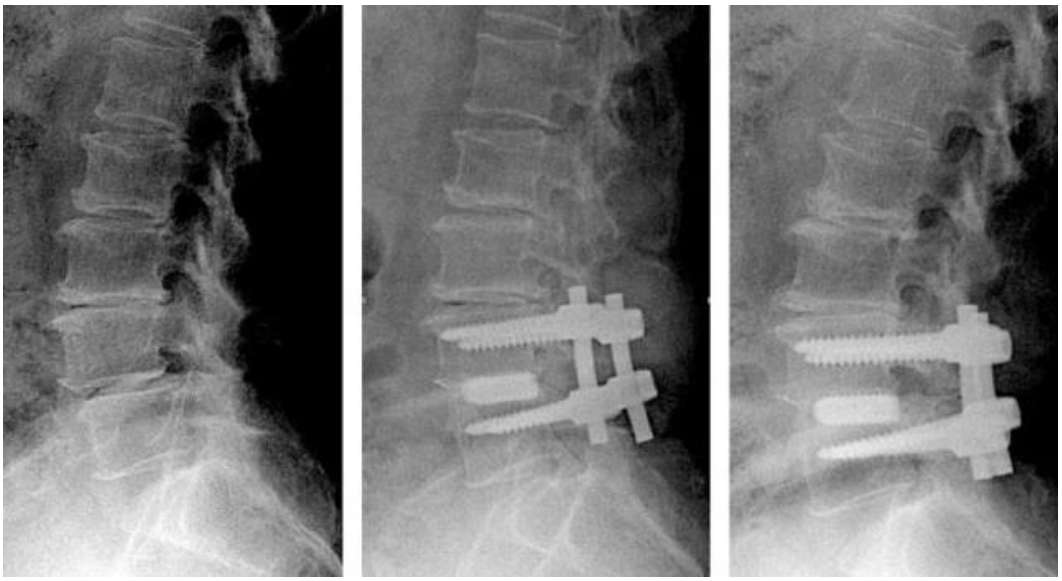

Fig 1: Pre op image of Grade I listhesis L4-L5. Immediate post-op X ray after PLIF. X ray at one year follow up.

One patient who had implant failure and two others who had persistent low back pain had poor results. But they have been maintaining on low dose of analgesics to improve symptomatically. {Table 5 : Results f the study group as assessed by Kim and Kim`s criteria.

KIM-KIM`S CRITERIA	NO.OF PATIENTS	PERCENTAGE
EXCELLENT	9	15%
GOOD	30	50%
FAIR	18	30%
POOR	3	5%

Table 5: Functional outcome as assessed by Kim and Kim`s Criteria

IV. Discussion

The concept of treatment of spondylolisthesis has been evolved from conservative measures like analgesics, muscle relaxants, activity restriction, lumbosacral corset and physiotherapy to open reduction and internal fixation with pedicle screw and rod fixation ,reduction of slippage.

Anterior column augmentation with PLIF using intervertebral spacers in addition to pedicular screw fixation was found to have superior fusion rate and improved clinical outcomes in spondylolisthesis[5-8] Recently, transforaminal lumbar interbody fusion has also been reported to produce a high fusion rate and excellent clinical outcomes. However, PLIF is more advantageous in achieving solid fusion by removing intervertebral material and cartilaginous endplates through bilateral wide annulotomy and harvesting a greater amount of local autograft[9].Evaluation of the long term outcomes of PLIF is important. Previously conducted studies had limitations in terms of different diagnoses, different levels and number of fused segments and different fusion techniques. Therefore, we evaluated the long term outcomes of PLIF using the same procedure in patients with degenerative spondylolisthesis. We compare our clinical results with **Mohammed et al[10]**, **BJ Shin et al1[11]**, **JC Lee et al[12]** based on Kim and Kim criteria.

Kim and Kim`s Criteria	***Present study (n=60)***		***Mohammed et al (n=40)***		***BJ Shin et al (n=12)***		***JC Lee et al (n=12)***		
Excellent	9	15%	8	20%	1	8.3%	8	66.7%	
Good	30	50%	18	45%	7	58.3%	2	16.7%	
Fair	18	30%	5	12.5%	2	16.7%	1	8.3%	
Poor	3	5%	9	22.5%	2	16.7%	1	8.3%	
total	60	100%	40	100%	12	100%	12	100%	

Table 6 : Comparision of Results.

The results are nearly similar to other studies i.e. in our study satisfactory (including excellent and good) results 65%, Mohammed et al 65%, BJ Shin et al 66.6%, JC Lee et al 83.4%.

Kim[4] et al reported an overall correction of 35% in anterior displacement without any attempt at reduction. Mohammed[10] et al, reported an average correction of anterior displacement of 35% was seen in the early postoperative period, though no separate attempt to reduce the slip was made. An average loss of

correction of 10% was noted subsequently.In our study, correction of anterior displacement by one grade in 60% and by two grades in 20% was seen in the early postoperative period and in 20% no reduction achieved. Kyung[13] et al showed that for relatively older less active patients, posterior instrumentation with posterolateral fusion is better due to simple and easy procedure.

This study has several limitations. First, we had no control group. Therefore, we could not evaluate the degenerative changes in the discs of nonsurgical patients. Van Horn and Bohnen [14], in a retrospective matched pair study of 16 patients with a minimum follow up period of 16 years after anterior spinal fusion, found radiographic degenerative changes in the adjacent discs at a rate similar to that in the corresponding levels of the control group. Second, this study was a small case series with a short follow up period of 2 years. We conclude that outcomes of PLIF for degenerative spondylolisthesis have shown the satisfactory outcome.

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