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## Study of functional outcome of surgical management in spondylolisthesis treated with pedicle screw fixation and posterior lumbar inter body fusion

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### Abstract

**Objective:** Assessment of the clinical outcome of pedicle screw fixation and posterior lumbar interbody fusion using Oswestry Disability Score comparing preoperative scores with postoperative (1 month, three months, six months and 1 year) scores, evaluate clinical improvement in terms of pain relief, mobility and radiological outcome in patients with spondylolisthesis.

**Materials and Methods:** Study was performed in the orthopedic department of Katuri medical college and hospital, Chinakondrupadu, Guntur from October 2016 to September 2018. Patients diagnosed with spondylolisthesis who underwent PLIF with pedicle screw fixation are included in our study.

**Results:** The average preoperative ODI score was 57. The ODI score at most recent follow up (1yr) was 12.53. The result was excellent in all cases improving from severe disability to minimal disability. Mean ODI at each follow-up visit was compared with preoperative using Paired T-test, and p values were calculated. P-value was found to be significant with each comparison. Radiological evidence did not reveal any signs of cage subsidence or disc space narrowing or migration of the cage. 28 (93.3%) patients showed radiological signs of fusion, and 2 (6.6%) patients had no signs of fusion.

**Conclusion:** PLIF technique supplemented with posterolateral fusion is an ideal technique in spondylolisthesis for achievement of reduction, maintenance of lordosis, direct decompression of nerve roots, interbody fusion and provides good biomechanical support by pedicular screw instrumentation and cage.

**Keywords:** Alif- anterior lumbar inter body fusion, is-isthmus spondylolisthesis, ds-degenerative

### 1. Introduction

The term spondylolisthesis is coined from the Greek word (Spondylos - vertebra, olisthesis - to slip or slide down a slippery path). It is defined slipping of one vertebra on another in either anterior or posterior direction. Herbineaux<sup>[1]</sup>, a Belgian obstetrician was the first to observe it. But the term was first used by Killian.

It is one of the common conditions of the lumbar spine resulting in low back pain which could be either static or radiating in nature. Forward slippage is called anterior or forward listhesis, and backward slippage is called retrolisthesis, the former is most common. Spondylolisthesis prevalence in general population is 5%, and the incidence of degenerative spondylolisthesis seen in women is twice that compared with men<sup>[2,3]</sup>. Treatment options include any one of the following techniques such as decompression, posterolateral fusion with or without instrumentation, and interbody fusion. All these have produced different degree of success and had their own share of complications.

The study aims to determine the functional outcome and the complications associated with posterior lumbar interbody fusion using Moss Miami system of rods and screws using a cage. In this study, 30 cases of spondylolisthesis of lumbar vertebrae were treated by PLIF at Katuri Medical College and Hospital, Chinakondrupadu, Guntur between June 2017 to October 2018 were included. The functional outcome is assessed and compared with other studies.

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## 2. Materials and Methods

### 2.1 Methods

**Study type:** This study is a hospital-based prospective study of clinical and radiological analysis of posterior lumbar interbody fusion using pedicle screw fixation in spondylolisthesis.

**Study area:** study was carried out in orthopedic department of Katuri medical college and hospital, Chinakondrupadu, Guntur from June 2017 to October 2018.

**Study population:** Patients diagnosed with spondylolisthesis who underwent PLIF with pedicle screw fixation are included in our study. Procedure was explained to all the patients, need for follow up, and written consent was taken. Thirty-three patients in total who underwent posterior lumbar interbody fusion with pedicle screw fixation for spondylolisthesis were eligible for the study. Three patients who were not available for regular follow-ups were excluded from the study. Thirty patients who were available for minimum of 1 year follow up were included in our study. These were done between June 2017 to October 2018.

### 2.2 Selection of the patients for surgery

#### 2.2.1 Inclusion

- All patients above within age group of 20-65yrs diagnosed with degenerative spondylolisthesis, isthmic spondylolysis and spondylolisthesis
- All patients with minimal disc degenerative changes with preserved disc height
- Both sexes
- Patients with severe low backache or severe symptoms of

root compression who did not have relief of symptoms with conservative methods

- Patient diagnosed with both spondylolisthesis with failed conservative treatment and consented for surgery.

#### 2.2.2 Exclusion criteria

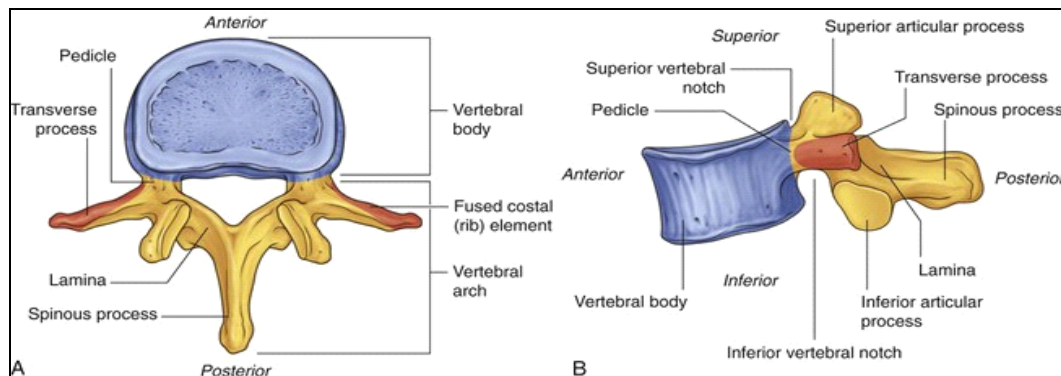
- Age less than 20yrs.
- Patient with local tissue condition making the surgery inadvisable
- Low backache of less than three months duration, patients with spondylolisthesis but with no clinical symptoms
- Patients with grade 5 spondylolisthesis.
- Patients who did not have regular follow up of minimum six months.
- Patient with congenital spinal deformities.
- Patients who have had earlier spine surgeries.

All patient data and clinical history were noted with reference to pain, neurological claudication, straight leg raise test, neurological deficits, grading of slip, activities or function (Oswestry disability index), achievement of fusion preoperatively and at scheduled follow-up visits

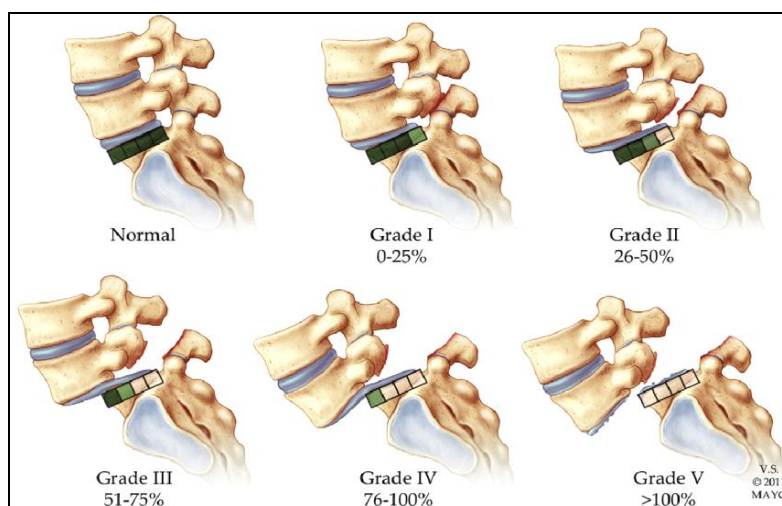
### 2.3 Materials

MOSS Miami system of rods and screws - ranging from 50mm-140mm Pedicle screws- poly axial ranging from 4.5 mm-6.5mm -monoaxial Threaded Titanium cages- 20mm length, diameter from 7-12mm -25mm length, diameter from 7-12mm -30mm length, diameter from 7-12mm.

### Anatomy



### Myerding Classification



**3. Results and Discussion**

**3.1 age and sex distribution**

The age ranges from 21-63 years with mean age of 45.93 years. Most of the cases are between the age group of 40 to 50 years constituting 56.6% of the study population. Of the 30 cases selected for the study, the majority are female patients. 24 patients are female constituting 80% of cases, and the rest 6 are male patients constituting 20% of the cases. Average age of patients in our study is 44.16 years. Youngest patient who underwent surgery was 21 years. The oldest patient was 63 years.

**3.2 Type of listhesis and preoperative myerding grade of listhesis**

Thirteen patients had isthmic spondylolisthesis out which three are male, and 10 are female i.e., 43.33% of total study. Seventeen patients had degenerative spondylolisthesis with three males and 14 females i.e., 56.6% of total study. Mean average age of isthmic spondylolisthesis patients are 36.61 years. Mean average age of degenerative spondylolisthesis are 50.11. Out of 30 patients 9(30%) patients had grade 1 listhesis, 16(53.3%) had grade 2, 5(16.6%) had grade 3 listhesis.

**3.3 Preoperative symptoms and neurological deficits**

Out of 30 patients, 13 patients (43.3%) had LBA, 8(26.6%) patients had LBA with right sciatica, 6 (20%) patients had LBA with left sciatica, 3 (10%) patients had bilateral sciatica. Motor and sensory deficits are seen in 3 (10%) patients, only motor deficits in 10 (33.3%) patients, only sensory deficits in 7 (23.4%) patients, and 10 (33.3%) patients had no deficits.

**3.4 Postoperative symptoms and neurological deficits**

Out of 30 patients, 19(63.4%) had no pain, 8(26.6%) had mild back pain, and 3 (10%) had frequent back pain. 23(76.6%) patients had no neurological deficits, 4 (13.4%) had sensory

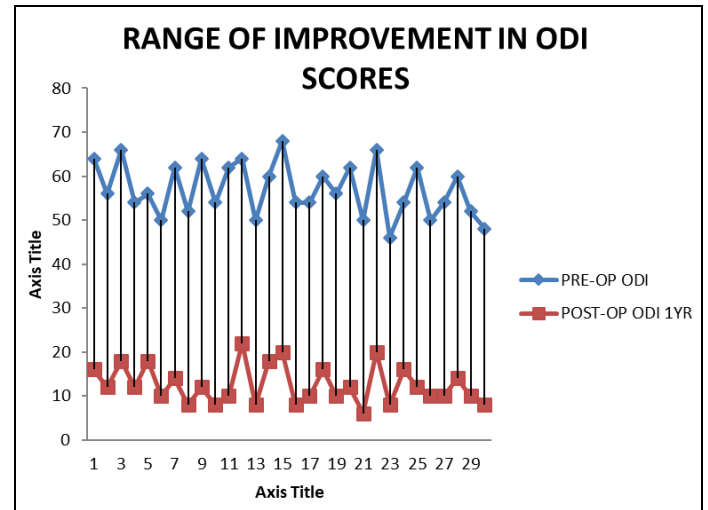
deficits, and 3 (10%) had motor weakness.

**3.5 Postoperative meyerding grading**

Out of 30 patients, 25 (83.4%) had no-slip, and 5 (16.7%) patients had grade 1 slip.

**3.6 Range of Improvement in ODI Scores**

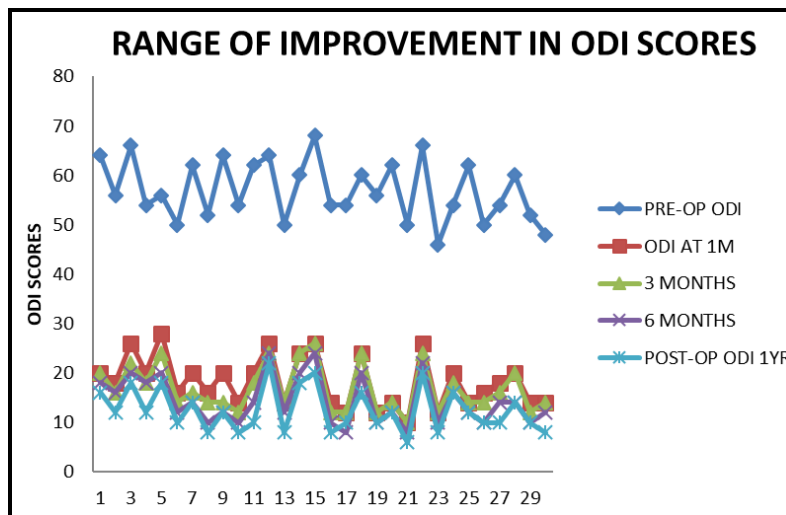
Chart 1



**Fig 1:** Range of Improvements in ODI scores Pre and Postoperative 1 year followup

Average improvement of ODI scores was 44.47

**3.7 Range of improvement in ODI scores at every followup**  
Chart 2



**Fig 2:** ODI scores at each followup till 1 year

**Clinical outcome:** The average preoperative ODI score was 57. The ODI score at most recent follow up (1yr) was 12.53. The result was excellent in all cases improving from severe disability to minimal disability. Mean ODI at each follow-up visit was

compared with preoperative using Paired T-test, and p values were calculated. P-value was found to be significant with each comparison.

**Table 1:** Statistics of pre-op & post-op ODI scores comparison

	Preop ODI	Postop ODI 1month	Postop ODI 3months	Postop ODI 6months	Postop ODI 1yr
Mean	57.000	18.267	16.800	14.400	12.533
Std.Deviation	6.0515	5.0850	4.7153	4.7387	4.3290

Chart 3: Comparison of preop and post-op ODI scores at every follow-up

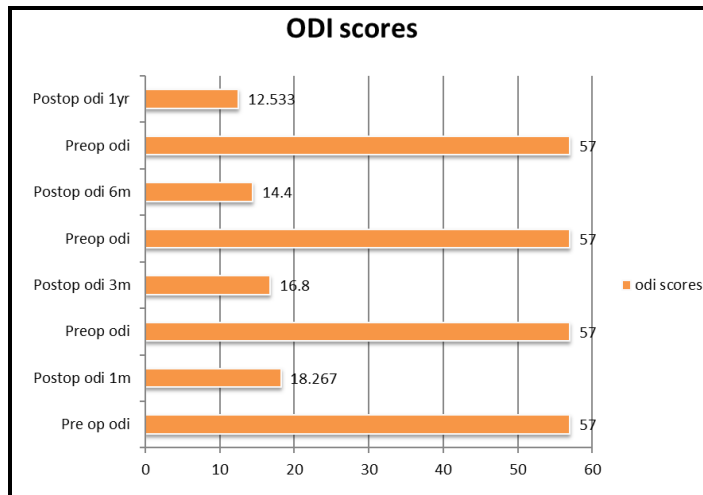


Fig 3: Comparitive ODI scores at each followup with preoperative score

### 3.8 Radiological outcome

Radiological evidence did not reveal any signs of cage subsidence or disc space narrowing or migration of cage. 28 (93.3%) patients showed radiological signs of fusion, and 2 (6.6%) patients had no signs of fusion.

Radiological union is confirmed when there is the presence of a fusion mass, which was usually seen in an average period of 8-12 months and we achieved union in all the 28 patients who turned up for review.

### 3.9 Pre and post-operative imaging studies of selected case

48/F with LBA with RT sciatica since 1yr



Fig 4: Preoperative radiographs, intraoperative image and postoperative radiograph

Postoperative straight leg raise and lumbar range of movements



Fig 5: Postoperative straight leg raise



Fig 6: Postoperative spine range of movements

### 3.10 Complications

There were no serious systemic complications or deep surgical site infections which might probably be due to the strict aseptic technique followed preoperatively and postoperatively. Ceftriaxone and tazobactam combination antibiotics used one dose before surgery and another dose after the surgical procedure. No immediate postoperative neurological complications were observed, although an incidental dural tear was observed in one patient (3.3%) This can be attributed to more required space for placement of the titanium cages that necessitates more dural traction.

### 3.11 Discussion

Conservative treatment has shown reasonably good results in

spondylolisthesis cases. But recently patient lifestyle and demands have shown more inclination towards surgery and the choice amongst surgical management is in debate now. PLF has shown there good results in many studies but has more post-operative problems. PLIF is more advantageous in these situations. The quality of is life of the patient is significantly improved after surgery. The mechanical instability ain spondylolisthesis demands rigid fixation and solid fusion. Rigid fusion between segments arrest further instability, and progressive vertebral slipping is also avoided. Adequate decompression is the important factor in success.

Interbody fusion provides several advantages over other fusion techniques in treating spondylolisthesis. When the graft is placed at the weight-bearing center of the spine, where 80% of the axial

load occurs. The disc height and the balance can be restored as well as optimal conditions are created for a higher fusion rate by keeping the graft under compression with an extensive blood supply from the adjacent vertebral endplates. PLIF limits the extent of posterolateral soft tissue exposure, muscle stripping, and injury as well as allowing direct neural decompression. PLIF can be done using either iliac bone graft or titanium cages; however, certain bone grafts tend to collapse and fracture. In addition, the loss of disc space height after insertion of these bone grafts had been identified because the compressive strength of the grafts placed is not more than the physiologic compressive loads of the spine

In cage fusion, the quantity of the bone graft required is significantly reduced. The cage design allows subsequent bone growth through and around it. When used along with a rigid posterior instrumentation system, the MOSS MIAMI system was effective in significantly increasing the stiffness of the fused segment in early stages above all other constructs<sup>[4-9]</sup>

Our study is a prospective study comprising of 30 patients with surgical management in Spondylolisthesis treated with pedicle screw fixation and posterior lumbar interbody fusion. Of the 30 cases included in the study majority do females (24) constitute 80% of cases, and the rest 6 are male patients constituting 20% of the cases. The mean age of the patients in the group is 44.16 years (Range from 21-63 years) which is similar to study done by Rolemberg Dantas *et al.*<sup>[10]</sup> there were 20 females and 10 males with mean age of 46.7 years and Jie Zhao *et al.*<sup>[11]</sup> who reviewed 27 patients and average age of patients was 46years

**Table 2:** Mean age and comparison with other studies

Study	Mean age 44.16 years
Dantas <i>et al.</i>	Mean age 46.7 years
Jie Zhao <i>et al.</i>	Mean age 46 years

Out of 30 patients included both adult isthmic spondylolisthesis i.e., 13 patients (3 male and ten female) and degenerative spondylolisthesis i.e., 17 patients (3 male and 14 female). Female preponderance was noted in degenerative spondylolisthesis which was similar to other study done by Ki-Tack Kim *et al.*<sup>[12]</sup> and Ching Hasio *et al.*<sup>[13]</sup> in which they included spinal conditions with degenerative spondylolisthesis in 47 patients (62%) and isthmic spondylolisthesis in 29 patients (38%).

#### 4. Conclusion

Although this study is limited by few numbers of patients and the duration of follow up is very short, the results suggest that the management of spondylolisthesis can be accomplished successfully with pedicle screw fixation and PLIF technique. The outcome showed high fusion rate and excellent clinical outcome in terms of pain relief and functional capabilities. Patients are satisfied with results, and most of them resumed their normal activities and are pursuing their routine work. Although in some patients, there are minor residual symptoms, but they did not limit the activity. Complications encountered in our short term follow-up did not affect the outcome at the end. Neither the complications like cage subsidence nor construct failure have not been found in our study nor analysis regarding survivorship and longevity of PLIF and pedicle screw fixation has been dealt with. Long term follow up is mandatory to analyze these aspects.

In conclusion, we would suggest PLIF technique supplemented with posterolateral fusion is an ideal technique in spondylolisthesis for the achievement of

1. Reduction and maintenance of lordosis
2. Direct decompression of nerve roots
3. Interbody fusion
4. Good biomechanical support by pedicular instrumentation and cage

Our study supports the usage of pedicle screw fixation and PLIF in both isthmic and degenerative spondylolisthesis. With the current trend, research and advent to new implants support PLIF in patients suffering from severe disability due to spondylolisthesis.

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