

ANALYSIS OF DEGENERATIVE SPONDYLOLISTHESIS TREATED WITH POSTEROLATERAL FUSION AND PEDICLE SCREW-ROD INSTRUMENTATION WITH DECOMPRESSION- A RETROSPECTIVE STUDY

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ABSTRACT

BACKGROUND

The aim of the study is to analyse the functional outcome of spondylolisthesis treatment by posterolateral fusion and pedicle screw-rod instrumentation with decompression produced at AVMC and Hospital in period between May 2013 to July 2016 are to be analysed.⁽¹⁾

MATERIALS AND METHODS

This is retrospective and prospective study comprising of 20 patients with spondylolisthesis who were treated with posterolateral fusion with Zeta Rods and pedicle screw fixation at Aarupadai Veedu Medical College and Hospital during the period between May 2013 to July 2016. These patients were reviewed periodically both clinically and radiologically for a minimum of 6 months following operative fixation.

Inclusion Criteria-

- Patients in the age group of 30-60 days.
- All cases of spondylolisthesis.

Exclusion Criteria-

- Inoperability in certain cases due to multiple comorbid factors/systemic disease.
- Bed ridden patients.

RESULTS

- The follow up ranged from 6 to 10 months with an average follow up of 7.67 months.
- Reduction of listhesis.
- The following parameters are calculated to determine the correction of slip.
- Fusion.
- The average time taken for fusion is six months. The fusion was solid in 13 patients (65%), possibly solid in 6 patients (30%) and 1 case of pseudoarthrosis (5%).

CONCLUSION

Our study is a retrospective and prospective study, which was conducted at Aarupadai Veedu Medical College and Hospital to analyse the functional outcome in twenty cases of degenerative spondylolisthesis who were treated by posterolateral fusion and pedicle screw (2) - rod instrumentation as a definitive treatment modality.

KEYWORDS

Spondylolisthesis, Degenerative Spondylolisthesis, Posterolateral Fusion, Zeta Rods and Pedicle Screw.

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BACKGROUND

Aim of Study

To analyse the functional outcome of spondylolisthesis treatment by posterolateral fusion and pedicle screw-rod instrumentation with decompression produced at AVMC and Hospital in period between May 2013 to July 2016 are to be analysed.

SPONDYLOLISTHESIS CLASSIFICATION

When the International Society for the Study of Lumbar Spine met in London in 1975, a classification was put forward, which is now widely accepted. It was based upon the five types proposed by Wiltse, Newman and MacNab based on the work of Neugebauer and Newman.⁽²⁾

Types I -	Dysplastic spondylolisthesis.
Type II -	Ischaemic spondylolisthesis.
Type III -	Degenerative spondylolisthesis.
Type IV -	Traumatic spondylolisthesis.
Type V -	Pathological spondylolisthesis.

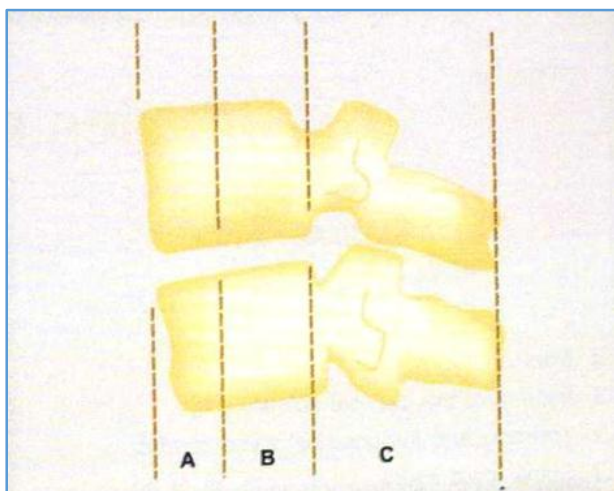
Isthmic Spondylolisthesis⁽³⁾

There are three types according to the integrity of the pars interarticularis.

Type A, lytic spondylolisthesis⁽⁴⁾ is always a fatigue fracture. It appears with the erect posture and tends to stabilise in young adulthood. It is the commonest type of spondylolisthesis under the age of 50 years.

Type B, attenuation of the pars is thought to be due to repeated micro fractures, which lead to attenuation rather than frank lysis, but is in effect the same condition as lytic spondylolisthesis.

Type C, an acute pars fracture is very rare and the result of severe trauma. These acute true pars fractures appear to lend support to the traumatic theory of spondylolisthesis, but they are part of multiple injury picture or a result of a fall from height rather than slow and insidious manner in which lysis develop.



Three-Column Concept of Spine- (A) Anterior Column, (B) Middle Column and (C) Posterior Column

The three-column is the latest description of the spine stability. The anterior column consists of anterior half of the vertebral body, anterior part of the disc and anterior longitudinal ligament. The middle column consists of posterior half of the body and the disc, the posterior longitudinal ligament. The posterior column consists of the

posterior vertebral arch consisting of transverse process, spinous process and the accompanying ligaments. One-column injury is stable, two-column injury is unstable and three column is invariably unstable. Unstable spine is a dangerous spine for it may injure the spinal cord.

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Our Method of Treatment

Initial Treatment

- All our cases underwent a thorough general physical and systemic evaluation.
- From the spine point of view, we acquired appropriate radiographs and MRI scans to evaluate the degree of slip and quantify the amount of neurological involvement.
- All systemic comorbidities like diabetes mellitus, hypertension, etc. were taken into consideration and managed appropriately.

Indications for Surgery

- Persistent/recurrent back or leg pain.
- Severe neurogenic claudication (5) leading to a significant reduction in quality of life.
- Failure of conservative trial of treatment.
- Worsening neurological deficit with bowel/bladder involvement.

Definitive Management

After thorough investigation and obtaining fitness for surgery from both the medical and anaesthetic teams, all 20 patients with spondylolisthesis underwent posterolateral fusion and posterior spinal instrumentation with pedicle screws and Zeta Rods under general anaesthesia, the slip grade was determined using Meyerding's method of grading. The slip angle and slip percentage were calculated by Tillard's method.

Operative Technique

Surgical treatment consisted of decompression, posterolateral fusion and stabilisation with pedicle screw and

Zeta Rod fixation. Patient in prone position through Mercedes-Benz incision, laminectomy and removal of loose fragments done. After adequate decompression, the bed of graft was prepared. Subperiosteal dissection was performed between the transverse process and lateral aspects of the facet joints. Graft was harvested from the excised lamina and placed in this bed after stabilisation with pedicle screws and Zeta Rods. Pedicle screws were placed under direct radiographic control after wide laminectomy. Decompression, stabilisation with PLIF and pedicle screws and Zeta Rod fixation and appropriate bone grafts placed.

Preoperative antibiotics were administered in all cases and continued for a minimum of 48 hours after surgery. There were no intraoperative complications. All the patients were mobilised in bed from 1st POD. All the patients were ambulated with lumbosacral corset from 2 wks. Lumbosacral corset⁽⁶⁾ was worn till 5 months after surgery by all patients while ambulating.

INTER OP PERIOD

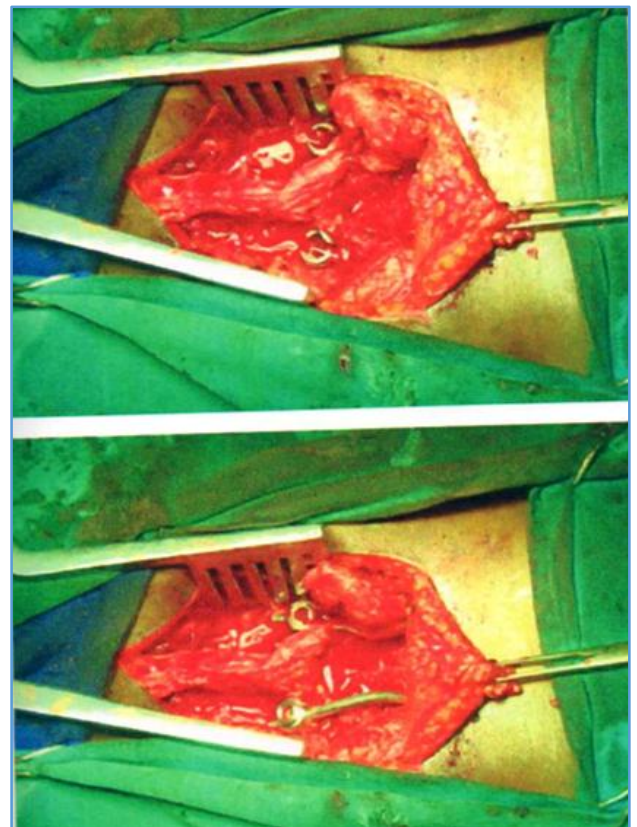
The average period of inter op time was about 2-3 hrs. for all patients who have undergone surgery.

BLOOD LOSS

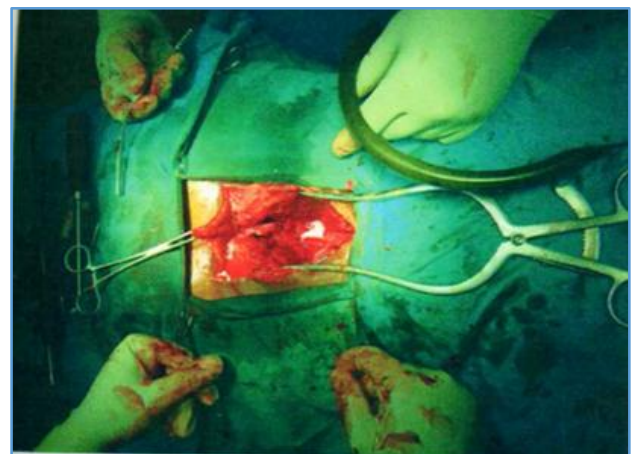
1-2 units of blood has been transfused for all 20 patients.

C-ARM SHOTS

Nearly 30 C-arm shots has been taken intraoperatively for all patients.



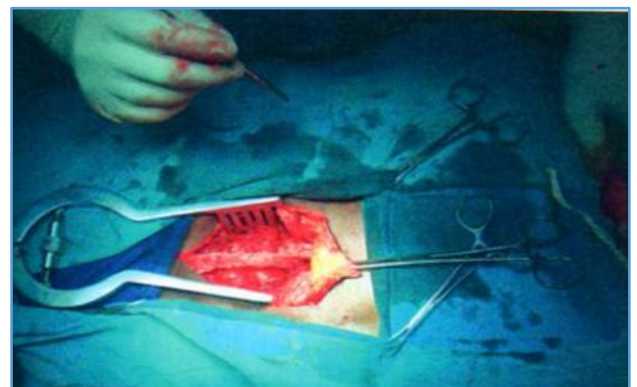
Pedicle Screws



Mercedes-Benz Incision



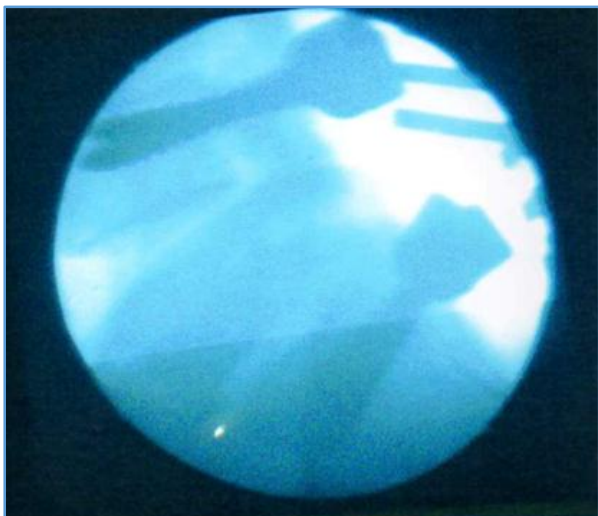
Instruments - Stainless Steel



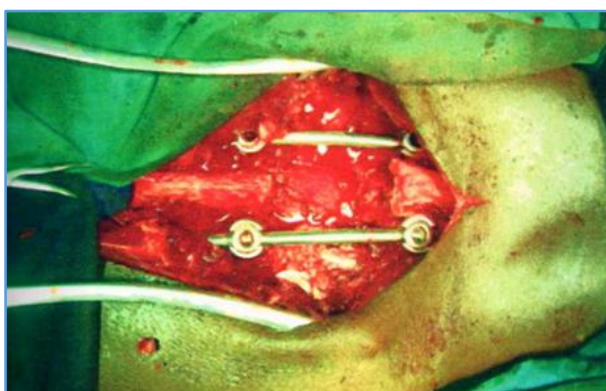
Showing Lumbar Spine



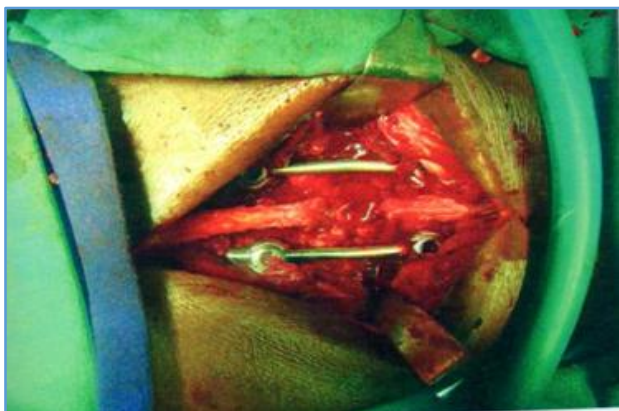
Patient Prone Position with Draping



Pedicle Screws Checked Under C-Arm



Pedicle Screws with Zeta Rods



Pedicle Screws with Zeta rods



Closure with Drain

Postoperative Protocol

- The patients received intravenous antibiotics for a minimum of days. They also received appropriate analgesics/anti-inflammatory drugs.
- The drain was removed after 48 hrs.
- Mobilisation was commenced on the 12th postoperative day with a lumbosacral corset.
- In the meanwhile, patients underwent bedside physiotherapy in the form of deep breathing exercises, active and passive limb range of motion exercises.
- Operative site was inspected 3rd, 7th, 10th and 14th postoperative days.
- Sutures were removed on the 14th postoperative day.

Follow Up

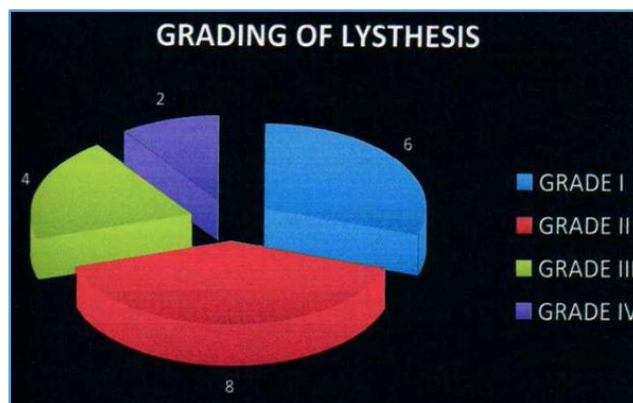
- Our patients were reviewed periodically after discharge at 6 weeks, 12 weeks and 6 months from day of surgery.
- The results were analysed in the forms of union, reduction of listhesis and clinical improvement in complaints of back pain, claudication pain and neurological deficits.
- Follow up radiographs were obtained at all the OPD visits to determine the amount of fusion and implant position.
- The clinical outcome was analysed using the Japanese Orthopaedic Association Scoring System.
- Radiographical outcome was analysed by calculating the slip angle and percentage of slip.
- Fusion was defined as SOLID when there was bridging trabecular continuity between the fused vertebrae. It was considered as POSSIBLY SOLID when trabecular continuity was not very clear and NONUNION as visible gap with graft collapse.

Patient's Data

Total number of patients- 20.

Grading of Listhesis

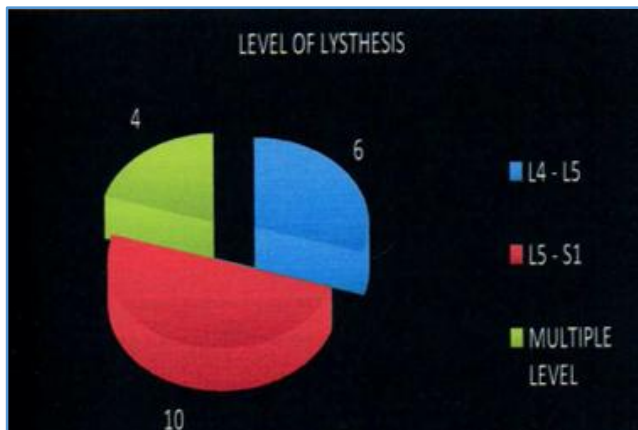
- Grade I - 6 patients.
- Grade II - 8 patients.
- Grade III- 4 patients.
- Grade IV- 2 patients.



Graph 1

LEVEL OF LISTHESIS

Between L4-L5- 6 patients.
 Between L5-S1- 10 patients.
 Multiple Level- 4 patients.



Graph 2

AGE DISTRIBUTION

The patients were in the age group of 30 to 60 years. The average being;

30-40 years- 2 patients.
 41-50 years- 12 patients.
 51-60 years- 6 patients.

RESULTS

The follow up ranged from 6 to 10 months with an average follow up of 7.67 months.

Reduction of Listhesis

The following parameters are calculated to determine the correction of slip.

Fusion

The average time taken for fusion is six months. The fusion was solid in 13 patients (65%), possibly solid in 6 patients (30%) and 1 case of pseudoarthrosis (5%).

Functional Outcome

- Before surgery, all the patients reported severe back pain, whereas at final postoperative follow-up, only 5 patients (25%) stated they have occasional back pain on strenuous work.
- Preoperatively, 16 patients had neurogenic claudication with an average walking distance of 15 m. Postoperatively, all the patients were relieved from claudication pain with an increase in their walking distance to 500 m.

- 16 patients had sciatica before surgery. After surgery, only 3 patients had occasional leg pain.
- Before surgery, all the patients reported that back pain often interfered with their activities of daily living. Postoperatively, 16 patients reported that pain never interfered with their activities of daily living.

Complication

There was only one case [5%] of pseudoarthrosis⁽⁷⁾ in our study. We had no cases of superficial infection or implant loosening.

Clinical Outcome

Patient’s perception of their quality of life improved markedly after surgery. Overall, clinical result was categorised into excellent, good, fair and poor by determining final correction of slip maintenance of correction and the functional outcome in which 10 patients (50%) had an excellent outcome, 6 patients (30%) had good result and 4 patients (20%) had fair results.

SI. No.	JOA Score Preop	JOA Score Postop
1.	15	26
2.	10	25
3.	12	20
4.	9	15
5.	10	19
6.	9	24
7.	8	16
8.	8	22
9.	16	25
10.	10	26
11.	11	19
12.	9	18
13.	10	25
14.	11	16
15.	9	18
16.	7	20
17.	9	18
18.	8	25
19.	10	16
20.	9	20
Total	200/20	413/20
Percentage	10%	20.65%

Scoring System

The Japanese Orthopaedic Association Scoring System (JOA)

	Score
Subjective symptoms (9 points)	
Low back pain	
None	3
Occasional mild	2
Always present or occasional severe	1
Always severe	0
Leg pain /tingling	
None	3
Occasional mild	2
Always present or occasional severe	1
Always severe	0
Ability walk	
Normal	3
≥ 500 m	2
≤ 500 m	1
At most 100 m	0
Objective findings (6 points)	
SLR (including hamstring tightness)	
Normal	2
30° – 70°	1
< 30°	0
Sensory abnormality	
Normal	2
Mild distance	1
Distinct	0
MMT	
Normal	2
Slight decrease	1
Marked decrease	0
Restriction of ADL (14 points)	
Turn over	
No restriction	2
Moderate restriction	1
Severe restriction	0
Standing	0,1, and 2 are same as those for turnover
Washing	
Leaning forward	
Sitting (about 1 hr)	
Lifting or holding heavy objects	
Walking	
Urinary bladder function	
Normal	0
Mild dysuria	-3
Severe dysuria	-6
Total	29 points

DISCUSSION

The discussion is carried out under various subtitles.

Age

The average age incidence seen in our study is 47.75 years ranging from thirty five to fifty six years. The age incidence in our study group is similar to the studies done by Kim et al (41.3 years), Lee et al (48 years) and Boeree et al (44.4 years).

Sex

The female [14 patients] to male [6 patients] ratio in our study was 2.3:1, which is almost similar when compared to the studies done by Boeree et al (2.5:1) and Kim et al (3:1). This is possibly due to the fact that female patients have a significantly higher amount of strain on their back due to the mechanical nature of household work. Other studies show a slightly different sex ratio, Lee et al (1.5:1).

Level

The most commonly involved level in our series is L5-S1, which is 50%. Other studies done by Kim et al (87.8%), Lee et al (74.7%) and Boeree et al (72.5%). Next common level encountered was L4-L5 (30%). We encountered 4 patients (20%) with multiple level involvement.

Fusion

In our study, we have 65% of solid fusions, which was less when compared to the Lee et al (81%), Kim et al (95%), and Boeree et al (87.5%). We had 1 case of pseudoarthrosis [5%], Kim et al study with no nonunion, Lee et al (7.5%) and Boeree et al (9.5%).

Although, various modalities of fusion have been in existence. Posterior lumbar interbody fusion gives equal or better results than posterolateral fusion.⁽⁸⁾ The advantages of PLF are it is a safer procedure, there is less intraoperative blood loss, less chance of injury to the nerves and dura and shorter operating time. The disadvantage of PLF is there is increased chance of pseudoarthrosis.

Complications

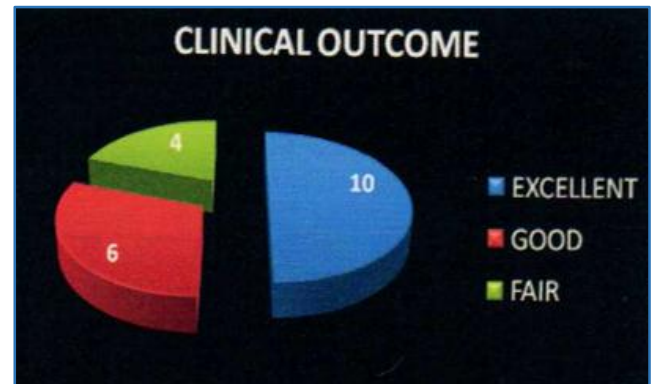
As stated previously, we had 1 case (5%) of pseudoarthrosis. We did not encounter any case of superficial infection [Kim et al (nil), Lee et al (nil) and Boeree et al (2.5%)] and there was no evidence of implant loosening when compared to the studies of Kim et al (5%) and Lee et al (5%).

Clinical Outcome

In our study, patient's perception of their quality of life also improved markedly after surgery. There were 80% [10 patients] of excellent to good results, which is almost the same when compared to the study of Boeree et al.

(81%) and slightly less than the studies of Kim et al (90%) and Lee et al (95%) the possible reasons for a fair outcome in 4 patients (20%) of our cases can be attributed to late presentation, severe claudication pain and neurological deficit at time of initial presentation, hamstring

spasm/sciatica and poor patients compliance with postoperative physiotherapy and follow up.



Graph 3

CONCLUSION

Our study is a retrospective and prospective study, which was conducted at Aarupadai Veedu Medical College and hospital to analyse the functional outcome in twenty cases of degenerative spondylolisthesis who were treated by posterolateral fusion and pedicle screw-rod instrumentation as a definitive treatment modality.

- The functional outcome in our study gave excellent to good results in majority of cases (80%), which was almost in par with studies conducted elsewhere [Boeree et al 81%].
- This treatment modality not only relieved the pain experienced, but also rectified neurogenic claudication in most of our patients. Hence, there was a significant improvement in the functional ability of our patients and thereby providing a better quality of life.
- The concept of pedicle screw-rod instrumentation provides us with a rigid three column fixation to help support the unstable spine. This also helps in restoring the right body posture and mechanics and simultaneously promote union.
- The functional and radiological outcome generally correlate with each other as found in our study.
- From our study, we can confidently say that posterolateral fusion⁽⁹⁾ is an effective treatment modality in patients with spondylolisthesis and the results obtained in our study are in par with the other studies that have been conducted elsewhere.

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