

Pedicle Screw Fixation and Posterolateral Fusion in Lumbar Spondylolisthesis - A Prospective Analysis

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ABSTRACT


Introduction: Spondylolisthesis is defined as the anterior slippage of one vertebra on another. The commonest level involved is L5 – S1 (89%). The displacement is a result of loose posterior locking mechanism which in turn leads to instability with symptomatic thecal sac and nerve root compression. Surgical stabilization helps in preventing further neurological insult and to enhance the recovery.

Materials and Methods: This is a prospective study comprising of 20 patients with spondylolisthesis who were treated with pedicle screw-rod fixation and postero-lateral fusion with iliac bone graft during the period of Jan 2013 to Mar 2014. These patients were reviewed periodically both clinically and radiologically for a period of 6 months following operative fixation. For determining the outcome, the Japanese orthopaedic association (JOA) Scoring system was used.

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

Conclusion: From our study, we conclude that pedicle screw fixation and postero-lateral fusion 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.

Key-Words: Spondylolisthesis, Postero-lateral fusion, Pedicle screw fixation.

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INTRODUCTION

Spondylolisthesis is defined as the anterior slipping or displacement of one vertebra on other. The commonest level involved is L5 – S1 (89%). The displacement is a result of loose posterior locking mechanism which in turn leads to instability with symptomatic thecal sac and nerve root compression. In a pars interarticularis defect, the facet joints no longer resist anterior translation shear motion. A bilateral pars defect may lead to spondylolisthesis, which implies that anterior displacement of the vertebral body at the spondylolytic level occurs over the subjacent vertebral body¹.

The mainstay of treatment is conservative, but patients who failed to respond should be considered for surgical treatment which accounts to 15% of the total². The purpose of the surgical treatment is to reduce low back pain and radiating pain, to relieve the neurologic symptoms, and to improve the posture and gait by eliminating the instability of the lumbosacral region.

Decompression and spinal fusion with or without instrumentation are the main principles of

surgery. Decompression results in gross segmental instability, calling for a fusion. Arthrodesis in the form of posterolateral fusion positively affects symptomatic isthmic spondylolisthesis. Even though there are several instrumentation systems available, pedicle screw fixation in conjunction with fusion provides many advantages, such as excellent control and fixation of the three column spine, efficient slip reduction, restoration of sagittal alignment and better control of the spine in corrected position³; it also enhances the rate of posterior fusion and early ambulation of the patient. The choice of surgery depends on the patients complaints, grade of slip and surgeons know how, it is important to choose the ideal surgery for the given patient to obtain a successful result⁴.

MATERIALS AND METHODS

This is a prospective study comprising of 20 patients with spondylolisthesis who were treated with Postero lateral fusion with Zeta rods and pedicle screw fixation during the period of Jan 2013 to Mar 2014. There were 6 male patients and 14 female patients in the study at a ratio of 1: 2.3. The mean age of the patients in the study was 44.6 years with maximum patients being in the 41-50 age group (12 patients).

All the patients were radiographically evaluated with plain roentgenograms-standing roentgenograms (flexion and extension) as advocated by Lowe et al⁵. Percentage of slip was graded according to Meyerding's^{6,7}.

The major indications for surgery were persistent / recurrent back or leg pain, severe neurogenic claudication leading to a significant reduction in quality of life, failure of conservative trial of treatment, worsening neurological deficit with bowel / bladder involvement.

After thorough investigation and obtaining fitness for surgery from both the medical and anaesthetic teams, all 20 patients with spondylolisthesis underwent Postero lateral Fusion with bone grafting from ipsilateral iliac crest and posterior spinal instrumentation with pedicle screws and zeta rods under general anaesthesia.

The patients received intravenous antibiotics for a minimum of 3 days. Mobilization was commenced on the 12th post-operative day with a lumbosacral corset. In the meanwhile patients underwent bedside physiotherapy in the form of deep breathing exercises, active & passive limb range of motion exercises. Our patients were reviewed periodically after discharge at 6 weeks, 12 weeks and 6 months from day of surgery. The results were analyzed in the forms of union, reduction of lysis and clinical improvement in complaints of back pain, claudication pain and neurological deficits. Follow up radiographs were obtained at all opd visits to determine the amount of fusion and implant position. The clinical outcome was analyzed using the Japanese orthopaedic association (JOA) scoring system^{8, 9}. Radiographical outcome was analyzed 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 a visible gap with graft collapse.

RESULTS

Among the 20 total patients, there were 6 grade-I patients, 8 grade-II patients, 4 grade-III patients and 2 grade-IV patients. 6 patients had lysis at L4-L5 level, 10 patients had lysis at L5-S1 level and 4 patients at 2 levels. The average time taken for fusion is five months. The fusion was solid in 13 patients (65%), possibly solid in 6 patients (30%) and 1 case of pseudo-arthrosis (5%). Neurological involvement and improvement after surgery is tabulated in table-1.

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 15m, postoperatively all the patients were relieved from claudication pain with an increase in their walking distance to 500m. 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.

There was only one case [5%] of pseudo arthrosis in our study. We had no cases of superficial infection or implant loosening. Patient's perception of their quality of life improved markedly after surgery. Overall clinical result was categorized 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. Table-2 about here

Table 1: Neurological improvement (pre and post op)

| | Pre-op | Post-op |
|-----------|--------|---------|
| Right-EHL | 2.8 | 4.2 |
| Left-EHL | 2.35 | 4.35 |
| Right-FHL | 2.55 | 4.45 |
| Left-FHL | 2.55 | 4.35 |

Table 2

| Sl. No. | JOA score Pre - op | JOA score Post - op |
|------------|--------------------|---------------------|
| Total | 200/20 | 413/20 |
| Percentage | 10 % | 20.65 % |

DISCUSSION

The average age incidence seen in our study is 44.6 years and is similar to the studies done by Kim et al (41.3 years)¹⁰, Lee et al (48 years)¹¹, Madan and Boeree et al (44.4 years)¹². 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 Madan and Boeree et al¹² (2.5:1) and Kim et al¹⁰(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. The most commonly involved level in our series is L5 – S1 which is 50%.

In our study we have 65% of solid fusions which was less when compared to the Lee et al (81%)¹¹, Kim et al¹⁰ (95%), and Madan and Boeree et al¹² (87.5%). We had 1 case of pseudo arthrosis [5%]. We did not encounter any case of superficial infection when compared to Kim et al¹⁰ (nil), Lee et al¹¹ (nil) and Madan and Boeree et al¹² (2.5%) and there was no evidence of implant loosening when compared to the studies of Kim et al¹⁰ (5%) and Lee et al¹¹ (5%). In our study patient's perception of their quality of life also improved markedly after surgery. There were 80% [16 patients] of excellent to good results which is almost the same when compared to the study of Madan and Boeree¹⁵ et al (81%) and slightly less than the studies of Kim et al¹³(90%)

and, Lee et al ¹⁴(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 patient's compliance with postoperative physiotherapy and follow up.

CONCLUSION

Pedicule screw-rod fixation with posterolateral fusion is an effective treatment modality for managing lumbar spondylolisthesis. It helps in correcting the deformity, maintaining the spinal angulation, to prevent further neurological insult and to improve the patient's quality of life. It is associated with less number of complications.

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