

Original Research Article

Study of midterm outcome of spinal fusion in low grade spondylolisthesis

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ABSTRACT

Background: The objective of our study is to measure clinical and radiological outcome of spinal fusion in low grade spondylolisthesis at minimum 5 years following surgery.

Methods: Monocentric prospective observational study was conducted to assess the mid-term outcome of spinal fusion in low grade spondylolisthesis with minimum 5 years following surgery in patients who underwent surgery from 2010 to 2015 in department of orthopaedics of Seth Nandlal Dhoot hospital, Aurangabad. Out of total 51 participants, there were 24 males and 27 females with mean age of 55.90 years of study participants. The patients were evaluated radiologically with AP and lateral X-rays views and dynamic flexion and extension views were taken and was evaluated with Lenke method and clinically with the visual analog scale (VAS) for back and leg pain, the Oswestry disability index (ODI), and the physical component (Physical functioning) of SF-36 health survey at minimum 5 years following surgery.

Results: In our study we observed high spinal fusion rate of 96.1% and satisfactory improvement in clinical outcome at minimum 5 years following surgery in 51 study participants who underwent spinal fusion for low grade spondylolisthesis.

Conclusions: The spinal fusion in low grade spondylolisthesis is a safe, simple and less morbid approach with low complication rate. We observed 96.1% of spinal fusion rate and highly significant decrease in post-operative mean ODI score, mean SF-36 physical component and mean VAS score with 78.4% patient did not develop any complications. Spinal fusion provides better functional outcome by providing pain relief and improving the quality of life in the patients. Spinal fusion restores the normal sagittal balance of spine and maintains the disc space height and also provides better fusion rates.

Keywords: Spondylolisthesis, Spinal fusion, Pedicle screw, Interbody fusion

INTRODUCTION

Chronic lower back pain affects the physical function and quality of life of a large number of people. Spondylolisthesis refers to displacement of a vertebral body on the one below it and has several etiologies, both spondylolysis and spondylolisthesis are prevalent in the general population. The incidence of spondylolisthesis in adult males is reported to be 5-6% and in females 2-3%.

The degenerative type is the most frequent one. Degenerative spondylolisthesis is common in individuals older than 50 years. Spinal instability caused by lumbar spondylolisthesis can lead to intermittent neurogenic claudication, lumbar radiculopathy and low back pain.¹⁻³

The knowledge of spinal anatomy increased in the 15th and 16th century, and the first concepts on biomechanical mechanisms emerged. The real foundation for spinal

fusion surgery for degenerative spine was laid in the 19th and 20th century. With the new technique and better instrumentation, the frequency of spinal fusions has increased dramatically, However, there is very small evidence in favour of more sophisticated technique such as inter body fusion. The fusion of lumbar spine still remains controversial.⁴⁻⁶

The axial load is mostly (approximately 80%) transmitted through the anterior column of the spine and posterior elements of spinal column resist tensile, shear, and rotational forces. There is some degree of lordosis in the sagittal alignment of the lumbar spine normally-maintaining or restoring this lordosis during spinal fusion is thought to be an important element of promoting normal spinal mechanics and function.

The spinal column is made up of functional motion segments composed of adjacent vertebral bodies articulating with an intervertebral disc anteriorly and facet joints posteriorly (the “triple-joint complex”).^{7,8}

Prevalence of spondylolisthesis is 11.5% of all causes of back pain.⁹ According to Roche and Rowe, the most frequent localization is L5-S1 in 82%, followed by L4-L5 in 11.3%, L3-L4 in 0.5% and L2-L3 in less than 0.5%.

Types of fusion surgery are commonly recommended for the treatment of spondylolisthesis, depending upon individual patient factors: Transforaminal lumbar interbody fusion (TLIF), posterior lumbar interbody fusion (PLIF), instrumented posterolateral fusion (pedicle screw fixation and posterolateral bone graft), anterior lumbar interbody fusion (ALIF), extra-cavitary lateral interbody fusion (XLIF) and oblique lateral interbody fusion (OLIF).

Aim

The aim of the study was to assess the mid-term (minimum 5 years following surgery) outcome of spinal fusion in low grade spondylolisthesis.

Objectives

Objectives if the study were to outcome will be measured on following parameters.

Clinical examination

Mid-term evaluation of the pain and range of motion of spine in post-operative spinal fusion patients, operated for low grade spondylolisthesis.

Radiological examination

Mid-term evaluation of the radiological fusion by doing AP and lateral X-rays views and if required dynamic flexion and extension views of operated patients.

With help of various scales

Mid-term evaluation of clinical outcome using VAS for back and leg pain, the ODI, and the SF-36 health survey among the study population.

METHODS

Study design

The study is a monocentric observational study.

Study site

The study was conducted in department of orthopaedics, Seth Nandlal Dhoot hospital, Aurangabad.

The study was planned to assess the outcome of spinal fusion in low grade spondylolisthesis at minimum 5 years following surgery in 51 cases. There were 24 males and 27 females.

Study population

The study population includes patients who underwent spinal fusion for low grade spondylolisthesis grade 1 and grade 2 from 2010 to 2015 with minimum follow up of 5 years.

Inclusion criteria

All patients who underwent spinal fusion for spondylolisthesis: grade I and II were included in the study.

Exclusion criteria

Patients having high grade spondylolisthesis, severe spinal deformity and paediatric spine were excluded from study.

Methodology

All the case records of the patients who underwent spinal fusion in low grade spondylolisthesis, from 2010 to 2015 was retrieved from the medical records section, the 84 case records was screened for eligibility for inclusion in the study. Out of which 51 eligible patients visited the hospital for follow up.

All those patients attended the hospital for the follow up visit, an informed written consent was obtained for participation in the study. The basic demographic details like age at the time of surgery, gender, type of surgery etc was documented in a structured proforma. Each participant was evaluated radiologically AP and lateral X-rays views and dynamic flexion and extension views and was evaluated with Lenke method and clinically with the VAS for back and leg pain, the ODI, and the physical component (Physical functioning) of SF-36 health survey at minimum 5 years following surgery. Transforaminal lumbar interbody fusion (TLIF) is commonly done for most of the spinal fusion surgeries.

Lenke method

The four fusion grades as judged from the anteroposterior radiograph were as follows: Grade A is bilateral definitely solid stout fusion masses present, grade B is probably solid with a unilateral stout fusion mass and contralateral thin fusion mass, grade C is probably not solid with a thin unilateral fusion mass and grade D is definitely not solid with thin fusion masses bilaterally with obvious pseudoarthrosis or bone graft dissolution bilaterally.

RESULTS

Demographic characteristics of study participants

The study includes (n=51) participants. Out of total 51 study participants, 24 (47.1%) were males and 27 (52.9%) were females. The mean age of study participants was 55.90(±14.097) years with minimum age of 22 years and maximum age of 81 years.

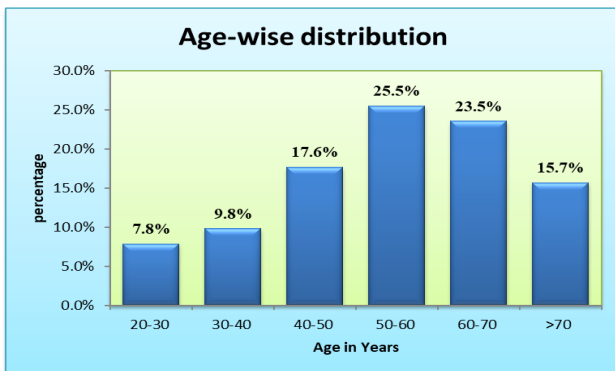


Figure 1: Age wise distribution.

Pre-operative and post-operative VAS score

The mean pre-operative VAS score was 6.373 (±1.280) and the mean post-operative VAS score 3.235 (±0.971). The mean difference between pre-operative and post-operative VAS score was 3.137. The pre-op and post-operative VAS scores were compared using paired sample t test. The result indicates highly significant decrease in post-operative mean VAS score (t=29.918, p<0.001).

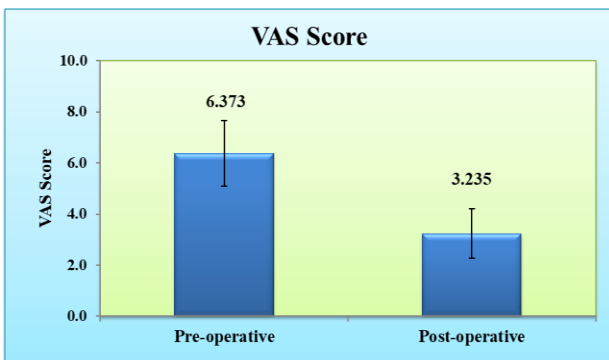


Figure 2: VAS score.

Lenke grading

Out of the total 51 study participants, 42 (82.4%) had Lenke grade A, 6 (11.8%) had grade B, 1 (2.0%) had grade C and remaining 2 (3.9%) study participants had the grade D.

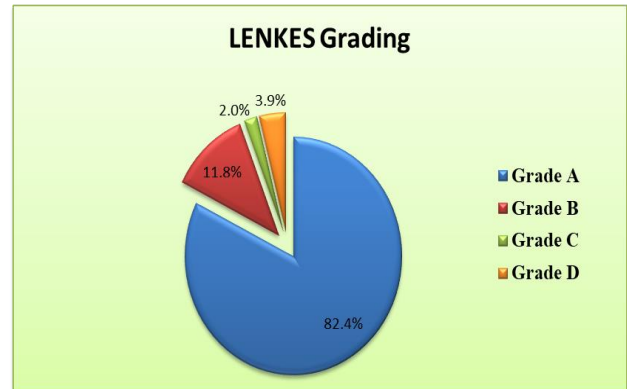


Figure 3: Lenke's grading.

ODI percentage score

The mean pre-operative ODI% was 76.118 (±5.677) and the mean post-operative ODI % was 14.667 (±6.458). The mean difference between pre-operative and post-operative ODI% was 61.451%. The pre-operative and post-operative ODI% were compared using paired sample t-test. The result indicates highly significant decrease in post-operative mean ODI% (t=61.228, p<0.001).

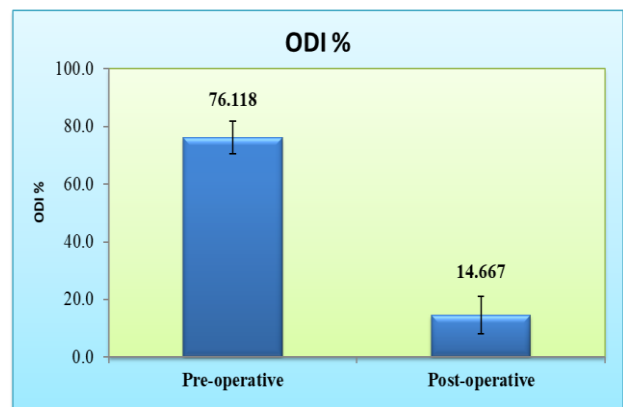


Figure 4: ODI%.

SF-36 physical component score

The mean pre-operative SF-36 physical component was 42.451 (±6.031) and the mean post-operative SF-36 physical component was 81.667 (±8.226). The mean difference between pre-operative and post-operative SF-36 physical component was -39.216. The pre-operative and post-operative SF-36 physical component was compared using paired sample t test. The result indicates high significant increase in post-operative mean SF-36 physical component (t=-32.474, p<0.001).

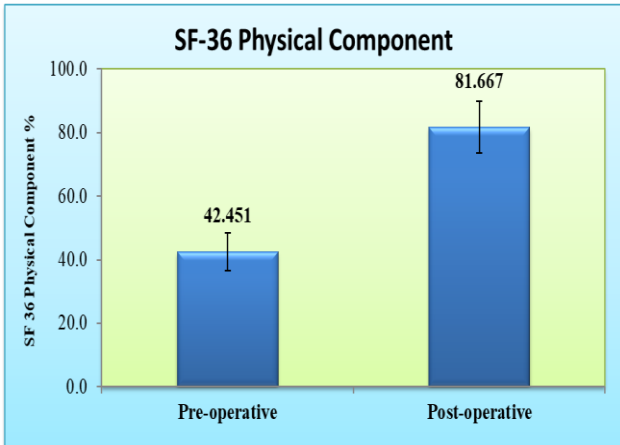


Figure 5: SF-36 physical component.

Out of the total study participants, 40 (78.4%) did not develop any complication, 5 (9.8%) had radicular pain, 3 (5.9%) had adjacent segment disease, 2 (3.9%) had Pseudoarthrosis and 1 (2%) suffered with initial superficial infection.

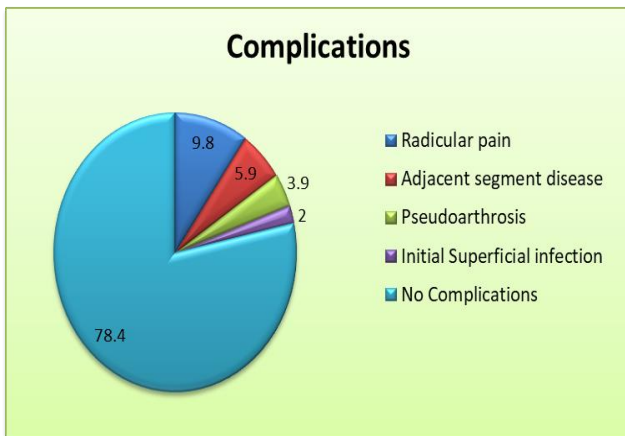


Figure 6: Complications.



Figure 7: Post op X-rays at 5 years follow up.



Figure 8: Post op functional outcome at 5 years follow up.

DISCUSSION

Spondylolisthesis in the lumbar spine is a common condition in the elderly population. Symptoms occur due to its association with lumbar spinal stenosis (LSS) resulting in nerve root compression, but also due to instability, and may include back pain, leg pain, as well as neurogenic claudication. Conservative management is generally accepted in patients without severe neurological deficits; yet, recent data meanwhile suggest a long-lasting superiority of surgical over nonsurgical treatment.¹⁰⁻¹²

The results of spinal fusion for low grade spondylolisthesis shows mixed results, with some studies showing good outcome and some showing not so good outcome. Pseudoarthrosis and radicular pain are the most common complaints in most patients postoperatively in many series.

Fischgrund et al did the prospective, randomized study on 67 patient comparing decompressive laminectomy and arthrodesis with and without spinal instrumentation in degenerative lumbar spondylolisthesis with spinal stenosis, they found successful spinal fusion occurred in 82% of the instrumented cases and clinical outcome was excellent or good in 76% of the patients in whom spinal instrumentation was done at 2 years follow up.¹³ Comparing to our study we found 96.1% successful spinal fusion with clinically highly significant Improvement.

Kornblum et al studied the long-term influence of pseudarthrosis on the clinical outcome of patients with degenerative spondylolisthesis and spinal stenosis, in a prospective, randomized study 47 patients were included with average follow up of 7 years, 8 months; clinical outcome was excellent-good in 86% of patients with a solid Fusion and in 56% of patients with a pseudarthrosis.¹⁴ Significant differences in residual back and lower limb pain was discovered between the two groups. In our study we have also found similar results, all symptoms has reduced and physical functions has

improved remarkably in patients who achieved solid fusion radiologically.

Yan et al comparing PLIF with TLIF technique for spinal fusion in lytic listhesis patients; the mean VAS score for pain improved from pre operatively 7.2 to post operatively 2.8.^{15,16} In another study by Yahya et al of 30 patients where spinal fusion was done in management of low-grade spondylolisthesis the VAS score for low back pain decreased from 7.0 to 2.1 and that for leg pain decreased from 6.4 to 2.0, whereas the ODI decreased from 69.3% to 11.8%.

Khan et al did prospective study is to analyze the Functional outcome of spinal fusion in spondylolisthesis using TLIF as surgical technique for spinal fusion in all cases.¹⁷ They found visual analog score for back pain was 10 which improved to 2 (1-4) at final follow up implying better pain score postoperatively. The mean preoperative visual analog score for leg pain was 8 which improved to 1 (1-5) at final follow up implying better pain score postoperatively. The mean preoperative ODI score was 64% (range from 56-74%) which improved to 20% at final follow up which indicates improvement in daily activities of the patient. The neurological improvement is seen in all patients postoperatively. The 80% of cases show fusion and none of the cases show pseudoarthrosis.

Kim et al studied the impact of sagittal balance on clinical outcomes in degenerative spondylolisthesis patients who underwent posterior interbody fusion.¹⁸

The mean preoperative VAS score was 6.81 and that improved to 1.63 and mean preoperative ODI score was 50.4 and that improved to 18.9 at last follow-up in the patients with improvement in pelvic tilt with posterior interbody fusion postoperatively. we also found similar results, in our study VAS score the mean pre-operative VAS score was 6.373 (± 1.280) and that improved to mean post-operative VAS score 3.235 (± 0.971) and the mean pre-operative ODI% was 76.118 (± 5.677) and that improved to mean post-operative ODI % 14.667 (± 6.458).

Martin et al studied the cumulative incidence of reoperation following lumbar surgery for degenerative disease and for specific diagnosis to compare the frequency of reoperation following fusion with that following decompression alone.¹⁹ They observed Patients with spondylolisthesis had a lower cumulative incidence of reoperation after fusion surgery (17.1%) than after decompression alone (28%) so they concluded spondylolisthesis, reoperation is less likely following fusion than following decompression alone, comparing to which none of the patient in our study under-went any kind of spine surgery in post-operative period at 5 years follow up.

De Kunder et al studied the effectiveness of PLIF and TLIF spinal fusion technique, assuming both techniques to be equal.²⁰ There was great reduction of occurrence of both

leg and back pain was seen in both groups of spinal fusion techniques. The overall complication rate including both techniques was 24% of which Infection was 4%, hardware failure was 4%, neurological deficit was 1%, dural tear was 9% and 5% underwent subsequent spine surgery. In our study 78.4% had not developed any complication, 9.8% had radicular pain, 5.9% had adjacent segment disease, 3.9% had pseudoarthrosis and 2% had initial superficial infection.

Suk et al studied PLF with instrumentation (n=35) vs. ALIF with pedicle screw fixation (n=21) in 56 patients who had adult low grade spondylolisthesis with 2 years follow up.²¹ This prospective study showed ALIF with pedicle screw instrumentation was superior to PLF with instrumentation in terms of preventing reduction loss for spondylolisthesis but no difference in complication rate clinical outcome.

Kim et al did similar study on 40 patients with follow up of 3.6 years; in retrospective study, fusion rate after 12 months was over 90% for both methods and satisfactory clinical results in 85% for ALIF and 90% for PLF + instrumentation.²¹ There was no statistically significant difference in clinical results between the two methods of spinal fusion in adult low-grade spondylolisthesis.

All patients included in our study were treated with spinal fusion and instrumentation, and surgical technique used was TLIF as well as PLF as per pre-operative clinical and radiological condition of patient but discussion about the use of surgical technique for spinal fusion is beyond the scope of present study. In our study we have observed high spinal fusion rate and satisfactory Improvement in clinical outcome in low grade spondylolisthesis patient at 5 years post-operative follow up.

CONCLUSION

The spinal fusion in low grade spondylolisthesis is a safe, simple and less morbid approach with low complication rate. We observed 96.1% of spinal fusion rate and highly significant decrease in post-operative mean ODI score, mean SF-36 physical component and mean VAS score with 78.4% patient did not develop any complications. Spinal fusion provides better functional outcome by providing pain relief and improving the quality of life in the patients. Spinal fusion restores the normal sagittal balance of spine and maintains the disc space height and also provides better fusion rates.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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