

Research Article

Functional and radiological analysis of posterior lumbar interbody fusion in spondylolisthesis

Ramanujam Muthu Manickam, Ganesan G. Ram*, S. Sundar, A. Prakash

Department of Orthopaedics, Sri Ramachandra Medical College, Porur, Chennai, India

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***Correspondence:**

Dr. Ganesan G. Ram,

E-mail: ganesangram@yahoo.com

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ABSTRACT

Background: Spondylolisthesis is present in 5% of the adult population with clinical evidence of low back pain. These patients are treated initially by conservative measures, failing of which surgical intervention is mandatory. Majority of patients with varying degree of slip and disability ultimately require surgical intervention. In this study we are trying to analyse the functional outcome following posterior lumbar interbody fusion in spondylolisthesis.

Methods: Posterior lumbar interbody fusion using pedicle screw and rods with cage was performed on 25 patients. 6 months follow-up was completed in 25 patients who were then reviewed at regular intervals. Out of the 25 patients, 17(68%) were females and 8(32%) were males. The mean age of the patients was 40.64 years. Out of 25 patients, 14 patients had listhesis at L4 – L5 level and another 11 at L5 – S1 level. 21(84%) were Isthmic variant and 4 (16%) were Degenerative spondylolisthesis.

Results: The mean follow up period in this study of 25 patients is 19 months. Out of 25 patients, there was mean improvement of 18.96 in the Oswestry scoring index. The Visual analogue scale score showed a mean improvement of 6.48. Radiologically, the percentage of slip was decreased by a mean of 8.40%. One patient had a cage extrusion with no neurological deficit.

Conclusions: The pedicle screw with rod and cage system is easy to use and provides the anatomic restoration of the isthmus in isthmic spondylolisthesis or restoring the stability after laminectomy/discectomy in degenerative spondylolisthesis. From our study, we strongly believe that this technique is very useful in low grade degenerative and isthmic spondylolisthesis.

Keywords: Spondylolisthesis, Oswestry scoring index, Visual analogue scale, Neurological deficit

INTRODUCTION

Spondylolisthesis is derived from the Greek word “spondylos” (vertebra) and “olisthesis” (“to slip or fall”). Spondylolisthesis is defined as the forward slippage of a cephalad vertebra on a caudal vertebra. Spondylolisthesis is present in 5% of the adult population with clinical evidence of low back pain. These patients are treated initially by conservative measures, failing of which surgical intervention is mandatory. Majority of patients with varying degree of slip and disability ultimately require surgical intervention. In this study we are trying

to analyse the functional outcome following posterior lumbar interbody fusion in spondylolisthesis.

METHODS

This is a prospective study carried out in patients with spondylolisthesis from June 2011 to June 2014. Among them 17 were females and 8 were male's. The youngest patient was 21yrs and the eldest was 55yrs and the mean age was 40.64yrs. The inclusion criteria were grade I and grade II spondylolisthesis between 18 years to sixty years with failure of conservative management. Cases included

in our study were isthmic and degenerative type of spondylolisthesis. Dysplastic, Congenital and Traumatic listhesis were excluded from our study. Also patients under age 18 years were excluded from our study due to the difficulty in interpretation of the functional status. Fourteen patients had spondylolisthesis at L4-L5 and 11 were at L5-S1. Twenty one patient had isthmic type and 4 were degenerative. The presenting symptom in all the cases was low back pain. Some patients also having leg pain/gluteal pain with radiculopathy were also included. The mean duration of symptoms during the initial presentation was 2 years. The radiological parameters taken into consideration were pre-operative and post-operative percentage of slip and slip angle. The quality of life was assessed by Oswestry scoring index and visual analogue scale as the social life, which is more important than the radiological indices.¹⁻³ Moreover the better radiological indices, does not always correlate with the better scoring indices and vice versa. Improvement during the post op period was categorized by Kirkaldy-Willis criteria.⁴

On clinical examination, most of the neurological examination was normal except in 2 patients with sensory and motor deficit. Anteroposterior and lateral radiographs of the lumbosacral spine centered at the appropriate level was used to evaluate all the patients. In all cases flexion and extension views were taken to assess the instability. More than 4 to 5 mm of sagittal translation and 10 degrees of rotation were considered as instability. All cases were evaluated further by MRI to evaluate facet joint pathology, sacralization, and to find the associated disc changes and the nerve root involvement.

All patients were treated by posterior lumbar interbody fusion. The patients were operated under general anaesthesia. After induction, patients were positioned prone on the bolsters. The level of listhesis was confirmed by C-Arm. Through midline posterior incision, paraspinal muscles were retracted laterally. Spinous process, lamina and the facet joints were exposed. Pedicle screws were inserted in the appropriate level after confirmation under image intensifier. The screws were connected with the help of connecting rods; the static screws were tightened followed by the reduction screws. Laminectomy/Discectomy of the appropriate level were done. Cage filled with bone graft was inserted after distraction of the vertebra.

The drainage tubes were removed after 48 hours and the patient is allowed to turn in bed. The sutures are removed on 12th day. Patients were allowed to ambulate after drain removal with a lumbosacral belt. After 3 months the lumbosacral belt is withdrawn gradually. The patients are not allowed to lift weights and to do flexion and extension movements of the lumbar spine until 6 months postoperatively. The patients were followed-up at regular intervals, i.e., every month during the first 3 months and thereafter every 3 months during the first year. The minimum follow up period was 6 months and the

maximum follow up was 27 months. During follow-up, patients were assessed clinically for pain, spasm and neurological deficit. Radiological assessment of spinal fusion, percentage of slip, slip angle was done using serial radiographs and oblique views if necessary. Post operatively, the percentage of slip was also estimated to look for the progression of listhesis.

RESULTS

Table 1: Mean pre op versus mean post op.

| Parameters | Mean Pre op | Mean Post op |
|------------------------|-------------|--------------|
| Oswestry scoring index | 32.96 | 14.00 |
| VAS Score | 7.52 | 1.04 |
| Percentage of slip | 25.08 | 16.72 |

The mean follow up period in this study of 25 patients is 19 months. Out of 25 patients, there was mean improvement of 18.96 in the Oswestry scoring index, when compared with the pre-operative Oswestry scoring index. The Visual analogue scale showed a mean improvement of 6.48 when compared to pre-operative status. Radiologically, the percentage of slip was decreased by a mean of 8.40% when compared to pre-operative percentage of slip. The mean pre op and post op for the above said parameters were tabulated in table 1.

One patient had a superficial wound infection in the immediate post-operative period, which subsided with antibiotics. One patient had a cage extrusion with no neurological deficit. He was symptomatically better on treating conservatively.

DISCUSSION

Spondylolisthesis is a fascinating condition reported over two centuries ago, with so many different types and degrees of slip. Community prevalence rates for the condition are not known but probably around 5 – 6% in the adult population.⁵ Thus widely disparate figures for those who are symptomatic has been reported – 50% in Magora’s study and less than 25 % in Lafond’s⁵ study. It is clear however, that only a small minority of affected individuals ever has symptoms but this proportion increases with severity of slip.

In our study of 25 cases, the mean age of the patients were found to be 40.6 years. This could possibly be because 84% of the patients had isthmic spondylolisthesis, which presents in the 2nd and 3rd decade while 16% of the patients had degenerative spondylolisthesis, which presents in the 4th and 5th decade of life. Many other observations in this study were also comparable to the established facts described in the literature. This includes the overwhelming female preponderance in this condition and spondylolisthesis

being commonest in the lower lumbar level. Dysplastic type of listhesis was uncommon whereas isthmic and degenerative were the commonest.

The aim of the surgical management in spondylolisthesis is to relieve pain and the neurological deficit, to provide stability and to prevent progression by fusion. While it is difficult to achieve these objectives, it is surprising that many different operative approaches are available to achieve them. The following are some of the pertinent points of debate. They were Whether surgery is indicated or not, Whether spinal decompression is required, Spinal fusion – whether posterior or anterior or combined, Whether instrumentation required for improving fusion, Whether reduction should be attempted or not.

In general, younger the patient with painful spondylolisthesis, the more definite is the indication for surgery and the surgery is more likely to be successful. Persistence of symptoms in spite of adequate conservative management constitutes the main indication in our study. 'Risk of progression of slip if not surgically treated' is an often – used surgical indication. However, it is difficult to quantify what the real risk of progressive slipping is. Wiltse and Hutchinson have described a reasonable policy for the surgical treatment of spondylolisthesis and are widely accepted.⁴ In isthmic spondylolisthesis, conservative management is the mainstay of treatment. Only if it fails, surgical management is considered. With the available literature, posterior lumbar interbody fusion is the current method of choice with decompression.

Decompressive procedures in spondylolisthesis have their proponents and there are two basic methods – removal of the loose posterior element or decompressive laminectomy.⁶ In dysplastic and isthmic types a true neurological deficit is common and radicular symptoms occasionally encountered resolve with solid fusion, along with other symptoms such as Hamstring tightness. In our study of 25 cases, our management involved posterior lumbar interbody fusion with decompression. All patients during their follow up showed an improvement in their clinical and functional outcome & radiologically showed a reduction in the slip.

With regard to spinal fusion, fixation of the unstable spine by posterior lumbar interbody fusion is the treatment preferred by most surgeons. Posterior rather than anterior fusion is preferred by most because its technique is more flexible; it permits exploration of the defects, nerve roots and intervertebral discs. In addition it is relatively safe. A high rate of successful fusion by the posterior lumbar interbody fusion technique has been reported by Watkins, Wiltse and others. In our study the overall fusion rate achieved was 95% and it is comparable with most literature. Another interesting debating point is whether spinal instrumentation is acquired to improve the results in surgery for spondylolisthesis. Pedicle screw fixation of plates or rods

has shown the greatest improvement in the overall fusion rates in adults.

From a biomechanical, anatomic, and physiologic standpoint, the theoretical advantages of interbody fusion seem obvious. Interbody support restores disc space height, facilitates correction of alignment and balance, prevents progression of spondylolisthesis, and provides load sharing to prolong the life of instrumentation. As the anterior and middle spinal columns support 80% of the spinal load, placing the bone graft in this load-bearing position subjects it to compressive forces that enhance bony fusion. Deguchi in their study of 83 cases concluded that for multilevel spinal fusion in isthmic spondylolisthesis a rigid pedicle screw fixation resulted in a high fusion rate and single level fusion was equally effective with either rigid or semi-rigid pedicle screw instrumentation.⁷ Fishchgrund observed that in patients undergoing single level posterior lumbar interbody fusion for degenerative spondylolisthesis, the use of pedicle screws may lead to a higher fusion rate but clinical outcome shows no improvement in pain in the back and lower limbs.⁷ In our study the fusion rate with pedicle screw instrumentation was 95%. The failure of fusion which occurred in one case could be attributed to inadequate immobilization, which led to the cage back out.

Interbody fusion can be achieved by an anterior transabdominal approach, but this has the risk of damage to the great vessels and to the presacral plexus; obesity also can be a relative contraindication for anterior spinal surgery. The advantage of PLIF over ALIF (Anterior Lumbar Interbody Fusion) is that the former accomplishes a 360° fusion via a single-stage approach.^{8,9} This decreases the operative time and spares the patient from the complications associated with a transabdominal approach. "Spondylolysis and Spondylolisthesis are diagnoses that, for most patients have a benign prognosis and can be managed non-operatively. For most symptomatic patients for whom this management fails, posterior lumbar interbody fusion yields a satisfactory and long lasting result and remains the gold standard against which other surgical treatment must be compared Smith et al, Brodke, Lund et al found that the combination of cage and posterior pedicle screw instrumentation was the stiffest on biomechanical testing, as compared to a standalone PLIF procedure.^{4,10}

CONCLUSION

Treatment of spondylolisthesis (grade I and grade II) using posterior lumbar interbody fusion is a technically effective and a safe procedure. It produces stable and secure fixation and minimizes the risk of neurologic injury. The pedicle screw with rod and cage system is easy to use and provides the anatomic restoration of the pars in isthmic spondylolisthesis or restoring the stability after laminectomy/discectomy in degenerative spondylolisthesis.

To conclude in our study we strongly believe that posterior lumbar interbody fusion yields 3600 global fusions and overall it gives an excellent result in low grade degenerative and isthmic spondylolisthesis. However, this study should further be extended to a wider sample of this type of patients with a long-term follow-up, which will enable us to come to a definite conclusion.

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