

Posterior lumbar interbody fusion for the management of spondylolisthesis

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ABSTRACT

The ideal surgical treatment of spondylolisthesis still remains controversial. There are several methods of treatment and posterior lumbar interbody fusion (PLIF) is one of them. We analyze the results of spondylolisthesis treated by PLIF in term of radiological union, improvement of pre-operative symptoms like back pain, radiating pain and return to normal activities including that of employment, by the review of the medical records. Total of 72 patients, 20 male and 52 female and the age ranges from 15 to 68 years with the mean age being 44.38 years were included in the study. Thirty (41.66%) patients had isthmic spondylolisthesis, 26 (36.12%) had congenital spondylolisthesis, and 16 (22.22%) cases had degenerative spondylolisthesis. There were 38(52.77%) cases of grade I, 14 (19.44%) cases of grade II and 20 (27.77%) cases of grade III according to the grading criteria of Meyerding. According to the evaluation criteria used by Stauffer and Coventry, 59 patients (81.94%) got good results, eight patients (11.11%) belonged to the fair group and five cases (6.94%) had the poor results. This study showed that PLIF is one of the effective and reliable techniques for the management of spondylolisthesis.

Keywords: Spondylolisthesis, posterior lumbar interbody fusion, spinal instrumentation, radiological changes.

INTRODUCTION

Spondylolisthesis is the subluxation of a vertebral body over another in the sagittal plane. It represents a particular and relatively frequent mechanism of intervertebral instability.¹ This pathology can be caused by ligamentous laxity, a defect in the pars interarticularis, previous surgery, or may be traumatic and occurs in up to 5% of the general population and affects all ages.²

The surgical treatment of spondylolisthesis is indicated for cases of neurogenic claudication, intractable radicular pain, severe low back pain, presence of neurological symptoms, failure of conservative management, radiological instability, progressive worsening of the listhesis, Meyerding grade III and IV listhesis, and spondyloptosis.³⁻⁵ The ideal surgical treatment remains controversial.^{6,7}

Lumbar interbody fusion is the most reliable fusion technique currently available for the lumbar spine as these constructs are biomechanically stronger, provide axial support with less graft subsidence or collapse comparing to those with posterolateral arthrodesis, and produce a better biologic fusion in lordotic alignment.^{8,9} In theory interbody fusion provides several advantages when compared with fusion techniques as it immobilizes the painful degenerated spinal segments, decompress the nerve roots, and restores disc height and root canal

dimensions, as well as load bearing ability of the anterior structures.¹⁰ A successful interbody construct reduces the postoperative segmental mobility and permits better graft incorporation.¹¹ The bilateral posterior lumbar interbody fusion (PLIF) procedure was first introduced by Cloward for lumbar interbody fusion and neural decompression.¹² We report our result of using PLIF for the management of spondylolisthesis (Fig. 1 and 2).

MATERIALS AND METHODS

From January 2001 to December 2008, total of 72 patients who underwent posterior lumbar interbody fusion (PLIF) for the management of spondylolisthesis at the Department of Orthopaedics of Amrita Institute of Medical Sciences, Kochi, Kerala, India were included in this study. There were 20 male and 52 female and the age ranges from 15 to 68 years with the mean age being 44.38 years. Thirty (41.66%) patients had isthmic spondylolisthesis, 26 (36.12%) patient had congenital spondylolisthesis, and 16 (22.22%) cases had degenerative spondylolisthesis. The severity of listhesis was defined by Meyerding grading criteria.³ There were 38(52.77%) cases of grade I, 14 (19.44%) cases of grade II and 20 (27.77%) cases of grade III patients in this study. The excluded cases were traumatic and pathologic spondylolisthesis and those patients managed by other surgical techniques like anterior lumbar interbody fusion

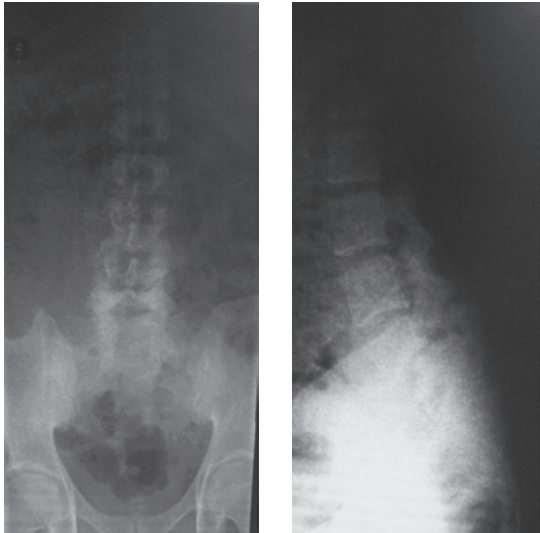


Fig 1 and 2. Anteroposterior (AP) and lateral view of 25 year old

(ALIF), transforaminol lumbar interbody fusion (TLIF) (Fig. 3).

Preoperatively all patient had plain radiographs of lumbosacral spine that included anteroposterior (AP), lateral, bilateral oblique, flexion and extension dynamic views. The assessment of cauda equina and nerve root was carried out by using magnetic resonance imaging (MRI) in all cases. Thirteen patients (18.05 %) were diagnosed as suffering from the other associated spinal problems like spinal bifida, lumbar canal stenosis (LCS) and prolapsed of intervertebral disc (PIVD).

All the cases were operated after a trial of conservative therapy for at least six. They were followed up for a mean of 18 months (12-32 months) after the surgery. The patients were evaluated for the bony fusion at the operated site and improvements of clinical symptoms and signs. Pseudoarthrosis was deemed present if there was no continuity in the fusion mass or if lateral flexion

and extension radiographs demonstrated more than two degree of angular motion or 2 millimetre (mm) of translation at the location of listhesis.¹³ We used the Stauffer and Coventry criteria for overall outcome evaluation.¹⁴

RESULTS

The most commonly affected level was L5-S1, which were found in 51 cases (71.83%) followed by L4-5 on 20 cases (27.77%) and in two cases (2.77%) the involvement was L3-L4. All the grade III listhesis were reduced to grade II or I and grade II were reduced to grade I or reduced completely. Grade I listhesis were reduced completely or in situ fixation was performed. In younger patient group the most common type of listhesis seen was dysplastic and in the elder group the degenerative type was the most common. Four cases (5.5%) had implants failure like screw back up, loss of rod placement, screws break up with loss of reduction and re-operation was done. The radiological union on x-ray was evaluated after 12 months of operation and union was seen on 66 (91.66%) patients and six patients (8.33%) got pseudoarthrosis according to the criteria proposed by Fishgrund.¹³ Four patient (5.5%) got wound infections which were treated by regular dressing and intravenous (IV) antibiotics.

According to the evaluation criteria used for the overall outcome by Stauffer and Coventry, 59 patients (81.94%) got good results, eight patients (11.11%) belonged to the fair group and five cases (6.94%) had the poor results.¹⁴ No patient had complications like cerebrospinal fluid (CSF) leakage and permanent neurological deficient after the operation. All the patients who were from good results group also had good radiological union on their follow up x-rays (Fig. 4 and 5).

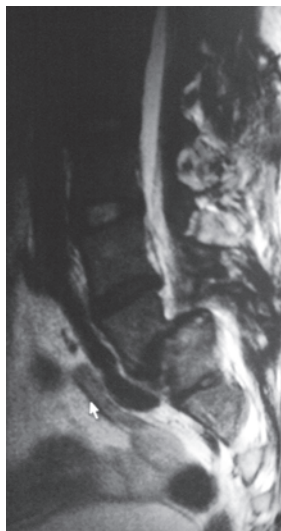


Fig. 3. MRI of the same patient

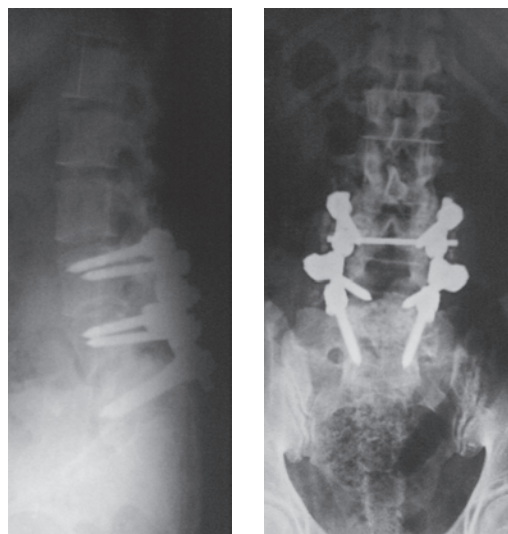


Fig 4 and 5. Six months after Post operative, good fusion seen on AP and lateral position

Table-1: The detail of the patients based on the age group

Age group	No. of patients	Common type seen
Up to 30	13	dysplastic
31 - 50	32	Lytic
More than 50	27	Degenerative

DISCUSSION

The surgical treatment of choice for the management of Spondylolisthesis remains a matter of controversy.^{6,7} The goal of surgical treatment of spondylolisthesis includes: stabilization of the motion segment, the decompression of neural elements, the reconstruction of disk space height and the restoration of sagittal plane translational and rotational alignment.¹⁵ The goal of stabilizing the spondylolytic level is accomplished by arthrodesis from a posterior, anterior, or combined approach; depending on the severity and clinical features of the spondylolisthesis, it may also be desirable to reduce the forward translation, increase disk space height, decompress the neural element, and increase or restore lumbar lordosis.¹⁶ PLIF was first attempted by Cloward¹² and later revised by Lin.¹⁷ The interbody fusion technique have apparent mechanical and surgical advantages, such as restricted motion by placing the graft bone in the centre of the segmental movement, giving the method the greatest theoretically possible restriction of motion and it also requires a small volume of bone to obtain for fusion.¹⁰ The interbody fusion immediately produces a biomechanically stable postoperative spine, thus enhancing the opportunity for arthrodesis.¹⁸

The commonest level involved is L5-S1 with 51 cases, 71.83% of the total cases followed by L4-L5 level (20 cases, 27.77%) and L3-4 level (2cases, 2.77%). Dantas¹ reported equal number (45%) of patients involving the L4-L5 and L5-S1 levels. Yan *et al*¹⁵ reported the L5-S1 affected rate of 52.27% and L4-L5 of 47.72%.

Yuan *et al*¹⁹ reported 1% implant failure rate like screw breakage, screw back up, screw loosening and rod slippage in his large multicentre studies and Dantas¹ reported the implant failure in his series of 5%. In this series the implant failure was four (5.55%) which is comparable with these previous reports. The wound infection rate in this study was four cases (5.55%), which was superficial and treated with regular dressing and intravenous antibiotics. Dantas¹ reported 6.6% of infection in his study on PLIF group and reported wound complications rate was 0.6% to 5%^{19,20}, which was comparable with our result.

In this series union was seen on 91.66% cases according to the criteria proposed by Fishgrund.¹³ The patients belonged to the good group had good union rate than

the other fair and poor group. Kai²¹ reported 92.9% fusion, Dantas¹ reported 96% union rate in his PLIF group. Patients managed by fusion and instrumentation with pedicle screw presented better union rates, but did not improve the clinical outcome.¹³

The criteria used to analyse the overall outcome was proposed by Stauffer¹⁴ which is based on relief of back and leg pain, return of employment, restriction of physical activities and use of analgesics for lumbar spine fusion. In this series 59 patients (81.94%) got good results, eight patients (11.11%) belonged to the fair group and five cases (6.94%) had the poor results. Stauffer got 81% good results with satisfactory clinical outcome which is comparable with our results.

Posterior lumbar interbody fusion (PLIF) is an effective method in the treatment of spondylolisthesis, as it provided good spinal fusion, less complication with satisfactory clinical outcome.

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