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Original Research Paper

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CLINICAL AND RADIOLOGICAL OUTCOMES IN PATIENTS TREATED WITH LUMBAR SPINE INSTRUMENTATION WITH PLF: A 5YR FOLLOW UP STUDY

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ABSTRACT

Introduction: Lumbar posterior instrumentation with fusion is a common surgical option for the treatment of degenerative disc disease. The fusion options are PLF(Posterolateral Fusion) or Interbody fusion, which include several approaches, each having certain advantages and disadvantages over the other. Although there is clear superiority of interbody fusion over PLF, not every lumbar posterior instrumentation requires an interbody fusion. PLF has been used over several decades and it shows promising results. In this study we aim to demonstrate the clinical and radiological outcomes of lumbar spine fusion with PLF at 5 years follow up. **Methods:** A retrospective, clinical and radiographic study was performed on 93 consecutive patients who underwent lumbar posterior instrumentation with PLF over a period of 2 years and followed up for 5 years. Radiographic and clinical functional outcomes were collected and compared at preoperative and at 5 years post operative time point. Parametric and nonparametric tests were used when appropriate with p value < 0.05 being significant **Results:** 93 consecutive patients were evaluated with an average age of 44.6 ± 11.6 years, and 57% were female. Mean Visual Analog Scale (VAS) for back pain decreased significantly by a mean of 6.04 ± 1.5 points from preoperative to 5 years postoperative ($p < 0.001$). **Conclusion:** Significant fusion rates were achieved and maintained at 5 years follow up after PLF. Clinically, the patients reported a significant decrease in VAS scores. PLF achieves improvement in functional outcomes and is still an alternate procedure to interbody fusion.

KEYWORDS : Lumbar instrumentation, posterolateral fusion, vas score, lenke's fusion criteria

INTRODUCTION

Spinal fusion has been the procedure of choice in the treatment of certain degenerative and traumatic diseases of the lumbar spine. (1) The purpose of the procedure is to provide stability to the spine with pedicle screw fixation and to achieve a solid spinal fusion, defined as the presence of trabecular bone between adjacent vertebral elements. Advantages of spinal fusion are correction of instability, alleviation of pain, prevention of neurological deficits and maintenance of alignment. (3)

It can be performed either by Interbody fusion or posterolateral fusion. Traditionally, instrumented posterolateral fusion (PLF) has been considered the gold standard (2). However, interbody fusion techniques have increasingly gained popularity because of the theoretical benefit of providing anterior column support and 360-degree fusion, indirect foraminal decompression, and restoration of lumbar lordosis. (4) The rate of fusion is dependent on several factors: age, smoking, use of instrumentation and the amount of bone graft used. Like most fusion studies we have focused on fusion rates. We used a radiological grading system described by Lenke(1). This is one of the most used classifications to assess posterolateral fusion.

The most used interbody fusion technique is an open transforaminal lumbar interbody fusion (TLIF) with posterolateral fusion, which has usurped PLF as the most used technique for treatment of lumbar spine diseases. However, there is substantial heterogeneity in the literature comparing TLIF with PLF alone regarding clinical and radiographic outcomes. One of the main goals when performing posterolateral spinal fusion is the achievement of bridging bone between the transverse processes. The most common method for assessment of this is plain radiographs, followed by CT scanning. However, interbody fusion has disadvantages such as adjacent segment degeneration, cage migration, higher operative times and blood loss, higher surgical costs. (6)

Our current study is aimed at assessing clinical outcomes and fusion rates in PLF at 5 years follow up.

MATERIALS AND METHODS

Patients who underwent instrumented posterior stabilization of the lumbar spine with PLF between January 2015 and December 2017 were retrospectively studied at 5 years follow up. We conducted a retrospective study of patients treated in our department between January 2015 and November 2017 by instrumented posterolateral lumbar spine fusion with at least 5 years follow up. Informed consent was obtained from all individual participants included in the study. All procedures followed were in accordance with the ethical standards of the Institutional review board.

Inclusion And Exclusion Criteria

Inclusion Criteria

(i) patients had degenerative or trauma lumbar spine condition; (ii) had undergone instrumented posterolateral fusion; and (iii) with complete preoperative data and at least 5 years follow up

Exclusion Criteria

(i) patients who were not followed up at our hospital; (ii) patients who had revision surgery or those for whom the surgery was the treatment for a previous infection (spondylodiscitis or paravertebral abscess) or neoplasia; and (iii) acute spinal cord injury patients (ASIA scale C or higher) treated perioperatively due to trauma or surgery.

Variables

For every patient, the demographic variables examined included age, gender, preoperative diagnosis (lumbar canal stenosis, disc disease, spondylolisthesis, or fracture), smoking, and comorbidity diagnosis.

Fusion Criteria

Evidence of radiological fusion was determined following

Lenke's criteria for posterolateral fusion with each patient being classified by the quality of spinal fusion according to one of the four grades proposed by Lenke.

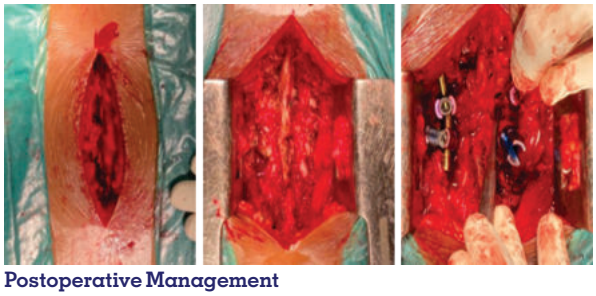
Radiographic criteria for posterolateral fusion according to Lenke(1)

- Grade A: Definitely solid, with solid big trabeculated bilateral fusion masses.
- Grade B: Possibly solid, with unilateral large fusion mass and contralateral small fusion mass.
- Grade C: Probably not solid, with small, thin fusion masses bilaterally.
- Grade D: Definitely not solid, with graft resorption bilaterally or fusion mass with obvious bilateral pseudarthrosis.

Surgical Technique

Under general anesthesia patient was positioned prone on a Wilson frame. Under sterile aseptic precautions, surgical site was scrubbed, painted, and draped. A midline linear vertical incision was made in the lumbosacral area. Dissection was carried down to subcutaneous tissue. Level marking was done under fluoroscopy. Paraspinal muscle were retraced on either side with the help of cob's retractor till the exposure of transverse process and facets joint, entry point for pedicle screw were confirmed clinically and with the help of c-arm. Lumbar instrumentation was done with application of pedicle screws which were connected to one another with connecting rods. The spinous processes were excised. Laminectomy done. Bone was prepared for graft placement. Decompression was done till the nerve roots were free. Wound was given injectable triamcinolone. Gel foam was placed on the exposed dura. Prepared bone autograft was placed between the adjacent spinous processes on both sides. A suction drain was usually placed and wound was closed in layers.

A: Incision **B: Exposure** **C: Instrumentation**



Postoperative Management

Patients were allowed to sit up and to walk with assistance when their general condition permitted (usually at 48 h post□surgery). They were discharged from hospital when the surgical wound looked good, postoperative pain was controlled with oral analgesia, and the patient could perform basic functions independently. In all cases, an elastic lumbar corset was worn during the first 2 months after surgery when sitting or walking. Adequate postoperative antibiotics were used.

Statistical Analysis

Statistical analysis was performed with JMP v17 software for Windows. Frequency analyses and paired sampled t-tests were used to calculate changes in ordinal and interval variables from preoperative to each postoperative follow-up time. Statistical significance was set at $p < 0.05$

RESULTS

Patient Demographic And Operative Data

From Jan 2015 to December 2017, 92 consecutive patients were considered in our study. Out of which 67 patients were included. Rest of them either lost to follow up, or inadequate data was available. The patients had an average age of 44.63 ± 11.1 years (Table 1).57% were female (Figure 2)

Table 1: Age Distribution Of The Study Population

AGE GROUP	NO OF CASES	%
21-30	9	13
31-40	14	20
41-50	20	29
51-60	22	32
61-70	4	6
MEAN	44.6	
SD	11.6	

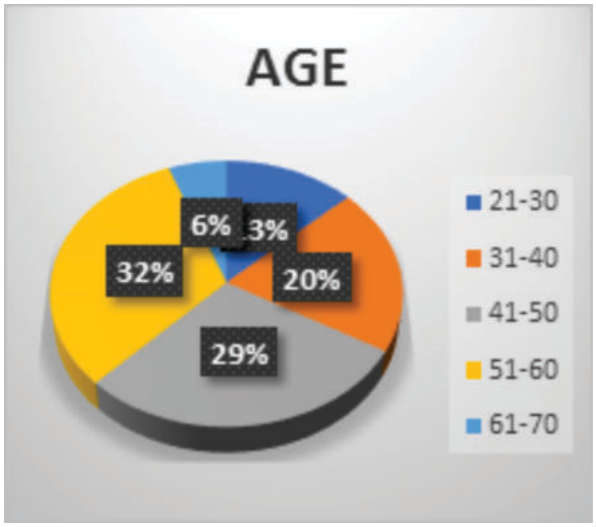


Figure 1: Age Distribution

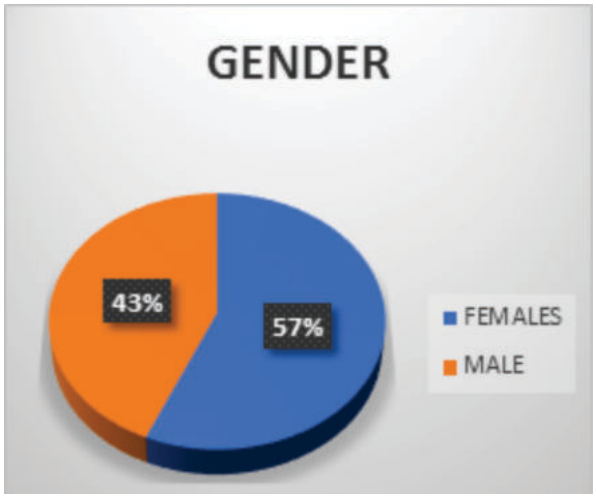


Figure 2: Gender Distribution

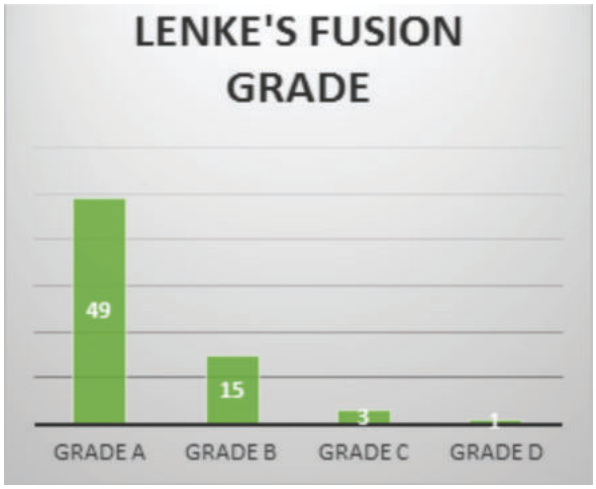


Figure 3: Lenke's Fusion Grades

Clinical Outcomes

Patients reported improvements in pain and disability. Mean VAS scores for back or leg pain decreased significantly from preoperative to 5 years by 6.7 ± 1.3 points ($p < 0.001$). (Figure 4)

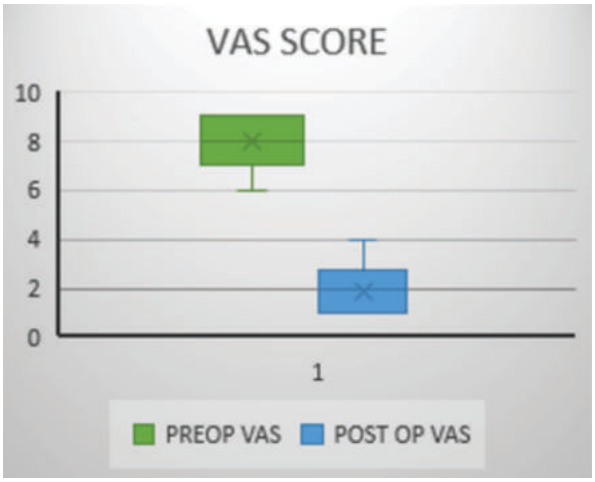


Figure: 4 VAS Score

Table 2: Fusion Grades

FUSION GRADE	NO OF PATIENTS
GRADE A	49
GRADE B	15
GRADE C	3
GRADE D	1

Radiographic Outcomes

There were 141 fusion levels. Majority were at L4-L5 level. Fusion grades assessed using Lenke's classification. 49 patients had grade A fusion (Table 2). 15 of the cases had grade B fusion. 3 had grade C while 1 had grade D at 5 years follow up. (Figure 3)

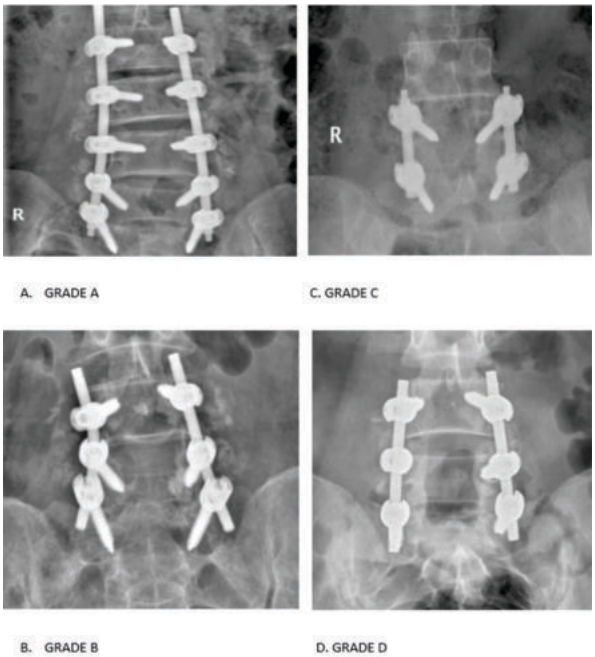


Figure 5 X Rays Showing Lenke's Fusion Grades

DISCUSSION

Fusion with bone graft following instrumentation for lumbar degenerative diseases has been widely studied. Interbody fusion with various approaches has been done. There is substantial literature on fusion rates following PLF to say that it has been a successful one in terms of clinical outcomes such as improvement in VAS scores and radiological fusion. Fusion rates are an indirect indicator of maintaining sagittal balance which is usually studied with lumbar lordosis, anterior and posterior disc heights, segmental lordosis, pelvic incidence. (11)

Posterolateral fusion, which was performed widely before the introduction of various interbody fusion techniques had shown variable or intermediate results as per literature although there isn't significant amount of long term follow up studies available. Our study was to assess the clinical and radiological outcomes of PLF which is the most performed spine surgery at our institution. The uniqueness of our study is that all the surgeries were performed by a single surgeon and patients were followed up for at least 5 years. Since all the surgeries were performed at the same facility using same implants, the reliability of the outcomes could be higher.

Lehr et al, (4) conducted a systematic review on image based fusion criteria for assessment of posterolateral fusion. They included 187 articles, of which 47% used image-based classification system for assessment of fusion. Fusion rates in those studies ranged from 63% to 84%, which is very similar to our study. Abdu et al (12) conducted a study on assessment of functional outcomes between different fusion methods. They concluded that improvement in VAS scores were noted among all the approaches to fusion and the difference between the approaches was statistically significant. The improvement in VAS scores in our study was by 6 points which was statistically significant and the p value was <0.001.

There are some limitations that affect the interpretation of our study. one of the concerns in interpreting the results of PLF procedures is the difficulty in determining fusion success radiographically. Although, computerized tomography has been suggested as a preferred modality for assessing posterolateral fusion (7), it is difficult to apply in a real clinical setting because of medical cost problem and higher radiation exposure. So, we define posterolateral fusion with Lenke's classification on plain radiograph images. (1)

CONCLUSION

We conclude that PLF has shown significant improvement in VAS scores at 5 years follow up. PLF achieves significant fusion rates although lower compared to interbody fusion. Lenke's classification for assessment for radiological fusion in PLF is a reliable modality. PLF can still be performed as a spine fusion procedure in cases where there are economical limitations to interbody fusion and in severe osteoporotic spines where there are higher changes of cage migration. In degenerative canal stenosis and listhesis PLF is better indicated than Interbody fusion. With increasing demands in physical activities and higher incidences of lumbar disc diseases in younger population there is a need for long term follow up studies following these surgical procedures.

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