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Double-level isthmic spondylolisthesis treated with posterior lumbar interbody fusion: A review of 32 cases

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ABSTRACT

Objective: The incidence of double-level isthmic spondylolisthesis is rare. The aim of this study is to evaluate the short-term functional and radiological outcomes of surgical treatment for double-level isthmic spondylolisthesis.
Patients and methods: Between 2004 and 2014, thirty-two patients with double-level isthmic spondylolisthesis who underwent posterior lumbar interbody fusion (PLIF) with autogenous bone chips were reviewed retrospectively. The clinical outcomes were measured by VAS (Visual analog scale) and JOA(Japanese Orthopedic Association) score.
Results: At an average follow-up of 2.8 years, the mean score on the VAS of back pain and sciatica decreased from 6.48 and 4.26 points preoperatively to 1.82 and 1.10 points at final follow-up, respectively. The average JOA score improved from 13.8 ± 3.1 preoperative to 25.6 ± 1.3 (range, 17–28) points postoperative. The average recovery rate was 77.6%. The good and excellent rate was 84.3% (27/32). The fusion rate was 87.5% (28/32). Changes in disc height, degree of listhesis, whole lumbar lordosis, and sacral inclination between the pre- and postoperative periods were significant.
Conclusions: Our findings suggest that PLIF with autogenous bone chips for double-level isthmic spondylolisthesis could yield good functional short-term results. It seems to be a viable approach in the treatment of double-level isthmic spondylolisthesis.

1. Introduction

The term spondylolisthesis is defined as the forward displacement of the vertebra on its adjacent caudal vertebra. Isthmic spondylolisthesis is the most common type of spondylolisthesis in adults at approximately 4–6% of the general population [1,2]. Symptomatic patient with isthmic spondylolisthesis usually require surgical intervention. Multiple surgical procedures have been used to treat isthmic spondylolisthesis; However, the prevalence of double-level spondylolisthesis is rare and it is revealed in only a few cases [3–6]. The lack of large scale clinical trials on the management of this lesion make it difficult to define an optimal treatment algorithm. We are reporting on the clinical and radiological results of a series of double-level spondylolisthesis treated by PLIF with autogenous bone chips. To our knowledge, this is the largest series of double-level spondylolisthesis treated by this technique.

2. Patients and methods

Between July 2004 and May 2014, 35 patients with double-level spondylolisthesis underwent PLIF with autogeneous bones were retrospectively reviewed in this study. The inclusion criteria for patients were the presence of double-level isthmic spondylolisthesis; persistent back pain with or without pain in the lower extremities pain who failed to respond to conservative treatment for at least 6 months; and no previous lumbar surgery or coexisting spinal deformity. Three patients who were lost to follow-up were excluded from this study. For the remaining 32 patients, the age of patients ranged from 36 to 67 years with the mean of 51.3 ± 10.25 years. There were 9 males (28.1%) and 23 females (71.8%). Main symptoms included low back pain in all cases, radiating leg pain in 25 (78.1%), numbness in 22(68.7%), weaknesses in 11 (34.3%), neurogenic claudication in 18(56.2%). The olisthetic level was at L4-5 and L5-S1 30 cases, at L3-4 and L4-5 2 cases. The minimum follow-up was 2-years (mean, 2.8 years; range, 24–72

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Table 1
Demographics.

N = 32 Average age	51.3 ± 10.25	
Male	9	28.1%
Female	23	71.8%
Main symptoms		
Low back pain	32	100%
Radiating leg pain	25	78.1%
Neurogenic claudication	18	56.2%
Numbness	22	68.7%
Weakness	11	34.3%
Olisthetic Levels		
L4-5 and L5-S1	30	93.7%
L3-4 and L4-5	2	6.2%

Table 2
The change in the pre- operation and final follow-up JOA scores.

Preoperative	Final follow-up	Recovery rate
13.8 ± 3.1	25.6 ± 1.3	77.6%

months). The summary of patient data is tabulated in Table 1.

The clinical outcomes were based on the visual analogue scale (VAS) for the preoperative back pain and radiating pain at the 1st, 6th, 12th and 24th postoperative month. Functional outcomes were measured using Japanese Orthopedic Association score (JOA score) preoperatively and at the last follow-up [Table 2]. The recovery rate of JOA score was calculated according to the formula: the recovery rate = [(postoperative score-preoperative score)/(29-pre-operative score)] × 100%. Excellent > = 75%, Good 50–74%, Fair 25–49%, Poor 0–24%.

Radiographic evaluation includes anteroposterior and lateral plain radiographs at each post-operative visit as well as flexion/extension lateral radiographs at one and two years post-operatively. The intervertebral height was calculated at the lateral X-ray by dividing the sum of the anterior, middle, and posterior intervertebral disc heights by three [7]. The amount of slippage was quantified according to the classification proposed by Meyerding [8].The angles of whole lumbar lordosis, pelvic incidence, and sacral inclination were recorded to evaluate sagittal alignment (Fig. 1). Radiologic proof of solid fusion required fulfillment of the following criteria: no radiolucent gap at the vertebral endplate interface, no evidence of mobility in flexion-extension roentgenogram, and presence of bridging trabeculae across the area of arthrodesis.

3. Surgical technique

The patients were carefully positioned in the prone position under general anesthesia. A routine midline approach was made. Reduction and regular pedicle screws were inserted in the conventional technique. Decompression was commenced via the midline. After central decompression, the foramina were inspected and decompressed nerves were then retracted medially to expose the disc space. A ring incision was made on one side of the annulus and the disc material was removed with pituitary rongeurs. After removal of the disc, the rods were contoured and cut to length after templating. Both rods were applied to the pedicle screw heads, with nut application. Then the disc space was distracted and reduction was performed from

bottom to top, the lower vertebra was used as a fulcrum. The endplates of the vertebrae were denuded by scrapers, without weakening the subchondral bone plates. In all cases, the bone procured from the decompression was cleared of any soft tissue and preserved to perform the bony fusion. Chips were compressed into the disc space to make it compact using a variety of straight and curved bone tamps. A keystone plug was tapped in posterior to the bone fragments and locked into place (The plug was made of large piece of lamina acquired during decompression). The plug was then countersunk approximately 2–5 mm to prevent iatrogenic compression of the cauda equina. A visual check ensured that there was no nerve root compression following the insertion of chips. Final tightening of the nuts was performed under compression with the torque wrench.

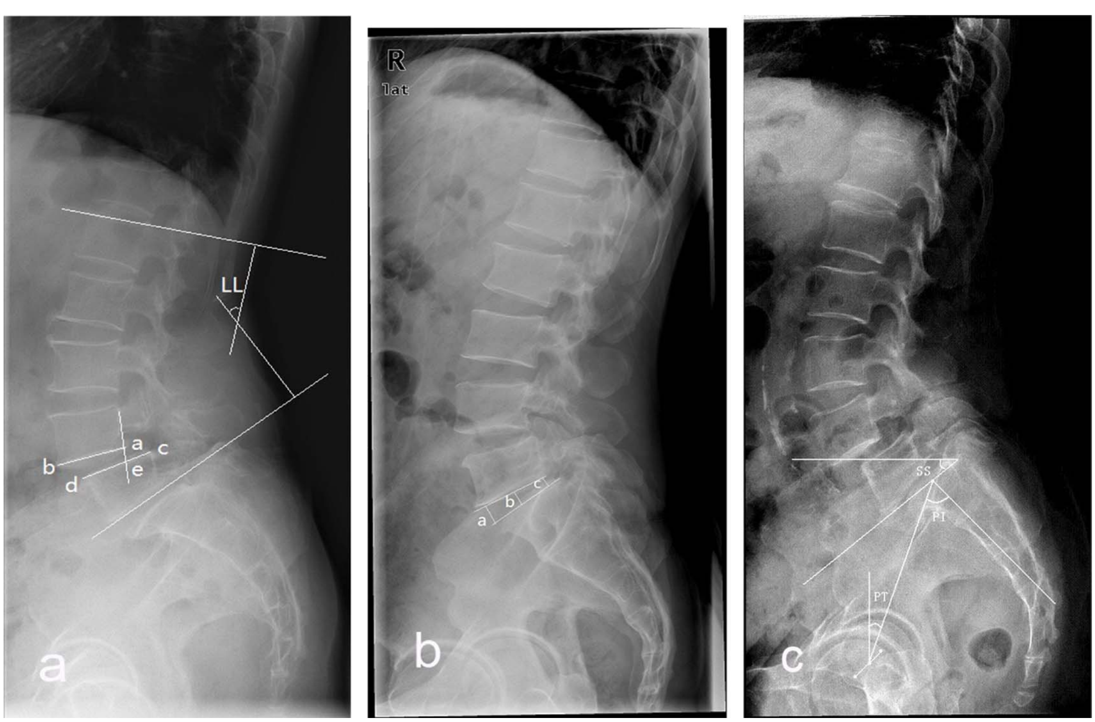

Fig. 1. All parameters were measured on standing upright lateral radiographs of the spine (a) ce/cd, slipping percentage; LL whole lumbar lordosis (b) (a + b + c/3) intervertebral height (c) PI, pelvic incidence; SS, sacral slope (sacral inclination).