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Technical Note & Surgical Technique

Transforaminal versus posterior lumbar interbody fusion as operative treatment of lumbar spondylolisthesis, a retrospective case series

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ABSTRACT

Objective: Spondylolisthesis can be treated by transforaminal lumbar interbody fusion (TLIF) and posterior lumbar interbody fusion (PLIF). The effectiveness of both techniques is assumed to be equal. TLIF may have advantages over PLIF concerning complication rate, blood loss, surgical time and hospital duration. In order to verify these assumed advantages of TLIF we retrospectively compared a case series of patients that have undergone TLIF or PLIF surgery for lumbar spondylolisthesis in our hospital.
Methods: 96 patients with spondylolisthesis (isthmic or degenerative) were analysed. Patient characteristics and surgical details were recorded.
Results: TLIF procedures were associated with significantly shorter surgical time. Overall complication rate was 25%. There was no difference in blood loss, hospital duration or occurrence of postoperative pain.
Conclusion: In this case series, TLIF was associated with shorter surgical time. Other assumed advantages of TLIF could not be verified in this retrospective patient series. Further prospective research is needed to confirm these results.

1. Introduction

Spinal instability caused by lumbar spondylolisthesis can lead to intermittent neurogenic claudication, lumbar radiculopathy and low back pain. If conservative measurements fail or if patients develop neurological deficits, surgical treatment by decompression and instrumented spinal fusion is more frequently considered: in the US, the national bill for instrumented spinal fusion increased 7.9 fold between 1998 and 2008 [1].

Classically, posterolateral fusion with pedicle screw fixation is performed, combined with interbody fusion surgery. The rationale for adding lumbar interbody fusion surgery is to improve fusion [2,3], thereby restoring balance and redeeming stability [4]. Different fusion techniques have been developed, including transforaminal lumbar interbody fusion (TLIF) and posterior lumbar interbody fusion (PLIF) (Figs. 1 and 2) [5,6]. Most spine surgeons are familiar with both and technical difficulty is similar. The unilateral approach to the intervertebral disc is a theoretical advantage of TLIF, based on a number of items [6]. First of all, the a priori chance of damaging nerve or dural sac is 50% less in TLIF. Secondly, in TLIF one facet joint remains unaffected while in PLIF both facet joints are involved in decompression necessary to place interbody cages. Thirdly, TLIF may affect the musculoligamentous complex of the lumbar spine to a lesser extent. Data from retrospective patient series suggest that TLIF may require less surgical time and is associated with less blood loss and fewer complications [7–9], while effectiveness of both techniques on back and/or leg pain is equal [4,8,9].

TLIF may thus be as effective as PLIF, technically equivalent and theoretically safer, suggesting that TLIF is a better technique to treat the instable lumbar spine.

2. Material and methods

All patients that underwent single level TLIF for lumbar spondylolisthesis in our hospital between January 2011 and December 2014 were retrospectively analysed. These TLIF patients were matched with PLIF patients, matched on indication for surgery, grade of spondylolisthesis, age and BMI. Surgery was always preceded by exploration of non-surgical interventions such as physical therapy or analgesics. Exclusion criteria were: <18 years at time of surgery or other spinal disorders (trauma, scoliosis, tumour or infection). Patient data were

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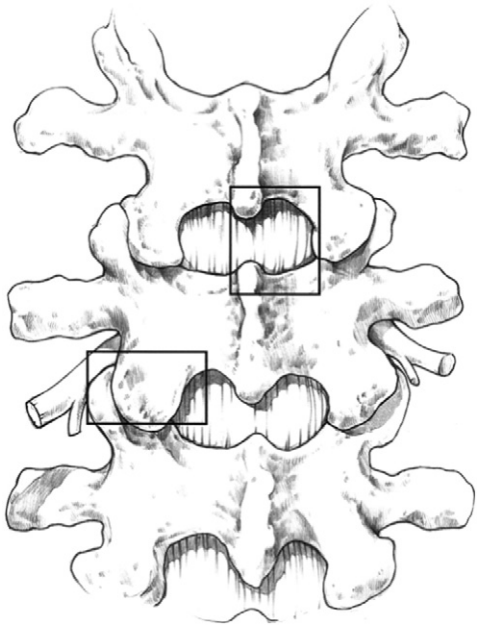

Fig. 1. Schematic representation of lumbar spine demonstrating the area of bony removal and route of access to the intervertebral body space. (Top) medial box represents area and access for the PLIF procedure; (bottom) lateral box represents area and access for the TLIF procedure.
(Reprinted from "Comparison of low back fusion techniques: Transforaminal lumbar interbody fusion (TLIF) or posterior lumbar interbody fusion (PLIF) approaches" by Cole CD, McCall TD, Schmidt MH, Dailey AT, (2009.) Curr Rev. Musculoskelet Med 2:118–126.)

obtained from medical records. Clinical parameters including gender, age, body mass index (BMI), smoking habits and history of previous back surgery were assessed (Table 1). Surgical details including surgical time, blood loss, operated level and dural tear, as well as postoperative details including infection, hematoma, hardware failure and neurological deficits, were recorded. Medical complications as pneumonia or urinary tract infection were evaluated and referred to as 'medical other'.

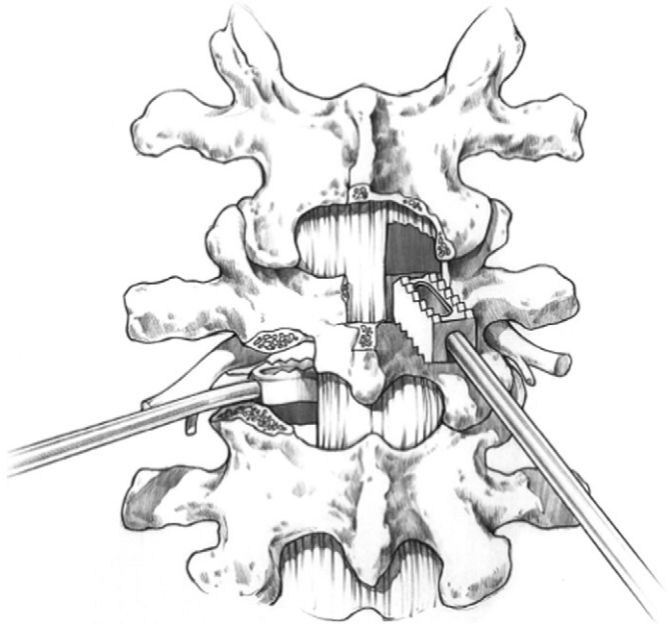

Fig. 2. Schematic representation of lumbar spine demonstrating the angle of interbody graft insertion for the PLIF procedure (top, medial) and TLIF procedure (bottom, lateral).
(Reprinted from "Comparison of low back fusion techniques: Transforaminal lumbar interbody fusion (TLIF) or posterior lumbar interbody fusion (PLIF) approaches" by Cole CD, McCall TD, Schmidt MH, Dailey AT, (2009) Curr. Rev. Musculoskelet. Med. 2:118–126.)

Table 1
Patient characteristics.

	TLIF	PLIF	Total	*p* value
Number of patients	48 (50%)	48 (50%)	96	–
Gender	Male 17 (35%) Female 31 (65%)	Male 23 (48%) Female 25 (52%)	Male 40 (42%) Female 56 (58%)	0.214
Age (in years)	58 (18–80, SD 13)	58 (18–78, SD 12)	58	0.917
BMI	28 (19–43, SD 5)	27 (19–37, SD 4)	27	0.842
Smoking	40%	38%	39%	0.834
Previous back surgery	38%	31%	34%	0.519
Indication for surgery				
Isthmic spondylolisthesis	16 (33%)	16 (33%)	32 (33%)	1.000
Degenerative spondylolisthesis	32 (67%)	32 (67%)	64 (67%)	1.000
Grade of spondylolisthesis				
Grade I	38 (79%)	38 (79%)	76 (79%)	1.000
Grade II	10 (21%)	10 (21%)	20 (21%)	1.000
Operated level				0.515
L2-L3	1 (2%)	0 (0%)	I (1%)	–
L3-L4	7 (15%)	7 (15%)	14 (15%)	–
L4-L5	30 (63%)	26 (54%)	56 (58%)	0.408
L5-S1	10 (21%)	15 (31%)	25 (26%)	0.245

The presence of leg and/or back pain, defined as: yes/no, was recorded pre-operatively and two months postoperatively. Follow-up was done at two, six or twelve months. Long-term fusion was not evaluated by radiological exams.

2.1. Operative methods

All patients were operated after receiving antibiotic prophylaxis under general anaesthesia in prone position. A midline posterior approach was performed, exposing posterior lumbar elements including facet joints. Poly-axial pedicle screws were placed bilaterally, using fluoroscopy or frameless navigation. In case of spinal canal stenosis, the central part of the spinal canal was decompressed by laminectomy. For TLIF, unilateral exposure to the intervertebral disc was assured by total unilateral facetectomy, decompressing the descending and leaving roots. For PLIF, bilateral access to the intervertebral disc was assured by resection of the pars articularis inferior and partial resection of the pars articularis superior of the facet joint, decompressing descending and leaving roots bilaterally. Subsequently, the intervertebral disc was removed and endplate cartilage was prepared to provide a host bed of bleeding subchrondral bone for placement of the cage(s). Using trial cages, appropriate cage size and position were determined. Definite cage(s) were packed using morcellized autologous bone from resected elements. For TLIF a banana shaped cage or a rectangular cage was used, based soley on the surgeons' preference. Morcellized autologous bone was inserted in the intervertebral disc space as scaffold for fusion. Two titanium rods interconnected the poly-axial screws. The wound was thoroughly irrigated and closed in several layers without suction drainage. All patients received postoperative analgesics adjusted to their needs and antithrombotic prophylaxis. All patients followed a standard mobilisation programme, including physical therapy. They were advised to mobilize with brace support for a period of 6 weeks postoperatively. (Fig. 3).

2.2. Statistical analysis

Data were processed and analysed with the Statistical Package for the Social Sciences (IBM SPSS Statistics, v22 for Mac). Before testing the following data were stratified: age under and over 57 years (57 being the mean in both groups), BMI in normal weight (BMI under 25),