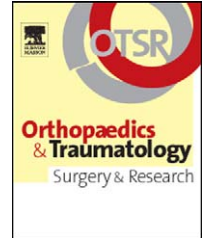




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ORIGINAL ARTICLE

Minimally invasive transforaminal lumbar interbody fusion through a unilateral approach and percutaneous osteosynthesis

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KEYWORDS

Spondylolisthesis;
Lumbar spine;
Minimally invasive;
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Summary

Objectives: To assess a surgical technique and the postoperative outcomes of a consecutive series of 22 patients treated for degenerative lumbar spondylolisthesis (DLS) through a minimally invasive unilateral approach associating interbody fusion and percutaneous osteosynthesis.

Patients and methods: Twenty-two patients were included in this study, with a mean age of 60 years (range, 35–77 years). All had low-grade single-level DLS. In all cases, the technique included a posterior unilateral paramedial approach through a tubular retractor that decompressed the vertebral canal and transforaminal intervertebral cage arthrodesis. Osteosynthesis was then systematically put in place. The evaluation criteria were clinical (pain, spinal symptoms, duration of hospital stay) and radiological. The entire series was followed up for a mean of 24 months.

Results: In this series, the procedure was performed with no technical problems. The mean hospital stay lasted 4.5 days. Postoperative pain assessment showed a mean VAS of 2/10 at discharge and 75% of the patients were asymptomatic at 6 months. The radiological exams showed no extrapedicular screws and the fusion rate was 95% at the last follow-up (with one patient needing surgical revision for malunion).

Conclusion: Transforaminal lumbar interbody fusion through a unilateral approach associated with percutaneous osteosynthesis is a reliable and effective technique in DLS surgery. The clinical and radiological results are encouraging, with low morbidity and a fusion rate comparable to conventional techniques. However, a longer follow-up will be necessary so as to assess the long-term results of this surgical strategy.

Level of evidence: Level IV. Retrospective study.

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Introduction

Degenerative lumbar spondylolisthesis (DLS) is defined as vertebral sliding most often located on the next to last mobile lumbar segment, resulting from arthritic failure of the posterior joint apophyses instigated by discal degeneration and the associated muscle deficiency. The true prevalence of this type of pathology is difficult to establish; however, in general, the different types of spondylolisthesis affect 3–7% of the general population [1]. The mean age at surgical management is usually around 60 years, but because of the aging of the population, increasingly older and more fragile patients are consulting.

Surgical treatment of DLS should provide a response to two imperatives: nerve decompression and spinal segment stabilization. The need for complete reduction of the sliding motion and the approach to use are, on the other hand, subject to controversy.

This debate opposes partisans of a single anterior or posterior approach and those who recommend a combined approach. However, the posterior approach seems to win the support of many authors [2–5]. This is also encouraged by the development of minimally invasive posterior techniques over the past decade. The existence of specific and adapted instrumentation responds to surgical imperatives (decompression, stabilization, and fusion) while minimizing muscle injury, the skin incision, and blood loss, making the minimally invasive approach particularly seductive in DLS surgery. The literature describing these minimally invasive techniques is currently in full expansion [3,6–9]. The good results reported by many authors on these minimally invasive techniques compared to the classic techniques [3,10–12] seem to indicate a turning point in DLS surgery via the posterior approach.

The objective of this study was to assess the postoperative results of a series of 22 patients operated for a unilateral approach DLS through a tubular muscle retraction system that allows decompression and transforaminal arthrodesis associated with percutaneous osteosynthesis.

Patients and methods

A total of 22 patients (12 females and ten males), with a mean age of 60 years (range, 35–77 years) were included in this retrospective study between January 2007 and September 2009. All of the patients presented symptomatic DLS. The study's exclusion criteria were high-slippage spondylolisthesis (Meyerding stage 3 and 4) and patients presenting isolated lumbago with no radiculalgia. A history of surgery at the incriminating segment was not an exclusion criterion except if there was also disease at the adjacent level.

During the initial clinical evaluation at the time of diagnosis, we found unilateral lumbar radiculalgia (11 patients), bilateral lumbar radiculalgia (five patients), one case of neurogenic claudication of the lower limbs (one patient), and a sensory and/or motor radicular deficit of the lower limbs (five patients).

Paraclinical explorations systematically included a lumbar myelography combined with a lumbar CT scan or MRI. These explorations found single-segment low-grade degenerative spondylolisthesis in all the patients.

The side of the incision was determined based on the data from the clinical exam and the imaging studies. The incision was made on the symptomatic side in cases of unilateral involvement and on the side on which the clinical and radiological signs were predominant in cases of bilateral symptoms. In cases of bilateral symmetrical clinical and radiological involvement, the choice was made according to the operator's preferences.

All of the patients included in this study were managed by a single operator using the technique described and were followed up after surgery on clinical criteria (neurological symptoms, pain, duration of hospital stay, and complications) and radiological criteria (verification of implant position and achievement of intervertebral fusion) with a mean follow-up of 24 months (range, 8–40 months).

Surgical technique

The patients were positioned in the ventral decubitus position on a radiotransparent table with blocks under the thorax and the iliac crests so as to prevent abdominal compression and install the spine in lordosis.

The entry points for the pedicular screws were identified (AP and lateral) using the C-arm to precisely determine the operative field.

The following stages were successively followed:

- 2 cm vertical paramedial skin incision located approximately 3–4 cm from the medial line of the side of the approach;
- the lumbar fascia was then incised, allowing dissection using the finger fracture technique, dissociating the muscle fibers until contact with the facet joint;
- introduction of progressively large dilating bougies and retractor placement (Quadrant®, Medtronic, Memphis, TN, USA) (Fig. 1a, b);
- ipsilateral laminoarthrectomy removing the isthmus, unilateral posterior arch of the vertebrae and the inferior joint facet of the subjacent vertebra using a reaming technique or an osteotome, then using curettes and gougers. Ablation of the ligamentum flavum. At the end of this stage, the pedicles, the passing and exiting roots, as well as the intervertebral disc were exposed. Contralateral recalibration was performed, if necessary, after partial resection of the base of the spinous process. The entire procedure was carried out under the surgical microscope with variable magnification, providing three-dimensional vision and sufficient lighting of the operative field;
- exeresis of the disc until contact was made with the anterior longitudinal ligament;
- progressive intervertebral distraction using increasingly large dilating bougies (Fig. 2a–c);
- transforaminal insertion of a PEEK cage (Capstone®, Medtronic, Memphis, TN, USA) filled with cancellous bone harvested from the posterior vertebral arch or the ipsilateral iliac crest. Complementary intervertebral grafting was systematically performed by placing bone around the cage so as to increase the intervertebral fusion rate;
- osteosynthesis through the Quadrant retractor on the ipsilateral side, to apply compression on the cage, then contralateral percutaneous osteosynthesis (Sextant®,

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