Bony Lateral Recess Stenosis and Other Radiographic Predictors of Failed Indirect Decompression via Extreme Lateral Interbody Fusion: Multi-Institutional Analysis of 101 Consecutive Spinal Levels

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■ OBJECTIVE: **Although extreme lateral interbody fusion (XLIF) largely provides successful indirect decompression, some patients have recurrent same-level pain and functional disability. Identifying risk factors for this failure would facilitate better patient selection and improve outcomes. The aim of this study is to identify preoperative radiographic risk factors for failure of XLIF.**

■ METHODS: **Patients undergoing XLIF were prospectively enrolled by 3 surgeons at 3 separate institutions. Radiographic variables measured included (1) anterior and posterior disc height, (2) foramen height and area, (3) central canal diameter, (4) central canal area, (5) right and left subarticular diameters, (6) facet arthropathy grade, and (7) presence of bony lateral recess stenosis. Patients failed indirect decompression if Oswestry Disability Index (ODI) scores did not improve by 20 points or revision surgery was required within 6 months postoperatively. Univariate and multivariate analyses were performed to identify radiographic predictors of failure of indirect decompression.**

■ RESULTS: **Of the 45 patients (age 65.6 ± 10.5 years; 14 male) involving 101 spinal levels included in this study, 13 (29%) failed indirect decompression. From univariate analysis, these patients had significantly smaller central canal diameter, foraminal height, and disc height ($P < 0.05$). In multivariate analysis of these parameters and those trending toward significance, bony lateral recess stenosis was the only significant independent predictor for failure of indirect decompression (coefficient, 0.55 [0.24—0.85]; $P < 0.001$).**

■ CONCLUSIONS: **Bony lateral recess stenosis is an independent predictor for failure to achieve adequate spinal decompression via XLIF and thus may benefit from undergoing direct decompression.**

INTRODUCTION

Spinal stenosis with radiculopathy is an increasingly common diagnosis in the aging population and the most common indication for spinal surgery in patients older than 65 years.[1] Conservative therapies are often successful, although patients failing such treatment may require surgical decompression. The standard surgical technique of decompressive laminectomy and foraminotomy, accompanied by instrumented fusion if spinal stability is a concern, is a successful procedure,[2] but carries a not insignificant risk of surgical morbidity.[3]

The extreme lateral interbody fusion (XLIF) technique, first described in 2006 by Ozgur et al.,[4] allows direct access to the disc space with minimal tissue dissection and no disruption of intra-abdominal space or posterior paraspinal musculature, facilitating indirect spinal decompression, with promising results.[5-8] However, a subset of patients with XLIF continue to have same-level persistent and recurrent pain and functional disability because of failure of indirect decompression.[9] Early studies have suggested

Key words
- Indirect decompression
- Lateral access
- Lateral recess stenosis
- Patient selection
- Radiographic predictors
- Risk factors
- XLIF

Abbreviations and Acronyms
AP: Anteroposterior
MRI: Magnetic Resonance Imaging
ODI: Oswestry Disability Index
XLIF: Extreme lateral interbody fusion

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some predictors of failure, such as severe central canal stenosis, low bone density, and smaller cage size, but preoperative radiologic risk factors are still too poorly characterized to guide patient selection.[10-12]

The purpose of this study is to identify preoperative radiologic factors that are predictive of failure of indirect decompression with the XLIF procedure.

METHODS

Study Design

This study is a retrospective review of prospectively collected data from patients undergoing lumbar interbody fusion via the XLIF approach to identify preoperative radiologic risk factors. The institutional review board approved this study.

Patient Selection

From January 2009 to December 2011, we queried a prospectively maintained data registry of all adult patients undergoing same-day, multistage lumbar interbody fusion via the lateral transpsoas approach by 3 surgeons, board-certified in neurologic or orthopedic surgery, of similar experience and skill. The inclusion criteria included (1) patients aged 18 years or older, (2) who failed at least 6 weeks of nonsurgical treatment, (3) who underwent lumbar interbody fusion via the direct lateral transpsoas approach, and (4) who had comprehensive baseline, 3-month, and 6-month follow-up data. All other patient demographics, clinical presentation, comorbidities, radiologic studies, and all treatment variables were reviewed for each case. Primary diagnosis requiring decompression was determined by the operating surgeon on reviewing preoperative imaging.

Radiographic Evaluation

Standing lateral plain radiographs, sagittal magnetic resonance imaging (MRI), and axial MRI were obtained for all patients preoperatively and immediate postoperatively. Radiographs were digitally stored in a medical center picture archiving and collecting system (PACS). All radiographic parameters were measured using measurement tools on PACS and Surgimap Spine software (Nemaris Inc., New York, New York, USA). Radiographic variables measured included (Figure 1) (1) anterior and posterior disc height, (2) foramen height and (3) foramen area; using sagittal MRI, (4) central canal diameter; using axial MRI, (5) central canal area, (6) right and left subarticular diameters, (7) facet arthropathy grade, and (8) presence of bony lateral recess stenosis. Only the spinal levels involved in the XLIF were included in radiographic analysis. For cases involving multiple levels, each level was independently measured for statistical assessment.

The degree of facet arthropathy on axial MRI was scored according to the Fujiwara facet joint osteoarthritis grading scale. The scoring system defines degree of facet arthropathy as follows: grade 1, normal; grade 2, mild (joint space narrowing or small

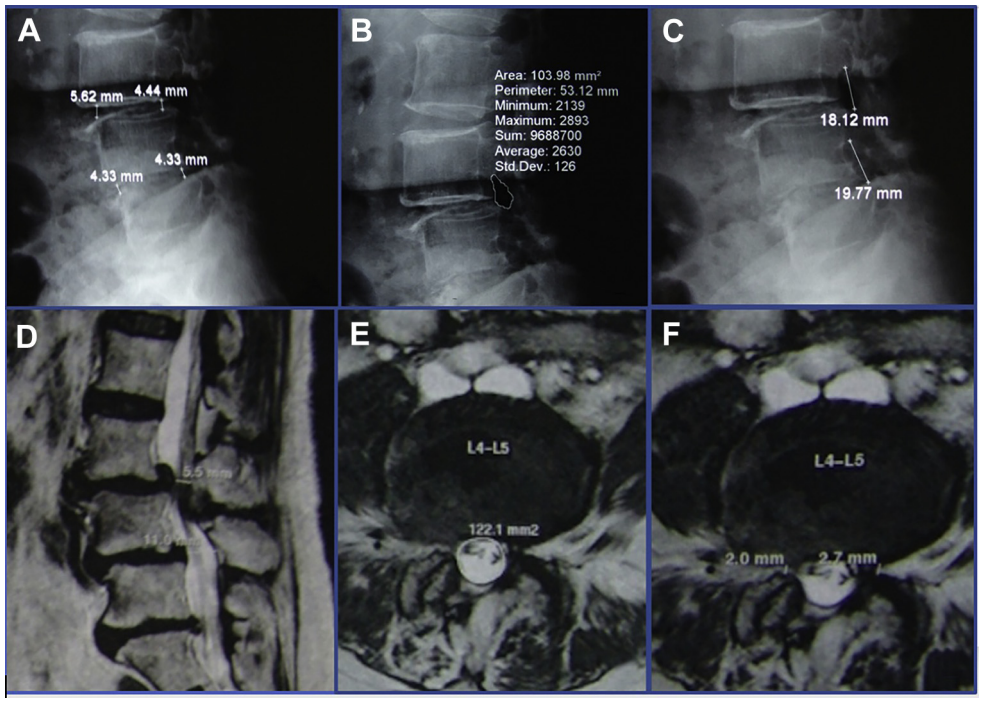

Figure 1. Radiographic variables measured include (**A**) anterior and posterior disk height, (**B**) foramen area, and (**C**) foramen height from the lateral plain film. From the magnetic resonance imaging, measured variables included (**D**) central canal diameter, (**E**) central canal area, and (**F**) right and left subarticular diameters.