The 'Lumbar Fusion Outcome Score (LUFOS)': A New Surgically-oriented Grading System for Pre-operative Prediction of Long-term Clinical Outcomes After Lumbar Spinal Fusion for Degenerative Disc Disease

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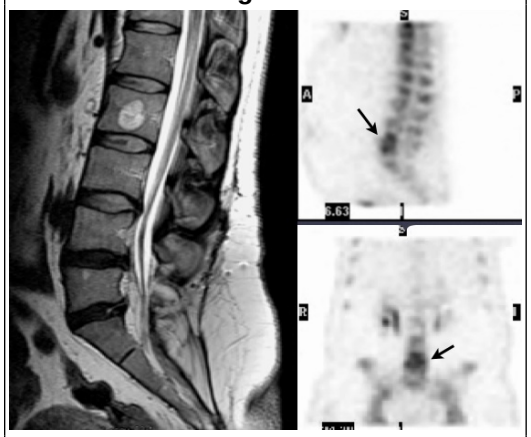
Introduction

Although degenerative disc disease (DDD) may be associated with chronic axial low-back pain, it is often challenging to determine with precision in each individual case the exact etiology and, up to now, there is no standard diagnostic algorithm for indicating lumbar fusion in the setting of DDD.

Methods

The authors performed a retrospective chart review of MRi findings (such as the presence of Modic changes and the degree of disc degeneration as evaluated by the Pfirmann classification) and Bone-scan results (99mTc Scintigraphy) of patients with DDD who underwent anterior lumbar inter body fusion at a single tertiary care hospital from 2007-2010. The results were correlated with the clinical outcomes (ODI and VAS) pre-operatively and at four standard post-operative follow-up time points (6 weeks, 3 months, 6 months, and 1 year post-operatively).

Figure 1

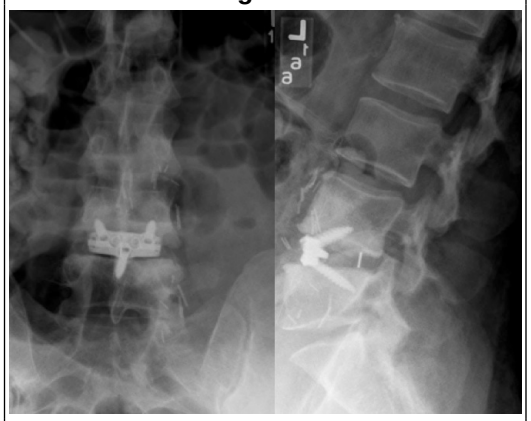


Left: T2 sagittal MRi of the lumbar spine in a patient with axial low-back pain demonstrating DDD L4/L5 and L5/S1. The Bone-scan (99mTc-Scintigraphy), by demonstrating marked uptake at the L4/L5 level, further suggested this to be the most likely symptomatic level.

Results

The strongest predictor of post-operative clinical outcomes ($p<0.05$), as measured by the estimated marginal means of VAS-back pain and ODI, was achieved by combining all the three preoperative variables under study (presence of DDD - 1 point, presence of Modic changes - 1 point and Bone-Scan endplate uptake - 1 point) in a new score named 'Lumbar Fusion Outcome Score' (LUFOS) - range 0 to 3. Variables which have been shown to be significantly associated with low-back pain in previous studies (such as age, smoking status and Bone Mass Index - BMI) were also evaluated regarding their possible influence upon outcomes. According to the Mixed Effect model, such grading system was very powerful in its capacity of preoperatively classifying patients in two different groups (Non-surgical: LUFOS 0 and 1 and Surgical: LUFOS 2 and 3). According to the performed statistical tests these two groups presented significantly different clinical outcomes beginning at three months and which were sustained after one year of follow-up.

Figure 2

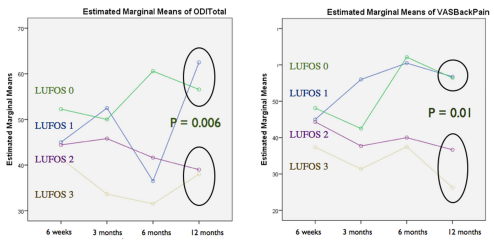


AP (left) and lateral (right) post-operative x-rays after L4/L5 ALIF in the same patient. The patient presented complete resolution of the axial low-back pain.

Conclusions

The authors successfully developed a surgically-oriented grading system for DDD with basis on pre-operative parameters from MRi and Bone-Scan (99mTc Scintigraphy) which has been shown to be highly predictable of long-term clinical outcomes after lumbar fusion for DDD

Figure 3



All four LUFOS subgroups were similar pre-operatively when compared using t-test for equality of means regarding the variables age, ODI-total and VAS-back pain. In the graph it is possible to visualize the estimated marginal means for ODI and VAS at the four post-operative times (6 weeks, 3 months, 6 months and 12 months) for each class of patients in the new proposed LUFOS classification. After the dichotomization between non-surgical (LUFOS 0 and 1) and surgical patients (LUFOS 2 and 3), a statistically significant difference was found in both clinical outcomes measures beginning at three months up to one year of follow-up (ODI-total: $p=0.006$ and VAS-back pain: $p=0.01$).

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Learning Objectives

- To understand the weakness of the scientific evidence regarding the relationship between degenerative disc disease and axial low-back pain.

- To understand the radiological and epidemiological factors which have already been proposed as possible pre-operative factors for selecting patients for fusion in the setting of degenerative disc disease.

- To understand the components of the new classification system and the possible socioeconomic impact of a grading system capable of predicting successful post-operative clinical outcomes after lumbar fusion in the setting of degenerative disc disease.