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Clinical Study

Clinical and radiographic degenerative spondylolisthesis (CARDS) classification

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Abstract

BACKGROUND CONTEXT: Lumbar degenerative spondylolisthesis (DS) is a common, acquired condition leading to disabling back and/or leg pain. Although surgery is common used to treat patients with severe symptoms, there are no universally accepted treatment guidelines. Wide variation in vertebral translation, disc collapse, sagittal alignment, and vertebral mobility suggests this is a heterogeneous disease. A classification scheme would be useful to differentiate homogenous subgroups that may benefit from different treatment strategies.

PURPOSE: To develop and test the reliability of a simple, clinically useful classification scheme for lumbar DS.

STUDY DESIGN: Retrospective case series.

PATIENT SAMPLE: One hundred twenty-six patients.

OUTCOME MEASURES: Proposed radiographic classification system.

METHODS: A classification system is proposed that considers disc space height, sagittal alignment and translation, and the absence or presence of unilateral or bilateral leg pain. Test cases were graded by six observers to establish interobserver reliability and regraded in a different order 1 month later to establish intraobserver reliability using Kappa analysis. To establish the relative prevalence of each subtype, a series of 100 consecutive patients presenting with L4–L5 DS were classified.

RESULTS: Four radiographic subtypes were identified: Type A: advanced Disc space collapse without kyphosis; Type B: disc partially preserved with translation of 5 mm or less; Type C: disc partially preserved with translation of more than 5 mm; and Type D: kyphotic alignment. The leg pain modifier 0 denotes no leg pain, 1 denotes unilateral leg pain, and 2 represents bilateral leg pain. The Kappa value describing interobserver reliability was 0.82, representing near-perfect agreement. Intraobserver reliability analysis demonstrated Kappa=0.83, representing near-perfect agreement.

FDA device/drug status: Approved (Pedicle Screws), (Interbody Cages).

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Grading of the consecutive series of 100 patients revealed the following distribution: 16% Type A, 37% Type B, 33% Type C, and 14% Type D.
CONCLUSIONS: A new radiographic and clinical classification scheme for lumbar DS with high inter- and intraobserver reliabilites is proposed. Use of this classification scheme should facilitate communication to enhance the quality of outcomes research on DS.

Keywords: Lumbar degenerative spondylolisthesis; Degenerative spondylolisthesis; Classification system; Lumbar spinal fusion; Spondylolisthesis; Iatrogenic destabilization

Introduction

Lumbar degenerative spondylolisthesis (DS) is a common, acquired, pathologic condition that can lead to disabling back or leg pain. Although surgery is commonly required for patients with severe symptoms secondary to DS, there are no universally accepted treatment guidelines. Many surgeons routinely perform spinal fusion when decompressing the neural structures for symptoms of neurogenic claudication or radiculopathy. This approach is based, in part, on the work by Herkowitz and Kurz [1], who demonstrated superior clinical outcomes for patients undergoing noninstrumented fusion for DS compared with those who underwent laminectomy alone. In recent years, fusion for DS has commonly been supplemented with instrumentation, which has been shown to enhance the rate of successful arthrodesis [2]. Recently, it has become increasingly common to encounter patients undergoing interbody fusion for DS [3–5]. At the other end of the spectrum, some surgeons perform a decompression without fusion, especially when using a minimally invasive approach that preserves the midline structures [6–9]. Another subset of surgeons advocate the use of dynamic instrumentation without fusion to address the potential instability after decompression [10]. Clearly, more clarity is needed to define the optimal treatment strategies for this common clinical condition.

A major difficulty with studying or discussing treatment approaches to DS is the heterogeneous nature of the condition. Radiographically, a wide range is seen in the magnitude of vertebral translation, intervertebral disc collapse, sagittal alignment, and mobility with flexion and extension, parameters that have been previously demonstrated to change the biomechanical loading environment of spinal elements [11] and also affect loads placed on spinal instrumentation. Based on these differences, optimal treatment strategies may vary to address the biomechanical goals of the specific case but no classification scheme has ever been developed to encourage discussion and investigation of anatomic variations in DS. Such a scheme should be simple and reproducible so that clinicians and researchers can easily define the subgroup of a given patient and then apply a research or treatment approach designed for a more homogeneous subgroup instead of the entire disease spectrum.

The present study was undertaken to develop and test the reliability among spine surgeons of a simple, four-part classification scheme for patients with DS. The purpose of this classification scheme is to subdivide the wide spectrum of DS into reproducible subgroups to facilitate communication between clinicians and promote high quality outcomes research to be performed.

Materials and methods

Radiographic measurement survey

A prior radiographic survey was conducted [12] involving 304 patients with L4–L5 DS. In this survey, measurements were taken of anterior and posterior disc heights, vertebral translation, and vertebral movement with flexion and extension. This survey demonstrated a wide range of values for each of the measured parameters. The data from each measured parameter were continuous, without any natural ‘‘breaks’’ in data that could be used to subcategorize DS patients.

Selection of clinical and morphologic characteristics for the classification scheme

Given the absence of any useful data patterns that could be used to develop a classification scheme, a literature-based review was conducted to define a list of clinical and morphologic characteristics that were attributable to DS. Using the Delphi process [13], radiographic features felt to be important for identifying morphologically and biomechanically distinct groups of patients with DS were suggested and refined through circulation between three senior spine surgeons using a spine fellow as the Delphi process mediator. Through repeated circulation of the selected radiographic criteria, a proposed radiographic classification scheme for DS was determined by consensus. Although this study only analyzes the reproducibility of radiographic features of the classification system, the presence or absence of lower extremity pain (including buttocks) was added as a modifier to further stratify the groups.

The proposed classification scheme was based on three radiographic variables and one clinical variable. The radiographic variables for the slip level were: the presence of bony apposition of vertebral end plates; the presence of kyphosis on any radiographic view; and the magnitude of translation on lateral radiographic views. The clinical variable used was the presence and nature of lower extremity pain reported by the patient (graded as absent, unilateral, or bilateral).