INTRODUCTION

Lumbar degenerative spondylolisthesis (DS), the forward slippage of a superior vertebra to the inferior vertebra, is recognized as a common condition in elderly individuals [1]. It frequently causes mechanical low back pain, radioculadicular limb pain and neurogenic claudication [2]. To reveal pathogenesis, explain clinical symptoms and decide treatment methods, kinematics of the vertebrae with DS have been studied. The objective of this study is to investigate the motion characteristics of different structures of the lumbar vertebral segments with L4 DS during weight-bearing postures using noninvasive imaging techniques [3].

MATERIALS AND METHODS

Approval of an institutional review board and written consents were obtained. 9 patients with L4 DS (mean age, 73.4) and 9 asymptomatic volunteers (mean age, 54.4) were included. 3D lumbar spine models were obtained from 3D MRI or CT scans in supine position. During functional postures (standing upright, flexion, and extension), a dual fluoroscopic system [3] captured the images of the lumbar spine. Kinematic of the spine were then obtained from a 3D-2D registration technique [3]. Range of motions (ROMs) and motion patterns of the anterior and posterior rims of the disc, the facet joints and the interspinous process were analyzed from the coordinate systems at the anatomic landmarks and compared between the two groups. Statistical analyses were performed using multi-way ANOVA.

RESULTS

Anterior disc heights were smaller in the DS group (6.50 to 8.69mm) than in the normal group (9.20 to 10.70mm), but only significantly at standing upright (p<0.05). Posterior disc heights were significantly smaller in DS group (3.04 to 3.99mm) than in the normal group (5.94 to 6.40mm) under all postures (Fig. 2).

The study showed that disc degeneration has certain relationship with DS since the discs of patients with DS had less height compared to normal. Vertebrae with DS had disordered motion patterns, which maybe resulted from asymmetric degeneration and proliferation of the vertebral body, intervertebral disc and facet joints [4]. Clinically, instability is an important factor in determining the surgical method. Our results suggested DS did not necessary result in instability in the lumbar spine. In elder patients, restabilization processes may have occurred [5] and surgical treatment should be planned accordingly.

SIGNIFICANCE

Lumbar degenerative spondylolisthesis is a common condition in elder individuals. This study investigated the motion patterns of the vertebrae with DS. The results may provide information to help reveal pathogenesis, explain clinical symptoms and decide treatment methods.

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REFERENCES


Fig. 1 Anatomic landmarks were chosen to analyze the motion patterns of the vertebrae. A=anterior rim of the endplate, P=posterior rim of the endplate, F= center of the facet joint, S=center of the spinous process

Fig. 2 Disk height under different postures

Motions of L4 with respect to L5 were plotted with supine posture as zero reference (Fig. 3-5). The x axes were drawn to scale to reflect the averaged distances between various structures of the vertebra. No significant difference in the ROMs was found between the two groups, with translations range from 0.12 to 3.64mm and rotations range from 0.04 to 4.42°. However, different motion patterns were observed. A left to right swing of L4 was observed from extension to flexion in the normal group, but not in the DS group (Fig. 3). When changing postures from supine to upright stand, the anterior and posterior structures of the vertebrae compressed approximately equally of about -0.25mm (Fig. 5) in the normal group. In the DS group, there were significantly larger compressions of the anterior parts of the vertebrae (-1.76mm) while the posterior spinous processes slightly opened (0.78mm).