

Degenerative Spondylolisthesis in Thoracic Spine

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A 66 year-old woman was admitted to our hospital for progressive weakness of both lower extremities since a month ago. Imaging study, based on plain X-ray, computed tomography and magnetic resonance image revealed spinal stenosis owing to anterior slipping of T10/11 segment. Degenerative spondylolisthesis is common in the lumbar spine and rarely occurs in the cervical spine^{2,5}. But there was no report of degenerative spondylolisthesis in thoracic spine. The authors experienced a case of degenerative spondylolisthesis in the thoracic spine. And we achieved a satisfactory result with posterior decompressive laminectomy alone.

KEY WORDS : Degenerative spondylolisthesis · Thoracic spine · Spinal stenosis.

Introduction

Degenerative spondylolisthesis in the lumbar spine is a common disease in old age. But, to our knowledge, spondylolisthesis in the thoracic spine has not been reported so far. In our spine center, there have been 84 cases of operation for thoracic spinal stenosis since 1983, which were ossification of posterior longitudinal ligament, ossification of ligament flavum, thoracic disc herniation, and so on. We encountered only one case of thoracic stenosis due to degenerative spondylolisthesis. This is a very unique and interesting case, because the thoracic spine is more fixed than cervical and lumbar spine owing to several anatomical properties.

Case Report

A 66 year-old woman was admitted to our hospital due to progressive weakness of both lower extremities since a month ago. She had no events of spine trauma and previous spinal surgery. She had not experienced low back pain and leg pain. She had a few medical problems, such as essential hypertension, ischemic heart disease and diabetes mellitus. Neurologic examination revealed that she had spastic paraparesis with Grade 4 motor weakness (MRC scale) without

urinary incontinence and sensory impairment. Plain X-rays of the thoracic spine showed Grade 1 (Meyerding classification) spondylolisthesis and reduced disc height of T10/11 segment (Fig. 1). Magnetic resonance(MR) image showed spinal cord compression caused by spondylolisthesis and ligament flavum thickening at T10/11 segment in sagittal view (Fig. 2). Total laminectomy and medial facetectomy of T10 and T11 spine were performed using high-speed drill under microscopic view. We found a significant stenosis caused by spondylolisthesis, ligament flavum thickening and bilateral facet joint hypertrophy, but there was no defect of pars interarticularis on operative findings. The previously compressed dural sac was reexpanded after decompressive surgery. The posterior spinal fixation was not needed after laminectomy and medial facetectomy, because it was not developed postoperative instability. She has been followed up for 25 months and she improved spasticity and motor weakness from Grade 4 to Grade 5.



Fig. 1. Plane lateral radiography of thoracic spine shows Grade 1 spondylolisthesis and reduced disc height of T10/11 segment.

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Discussion

Spondylolisthesis is anterior slipping of a upper vertebral body on the lower vertebral body. Spondylolisthesis may be caused by facet dysplasia, elongation or fracture of the pars interarticularis. Degeneration and secondary instability of the facet joints, trauma, pathologies involving bone including tumor, osteogenesis imperfecta, or primary bone disorders⁹⁾ can cause spondylolisthesis. It is known that degenerative spondylolisthesis usually occurs in the lumbar spine. But in the thoracic spine, spondylolisthesis can not occur easily because of its reduced mobility, which is due to several anatomical properties of the thoracic spine.

First, the thoracic spine have their ribs, which serve to restrict the motion of the thoracic spine and provide a major degree of stability. Andriacchi et al. studied the effect of the rib cage on the thoracic spine and found that the rib cage increases stiffness 2.64 times in extension and 2.14 times in flexion¹⁾. Oda et al. investigated the biomechanical role of the costovertebral joint and rib cage through sequential resection of the thoracic spinal column. They showed bilateral destruction of the costovertebral joints and rib cage resulted in instability of the thoracic spinal motion segment, and concluded that the costovertebral joint and rib cage confer stability on the thoracic spine^{6,8)}. In addition to these skeletal properties, the articular capsule and ligaments such as the radiate, costotransverse and intraarticular ligaments connect the ribs to the posterolateral aspect of the adjacent two vertebrae and the intervertebral disc lying between them⁷⁾.

Secondly, the facet joint orientation have an important role in the development of degenerative spondylolisthesis. The facet joint angles vary throughout the whole spine. At the thoracic spine, the facet angles are oriented more in the coronal plane, whereas the facet angles are almost completely oriented in the sagittal plane at the lumbar



Fig. 2. T2-weighted sagittal magnetic resonance images shows spinal cord compression owing to spondylolisthesis at T10/11 level and ligamentum flavum thickening at T11/12 level.

spine. In this case, the facet joint also shows coronal orientation (Fig. 3). Spondylolisthesis can not occur easily, because the superior articular process of lower vertebrae is located in front of the inferior articular process of upper vertebrae. The increased sagittal plane angulation and consequent decreased coronal plane angulation diminished the anatomic resistance to shearing forces and created a biomechanical environment in which anterolisthesis could occur^{3,4)}.



Fig. 3. The facet joint plane shows coronal orientation in T10/11.

Both of fracture dislocation and degenerative spondylolisthesis could be possible mechanisms for the anterior slipping of vertebral body. But fracture dislocation involves all three columns, so the spinal column would be very unstable and kyphosis would progress. In this case, she had no major trauma history and her symptom had very insidious onset. Moreover, there was no kyphosis on imaging study, so, the pathology of this patient is likely degenerative spondylolisthesis.

Degenerative spondylolisthesis is not easy to develop in this patient, because she had intact rib cage and normal coronally planed facet joint. But she was a heavy worker and this could facilitate degenerative change of the spinal column including facet loosening.

Conclusion

The thoracic spine is less mobile than lumbar and cervical spine due to their ribs and coronal-orientated facet joints. By these anatomical properties, the thoracic spine is protected against shearing forces at the level of the intervertebral disc. But in spite of these conditions, spondylolisthesis can occur in the thoracic spine, and we achieved a satisfactory result with only posterior decompressive surgery.

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