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ORIGINAL ARTICLE

Lumbar spine MRI axial loading in patients with degenerative spine pathologies: Its impact on the Radiological findings and treatment decision

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KEYWORDS

Axial loading;
MRI Lumbar spine;
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Abstract *Purpose:* The aim of the study was to assess the Radiological changes occurring after axial loading of the lumbar spine during MRI in patients whose conventional MRI did not explain their clinical symptoms and to evaluate the impact of these changes on the treatment decision.
Materials and methods: 20 patients (11 males and 9 females) with neurological symptoms are included in this study. Their symptoms included low back pain, sciatica and neurogenic claudication. Conventional MRI findings alone were not sufficient to explain their clinical complaint.
Results: Axial loaded MRI of the lumbar spine revealed changes in the vertebral alignment in 45% of patients, prominence of the already existing disk lesion in 60% of patients, newly seen disk protrusion in 10% of patients and prominent ligamentum flavum in 80% with subsequent spinal canal stenosis and thecal sac indentation.
Conclusion: Patients with clinical symptoms not explained by conventional MRI can benefit from Axial loading MRI which can add more information and also can change the treatment decision plan.
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1. Introduction

We commonly encounter patients with low back pain, and these patients with acute low back pain often experience increased symptoms during standing or sitting as compared to lying supine (1). It is well known from clinical work that a number of patients with significant symptoms do not have corresponding imaging abnormalities, even with the most sophisticated techniques (2).

MRI is the most accepted imaging modality in assessment of the lumbar spine pathologies in patients with low back pain, sciatica and neurogenic claudication.

Since symptoms are usually induced or exaggerated by standing or walking, so imaging in the most symptomatic

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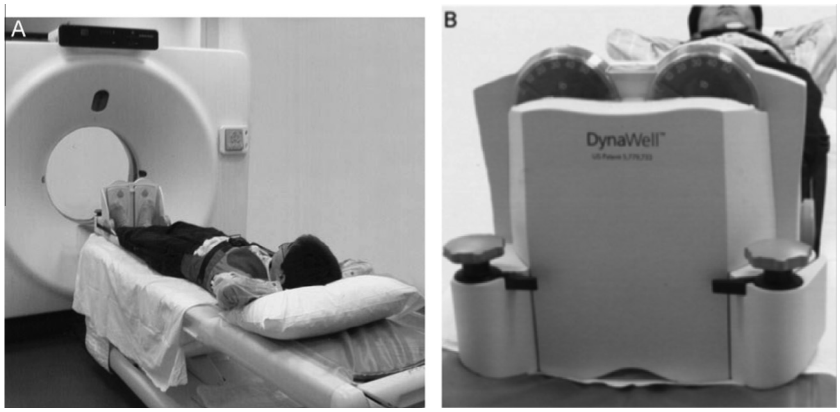

Fig. 1 Patient in position during axial compression. (A and B) Device consists of nonmagnetic harness/jacket with straps connected to a footplate. By tightening or loosening the adjustment knobs on the compression part, the load can be regulated and equally distributed to both the legs. The applied load can be measured by using scales on the footplate (2).

position may yield more diagnostic information than imaging in psoas relaxed neutral position.

Ideally, imaging in standing position would be optimal with the normal gravitational pressure exerted on the spine. This is impractical, however, since it would require the patient to stand motionless for about 30 min.

To simulate upright position, clinicians and researchers have developed a device (DynaWell L-spine; DynaWell Int. AB, Billdal, Sweden) (Fig. 1) that loads axially to the spine in the supine position (3–7).

This device consists of a harness/jacket with straps connected to a footplate. By tightening the straps, an axial load can be applied to the patient's spine during imaging (2).

Our hypothesis is that the intervertebral disk height and accordingly the disk circumference changes with axial loading, which may account for symptom alteration, also the degree of neural compression, lateral recess narrowing and ligamentum flavum thickening will change during axial loading of the lumbar spine.

Table 1 Age and gender distribution with changes occurring after axial loading of the lumbar spine.

Patients	Gender	Age	Changes after axial loading	
1	Male	38	Decreased height of the disk space	Ligamentum flavum thickening
2	Male	34		
3	Male	29		
4	Male	47		
5	Female	52		
6	Male	54		
7	Female	49		
8	Male	38		
9	Female	21		
10	Male	56		
11	Female	58		
12	Male	40		
13	Female	48		
14	Female	38		
15	Male	52	Exaggerated lordosis	
16	Male	51		
17	Male	47	Exaggerated lordosis	
18	Female	53		
19	Female	43	Increase in scoliosis	
20	Female	41		

2. Patients and methods

2.1. Patients

Twenty patients were enrolled into the study, including 11 males and 9 females, aged 21–58, with a mean age of 39.5. Fourteen patients had low back pain, ten had sciatica and five had neurogenic claudication. The selection of the patients was based on their conventional MR imaging which failed to explain their clinical symptoms and in such cases the neurosurgeon was not convinced by the results and was not confident about the surgical decision plan. The study included patients who had single level of disk pathology to make sure that the symptoms are related to this particular level affection.

2.2. MR Technique

The examination was conducted using 0.32T system using a surface coil, and scanning was done in supine position with slight hip flexion with pillow under the knee.

The scan included two parts, in the first part, routine MR imaging consisted of sagittal T2 weighted (3190/128/3) [TR/TE/number of excitation] and sagittal T1 weighted (790/17/3) turbo spin echo sequences, axial T2 and T1 weighted, coronal and axial gradient 3D thin cuts. Slice thickness is 4 mm with intersection gap 1.4 mm.

After the routine MR imaging, the second part of the examination; the axial loading was applied using the commercially available device (DynaWell L-Spine; DynaWell Int. AB, Billdal, Sweden) (Fig. 1), and the device is United States Food and Drug Administration approved (3–7).

The device includes a nonmagnetic Jacket with straps connected to a footplate with compression mechanism. The Jacket was applied before start of routine MR imaging, then during axial loading the side straps are tightened to apply pressure on the trunk against the footplate, the applied load is approximately 60% of the patient weight, and this load is equally distributed on both legs, for example; patient weight 100 kg and

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