Lumbar spine MRI in upright position for diagnosing degenerative disorders

Poster No.: C-0643
Congress: ECR 2014
Type: Scientific Exhibit
Authors: A. Bazhin, E. Egorova, E. Kozlov; Moscow/RU
Keywords: Connective tissue disorders, Technical aspects, MR, Neuroradiology spine, Musculoskeletal spine, Bones
DOI: 10.1594/ecr2014/C-0643

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Aims and objectives

Lumbar spine degenerative disorders mostly manifestate by back pain [6, 7]. According to epidemiological studies 60-80 % of population experience low back pain at least once in life [2].

Up to 10 % of the patients with degenerative spine disorders become disabled, with not less than 70 % of disabled among patients that underwent surgery. According to H. L. Asch (2002) and V. V. Shchedrenok (2011), even after microdiscectomy not more than 61 % of patients can return to their work.

A number of experimental studies have shown that even physiological load on intervertebral discs (IVD) results in decrease of their height and increase of width [8]. It is also known that degenerative IVD are much less resistant to stress. According to several surveys, a normal IVD can resist up to 12000 H of axial load, as long as degenerative IVD - only 100 H [3, 4]. The same degenerative changes occur in other elements of the vertebral- motor segment - the intervertebral joints, yellow ligaments.

Traditional pain films enable to do studies in the upright position and perform functional tests, but it doesn't allow to estimate the soft tissues, and consequently, to understand the cause of pain. Magnetic Resonance Imaging (MRI) at the beginning didn't allow to study the patient using axial stress.

In order to minimize these drawbacks, define the relationship of neural structures of the spinal canal and parts of the vertebral-motor segment, there have been developed technologies allowing to perform MRI in the upright position. As a result there was obtained an up-to-date technique estimating the static-dynamic changes of the spine [5].

The purpose of this study was to determine the capabilities of upright MRI in studying lumbar spine degenerative disorders.
Methods and materials

56 patients were taken into the study, aged 24 to 79 years, suffering from chronic lumbar pain.

The study was conducted using a 0,25 T MRI tomograph and included two parts. During the first part a standard MRI protocol in the supine position was used, including coronal #2-wighted images (T2-WI); saggital #1-, #2-WI and a sequence suppressing signal from fat tissue (STIR - short TR inversion recovery), with the scan slice width 4,5 mm, the interval between them - 5 mm. Axial T2-WI isotropic images with slice sickness 2mm were also included. The second part was the upright position study: the tomograph’s table was rotated with angle of 84 ° to the ground, allowing to obtain adequate axial load while maintaining the minimal support for the patient. This aspect is important, taking into consideration that the pain is likely to increase in the vertical position during the relatively long period of MRI examination time (15-18 min). Upright position protocols included T2-WI in the coronal, saggital (slice sickness 4,5 mm, interval 5 mm) and axial planes (isotropic images, slice sickness 2 mm).
Results

In the upright position in 100 % of cases all the characteristic lumbar spine static changes were revealed, such as the increase of physiological lordosis in 91,1 % (n = 51), pathological kyphosis appearance in 9 % (n = 5) cases. If scoliosis (83,9 %, n = 47) was present in horizontal position, after verticalization it increased on 7,2 ± 4,4 ⁰ (fig. 1).

Displacement of the vertebrae, revealed in 26,8 % patients in the supine position (n = 15) were found to increase in the upright position with 3,1 ± 2,2 mm, in 12,5 % cases (n = 7) displacement appeared only in the vertical position (fig. 2), which allowed to diagnose instability of interested spinal motion segments in 17 patients (30,4 %).

Protrusions and hernias of the intervertebral discs, revealed in 50 patients (89,3 %), augmented their dimensions in vertical position of 2,9 ± 2,2 ##, and in 7 % cases (n = 4) - they could be only seen during verticalization (fig. 3). In 14,3 % cases (n = 8) these changes occurred in dural sac neural structures compression.

In 2 patients (3,6 %) during verticalization a formation of absolute stenosis was reavealed, as a result of increased herniation of intervertebral discs, ligamentum flava thickening and vertebrae listhesis (fig. 3).

In 3,6 % cases (n = 2) the upright examination couldn't be performed because of the appearance in patients of severe low back pain.
**Images for this section:**

**Fig. 1:** Lumbar spine MR images, coronal #1-WI in the supine (a) and upright position (b). During the vertical examination, an increased of 7° scoliotic angle is revealed.

© - Moscow/RU
Fig. 2: Lumbar spine MR images, sagittal T2-WI. In the supine position there is anterolisthesis L4 present (a), during verticalization the anterior displacement of the vertebra is increased of 6 mm (b).

© - Moscow/RU
Fig. 3: Lumbar spine MR images in the supine (a, b) and upright position (c, d), T2-WI in sagittal (a, d) and axial (b, c) planes. During verticalization there appears an absolute spinal cord stenosis at the L4-L5 level, because of listhesis formation, thickening of ligamentum flava and anteriorly dislocated L4 inferior articular processes. In segment L2-L3 in the upright position there appears a protrusion, which hasn't been revealed in the supine position.

© - Moscow/RU
Conclusion

MRI in upright position provided additional information in 91.1% of cases, which appeared to be clinically important in 17.9%. This technique is able to presice the degree of central canal stenosis, the severity of degenerative changes and reveal the presence of vertebral-motion segments instability, which can all influence the choice of further management.
References


