



Radiation Diagnostics of the State of the Posterior Longitudinal Ligament in Lumbar Osteochondrosis

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Annotation: Currently, it is considered proven that osteochondrosis of the spine is the most severe form of degenerative-dystrophic lesions of the spine. This process is based on degeneration of the intervertebral disc with subsequent involvement of the bodies of adjacent vertebrae, intervertebral joints, intracanal ligamentous apparatus, spinal cord, its roots and neuroreflex mechanisms (1,3,6,7).

Keywords: osteochondrosis, longitudinal ligament, Modern programs, multiplanar spin-echo.

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Introduction

The most common and most severe manifestation of osteochondrosis of the spine are hernias between the vertebral discs. The disease occurs as a result of a rupture of the intervertebral disc. In this case, a hernia is formed, protruding back and to the side, presses on the posterior longitudinal ligament, spinal cord, spinal cord roots and causes inflammation, accompanied by edema (3,4,7,11).

Modern programs for determining the state of the posterior longitudinal ligament in lumbar osteochondrosis have been selected by us from the above lesions and include both traditional and modern methods of radiation studies. The introduction of magnetic resonance imaging (MRI), including multiplanar spin-echo (SE) and gradient-echo (GSE) sequences, makes MRI the most sensitive and, therefore, the most valuable method in diagnosing and assessing structural changes in the intracanal ligamentous apparatus (4,5,8,9,10,12).

The purpose of this study

Is to study the state of the posterior longitudinal ligament of the lumbar spine in osteochondrosis and to determine the types of its changes using X-ray and MRI research methods.

Materials and methods.

The materials of our work were 153 patients with signs of osteochondrosis of the lumbar spine, aged 20 to 70 years (73 men and 80 women) with a disease duration of one month to 15 years, with various clinical disorders characteristic of diseases of degenerative-dystrophic lesions of the spine .

The studies were carried out on MAGNETOM OPEN VIVA NMRI by SIEMENS (Germany), with a magnetic field power of 0.2 Tesla. MRI was performed using special surface coils of the Body-SP type. The research methodology involved obtaining T1w and T2w and proton-weighted (PD) images using spin-echo () and gradient-echo () sequences. The contrast between different tissues was changed by increasing or decreasing repetition () and echo (). Scanning was performed with the patient lying on his back in the sagittal and transversal planes. On the obtained scans, the nature of the MRI signal from the structures of the intracanal ligamentous apparatus, herniated discs, their level of damage and the state of the contours were evaluated.

Results and discussions.

X-ray examination revealed osteochondrosis of the intervertebral discs of the lumbar spine in all patients. The pathological process usually covered 1 to 2-3 intervertebral discs.

On radiographs (in direct and lateral projections) there was a decrease in the height of the intervertebral disc, sclerotic changes in the subchondral part of the vertebrae, irregularity and sclerosis of the cartilage plates, marginal compact osteophytes, the presence of cartilaginous hernias, often surrounded by a sclerotic border, calcification of the posterior longitudinal ligament.

At the level of the altered posterior longitudinal ligament, a calcification band 3–8 mm wide was determined, which was well identified in the lateral projections of the plain radiograph of the spine. It is closely adjacent to the anterior wall of the spinal canal, corresponding to the anatomical location of the posterior longitudinal ligament, the data of the literature (4,9) and the results of our X-ray examination do not allow us to fully assess all the constituent components of the intervertebral discs and the posterior longitudinal ligament, which can be clearly detected by MRI. – research methods.

The earliest degenerative changes in the intervertebral discs (MD) include: a decrease in the MRI signal from the MD, loss of differentiation between the nucleus pulposus and the annulus fibrosus on T1w and T2w, dehydration of the disc. In case of advanced MD lesions, in addition to the listed radiographic signs, MRI makes it possible to differentiate protrusion and the depth of disc prolapse into the spinal canal, determine the presence of a rupture of the fibrous ring, determine the condition of the posterior longitudinal ligament, etc. The depth of disc prolapse into the spinal canal is shown in Table 1.

Table 1. Prolapse of herniated intervertebral disc into the spinal canal with its lateralization.

| Herniasize (inmm) | gender | Variantsofherniateddiscs | | | | | Numberofpatients | | |
|------------------------|--------|--------------------------|------------|-------|----------------|-------|------------------|-----|------|
| | | Median | Paramedian | | posterolateral | | Bygender | Abs | B% |
| | | | Left | Right | Left | Right | | | |
| Upto 3 (protrusion) | M | 2 | 1 | 2 | - | 1 | 6 | 12 | 7,8 |
| | F | 2 | 2 | 2 | - | - | 6 | | |
| 4-6 | M | 6 | 9 | 6 | 1 | 1 | 23 | 49 | 32.1 |
| | F | 5 | 9 | 8 | 1 | 3 | 26 | | |
| 7-9 | M | 5 | 5 | 7 | 2 | 3 | 22 | 53 | 34,6 |
| | F | 2 | 6 | 4 | - | 1 | 13 | | |
| 10-12 | M | 2 | 4 | 3 | 3 | 2 | 14 | 27 | 17,7 |
| | F | 2 | 6 | 4 | - | 1 | 13 | | |
| Above 12 | M | 1 | 3 | 4 | - | - | 8 | 12 | 7,9 |

| | | | | | | | | | |
|------------------|-----|------|------|------|-----|------|-----|-----|-----|
| | F | 1 | 1 | 1 | - | 1 | 4 | | |
| Total | M | 16 | 22 | 22 | 6 | 7 | 73 | 153 | 100 |
| | F | 17 | 27 | 23 | 3 | 10 | 80 | | |
| Numberofpatients | Abs | 33 | 49 | 45 | 9 | 17 | 153 | | |
| | B% | 21.6 | 32.0 | 29.4 | 5.9 | 11.1 | 100 | | |

The first manifestations of disc dehydration are a change in the normal cleft, a decrease in the signal T2w mode from the structure of the nucleus pulposus. In this case, the protrusion of the structures of the fibrous ring occurs without violating the integrity (4,5). The intensity of the MRI signal of the bulging part of the disc, as a rule, does not differ from the non-bulging part. Hernial bulges typically range from a few millimeters to 1.5 centimeters, which are clearly seen on T2w sagittal scans as a low signal area against a bright signal from the dural sac. At the same time, compression of the posterior longitudinal ligament is noted and enhanced MRI is visible - a signal above and below the hernia. The T2w mode gives good contrast between the nucleus pulposus and the annulus and the ability to differentiate between annular rupture and non-rupture protrusion. Protrusion of MD tissues on the posterior contour of the vertebral body in the spinal canal up to 3 mm, called protrusion, was observed in 7.8% (12 people) of research cases. Basically, MD hernia was recorded with a depth of 4-9 mm in 66.7% (102 people), 10-12 mm - in 77.7% (27 people), and above 12 mm was observed in 7.9% (12 people) cases. At the same time, a hernia in the median variant occurred in 21.6% (33 people) of cases, in the paramedian variant - in 61.4% (94 people) and in the posterolateral variant - in 17.0% (26 people) of cases.

When the fibers of the fibrous ring are ruptured, the pulpous nucleus prolapses subligamentally. The MRI posterior longitudinal ligament is well demarcated and presents as a black ribbon-like structure that is adjacent to the bones and the annulus fibrosus. The MD hernia, being subligamentary, is in contact with the posterior longitudinal ligament, and causes the following MRI options - signs of changes in the LLJ in the age aspect, which are described in Table 2.

Table 2. Changes in the posterior longitudinal ligament in the age aspect

| Herniasize (inmm) | gender | Posteriorlongitudinalligament | | | | Numberofpatients | | |
|-----------------------|--------|-------------------------------|------|----------|-------|------------------|------------|---------------|
| | | pullback | Seal | thinning | Gap | By gender | abs | B% |
| | | | | | | | | |
| ДО 20 лет | M | 1 | - | - | - | 1 | 1 | 0.6 |
| | F | - | - | - | - | - | | |
| 21-30 | M | 3 | 8 | 6 | 6(2) | 23(2) | 34(3) | 22,2 (2,0) |
| | F | 2 | 6 | 2 | 1(1) | 11(1) | | |
| 31-40 | M | 2 | 12 | 3(1) | 5 | 22(1) | 44(2) | 29,4 (1,3) |
| | F | 2 | 12 | 3(1) | 5 | 22(1) | | |
| 41-50 | M | - | 5 | 2(1) | 6 | 13(1) | 36(2) | 23,3 (1,3) |
| | F | 1 | 9 | 7(1) | 6 | 23(1) | | |
| 51-60 | M | - | 3 | 2 | 2 | 7 | 22 | 14,2 |
| | F | 1 | 5 | 4 | 5 | 15 | | |
| 61-70 | M | - | 3 | 1 | 3 | 7 | 15(1) | 9,7 (0,6) |
| | F | - | 2 | 3 | 3(1) | 8(1) | | |
| Старше 70 лет | M | - | - | - | - | - | 1 | 0,6 |
| | F | - | - | - | 1 | 1 | | |
| Всего | M | 6 | 30 | 15(2) | 22(2) | 73(4) | 153 (8) | 100 (5,2) |
| | F | 6 | 34 | 19(2) | 21(2) | 80(4) | | |
| Количество больных | Abs | 12 | 64 | 34(4) | 43(4) | 153(8) | | |
| | B% | 7,9 | 41,8 | 22,2 | 28,1 | 100 (5,2) | | |

| | | | | | | |
|--|--|--|--|-------|-------|--|
| | | | | (2,6) | (2,:) | |
|--|--|--|--|-------|-------|--|

Note: In (5.2%) cases, thinning of one level was combined with a rupture of another level, which are indicated in brackets.

In our observations, retraction, compaction, expulsion and rupture of the posterior longitudinal ligament were noted. Retraction of the posterior longitudinal ligament was registered in 7.9% (12 people) of cases, indurations - in 41.8% (64 people), exacerbation - in 22.2% (34 people) and rupture - in 28.1% (43 people) cases. The lesions of the posterior longitudinal ligament were mainly at the age of 21 to 60 lei - 89% (136 people) in patients under 20 and over 60 years old - 10.9% (17 people) of cases.

The level of damage and condition of the posterior longitudinal ligament is illustrated in Table 3.

Table 3. Lesion level and condition of the posterior longitudinal ligament.

| Herniasize (inmm) | gender | Posteriorlongitudinalligament | | | | Numberofpatients | | |
|-----------------------------|--------|-------------------------------|------|---------------|---------------|------------------|------------|--------------|
| | | pullback | Seal | thinning | Gap | By gender | Abs | B% |
| | | | | | | | | |
| L4-L5 | M | 2 | 16 | 8 | 9(1) | 35(1) | 72(2) | 47,0(1,3) |
| | F | 3 | 18 | 8(1) | 8 | 37(1) | | |
| L5-S1 | M | 2 | 10 | 5(1) | 7 | 24(1) | 47(2) | 30,7 (1,3) |
| | F | 2 | 6 | 2 | 1(1) | 11(1) | | |
| L3-L4 | M | - | 2 | 0(1) | 2 | 4(1) | 10(2) | 6,5 (1,3) |
| | F | - | 2 | 1(1) | 3 | 6(1) | | |
| L2-L3 | M | - | - | 2 | 2 | 4 | 9 | 5,8 |
| | F | - | 1 | 2 | 2 | 5 | | |
| L1-L2 | M | 1 | 1 | - | 1 | 3 | 7 | 4,8 |
| | F | - | - | 2 | 2 | 4 | | |
| На нескольких уровнях | M | 1 | 1 | - | 1(1) | 3(1) | 8(2) | 5,2(1,3) |
| | F | - | - | 3 | 2(1) | 5(1) | | |
| Всего | M | 6 | 30 | 15(2) | 22(2) | 73(4) | 153 (8) | 100 (5,2) |
| | F | - | 34 | 19(2) | 21(2) | 80(4) | | |
| Количество больных | Abs | 12 | 64 | 34(4) | 43(4) | 153(8) | | |
| | B% | 7,9 | 41,8 | 22,2 (2,6) | 28,1 (2,6) | 100 (5,2) | | |

Notes are the same as in Table 2.

In Table 3, it should be noted that the damage to the MD and, accordingly, the posterior longitudinal ligament at the levels L4-L5 is mainly 47% (72 people) and L5-S1 - 30.7% (47 people) of cases. Only 15.8% (24 people) of cases were registered at other levels. Of these, in 5. % (8 people) of cases, the lesion occurred at several levels.

Clinical symptoms in MD prolapse involving the posterior longitudinal ligament were variable and did not always depend on the size of the hernia and the condition of the posterior longitudinal ligament. In some cases, we observed median protrusions that did not cause any clinical manifestations. When evaluating MRI data, attention should be paid not only to the size of the hernia, but also to the condition of the posterior longitudinal ligament.

Conclusions

1. X-ray examination makes it possible to evaluate dense (calcification) structural disorders of the intervertebral discs. However, they are limited in assessing the visualization of the contents of the intervertebral disc and dural sac.
2. MRI makes it possible to differentiate disc protrusions and prolapses involving the posterior longitudinal ligament more clearly than other methods. Allows you to accurately determine the stage and degree of change.
3. With the help of an MRI study, it is possible to determine the level of the lesion and differentiate various conditions of the posterior longitudinal ligament.
4. The MRI examination should be started by using the (SE) sequence program in T2w mode in the sagittal view. Then in transversal projection in T1w mode, depending on the situation.

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