Lumbar intervertebral disc disease

The Hippocratic physicians knew the signs and symptoms of lumbar disc disease, which they then called “sciatica”. But, they subsumed different disorders, like hip diseases under this term.

For many centuries, physician had no clear understanding of the anatomical condition and the pathomechanism of this disease. Therefore, no rational treatment was available.

With the landmark report of the New England Journal of Medicine in 1934, the two American surgeons, William Jason Mixter (1880-1958) and Joseph Seaton Barr (1901-1963), finally cleared the pathomechanism of lumbar disc disease.

Today, lumbar disc disease is a very common disease, which will be often seen in both the family practice as well as in the consultations of orthopedics, neurology, rheumatology or neurosurgery.

see Lumbar disc herniation

Clinical Features

Lumbar intervertebral disc degeneration has been implicated in the etiology of low back pain.

Scales

see Timed Up and Go test.

Visual Analog Scale

Roland Morris Disability Questionnaire

Oswestry Disability Index

Euro-Qol (EQ-5D)

Short Form (SF-12) questionnaires.

Diagnosis

Magnetic resonance imaging (MRI) is the most important method for the clinical assessment of intervertebral disc pathology. The signal characteristics of the disc in T2 weighted image reflect changes caused by aging or degeneration [1) 2) 3)].

Grading systems

A number of morphologic grading systems for lumbar disc degeneration have been proposed.

Most previous classification systems and reliability studies of lumbar disc abnormalities on MRI have focused on the posterior aspect of the disc, distinguishing among bulging, protrusion, and extrusion.

Studies focusing on the MRI characteristics of the disc structure are rare.

Disc degeneration can be graded reliably on routine T2-weighted magnetic resonance images using the grading system and algorithm presented in this investigation [4].

see Pfirrmann grading system.

The degeneration degree can be determined according to Schneiderman's classification, meaning: grade 1 (normal), 2 (intermediate, reduced intensity of heterogeneous sign), 3 (marked, diffuse loss of sign), 4 (absent, null sign) [5].

MRI of the lumbar spine showing multilevel degenerative disc disease (DDD). Note the loss of hydration demonstrated at L3-4 and L4-5.

MRI of the lumbar spine. Sagittal T2 image showing DDD at L5-S1. Note the loss of white signal (dehydration), loss of disc height, and inflammatory endplate changes (orange arrow pointing to white signal in L5 vertebral body).

Apparent diffusion coefficient

T1-weighted, T2-weighted and diffusion weighted (DWI) MR images of 100 consecutive patients admitted to the spinal surgery service were assessed. ADC maps were generated from DWI images using Osyrix software. The ADC values and characteristic ADC maps were assessed in the regions of interest over the different pathological entities of the lumbar spine. RESULTS: The study included 452 lumbar vertebral segments available for analysis of ADCs. Characteristic ADC map features were identified for protrusion, extrusion and sequester types of lumbar disk herniations, spondylolisthesis, reactive Modic endplate changes, Pfirrmann grades of IVD degeneration, and compromised spinal nerves. Compromised nerve roots had significantly higher mean ADC values than adjacent ($p < 0.001$), contralateral ($p < 0.001$) or adjacent contralateral ($p < 0.001$) nerve roots. Compared to the normal bone marrow, Modic I changes showed higher ADC values ($p = 0.01$) and Modic 2 changes showed lower ADC values ($p = 0.02$) respectively. ADC values correlated with the Pfirrmann grading, however differed from herniated and non-herniated disks of the matched Pfirrmann 3 and 4 grades. CONCLUSION: Quantitative and qualitative evaluation of ADC mapping may provide additional useful information regarding the fluid dynamics of the degenerated spine and may complement standard MRI imaging protocol for the comprehensive assessment of surgical patients with lumbar spine pathology. ADC maps were advantageous in differentiating reactive bone marrow changes, and more precise assessment of the disk degeneration state. ADC mapping of compressed nerve roots showed promise but requires further investigation on a larger cohort of patients [6].

Treatment

Lumbar intervertebral disc disease treatment.

1)
Modic MT, Masaryk TJ, Ross JS, et al. Imaging of degenerative disk disease. Radiology 1988;168:177–86.
2)
Pearce RH, Thompson JP, Bebault GM, et al. Magnetic resonance imaging reflects the chemical changes of aging degeneration in the human intervertebral disk. J Rheumatol Suppl 1991;27:42–3.
3)
Sether LA, Yu S, Haughton VM, et al. Intervertebral disk: normal age-related changes in MR signal intensity. Radiology 1990;177:385–8.
4)
Pfirrmann CW, Metzdorf A, Zanetti M, Hodler J, Boos N. Magnetic resonance classification of lumbar intervertebral disc degeneration. Spine (Phila Pa 1976). 2001 Sep 1;26(17):1873-8. PubMed PMID: 11568697.
5)
Schneiderman G, Flannigan B, Kingston S, Thomas J, Dillin WH, Watkins RG. Magnetic resonance imaging in the diagnosis of disc degeneration: correlation with discography. Spine (Phila Pa 1976). 1987 Apr;12(3):276-81. PubMed PMID: 2954224.
6)
Belykh E, Kalinin AA, Patel AA, Miller EJ, Bohl MA, Stepanov IA, Bardonova LA, Kerimbaev T, Asantsev AO, Giers MB, Preul MC, Byvaltsev VA. Apparent diffusion coefficient maps in the assessment of surgical patients with lumbar spine degeneration. PLoS One. 2017 Aug 28;12(8):e0183697. doi: 10.1371/journal.pone.0183697. eCollection 2017. PubMed PMID: 28846710.