

Radiology of the degenerative lumbar spine

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The radiological modalities for evaluation of low-back pain are: plain films, myelography, CT and MRI—each with its own advantages and disadvantages. In special cases, discography and diagnostic nerve root block can be undertaken. The choice and combination of modalities are related to several factors, such as availability of the equipment, cost and experience of the radiologist with the method. Furthermore, the situation is not static since the rapid spread, technical development and improved image quality of MRI will influence the choice in the nearby future.

Plain films

Although plain films do not give information about the soft tissue, each evaluation should start with this modality which gives a good over-view and shows anomalies, which are important for determination of level for surgery. Plain films also show degree of spondylosis, scoliosis and different dislocations, which guides the choice of modality for further soft tissue evaluation.

Myelography

Myelography has been used for many decades for evaluation of low-back pain and most radiologists are familiar with the method. The advantages of the method is that it gives good over-view. It shows intradural morphology with a very high spatial resolution. Furthermore, it has a capability of showing spinal block and allows provocation, which is of special importance in patients with spinal stenosis. In patients with intradural cyst formation and inflammatory adhesions, myelography is usually superior to CT and also to MR in the majority of cases. The disadvantages of myelography are that the method is invasive and that the area beyond the root sleeve is not visualized. When there is a free choice of modality in well-equipped centers, myelography is nowadays rarely used and should only be used in selected patients.

Computed tomography (CT)

Almost every hospital in the western world is nowadays equipped with a CT-scanner and radiologists of today have considerable experience in diagnosis of lumbar disease with this modality. CT is very valuable for evaluation of low-back pain for many reasons: the method is non-invasive, it is quick, it gives an excellent visualization of the bone in the axial projection and it shows the root canals and paraspinal area. It is usually easy to make a diagnosis of disc herniation, as well as bony elements narrowing the spinal canal, recesses and/or root canals. CT is therefore especially valuable for diagnosis of the different components of spinal stenosis. The draw-backs are that for practical reasons only a limited number of disc levels are routinely covered at most institutions, and only axial direct views can be obtained. Other projections than the axial view can be obtained by using thin slices and reformation. However, if a large area is to be visualized, there will be a significant irradiation to the patient. Another, and probably more important draw-back is that the content of the dural sac is not visualized, unless contrast has been injected into the subarachnoid space, and therefore an intradural tumor might be missed.

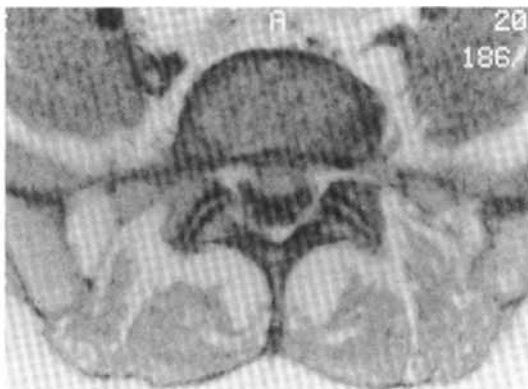
Magnetic resonance imaging (MRI)

MRI has been available already for more than ten years, but early images were of poor quality. There is a dramatic technical development still going on in this field, and the quality is steadily improving. Furthermore, MRI is now rapidly becoming more available also in general hospitals and the modality must therefore be evaluated against the other ones in the evaluation of low-back pain. The advantages of the method are that it is non-invasive, it gives a good over-view from the sacrum to the conus, all projections can be obtained, and the content of the dural sac, root canals and paraspinal area is visualized. It also provides good information about the bone marrow. Cortical bone is not as well visualized as with CT, but with improving quality this difference has been diminished. Another

Figure 1. Huge L5/S1 disc herniation. The advantage of MRI compared to CT is that MRI does not only show the disk herniation but also the complete lumbar spine and the intradural content including the conus, which in this case is normal.



CT



MR T1-weighted image in axial projection.



Lateral T1-weighted image shows the disc herniation at L5-S1 level.

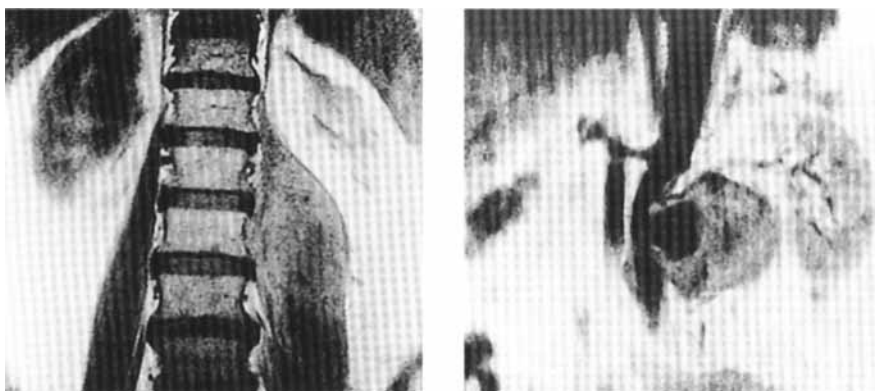


T2-weighted image. The demarcation and condition of the discs are better visualized than on the T1-weighted image.

draw-back of the method is that it is rather time-consuming, but this is changing due to technical development allowing high resolution examinations in a few minutes. Several investigations have shown that MRI provides equal or better information than myelography or CT in the diagnosis of degenerative disease in the lumbar spine (1-4). With modern MR-scanners this will probably shift further in favour of MRI. A standard evaluation of the lumbar spine should include T1-weighted sagittal images covering the area from the conus down to the sacrum, from neural foramen to

neural foramen. Axial views should be obtained at the levels of interest. T2-weighted images with standard spin-echo-technique are time-consuming and usually not required but can be helpful when the disc is difficult to delineate and when a more thorough evaluation of the disc content is necessary, as for instance in a suspected infection. With new technique, T2-weighted images can be obtained in a much shorter time, and this technique might be the standard for evaluation in the near future. In Figure 1, a routine examination of the lumbar spine with MRI is presented. The specific-

Figure 2. Illustration of specificity of MRI.



Patient with severe pain thought to be caused by disc sequester. MRI, however, shows a normal spinal canal, but instead discloses an aneurysm of the aorta, which has ruptured into the psoas muscle.

ity of MRI is high since not only pathology in the spinal canal is disclosed, but also pathology in adjacent organs, such as the aorta, which might mimic disease originating in the spine (Figure 2). MRI is therefore superior to other methods, especially in cases with unclear symptoms. However, in patients with typical history and location of the symptoms to one level and one side, CT is usually sufficient for diagnosis. The following strategy for evaluation of patients with low-back pain and sciatica is suggested: Routine patient: 1) plain films, 2) MRI. Patient with advanced spinal stenosis or severe scoliosis: 1) plain films, 2) myelography, 3) CT at selected levels, after myelography.

Discography

Discography is necessary in the evaluation of patients intended for chemonucleolysis and might be helpful in the evaluation before percutaneous discectomy. The method has also been used for evaluation in patients with uncertain findings and in selecting proper level in cases with multiple pathology (5). However, there are different opinions on the value of the method in this aspect. Some authors have tried to correlate the induced pain with the therapeutical result. In a recent study with a large material, the value of the method in this aspect was found to be low (6).

Diagnostic lumbar nerve root block

Another method for evaluation in patients with a normal finding on MR, CT or myelography, or multiple pathological levels, is diagnostic nerve root block. In this method, a small amount of carbocain is injected in close relation to the nerve under investigation. The neurological state before and after nerve-block is care-

fully recorded. The method is easy to perform and has been shown to be of value in selection of level and in the evaluation of patients with uncertain findings (7).

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