



How to image patients with spine pain



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ABSTRACT

Different radiological methods play an important role in the work-up of patients complaining of spine pain. Depending on the symptoms and the suspected underlying etiology different methods are selected. In the following presentation we briefly present the different radiological and magnetic resonance tomography methods that are at hand, give some guidance in which method to use, and present the typical imaging findings in some of the most common conditions that presents with spine pain.

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1. Introduction

Different radiological methods play an important role in the work-up of patients complaining of spine pain. The causes for spine pain vary including for example degenerative changes, spinal stenosis, disk herniation, synovial cysts, traumatic injuries, bone lesions secondary to metastatic disease or primary bone tumors that might cause pain and postsurgical treatment failure with remaining pain. Depending on the symptoms and the suspected underlying etiology different methods are preferred. In general computer tomography (CT) is the method preferred when evaluating the bone structures of the spine while MRI of the spine are the method of choice for evaluation of the spinal cord, ligaments and lesions in the spinal canal and for demonstration of widespread degenerative changes in the spine. Several interventional procedures are also performed under fluoroscopic guidance. In the following presentation we briefly present the different radiological and magnetic resonance tomography methods that are at hand, give some guidance in which method to use, and present the typical imaging findings in some of the most common conditions that presents with spine pain.

2. Radiological imaging methods

2.1. Plain film

Conventional radiographs of the spine have a very limited role in the work-up of patients with back pain. On the other hand, plain films might still have a value to evaluate the bony structures of the spine in combination with CT or MRI of the spine and fluoroscopic guidance are often needed when performing some interventional spine procedures such as kyphoplasty and vertebroplasty. Fluoroscopic guidance can also be used for injection of steroids and local anesthesia in foramina and facet joint in patients with spinal pain conditions.

2.2. Computed tomography (CT)

When assessing the bony structures of the spine, CT is the examination of choice. The choice of imaging parameters determines the image quality and the radiation dose. Overall the image quality and the diagnostic performance depend on the choice of imaging parameters and also of the post-processing such as reconstruction algorithm and reformatting parameters. High kV and mAs settings, thin collimation, and low pitch result in the best image quality. In general, thin slices with reconstruction in soft tissue- and bone algorithms should be performed, followed by 3D reformatting in sagittal, coronal, and axial planes [1]. In trauma patients the multi-trauma protocols is an established imaging protocol today. To reduce the high radiation dose to the patient there is a rapid increase of different so-called “low dose protocols” by improvements of the CT scanners and development of dose modulation- and new reconstruction techniques that decrease the radiation dose to the patient without sacrificing image quality.

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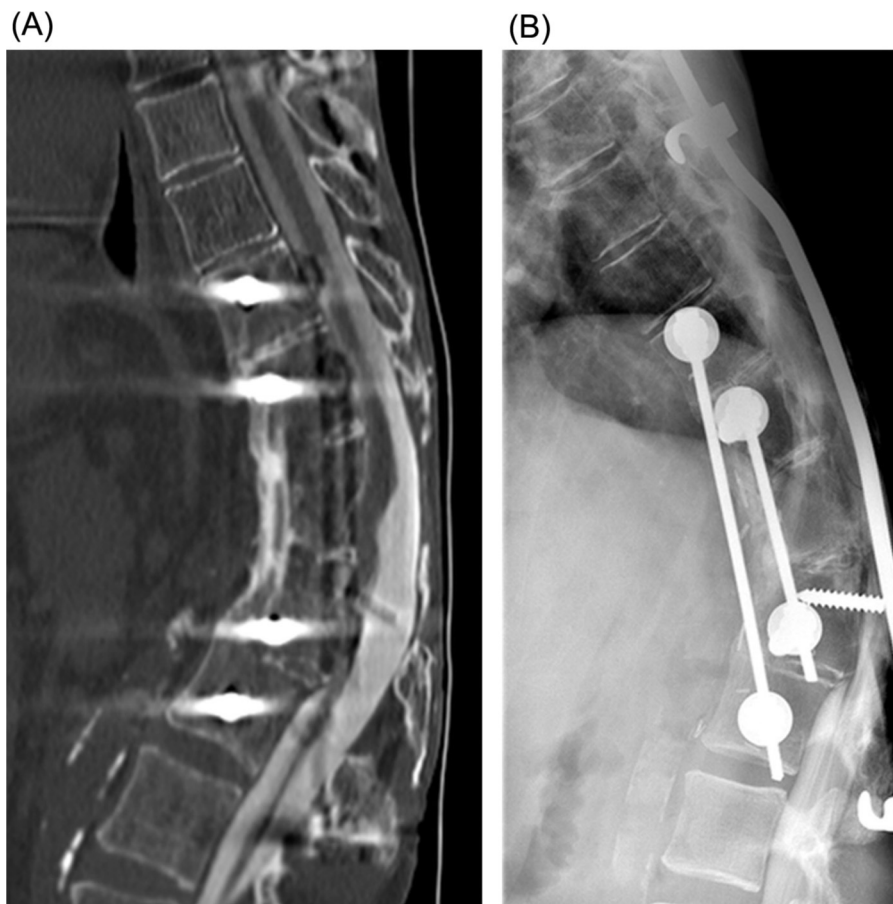


Fig. 1. (A and B) CT-myelogram of the thoracic spine: CT-myelogram performed in 55 year old female with continuous thoracic pain after a resection of thoracic lesion. Despite the hardware causes some artifacts the kinking of the thoracic cord can be well seen on the CT-myelogram (A) compared to the fluoroscopic image (B) obtained after the injection of contrast media.

2.3. Myelography and myelo-CT

Myelography (perimyelography) is an old established technique. Even if not used as frequent anymore due to MRI it is still a valuable method for assessing nerve root compression in the lateral recess and neural foramina [2], for assessing spinal canal stenosis, and allows for dynamic imaging sequences, including positional changes of the patient and thereby provides valuable diagnostic information beyond the limits of conventional MRI. In addition, CT myelography is very useful in the evaluation of postoperative spine, with fewer artifacts related to surgical hardware than MR imaging (Fig. 1). Furthermore, myelography or myelo-CT is the only method to evaluate patients in which MR imaging is not possible for safety reasons (e.g. pacemaker, metallic objects, etc.), in patients with severe kyphoscoliosis. A recent study has also shown that myelography combined with myelo-CT is “more reliable and reproducible than MRI” when deciding the level on which decompressive lumbar surgery should be performed [3] and better evaluate the degree of the spinal stenosis [4,5].

2.4. Magnetic resonance tomography (MRT)

Magnetic resonance imaging is “the method of choice” to examine the intervertebral discs, ligaments, spinal cord, spinal canal content and is also valuable in evaluation of the paravertebral soft tissue. Standard morphological MRI sequences for the evaluation of the spine include sagittal and axial T1- and T2-weighted images, sagittal STIR (short TI inversion recovery) – a sequence that is less specific but even more sensitive to signal abnormalities in

the vertebral bodies than T2-weighted images, T1-weighted sagittal and axial images after contrast administration are needed when the clinical question is spinal tumor, infectious, demyelinating or inflammatory disease and in post-surgical patients, especially, if they are evaluated for recurrent disk herniation versus scar tissue. More recent new imaging techniques like diffusion weighted imaging (DWI) and perfusion (PWI) have been suggested to be helpful in detection and differentiation of benign from pathological vertebral body compression fractures [6–9]. In patients with pain secondary to suspected vascular lesions such as AVM or fistula MR angiography (MRA) of the spine might be valuable. Reports on the reliability of findings on lumbar spine MR imaging show overall good inter- and intraobserver agreement in rating disk degeneration, and good intraobserver agreement in rating spondylolisthesis, “Modic changes”, facet arthropathy but only moderate interobserver agreement in rating spondylolisthesis, “Modic changes”, facet arthropathy [10,11]. Other studies demonstrated good intraobserver agreement in assessing spinal stenosis but only moderate agreement in assessing foraminal stenosis and nerve root impingement [12].

3. Degenerative spine disease

Degenerative spine changes can cause both pain and motor and sensibility disturbances depending on type and severity. General degenerative changes such as reduced height of the intervertebral space, osteophytes, sclerosis, Schmorl’s nodes, endplate shape alterations and calcifications, facet joint disease, and narrowing of

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