



Post-therapeutic imaging findings



Saverio Pollice^{a,*}, Mario Muto^{b,1}, Tommaso Scarabino^{a,2}

^a Department of Radiology and Neuroradiology, "L. Bonomo Hospital", 76123 Andria, BT, Italy

^b Department of Neuroradiology, "Cardarelli Hospital", Naples, Italy

ARTICLE INFO

Article history:

Received 8 March 2014

Received in revised form 18 June 2014

Accepted 19 June 2014

Keywords:

Spine
Surgery
Imaging
MR
CT
XR

ABSTRACT

Any surgical approach modifies the normal anatomical and functional arrangement of the segmental spine which is aimed, therefore image interpretation cannot ignore a correct set of knowledge in the field of anatomy, pathophysiology, drug compliance, interventional radiology and surgery.

Neuroradiological imaging has an important role before surgery to direct the surgeon or interventional radiologist during the operation, both in post-surgery, where imaging examination can rightly evaluate properties and effects of the treatment and can detect potential complications as infections, abscess, bleeding, exuberant scar, mobilization and rupture of devices.

The available methods of imaging are the X-rays (XR) made at least in two projections, Computed Tomography (CT) with MPR (multiplanar) and VR (volume rendering) reconstruction, and Magnetic Resonance (MR), often performed before and after contrast media injection.

Imaging assessment of spine after surgery is complex and depends upon several factors, including surgical procedures and disease for which it was performed; biomechanical of the underlying cortical and cancellous bone findings; conditions of muscles, intervertebral disk and ligaments; time since surgery procedures; duration and nature of the post-surgical syndrome.

Depending upon several factors, one or a combination of complementary imaging modalities (X-rays, Computed Tomography, Magnetic Resonance) may be required to evaluate effectiveness of the treatment; to demonstrate any clinically relevant abnormality at the treated region and adjacent structures (complications such as inflammation, abscesses, bleeding and misplacement of the device); to assist the interventional radiologist or surgeon in deciding if is necessary intervene again, in which nature and in which vertebral level(s).

© 2014 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Imaging has an important role before surgery to direct the surgeon or interventional radiologist during the operation, both in post-surgery, where imaging examination can rightly evaluate properties and effects of the treatment.

The available methods of imaging are the X-rays (XR), Computed Tomography (CT) and Magnetic Resonance (MR) to perform often before and after contrast media injection. Modality and protocol used to image the postoperative spine depend on several factors like district, clinical question and type of treated disease [1,2].

2. XR

XR is first step in diagnostic imaging because is non-invasive, low cost, wide availability, easy to perform and evaluate. It is effective to check accurate spinal alignment and spine stability without synthetic means artifacts. It is performed to assess bone component, exact position of the devices (Figs. 1–3) or distribution of used materials (such as cement post-vertebroplasty) (Fig. 4) [3]. XR have a few limitations: mostly it cannot evaluate soft tissue (neural elements, recurrent disk herniations or scar tissue).

X-rays are performed in the upright position in antero-posterior, lateral and oblique-lateral projection and sometimes is associated with a dynamic study in flexion–extension, if required.

3. CT

CT is considered the gold standard in the assessment bone detail, osseous formation and implant position (Fig. 2). It has an important role in postoperative assessment of fusion surgery [4]. CT is useful

* Corresponding author. Tel.: +39 0883299229; fax: +39 0883299229.

E-mail addresses: saveriopollice@hotmail.it (S. Pollice), mutomar@tiscali.it (M. Muto), tscarabino@hotmail.com (T. Scarabino).

¹ Tel.: +39 0817471111; fax: +39 0817471111.

² Tel.: +39 0883299220; fax: +39 0883299220.

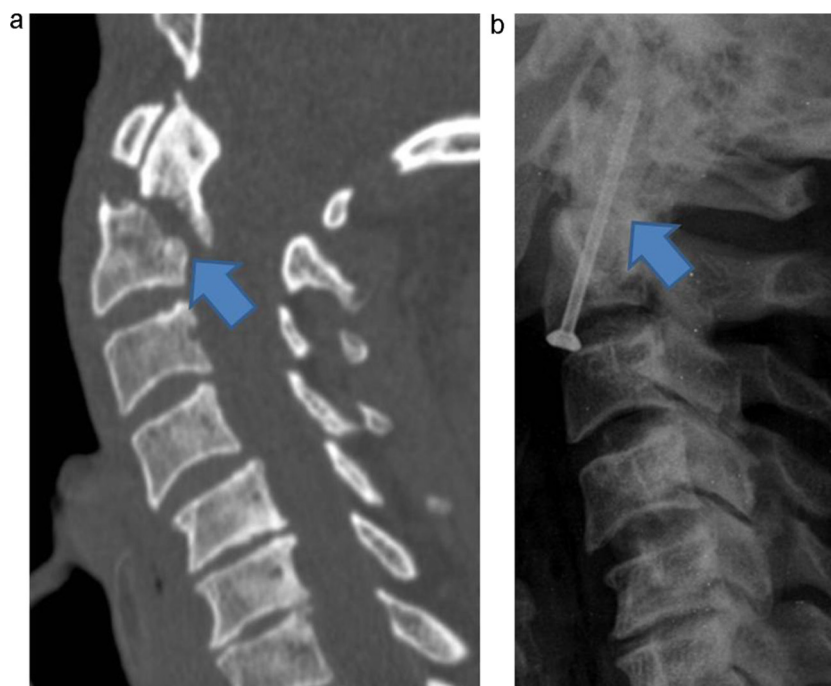


Fig. 1. (A) CT preoperative control in post-traumatic type 2 odontoid broken fracture. (B) XR post-operative control: screw positioning with the realignment of the bone fragments.

for detecting and grading spinal and/or foraminal stenosis and in follow-up after surgery.

You should use multi-layer scanner, with a high number of detectors [16,30,64]. Acquisitions are made on axial plane with thickness preferably less than 1 mm (0.625). Afterwards you can make at the workstation *multiplanar* reconstructions (MPR) in sagittal and coronal plane and volume rendering (VR), on the basis of our utility and of the neurosurgeon.

Intraoperative 3D scans after pedicle screw positioning allow to avoid false placement and primary neurovascular damages. Immediate correction of misplaced screws decreases the secondary revision rate and prevents secondary neurovascular problems, instability or dislocation of the fixator [6].

Quality of imaging can be affected by the presence of artifacts due to metallic devices. To reduce these disadvantages are currently used new materials (titanium), special projections (perpendicular to the orthopedic implant), appropriate imaging algorithms (high peak voltage, high tube current, narrow collimation) and reconstruction (use of thick sections, lower kernel values) [7].

4. MR

MR is the gold standard in the evaluation of post-surgical procedures and in the assessment of patients with persisting or recurrence of pain with characteristics similar or different than previous surgery [8].

MR imaging is much more accurate respect to CT in the evaluation of soft tissue enhancement (allowing easier discrimination between herniation versus epidural fibrosis) [9], bone marrow edema and in documenting and monitoring complications such as soft tissue and joint inflammation, hemorrhage, spinal stenosis (Fig. 5).

Artifacts by synthesis material (metallic implant), in the past often present, are currently less evident thanks to new materials (titanium) and to the use of particular sequences less sensitive to magnetic susceptibility (Fast SE) [10–13].

Basic study includes sagittal and axial images T1 and T2 weighted (FSE), shortly affected by artifacts caused by metal or any other surgical material used [14,15]; in the presence of synthesis means (clips, prostheses, stabilizers), SE and GE sequences should be avoided because particularly sensitive to magnetic susceptibility (Fig. 6). Fat saturation (FAT SAT) TSE T2 (or STIR) best emphasize pathology within spinal or epidural adipose tissue [16]. Moreover it is essential, especially in the case of inflammation the use of the contrast agent in TSE T1 Fat Sat [5,17]. FAT SAT TSE T2 and TSE T1 after contrast medium increases the sensitivity and emphasize the characteristic “edema pattern” index of bone bruising, inflammation or cellular infiltration [18,19].

Advanced methods of MR imaging, such as diffusion and perfusion are recently developed in the study of the column with not yet definitive results [20–22].

Open MRI systems, low and medium intensity magnetic field allows a study even in the upright position especially in order to assess the amplitude of the spinal canal in a more physiological state or by using axial loading either by flexion–extension [23–26].

It was shown that the space within the canal is posture dependent because there is a significant reduction of spine cross-sectional area during axial loading resulting in increased diagnostic specificity of the spinal stenosis [27]. It is possible to document also spondylolisthesis and radicular conflicts, not detectable with a static study.

5. Post-therapeutic imaging

Causes of surgery and interventional radiology on spine are represented largely by disk herniation (most commonly lumbar), and stenosis of the vertebral canal, vertebral instability, vertebral fractures.

The therapeutic treatment of spinal pathology initially include conservative therapy and in case of failure a number of surgical procedures and/or interventional radiology approaches, with varying degrees of invasiveness, such as discectomy, vertebroplasty, AT, surgical stabilization (traditional and dynamic) [1,2].

Download English Version:

<https://daneshyari.com/en/article/4225404>

Download Persian Version:

<https://daneshyari.com/article/4225404>

[Daneshyari.com](https://daneshyari.com)