The role of magnetic resonance imaging in the diagnosis of postoperative spondylodisctis

Tatjana Stošić-Opinčal*, Vesna Perić*, Danica Grujičić*D, Svetlana Gavrilović*, Ivana Golubić*

Clinical Center of Serbia, *Center of Magnetic Resonance, DInstitute of Oncology and Radiology, Belgrade; Institute of Neurosurgery, Belgrade

Background. Spondylodisctis, discitis associated with vertebral osteomyelitis may follow disc-removal surgery. A targeted successful treatment of spinal infections requires clinical and laboratory data that are completed by the contribution of imaging procedures. Neuroimaging provides precise information on correct topography, localization, propagation, and differential diagnosis of spinal infectious lesions. The aim of this study was to present magnetic resonance imaging (MRI) findings in patients with postoperative spondylodisctis.

Methods. MRI was performed in 6 patients aged 29–50, with clinically suspected postoperative spondylodisctis. Initial examination was performed 3–8 weeks after surgery and 3, 6, or 12 months after the treatment by antibiotics. Patients underwent MRI on a 1T imaging unit (Siemens, Magnetom-Impact), including sagittal T1W and T2W images and axial T1W images before and after the administration of gadolinium contrast medium. Results. MRI findings included: significantly decreased signal intensity with the loss of distinction between vertebral body and intervertebral disc space on T1W, increased signal intensity in the adjacent vertebral body and end-plates on T2W, contrast enhancement of vertebral body and disc space and paravertebral soft tissue changes. Follow-up examinations performed 3, 6, or 12 months after the treatment showed less abnormal signal intensities on both T1- and T2-weighted images. Conclusion. Postoperative spondylodisctis is a rare but severe complication of lumbar disc surgery. Since conventional imaging techniques are not reliable for detecting spondylodisctis in its early stages, MRI is of great significance in the diagnosis of postoperative spondylodisctis.

Key words: discitis; postoperative complications; diagnosis; magnetic resonance imaging.

Introduction

Postoperative spondylodisctis is a rare but severe complication of lumbar disc surgery, which occurs in 0.1–3% (1, 2) of operated patients. The infection is the result of intraoperative contamination rather than hematogenous spread, and, theoretically could be prevented by prophylactic administration of antibiotics. As in spontaneous discitis, most commonly isolated organism is Staphylococcus aureus, but Staphylococcus epidermidis and Streptococcus species should also be considered.

Symptoms usually occur several days to several weeks after surgery (3, 4), involving pain resistant to analgesia and bed rest, without neurological abnormality, limited movement, and localized tenderness. Other symptoms include malaise, fever, and the development of neurological signs, which usually indicate the spread of infection to the epidural space. However, superficial signs of infection are rare, seen in only 10% of cases (5).

Laboratory findings are usually within the normal range, except the elevated erythrocyte sedimentation rate and positive C-reactive protein.

A targeted successful treatment of spinal infectious diseases requires clinical and laboratory data that are completed by the contribution of imaging procedures. Prompt and accurate diagnosis of spinal infections requires a high
index of suspicion in at-risk patients, and the appropriate evaluation to identify the organism and determine the extent of the infection. Diagnostic procedure should include percutaneous needle biopsy and culture retrieved material. Neuroimaging provides essential information on the correct topography, accuracy, and differential diagnosis of spinal infectious lesions.

The treatment primarily includes antibiotic therapy and immobilization of the affected spinal segment. Surgical treatment may be appropriate in cases when either epidural propagation or spine instability is present or when the applied antibiotic therapy is unsuccessful (6).

Methods

This is a retrospective study of 6 patients with spondylodiscitis following lumbar discectomy during the period 2000–2002. The onset of symptoms ranged from 10 to 21 days after surgery (16 days average). Clinical features were similar in all the patients: localized low back pain, limited motion, elevated white blood cell count and sedimentation rate, and positive C-reactive protein, except in one patient with negative C-reactive protein. In 2 patients there were neurological signs of the disease (sciatica).

MR imaging was performed 1–6 weeks after the onset of symptoms (3 weeks average). MRI examination on 1T imaging unit (Siemens, Magnetom-Impact) included sagittal T1- (TR/TE[ms]:600/12) and T2- (TR/TE[ms]:4000/112) weighted images, and axial T1- (TR/TE[ms]:650/22.9) weighted images before and after the administration of gadolinium contrast medium.

Follow-up MRI examinations were done 3, 6, or 12 months after broad-spectrum antibiotic treatment during 6 weeks.

All MRI findings were reviewed independently, without the knowledge of other clinical data. Review criteria were: signal intensity of vertebral endplates and contrast enhancement; estimation of disc space signal intensities, disc structure and contrast enhancement; involvement of paravertebral soft tissue and contrast enhancement; epidural propagation and distinguishing between encapsulated purulent collections and chronic granulation tissue.

Results

MRI findings characteristic for spondylodiscitis were: vertebral bone marrow changes, hypointense on T1-weighted images, with indistinct border between vertebral body and disc space, and hyperintense on T2-weighted images, contrast enhancement of the intervertebral space and vertebral endplates seen in all the patients (Fig. 1), and paravertebral soft tissue involvement with moderately enhancing rim laterally and anteriorly (except in one patient) (Fig. 2). Epidural propagation was found in two patients: one was presented with encapsulated purulent collection and another with chronic granulation tissue (Fig. 3).

Follow-up MRI examinations were performed 3 and 12 months after the treatment of spondylodiscitis (in 2 patients), after 3 months (in 2 patients), and after 6 months (in
findings. Clinically, severe low back pain with or without sciatica occurs 7–28 days postoperatively (3). All the patients in our study were with recurrent low back pain, and two of them were with sciatica, as well.

Elevated erythrocyte sedimentation rate and C-reactive protein – the most consistent laboratory abnormalities seen in cases of discitis were found in 5 of 6 patients. C-reactive protein is regarded as much more reliable screening test for infectious complications after lumbar discectomy (7). Elevated white blood cell count occurred in 3 of 5 patients.

MRI remains the most sensitive and specific procedure for the diagnosis of postoperative spondylodiscitis (8–10), particularly in very early stages of the disorder when other investigations still yield negative results. In cases observed in the acute stage (clinical evolution between 7 and 20 days) (4), T1W imaging demonstrated remarkably decreased signal intensity with the loss of distinction between vertebral body and disc space. T2W images showed increased signals in both disk space and surrounding vertebral bodies. Contrast enhanced images had homogenous enhancement of vertebral body and disc space. These MRI findings were seen in all our patients, which is consistent with literature data (9, 11). Changes in signal intensity of vertebral-body bone marrow, consisting of decreased intensity on T1W and increased intensity on T2W of vertebral endplate, could also be seen in degenerative disc disease (Modic type 1) (3). Furthermore, the oper-

one patient there were no signs of infection. In all the patients the narrowing of the disc space was evident. Follow-up examination performed 6 or 12 months after the treatment showed no signs of infection. However, substantial changes like narrowing of the disc space and reactive bone sclerosis were obvious (Fig. 5).

Table 1. summarizes clinical and MRI findings, as well as the follow-up of 6 cases.

**Discussion**

The diagnosis of postoperative spondylodiscitis depends on a combination of clinical, laboratory, and imaging

---

Fig. 3 – Postoperative spondylodiscitis 8 weeks after surgery. A), B) Pre- and postgadolinium axial MR sections show postlaminctomy changes and epidural involvement.

Fig. 4 – MRI follow-up 3 months after the treatment. A), B) Sagittal T1- and T2-weighted images show less abnormal signal intensities. Narrowing of the disc space can be observed.

Fig. 5 – MRI follow-up 12 months after the treatment. A), B) Sagittal T1- and T2-weighted images show no signs of infection. Normal bone marrow signal intensities and narrowing of the disc space can be observed.
<table>
<thead>
<tr>
<th>Sex/age (years)</th>
<th>Onset of symptoms after surgery (days)</th>
<th>Clinical features and neurological signs</th>
<th>Delay to imaging (weeks)</th>
<th>MRI findings</th>
<th>Follow-up MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/29</td>
<td>10</td>
<td>Localized low back pain, limited motion, elevated sedimentation rate, positive C-reactive protein</td>
<td>2</td>
<td>Vertebral endplate changes, enhancement of the disc space, enhancing rim of paravertebral soft tissue</td>
<td>No signs of infection</td>
</tr>
<tr>
<td>M/44</td>
<td>15</td>
<td>Severe low back pain, elevated white blood cell count, elevated sedimentation rate, positive C-reactive protein</td>
<td>3</td>
<td>Vertebral endplate changes, enhancement of the disc space, enhancing rim of paravertebral soft tissue</td>
<td>Less abnormal</td>
</tr>
<tr>
<td>F/47</td>
<td>10</td>
<td>Pain exacerbated by motion, elevated white blood cell count,</td>
<td>1</td>
<td>Vertebral endplate changes, enhancement of the disc space</td>
<td>No signs of infection</td>
</tr>
<tr>
<td>M/49</td>
<td>14</td>
<td>Pain, fever, decreased motion, elevated white blood cell count, elevated sedimentation rate, sciatica</td>
<td>6</td>
<td>Vertebral endplate changes, enhancement of the disc space, enhancing rim of paravertebral soft tissue, epidural propagation</td>
<td>Less abnormal</td>
</tr>
<tr>
<td>M/50</td>
<td>21</td>
<td>Pain, fever, decreased motion, elevated white blood cell count, elevated sedimentation rate, sciatica</td>
<td>5</td>
<td>Vertebral endplate changes, enhancement of the disc space, enhancing rim of paravertebral soft tissue, epidural propagation</td>
<td>Less abnormal</td>
</tr>
<tr>
<td>M/33</td>
<td>14</td>
<td>Severe low back pain, elevated white blood cell count, elevated sedimentation rate, positive C-reactive protein</td>
<td>2</td>
<td>Vertebral endplate changes, enhancement of the disc space, enhancing rim of paravertebral soft tissue</td>
<td>No signs of infection</td>
</tr>
</tbody>
</table>

MRI always shows more or less extensive changes due to the surgical intervention itself and a normal postoperative aseptic inflammatory response. The absence of Modic type I changes has an important negative predictive value for spondylodiscitis. Contrast enhancing anterolateral paravertebral soft-tissue rim suggests spondylodiscitis. Only in one patient, who had negative serum C-reactive protein, no paravertebral masses were found, which could be suggestive of aseptic spondylodiscitis (12).

All the patients underwent follow-up examination after the initial examination (2 of them underwent two follow-up examinations 3 and 12 months after the antibiotic treatment). Various signal changes in the vertebral body were recognized. The longer follow-up period, the lesser abnormal signal intensities became on both T1- and T2-weighted images. However, substantial changes like the narrowing of the disc space and reactive bone sclerosis were prominent.

The obtained results and literature data designated MRI as the most sensitive technique for the diagnosis of postoperative spondylodiscitis and the procedure of choice in the evaluation of patients with suspected spine infection.

**REFERENCES**


The paper was received on Juny 5, 2003.

A p s t r a k t


ULOGA SNIMANJA MAGNETNOM REZONANCOM U DIJAGNOZI POSTOPERATIVNOG SPONDILODISCITISA


K l j u č n e r e č i: discitis; postoperativne komplikacije; dijagnoza; magnetna rezonanca, snimanje.

Correspondence to: Tatjana Stošić-Opinčal, Clinical Center of Serbia, Center of Magnetic Resonance; Pasterova 2, 11 000 Belgrade, Serbia and Montenegro. Tel.: +381 11 36 15 554, E-mail: tanja.stosic@kcs.ac.yu