MR diagnosis and diagnostic yield of CT-guided biopsy for infectious spondylodiscitis in 97 consecutive patients

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Aims and objectives

Spinal infections comprise vertebral osteomyelitis, spondylitis, and discitis. Pyogenic, granulomatose and parasitic forms of spinal infections can be distinguished etiologically. Spondylodiscitis is a rare inflammatory disease of the bony spine column, the intervertebral discs and or the ligaments of the extradural spine [1]. Hematogenous spread of infection is the most common route, followed by direct inoculation after spine surgery. Spread of the infection into the subdural or epidural space can lead to abscess formation and potentially high morbidity and mortality if undiagnosed and untreated [2; 3]. Appropriate and fast diagnosis is made with imaging, especially MRI. Microbiological studies have to reveal the causative organism and help establishing the correct diagnosis. [1; 4; 5]

The aim of our study was to evaluate the role of CT-guided biopsy in the diagnosis of spondylodiscitis.

Methods and materials

Our RIS database was reviewed for "spondylodiscitis". Patients records were reviewed for ICD-10 (2014) codes M46.3 (Infection of intervertebral disc (pyogenic)) or M46.4 (Discitis, unspecified) or M46.8 (Other specified inflammatory spondylopathies).

Retrospectively, the patient records diagnosed with spondylodiscitis between January 2007 and April 2014 were evaluated for clinical symptoms, laboratory markers of inflammation (C-reactive protein (CRP), interleukin &IL- 6 and leukocyte count), radiologic diagnosis (X-ray imaging and MRI (Philips Achieva 1.5T, Best, Netherlands with either spine coil or body coil with intravenous contrast medium (CM) gadoterate meglumin, (Dotarem®, Guerbet, France), results of microbiological testing and subsequent therapies (antibiotic treatment either as conservative therapy or combined with surgical treatment).

MR Diagnosis was based on findings [1]:

[1; 4; 5]
1. Disc Space: T2 hyperintensity, CM enhancement, height loss
2. Adjacent vertebral bodies: endplate destruction, T1 hypo-, T2 hyperintensity, CM enhancement
3. Paraspinal soft tissue: ill-defined inflammation, swelling, abscess
4. Epidural space: reactive enhancement/ venous plexus distension, phlegmon, abscess

CT guided biopsy under CT fluoroscopic guidance was performed between 2007 and 2012 on a Philips Brilliance 64 CT scanner (Philips, Best, Netherlands) and after 2012 on an Optima 660 CT scanner (General Electrics, Milwaukee, USA). When a paravertebral abscess or a large fluid accumulation was detected fine needle aspiration (FNA). In the majority of patients transpedicular large core bone biopsy was performed (11 French - 18 French).

Results

97 patients (47 female and 50 male patients with a mean age of 65 years (age 30 to 91 years) were diagnosed with spondylodiscitis between January 2007 and April 2014 were retrieved from patient records and radiological databases.

All patients were referred to magnetic resonance imaging based on clinical presentation and laboratory findings. All patients suffered from back pain, 27 of 97 patients (28%) initially presented with neurological deficits ranging from decreased sensation to complete paresis.

In all patients, laboratory markers of inflammation were determined. In 93 of 97 patients increased markers of inflammation (CRP, IL - 6 and leukocytes) were found.

All patients underwent MRI examination of the affected spine section.

MR diagnosis of spondylodiscitis was made in 94 patients, the lumbar spine was involved in the majority (66%) of cases (in 62 of 94 patients - Table 1).
33 patients were transferred directly to the operating room for surgical drainage of abscesses and/or spine decompression, in 5 patients surgical drainage of abscesses and/or spine decompression was performed after CT guided biopsy.

Spondylodiscitis was confirmed by surgery in all of the 38 patients.

CT guided biopsy (Figures 1,2):

CT-guided biopsy was performed in 62 patients.

In 42 patients Large Core biopsy (11G - 18G) was performed in 20 patients fine needle aspiration (+ drainage of paravertebral abscesses in 6/ 20 patients) was performed.

There were no reported adverse events after CT guided biopsy.

Microbiological Examinations:

In 15 of 28 patients (54%) microbiological examination of blood cultures demonstrated a pathogen. The most common pathogen was staphylococcus aureus (in 8 of 15 patients) and staphylococcus epidermidis in 2 patients. 13 of 28 blood cultures (46%) were negative.

In 31 of 62 biopsies (50%) microbiological pathogens were found after microbiological examination (Table 2) with staphylococcus aureus and staphylococcus epidermidis being the most common (16 of 31). Infections were monobacterial in 27 patients and polybacterial in 4 patients.

In 31 biopsies no microbiological pathogens were found. In 7 of 31 patients (23%) antibiotic therapy had been started or performed prior to biopsy.

Large core biopsy detected pathogens in 47% of the biopsies performed, FNA had a yield of 62%, when FNA was combined with drainage of an abscess the yield was 80%.
Overall diagnosis of spondylodiscitis was confirmed by histopathology and microbiology in 61 of 97 patients.

Images for this section:

**Fig. 1:** 64 year old female patient with severe pain in the neck and right arm and elevated markers of inflammation. MR confirmed spondylodiscitis at the level of C5/C6 with marked prevertebral inflammation. Fine needle aspiration of the prevertebral inflammation demonstrated staphylococcus aureus as the causative pathogen.
Fig. 2: 33 year old male patient with severe back pain and elevated markers of inflammation. MRIs confirmed spondyloisctis and progressive epidural abscess formation. Large core biopsy didn’t demonstrated proprionisbacterium acnes as the causative pathogen. The patient was referred to surgery.

<table>
<thead>
<tr>
<th>Diseased spine sections were demonstrated by MRI in the</th>
<th>n (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cervical spine only</td>
<td>12</td>
</tr>
<tr>
<td>thoracic spine only</td>
<td>19</td>
</tr>
<tr>
<td>lumbar spine only</td>
<td>59</td>
</tr>
<tr>
<td>cervical &amp; thoracic spine combined</td>
<td>1</td>
</tr>
<tr>
<td>thoracic &amp; lumbar spine combined</td>
<td>1</td>
</tr>
<tr>
<td>cervical &amp; lumbar spine combined</td>
<td>2</td>
</tr>
</tbody>
</table>
**Table 1:** Location distribution of spondylodiscitis demonstrated by MRI

<table>
<thead>
<tr>
<th>Pathogens found after microbiological work-up of CT guided biopsies</th>
<th>n (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>staphylococcus aureus</td>
<td>8</td>
</tr>
<tr>
<td>staphylococcus epidermidis</td>
<td>8</td>
</tr>
<tr>
<td>propionobacterium acnes</td>
<td>4</td>
</tr>
<tr>
<td>streptococcus species</td>
<td>3</td>
</tr>
<tr>
<td>Others: <em>viridans streptococi</em>, <em>mycobacterium tuberculosis</em>,</td>
<td>10</td>
</tr>
<tr>
<td><em>coagulase neg. staphylococcus</em>, <em>staphylococcus hominis</em>,</td>
<td></td>
</tr>
<tr>
<td><em>enterococcus spp.</em>, <em>aerococcus urinae</em>, <em>prevotella intermedia</em>,</td>
<td></td>
</tr>
<tr>
<td><em>saccharopolyspora spp.</em>, <em>enterobacter cloacae</em>, <em>pseudomonas micro micros</em></td>
<td></td>
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</tbody>
</table>

**Table 2:** Pathogens found after microbiological examination of CT guided biopsies
Conclusion

Magnetic resonance imaging is an important tool for rapid diagnosis of spondylodiscitis and its complications.

MRI scan of the entire spine is the method of choice to detect remote complications and multi-locular involvement. Neurological presentation and MRI diagnosis findings enable the triage of patients to surgery (abscess drainage and spinal decompression) or to conservative therapy.

Blood cultures are an important tool for non-invasive diagnosis of pathogens in suspected spondylodiscitis. Blood cultures should be performed prior to the start of antibiotic treatment.

In cases of MRI confirmed spondylodiscitis, a CT-guided bone biopsy is recommended to confirm diagnosis and pathogens for antibiograms and targeted antibiotic therapy. CT guided biopsy in suspected spondylodiscitis is an effective and safe procedure.

Antibiotic therapy against the most common pathogens (staphylococcus aureus, staphylococcus epidermidis…. ) has to begin immediately after completion of diagnostics. Histological diagnosis and microbiological confirmation of pathogens, when possible, is necessary before initiation of therapy; histological diagnosis may be helpful in cases where cultures are negative [6; 7].

Blood culture, MRI diagnosis and CT-guided biopsy are effective methods for timely and correct diagnosis of spondylodiscitis and its complications.

LIMITATIONS:

A limitation of our study is that it was retrospective. All patients diagnosed with spondylodiscitis were preselected by clinical presentation and laboratory findings. Also referral to MRI was based on clinical presentation and laboratory findings. This may have influenced our results.

There are still some cases with MRI proven spondylodiscitis but negative CT guided biopsy (microbiological examination). Overall the microbiological yield is not sufficiently
high for identification of pathogens in the majority of patients, also demonstrated by other studies [8; 9]. 23% of patients with negative biopsy had prior antibiotic therapy, which could have been an explanation for a negative CT guided biopsy [8].

**Personal information**

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**References**


