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SUMMARY

Master thesis by Eva Protas. Supervisors – Dr. Egidijus Eviltis. Lithuanian University of Health Sciences, Faculty of medicine, Department of Rheumatology, Kaunas

**Title of work.** Clinical and microbiological characteristics of septic spondylodiscitis.

**The aim and objectives.** The purpose of this study was to investigate the clinical characteristics and microbiological features and etiology of septic spondylodiscitis. In this study it was determine the most affected population, most prominent involved vertebral region, most common clinical sign of spondylodiscitis, most used imaging study modality, most common causative microorganism, and the correlation between the presence of neurological signs and the affected vertebral region.

**Materials and methods.** 51 medical history books of patients with the diagnosis of spondylodiscitis were analyzed.

**Results and conclusions.** Pyogenic SD affects males and females at equal ratio, and elderly are more likely to be affected with average age of 61-year-old, 52.9% of patients are >60 years old. Pyogenic SD may affect any region of the vertebral column, but the most prominent region was the lumbar vertebral region (78.4%). The main presenting symptom in most of the patients was a back pain, it was well localized to the level of the vertebral column which was involved (96%). To confirm the diagnosis of SD more than 1 imaging technique needed to be used. The most frequently used and the most accurate imaging modality for diagnosis is the MRI test. (80.4%) In those patients that the blood culture (27.4%) and urine culture (13.7%) was positive, the predominant bacterial agents in blood and urine were *Staphylococcus aureus* (50%) and *Escherichia coli* (56%), respectively. 33 patients were presented with neurological signs (64.7%), the most common neurological sign was radiating pain to the extremities (63.6%), patients with SD of thoracic or/and lumbar vertebral region complained more about numbness and weakness. Although 37 patients had indication to preform CT guided biopsy of the bone or the intervertebral disc, none of the patients undergo the procedure.

**Practical recommendations.** CT guided needle biopsy of the bone or intervertebral disc should be performed in patient whom the blood culture was not informative but with confirmed imaging study.

**Keywords.** Spondylodiscitis. Vertebral region. Clinical signs. Causative microorganism.
DĖL PRITARIMO TYRIMUI


Bioetikos centro vadovo pavaduotojas


doc. E. Peičius
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>Spondylodiscitis</td>
</tr>
<tr>
<td>CT</td>
<td>Computer Tomography</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
</tr>
<tr>
<td>CRP</td>
<td>C - Reactive Protein</td>
</tr>
<tr>
<td>ESR</td>
<td>Erythrocyte Sedimentation Rate</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>IE</td>
<td>Infective endocarditis</td>
</tr>
<tr>
<td>MRSA</td>
<td>methicillin-resistant S. aureus</td>
</tr>
<tr>
<td>PET</td>
<td>Personal Electronic Transactor</td>
</tr>
<tr>
<td>PMNs</td>
<td>Polymorphonuclear cells</td>
</tr>
</tbody>
</table>
INTRODUCTION

The term vertebral disks osteomyelitis, also known as spondylodiscitis, refer to a state of bacterial inflammation of the Osteoligamentous spine, which may spread to adjacent structures of the spinal canal and the surrounding soft tissue. (1)

The symptoms and the signs of spondylodiscitis may be nonspecific and insidious. Spondylodiscitis reported in diabetic and immunocompromised patients in higher rate, particularly among patients with malignancies which undergo anti-metabolite treatment and those receiving chronic steroid therapy or dialysis. Patients that underwent elective disc or other invasive spine surgery. IV drug abusers and patients with endocarditis are also well known risk factors. Advanced age is also well known predisposition risk factor, and usually is the only one which may be recognized in Spondylodiscitis patient. (2)

The diagnosis of spondylodiscitis can often be delayed several months and may initially be misdiagnosed and mismanaged. Spondylodiscitis is typically diagnosed in the setting of persistent back pain unresponsive to conservative measures and in cases of back pain and elevated inflammatory markers with or without fever. (3)

The accuracy of the diagnosis based on the clinical symptoms and signs combined with imaging findings. In many cases plain radiography and CT scan is performed before MRI which is often required for definitive diagnosis.

Identification of the causative pathogen is very important in the treatment; however, not in all cases the blood culture is positive, as such, bone biopsy by percutaneous needle biopsy is often required to determine the causative pathogen. (7)

The incidence has increased in the past two decades, despite advances in medical knowledge, imaging modalities and surgical interventions. The diagnosis of spondylodiscitis is still challenging since the initial clinical features and symptoms may be misleading and insidious. (6)

The study goal was to determine the most common clinical characteristics and microbiological etiology that could help to achieve more efficient and faster diagnosis and more efficient treatment.
AIM

To investigate the clinical characteristics and microbiological features and etiology of septic spondylodiscitis.

OBJECTIVES

1. To determine the most effective population.
2. To determine the most prominent involved vertebral region.
3. To determine the most common clinical sign of spondylodiscitis.
4. To determine the most used imaging study modality.
5. To determine the most common causative microorganism.
6. To determine the correlation between presence of neurological signs and the effected vertebral region.
LITRETURE REVIEW

Definition:

Septic spondylodiscitis is an infection of the vertebral endplates and intervertebral disks infection which predisposing patients toward variety of neurologic deficits, disabling pain, and in some instances even death. The paravertebral, epidural tissue and the posterior elements of the spine can also be involved in Septic spondylodiscitis. (10)

The terms vertebral osteomyelitis and discitis are often used interchangeably, and the diagnosis and management of the two entities are similar in most patients. The term pyogenic spondylitis refers to either vertebral osteomyelitis or discitis.

Epidemiology:

Septic SD is a rare, life threatening disease and in current days its incidence seems to be rising as a result of many factors; better medical treatment of patients with chronic diseases which decrease the concomitant illness and related mortality, and as such, improve and prolong life expectancy of such patients predisposing them to other diseases (i.e. Septic SD) ; rise in the prevalence of immunosuppressed patients and intravenous drug abusers; the increase in interventional surgeries involved the spinal cord.

Estimated incidence ranged from 1:40 000 populations per year to 1:250 000 populations per year. Septic SD mainly occurs in elderly persons; the average age of patients is ~60 years. Men to female ratio is approximately 2:1 respectively in most case series studies which were performed. (2,3,9,11,12)

Pathogenesis:

Bacteria can infect the vertebrae by three main routes:

1. **Hematogenous spread** – Is by far the most common cause of vertebral osteomyelitis of above mentioned pathogenesis. Adult vertebral bone is highly vascular with abounded marrow which receive high-volume of blood via vessels of the posterior spinal artery and as such, may predispose to high incidence of infection in cases of bacteremia (2,3). As person age, vertebral vessels progressively become tortuous and develop the characteristic "corkscrew" appearance which lead to slower blood flow and may predispose to bacterial hematogenous seeding. (3)

Normal bacterial flora of the human intestine, can lead to discitis due to close anatomical relationship. A urinary tract infection in the pelvic space could disseminate directly to the lumbar spine via the spinal venous-plexus, without passing through the systemic circulation, infection
from genitourinary system can spread via the Batson's plexus, located between the venous drainage of the urogenital tract and the spinal system. Such infections are more prevalent among patients with diabetes mellitus compare to nondiabetic patients. (15)

Blood borne micro-organisms that randomly pass through the marrow cavity of the vertebrae can spontaneously seed and lead to suppurative infection. Recent or previous trauma to the vertebrae may lead to disruption of normal architecture and predispose to higher rate of infection. (2)

The segmental arteries which are numerous small arteries originating from the Subclavian artery, this branches supply the vertebrae and usually bifurcate to supply two adjacent end plates of contiguous vertebrae. Thus, most of the cases of vertebral osteomyelitis that caused by hematogenous spread manifest to bone destruction of two adjacent vertebral bodies and their intervertebral disk. (2,3)

1. **Contiguous spread** – Occur when micro-organisms spread from tissues which located in close anatomical proximity to the vertebral column, such as the aorta, esophagus, urinary tract or bowel. This route of infection may occur following trauma, invasive spinal diagnostic procedures, or spinal surgery when bacteria reach directly to the vertebrae (14,15,16,18)

2. **Extension of infection** – Epidural abscess, subdural abscess, or meningitis was observed when the infection spread posteriorly. Extension anteriorly or laterally can lead to paravertebral, retropharyngeal, mediastinal, sub phrenic, retroperitoneal, or psoas abscesses. Case series study demonstrate development of pleural space empyema in patients with thoracic vertebral infections, suggesting extension of the infection. (13)

**Microbiology:**

Most patients usually have mono-microbial infection; the most common pathogen of vertebral osteomyelitis is coagulase positive staphylococci (i.e. *staphylococcus aureus*), which accounting for more than 50 percent of cases in most case series studies in developed countries.

Increased incidence of infection with methicillin resistant staphylococcus aureus (MRSA) was observed due to rise in the prevalence of MRSA carriers among the general population. (17)

Other pathogens and of septic SD include:
• Enteric gram-negative bacilli, particularly following urinary tract instrumentation and intervention. (15)
• Pseudomonas aeruginosa and Candida species, which are frequently associated with intravascular access sepsis or injection drug use (14)
• Streptococcal spp. associated with endocarditis (28,29)
• Tuberculous infection, usually co-exist with psoas muscle abscess. (21)
• Brucellosis (20)

Clinical features:

Symptoms and signs:
The main presenting symptom in vertebral osteomyelitis is back pain, the pain is well localized and may be exacerbated by palpation of the involved segment, the pain may radiate to the abdomen, leg, scrotum, groin, or perineum. The pain is not always severe and/or disabling, but in most cases it tends to be persistent, unrelated to posture or movement and not relieved by rest. (2)

In cases where infections exhibit to extend posteriorly into the epidural space, patients presented with clinical features of an epidural abscess; which consists of focal and severe back pain, followed by radiculopathy, later patients developed motor weakness and sensory changes, and eventually paralysis of the area that innervated by the impinged nerves.

The absence of fever not exclude infection process as fever is not specific nor sensitive finding, as such fever may be absent in most cases; in some case studies, review from nine case report studies found that only 50 percent of patient presented with fever. (2)

Physical examination:
Localized muscle spasm at the involved segment with a decreased range of spinal movement. (2)

The physical examination should include palpation of the involved area of the back, evaluation for signs of psoas abscess (i.e flank pain and exacerbation of pain with hip extension), and a careful neurologic assessment of the lower limbs which include full assessment of deep tendon reflexes bilaterally, signs of upper or lower motor neuron damage, muscle strength and sensory examination (4)

Laboratory findings:
The main 3 laboratory changes may be in WBC count, that may be normal or elevated, and elevation in ESR and CRP.

In cases when above are increased, following their level may be useful in the follow up of the efficacy of the treatment. (4)

**Diagnostic tools:**
Diagnostic tools for septic SD include cultures (blood and urine), imaging studies, and biopsy;

1. **Microbiology cultures:**
   Blood and urine cultures should be obtained in all patients with suspected septic SD; they are positive in up to 50 percent of cases. (17)
   In the setting of positive blood cultures with gram-positive organisms, evaluation for concurrent Infective endocarditis is necessary, especially in patients with underlying valvar disease and/or new-onset heart abnormalities. (14)

2. **Radiographic imaging:**
   MRI is the most sensitive radiographic technique for diagnosis of septic SD, vertebral osteomyelitis and epidural abscess. (21)
   Typical MRI findings in vertebral osteomyelitis include: (5,22,23)
   - Low signal intensity in the vertebral bodies and disc and loss of endplate definition (T1-weighted images)
   - Increased disc signal intensity; less often, increased vertebral body signal intensity (T2-weighted images)
   - Contrast enhancement; Ring enhancement of paraspinal and epidural processes correlates with abscess formation, whereas homogeneous enhancement correlates with phlegmon formation.

CT; demonstrates findings of vertebral osteomyelitis before such changes are apparent on plain films. CT scanning is also useful for detecting bony sequestra or involucra, adjacent soft tissue abscesses, and in localizing the optimal approach for a biopsy. (24)

Plain films may be performed if neither CT nor MRI is available, but demonstrate significant findings only in the setting of advanced disease. Plain radiographs are often normal in the early phases of infection. Typical findings in vertebral osteomyelitis consist of destructive changes of two contiguous
vertebral bodies with collapse of the intervening disc space. (2) Bone destruction may not be apparent for two to three weeks or more after the onset of symptoms (24).

Chest radiography is warranted in the setting of clinical suspicion for tuberculosis or unclear origin of pleural effusion, but a normal chest film does not reduce clinical suspicion of tuberculous spinal disease. (13)

Radionuclide scanning may be useful if MRI cannot be performed because of claustrophobia or the presence of an implantable cardiac or cochlear device. (4)

Radioisotope studies may be a useful when other modalities are equivocal and the suspicion for osteomyelitis is high. PET scanning using 18-fluorodeoxyglucose, especially when combined with CT (PET-CT), is highly sensitive, with a negative predictive close to 100 percent. The specificity is good but may be compromised by the presence of tumor, degenerative spinal disease, and/or spinal implants. (25)

**Biopsy:**

Biopsy is necessary for confirmation in cases when there is a clinical and/or radiographic suspicion of vertebral osteomyelitis; biopsy is also necessary to identify the causative agent.

Biopsy material may be obtained via an open procedure or needle biopsy by CT guidance. In one study of 92 patients with vertebral osteomyelitis who underwent biopsy, open biopsies had a higher microbiologic yield than needle biopsies (91 versus 53 percent). (6)

Prior antibiotic exposure may increase the rate of the false negative results of the culture. (19)

Nucleic acid amplification testing may be useful if initial aerobic and anaerobic cultures are negative. (4) In one study including 19 patients with discitis, amplification-based DNA analysis of aspirated material correlated well with traditional culture methods. (26)

**Treatment:**

1. **Antimicrobial therapy:**

Selection of antimicrobial therapy should be adjusted to the results of the biopsy or blood culture results.

If possible, antimicrobial therapy should be withheld until a microbiologic diagnosis is confirmed. Clinical exceptions include neurologic compromise and sepsis; in these circumstances, empiric antibiotic therapy is warranted. (4)
In one retrospective study including 92 patients with vertebral osteomyelitis, administration of antibiotics prior to biopsy did not diminish the yield of culture results. (6)

**Empiric therapy** - Patients with negative Gram stain and culture results should be treated with an antimicrobial regimen with activity against the common causes of vertebral osteomyelitis, including staphylococci, streptococci, and gram-negative bacilli.

If empiric therapy does not result in clinical improvement in 3 to 4 weeks, a repeat percutaneous needle biopsy or open surgical biopsy should be done.

Treatment duration in most cases is 6 weeks, longer therapy (up to 12 weeks) may be necessary for patients with evidence of infection due to drug-resistant organisms, bone destruction and/or paravertebral infection. Most patients receive initially parenteral therapy followed by oral therapy. (4,30)

**Clinical and laboratory monitoring:**

During therapy, patients should be followed carefully for clinical signs of soft tissue extension, paraspinal abscess, and cord compression.

Patients should also be followed with serial monitoring of inflammatory markers (ESR and CRP). (4)

**Role of imaging:**

Follow-up imaging studies are not necessary. In patients whose clinical status has not improved during the treatment window time, follow up imaging may be necessary in order to evaluate for the presence of an abscess or other causes which may necessitate surgical intervention. (4)

2. **Surgery:**

Indication for surgery include (4):

- Presence of neurologic deficits.
- Presence of epidural or paravertebral abscesses.
- Threatened or actual cord compression.
- Progression, persistence, or recurrence of disease (persistent positive blood cultures or worsening pain) despite appropriate antimicrobial therapy.

**Prognosis:**

A longer time till establishment of the diagnosis may lead to permanent neurological deficits and severe outcome of SD. (8)
Multivariate analysis indicated that infection with S. aureus was associated with increased risk of relapse. Longer-term outcomes included neurological deficit (16%) and persistent back pain (32%). (7)

**Mortality:**

Mortality due vertebral osteomyelitis in the antibiotic era is less than 5 percent, and the rate of residual neurologic deficits among survivors is less than 7 percent. Delays in diagnosis can lead to disabling complications. (4)

The association between SD and increased long term mortality is directly related to age. The prognosis is poor for patients with severe comorbidities such as diabetes, IHD, stroke, COPD, hemodialysis use, IE, malignancy, liver cirrhosis and alcohol dependence. (7,9)
PATIENTS AND METHODS

Object: Patients of Hospital of Lithuanian University of Health Sciences Kaunas Clinics who have diagnosed with spondylodiscitis that confirmed by imaging studies.

Patient selection and amount: Patients were identified who met the following criteria:

- Hospitalized in Hospital of Lithuanian University of Health Sciences Kaunas Clinics
- Diagnosed with spondylodiscitis
- Time period 2008/01/01 – 2015/12/31
- Registered in the database of Kaunas Clinics data base software.

Data was collected from medical history records of those patients; the following parameter was evaluated:

- Gender and age.
- Location of the effected vertebral region.
- Symptoms and sign such as pain, fever, dyspnea, chest pain and neurologic signs (pain radiation, weakness, numbness, headache)
- Laboratory results such as leukocytes count, CRP and ESR level.
- Culture results of blood and urine.
- Imaging modalities which was performed in each patient, this include plain radiography, CT and MRI.
- Bone biopsy or percutaneous needle biopsy.
- Additional diagnosis of sepsis or abscess (epidural, psoas, retropharyngeal, paravertebral).

In total, 51 medical history records of patients with the diagnosis of spondylodiscitis were analyzed.

Methodology: the collected data from medical history records were aggregated in standard Excel summary table and evaluated statistically using appropriate software which helped to find correlations and statistical significance between different parameters.
Microsoft Excel and SPSS 17.0 software was used for the analysis. Various parameters were calculated in order to analyze the data and find out distribution, mean values and standard deviation (X±SD):

- Population (gender, age).
- Involved vertebral region.
- Clinical examination.
- Laboratory investigation.
- Blood and urine culture.
- Imaging investigation.
- Additional diagnostic findings.
- Bone biopsy and percutaneous biopsy.

Percentage distribution was calculated and graphically presented for:

- Involved vertebral region.
- Neurological sings.
- Bacterial pathogen identification in blood culture.
- Bacterial pathogen identification in blood culture.
- Abscess location.
RESULTS AND DISCUSSION

Patient Analysis of distribution:

By gender;

According many scientific researches septic SD more common in male in a ratio of 2:1 (2,3,9), in the population of the study, in Kaunas medical hospital, comparing the distribution of males and females there were no evidence of statistically significant differences.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Percent (%)</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>30</td>
<td>58.8</td>
<td>1.588</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>41.2</td>
<td></td>
</tr>
</tbody>
</table>

By age;

The average age of patients with SD was 61 years of age, and it was quite similar to the one that found in other scientific researches, 52.9% are patient >60 years old. (2,3,9)

The table shows the distribution of age in patients with septic SD.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>min</th>
<th>max</th>
<th>mean</th>
<th>Sta. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>age</td>
<td>51</td>
<td>39</td>
<td>86</td>
<td>61.73</td>
<td>12.177</td>
</tr>
</tbody>
</table>

Involved vertebral region;

According to the data which was collected the vertebral column segments which were affected is shown in the table below

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>cervical</th>
<th>thoracic</th>
<th>lumbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>4</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

Note: 3 of the 51 patients had 2 involved vertebral region.

The graph shows percentage of distribution of the involved vertebral segments in 51 patients with SD:
Analysis of Clinical examination;

The symptoms and signs of septic SD are not clear nor specific, the main presenting symptom was back pain (96%), this finding is consist with the one that was found in the scientific researches. (2)

In the analyzed population the main presented symptom was back pain as well.

<table>
<thead>
<tr>
<th>Complain</th>
<th>Back pain</th>
<th>Chest pain</th>
<th>Dyspnea</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=51</td>
<td>49</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

Fever is a nonspecific sign that may be present in many different processes in the body. In septic SD fever is even less specific sign (43.1%), which indicate some inflammatory process.

The percent of patients, which were presented with fever, are similar to the percent found in scientific studies. (2)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>minimum</th>
<th>maximum</th>
<th>mean</th>
<th>Sat.deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>22</td>
<td>37.0</td>
<td>40.0</td>
<td>37.350</td>
<td>0.7999</td>
</tr>
</tbody>
</table>

Pain may radiate to the abdomen, leg, scrotum, groin or perineum. According to the statistical analysis, it was found that radiation to the leg is the most common (63.6%) neurological sign that patients were present with.

In patients that SD was associated with epidural abscess, patients were presented with signs and symptoms of radiculopathy, weakness, sensory deficits and paralysis/paresis. (2)

According to the statistical analysis, there was no significant correlation between the presence of neurological signs/findings and epidural abscess, conversely, according to the statistical analysis; a
significant correlation was found in patients who had thoracic or/and lumbar vertebral region involvement and symptoms of numbness and weakness.

<table>
<thead>
<tr>
<th>Neurological signs</th>
<th>Radiation pain to lower extremities</th>
<th>Weakness</th>
<th>Numbness</th>
<th>Headache</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=33</td>
<td>21</td>
<td>10</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Percent of the distribution of neurological signs among 33 patients that were presented with

![Pie chart showing distribution]

Laboratory investigation:

The main 3 laboratory findings, which may be altered, are WBC count, which may be normal or elevated, elevation in ESR and CRP level.

In patients with elevated WBC, ESR or/and CRP level, there level may be useful in the following of the efficacy of the treatment and determine if there is response to the antibiotic regimen (4)

The table demonstrates the statistical distribution of those inflammatory markers that were found during the collection of the data in all 51 patients with SD.

<table>
<thead>
<tr>
<th></th>
<th>minimum</th>
<th>maximum</th>
<th>Mean</th>
<th>Sta. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukocyte</td>
<td>4.70</td>
<td>24.50</td>
<td>10.095</td>
<td>4.059</td>
</tr>
<tr>
<td>CRP</td>
<td>1.10</td>
<td>421</td>
<td>108.898</td>
<td>90.184</td>
</tr>
<tr>
<td>ESR</td>
<td>3</td>
<td>148</td>
<td>72.24</td>
<td>31.757</td>
</tr>
</tbody>
</table>

Out of 51 patients the elevation of inflammatory markers was:
• In 17 patients the WBC count was elevated (33.3%)
• In 37 patients the CRP was elevated, >50 mg/l (72.5%)
• In 49 patients the ESR was elevated, >20 mm/h (96%)

**Blood and urine cultures:**

Blood and urine cultures should be obtained in all patients with suspected septic SD; in most of the cases they are positive in up to 50% of cases. (17)

According to the statistical analysis, it was found that only in 14 patients the blood culture was positive and the causative agent was identified (27.4%), regarding urine culture; only in 7 patients the urine culture was positive and the causative agent was identified. (13.7%)

The graphs below demonstrate the parentage distribution of the identified pathogens in blood and urine.

Positive Blood culture of 14 patients. Positive Urine culture of 7 patients.

**Imaging investigation;**

Although MRI is the most accurate imaging modality, in most of the cases it is not the first test.

This could be explained by the fact that the clinical symptoms and signs of SD are not so clear and obvious, usually many patients should be imaged by other investigation which are helpful in excluding other pathologies in the differential diagnosis, but those are inferior to MRI in the confirmation the diagnosis of SD; from the analysis of 51 patients it was found that patients who complained for chest pain, the first imaging modality which was performed for them was a plain radiograph of the chest, later those patients were also diagnosed with SD of the thoracic vertebral region, this finding could be explained by the fact that in some patients with thoracic vertebral SD the infections can extend into the pleural space and produce infection of the pleural space (i.e. empyema). (13)
The table and the graph below demonstrate the distribution of the use of the imaging modalities and their percentage, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Plain radiography</th>
<th>CT</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>51</td>
<td>27</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>38</td>
<td>42</td>
</tr>
</tbody>
</table>

Note that some patients underwent more than one imaging technique for the diagnosis.

- In 27 patients (52.9%) that the Plain radiography was preformed it was not enough for the establishment of the diagnosis, and a second imaging modality was mandatory.
- Out of the 38 patients that the CT test was made for them, in 9 patients (23.6%) the CT test changes conformation the diagnosis, the rest of the patients needed the MRI test for establishment of the diagnosis.
- In most of the patients the MRI test was performed as the second or even the third test during the process of the diagnosis. Only in 4 patients (9.5%) the MRI test was the only test that preformed.

Over all the most used and most confirmatory imaging test is the MRI test, which shows specific changes of SD in all 42 patients.

**Additional diagnostic findings;**

In some patients with septic SD coexistence of epidural abscess, subdural abscess, paravertebral, retropharyngeal, mediastinal, sub phrenic, retroperitoneal, or psoas abscesses may be found, such findings suggest an extension of infection posteriorly or laterally dependent on the location of the soft tissue involvement. (13)

From the 51 patients that were diagnosed with septic SD, 25 patients (49%) demonstrated coexistence of abscess in the spinal region, which was recognized by imaging.

The most common cause of septic SD is spread by hematogeneous rout of infection, in those cases the pathogenic microorganism was present in the blood and some of the patients presented with sepsis. From the analyzed medical records, 10 patients (19.6%) were presented with signs and symptoms of sepsis.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Total number of patients</th>
<th>Sepsis</th>
<th>Abscess in spinal region</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>51</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>
The graph demonstrates the absolute numbers and their percentage of different abscess location. Some of the patients had abscess formation in more than one region.

![Graph showing abscess location percentages]

**Bone biopsy or percutaneous needle biopsy:**

The identification of the specific pathogenic microorganism is necessary in cases where the blood culture was not informative and the imaging study suggests SD, a CT guided needle aspiration biopsy of the bone or disc should be performed. (6,10,27)

From the analyzes of the 51 medical records of 37 patients, 28% were met the indication for the CT guided biopsy, but the procedure was not performed.
CONCLUSIONS

1. Pyogenic SD affects males and females at equal ratio, and the average age of affected patients is 61 years old. 52.9% are patient >60 years old.

2. Pyogenic SD may affect any region of the vertebral column, but the most prominent region is the lumbar vertebral region (78.4%).

3. The main presenting symptom was back pain, well localized to the level involved in all patients (96%).

4. To confirm the diagnosis of SD more than 1 imaging technique needed to be used. The most used and establishing the diagnosis is the MRI test. (80.4%)

5. Although as part of the investigation protocol, blood and urine specimen culture is preformed, not in all cases the bacterial agent is identified. In those patients that the blood culture (27.4%) and urine culture (13.7%) was positive, the predominant bacterial agents in blood and urine were *Staphylococcus aureus* (50%) and *Escherichia coli* (56%), respectively.

6. 33 patients were presented with neurological sing (64.7%). that the most common neurological sign was radiating pain to extremities (63.6%), patients with SD of thoracic or/and lumbar vertebral region complain more about numbness and weakness.

7. Although 37 patients had indication to preform CT guided biopsy from bone or disc, none of the patients had the procedure.
RECOMMENDATIONS

The clinical symptoms and signs of septic SD are usually not specific, as such septic SD may be miss diagnosed in many cases, when the diagnosis of SD is established, the treatment should be aimed directly to specific pathogenic microorganism.

In patients whom the blood culture was negative, and the diagnosis of septic SD was confirmed by imaging modalities, CT guided biopsy of the involved disc or bone is indicated in order to determine the specific pathogen. (6,10,27)

From the 51 medical records which were analyzed, the patients that were diagnosed in Lithuanian University of Health Sciences hospital, only 14 cases were positive on blood culture which identified the pathogenic MO, but for rest of the patients (37) who does meet the criteria for the biopsy, the biopsy was not preformed.

Strong recommendation would be to preform CT guided biopsy for microbiological and pathohistological analysis in patients with negative blood culture and positive imaging study.
REFERENCES


