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ORIGINAL ARTICLE

Infectious spondylodiscitis treated at the Department of Infectious Diseases, Cantonal Hospital Zenica, during the period from 2022 to 2023

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ABSTRACT

Aim Infectious spondylodiscitis is a rare but serious spinal infection that often presents with nonspecific symptoms like fever and back pain, causing delayed diagnosis. This study aimed to describe the clinical features, identify etiological agents, and outline treatment approach in patients treated at the Department of Infectious Diseases, Cantonal Hospital Zenica, Bosnia and Herzegovina, from January 2022 to December 2023.
Methods This retrospective descriptive study included 60 patients diagnosed with infectious spondylodiscitis based on clinical symptoms (fever and/or spinal pain) and confirmed by magnetic resonance imaging (MRI) or scintigraphy. Data were collected from medical records and included demographic information, clinical presentation, laboratory results: haemoglobin, leukocytes, C-reactive protein (CRP), liver enzymes), microbiological findings (blood cultures and serology), imaging, and treatment details.
Results Median time from symptom onset to hospital admission was 30 days. Blood culture was positive in 31 (51.6%) patients, while etiology was identified in 57 (95%) cases. *Brucella* species was the most common pathogen, confirmed serologically in 46 (90.2%) brucella cases. Most patients had a history of unpasteurized dairy consumption or animal contact. The MRI was performed in 58 (96.7%) patients, confirming vertebral inflammation. Complications such as abscesses, epidural collections, or empyema occurred in 35 (58.3%) patients.
Conclusion Due to its nonspecific presentation, infectious spondylodiscitis is often diagnosed late. In endemic regions, brucellosis should be considered as a potential cause. Blood cultures and serology are key for etiological confirmation, while MRI remains the diagnostic gold standard. Targeted antimicrobial therapy is the mainstay of treatment, with surgery indicated in complicated cases.
Keywords: antibiotics, brucellosis, magnetic resonance imaging (MRI), vertebral osteomyelitis

INTRODUCTION

Infectious spondylodiscitis (vertebral osteomyelitis) is an infection that affects the intervertebral discs and adjacent vertebrae, causing inflammation and destruction of the affected structures. Although rare, spondylodiscitis carries a high risk of severe complications, including irreversible sequelae if not recognized and treated promptly (1). Spondylodiscitis is often referred to as a chameleon among infectious diseases due to the lack of specific symptoms, which often leads to delayed diagnosis (2). Infectious spondylodiscitis may be caused by bacterial, fungal or parasitic organisms, with bacteria being the most common source of infection encountered in clinical practice (3). *Staphylococcus aureus* was reported as the predominant pathogen for bacterial spondylodiscitis (4). Tuberculous spondylodiscitis, also known as Pott's disease, remains a major public health issue, particularly in regions with high tuberculosis prevalence (5).

Brucellar spondylodiscitis is most commonly seen in countries where brucellosis remains endemic, including Bosnia and Herzegovina (6). Compared with pyogenic spondylodiscitis, brucellar spondylodiscitis has a slower symptoms progression with a long and recurrent course (6). Fungal infections are extremely rare, mostly responsible for opportunistic infections in immunocompromised patients. The most common causative agents are *Candida spp.* and *Aspergillus spp*. (7).

This study was conducted after an increasing number of hospitalized patients with spondylodiscitis was observed in our Department. Our aim was to analyse the etiological spectrum, leading clinical manifestations, radiological findings, treatment modalities, and treatment duration in order to improve patient management in the future. While international literature often emphasizes surgical approaches and CT-guided microbiological diagnostics, our study highlights the predom-

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inance and effectiveness of conservative treatment in our setting, where invasive diagnostic procedures are not routinely performed and a prevalence of cases remains etiologically unresolved. There are several studies in our country and region, mostly from infectious disease specialists, regarding this topic, that have examined etiology and treatment duration (8,9). Presented research reflects local epidemiological characteristics, therapeutic limitations and outcome.

The aim of this study was to investigate demographic, epidemiological, clinical, and laboratory characteristics, etiology, treatment and outcomes of patients with infectious spondylodiscitis treated at the Department of Infectious Diseases, Cantonal Hospital Zenica, over the period of two years.

PATIENTS AND METHODS

Patients and study design

This retrospective descriptive study analysed medical histories of 60 patients diagnosed with infectious spondylodiscitis who received treatment at Department of Infectious Diseases in the Cantonal Hospital Zenica, Bosnia and Herzegovina, from 1 January 2022 to 31 December 2023.

The Cantonal Hospital Zenica has 858 beds, with 60 beds in the Department of Infectious Diseases. Each year, 9,000 to 10,000 patients pass through the emergency admissions unit at our Department, and around 1,300 are hospitalized. The hospital provides medical care for the Zenica-Doboj Canton and Central Bosnia Canton, with around 300,000 and 250,000 inhabitants, respectively.

The diagnosis of spondylodiscitis was based on the presence of fever and/or spinal pain including changes verified on spine MRI scan or on a scintigraphic examination.

The study was approved by the Ethics Committee of the Cantonal Hospital Zenica (No: 00-03-35-18-6/25). It was conducted in compliance with the Ethical Principles for Medical Research Involving Human Subjects outlined in the Helsinki Declaration.

Methods

The data used for this study were obtained from the patients' medical records, including socio-demographic and epidemiological characteristics (age, gender, urban or rural residence, contact with domestic animals, consumption of unpasteurized dairy products), symptoms prior to hospitalization, clinical manifestation (back pain, fever, weakness, loss of weight, loss of appetite, night sweats), laboratory findings (haemoglobin level, erythrocytes, leukocytes, neutrophil granulocytes and platelets count, urea, creatinine, level of C-reactive protein - CRP, as well as aspartate aminotransferase and alanine aminotransferase level), blood cultures, serology tests (Rose Bengal test and enzyme-linked immunosorbent assay - ELISA for detection of anti-Brucella antibodies), contrast enhanced magnetic resonance imaging (MRI) findings, duration and type of antibiotic treatment.

Statistical analysis

Categorical variables are described using frequencies and percentages, while numerical variables are presented with medians and ranges.

RESULTS

A total of 60 patients treated at the Department of Infectious Diseases of the Cantonal Hospital Zenica with a diagnosis of infectious spondylodiscitis were included in the study. Of these, 42 (70.0%) were male and 18 (30%) were female; median age was 67 years (range 13–87 years).

Thirty-nine (65.0%) patients were from Zenica-Doboj Canton, while 21 patients (35.0%) were from Central Bosnia Canton; 54 (90.0 %) patients lived in rural, six (10.0%) patients in urban area. Among brucellosis spondylodiscitis, 33 (out of.51; 64.7%%) had a history of both consumption of the raw milk and close animal (sheep, goat or cow) contact. Other patients, 18 (35.2%), with brucellar spondylodiscitis had negative or unclear epidemiological histories. Patients with spondylodiscitis of other etiologies had endogenous infection routes (dental caries, urinary infections, otitis), except for one patient whose definitive causative agent was not identified.

Overall median time from symptom onset to hospitalization was 30 (range 2 – 365) days. During the initial examination, the predominant clinical presentations were back pain and fever (Table 1), accompanied by moderately elevated CRP level (Table 2).

Table 1. Main clinical manifestations in 60 patients with spondylodiscitis

Symptom	No (%) of patients
Back pain	53 (88.3)
Fever	50 (83.3)
Sweating	46 (76.7)
Malaise	40 (66.7)
Loss of appetite	40 (66.7)
Weight loss	21 (35.0)

Table 2. Laboratory parameters in 60 patients with infectious spondylodiscitis

Laboratory parameter (reference value)	Median (range)
Leukocytes (3.4–10.0) (x 10^9/L)	8.0 (2.7-29.3)
Erythrocytes (3.9–5.1) (x 10^{12}/L)	4.2 (3.2– 5.6)
Hemoglobin (119.0–157.0) (g/L)	119.0 (98.0–162.0)
Neutrophils (2.1–6.5) (x 10^9/L)	3.7 (0.4–26.3)
Platelets (150.0–400.0) (x 10^9/L)	260.0 (0.4–26.3)
CRP (0.0–10.0) (mg/L)	33.1 (0.1–239.0)
AST (10.0–34.0) (U/L)	36.5 (9.0–128.0)
ALT (10.0–49.0) (U/L)	42.9 (6.0–185.0)
Urea (3.2–8.2) (mmol/L)	5.5 (2.5–27.1)
Creatinine (44.2–97.2) (μmol/L)	65.0 (37.0–246.0)

CRP, C-reactive protein; AST, Aspartate aminotransferase; ALT, Alanine aminotransferase

Brucella species (spp.) was the most common causative agent in patients with spondylodiscitis, identified in 51 (85%) cases, whereas among patients with brucellar spondylodiscitis, the disease was serologically confirmed in 46 (90.2%) patients. (Table 3.)

Positive blood culture was found in 31 (51.7%) patients: *Brucella* spp. in 25 (80.6%), *Staphylococcus aureus* in four (12.9%), *Escherichia coli* in one (3.2%), and *Proteus mirabilis* in one (3.2%) patient.

Table 3. Etiological agents identified in blood cultures

Microorganism isolated	Number (%) of patients
Brucella species	25 (80.6)
Staphylococcus aureus	4 (12.9)
Escherichia coli	1 (3.2)
Proteus mirabilis	1 (3.2)
Unknown	3 (9.7)

The MRI scan was performed in 58 (96.7%) patients revealing inflammatory disorders of the vertebral column in all cases. Bone scintigraphy was used in two (3.3%) patients as MRI could not be performed due to the presence of metallic foreign bodies. The scitigraphy showed increased radiopharmaceutical accumulation in the thoracic segments of the spine (the data are not shown).

Our data showed that 25 (41.7%) patents had isolated spondylodiscitis, while 35 (58.3%) had additional complications such as abscesses, epidural collections, or empyema. Affected areas included the psoas muscle (often bilateral or ipsilateral), paravertebral muscles (edema, cellulitis, or fluid collections), sacroiliac joints (sacroiliitis), and gluteal muscles (edema or fluid collections). Among the 35 patients with additional complications, 28 (80.0%%) had brucella spondylodiscitis, and seven (20%) had pyogenic spondylodiscitis (four caused by *Staphylococcus aureus*, one caused by *Proteus mirabilis*, one by *Escherichia coli*, and one by an unknown agent (the data are not shown).

Spinal segments were affected by spondylodiscitis in 82 patients, lumbosacral in 67, cervical in five, and thoracic region in 10 patients. In 48 patients, only one spinal segment was affected, and 12 patients had changes in 34 spinal segments; 10 of 12 patients from the last group had brucellar spondylodiscitis, one had staphylococcal spondylodiscitis, and one had spondylodiscitis of unknown etiology (the data are not shown).

Patients with spondylodiscitis were treated with combined antibiotic therapy involving two or three antibiotics, depending on the etiology. Spondylodiscitis caused by *Brucella* infection were treated with doxycycline 2x100 mg and gentamicin 2x80 mg or 2x120 mg (depending on the age of the patient and creatinine level), for three weeks, followed by doxycycline and rifampicin 3x300 mg for three, six, or nine months (depending on clinical presentation and MRI findings). The average duration of therapy for brucellar spondylodiscitis was six months (the data are not shown).

For the treatment of patients with non-brucellar spondylodiscitis, the most commonly used antibiotic combinations included (daily dose) cloxacillin 6x2 g with gentamicin 2x80 mg or 2x120 mg or meropenem 3x2 g with vancomycin 2x1 g for three to six months, as well as piperacillin and tazobactam 4x4.5 g together with metronidazole 3x500 mg or clindamycin 3x600 mg for four to six months. Despite the therapy, one patient with spondylodiscitis died during the hospital stay due to sepsis caused by *Staphylococcus aureus* (the data are not shown).

Post-treatment care and patients' follow-up involved regular clinical assessments and imaging diagnostics. No significant sequelae were observed, except for occasional mild to moderate pain in the affected spinal segments. There were no cases of relapse or reinfection of the primary disease.

Follow-up MRIs of the spine were performed after completing antibiotic therapy. Successful treatment outcomes were observed, with regression of spinal lesions following the conclusion of therapy (Figures 1, 2).

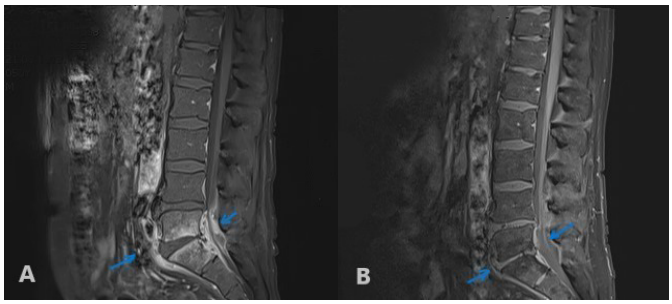

Figure 1. A) Inflammatory changes at the L5/S1 level with fluid collections compressing the dural sac, affecting the pre- and paravertebral musculature on the right side (arrow) (MRI) (Cantonal Hospital Zenica, 2024, 2023)**; B) Complete regression of previously observed inflammatory changes (arrow) (MRI)** (Cantonal Hospital Zenica, 2024)

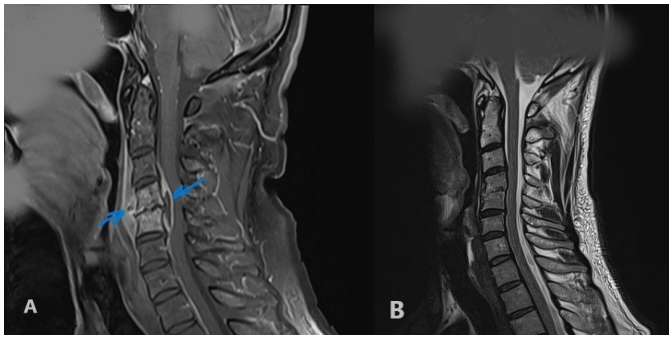

Figure 2. A) Pronounced inflammatory changes at the C4/C5 level with a reduction in intervertebral space width, erosions of both disc endplates, inflammatory changes in the prevertebral area, and within the spinal canal at the same level, and a fluid collection with a compressive effect on the spinal cord (arrow) (MRI) (Cantonal Hospital Zenica, 2023)**; B) Complete regression of inflammatory changes in the prevertebral area and spinal canal, along with post-inflammatory changes at the C4/C5 disc level (MRI)** (Cantonal Hospital Zenica, 2024)

DISCUSSION

Infectious spondylodiscitis presents a significant diagnostic and therapeutic challenge. Diagnosis is often delayed or missed due to the rarity of the disease and nonspecific symptomatology. The annual incidence in Europe has been estimated to be from 4–24 cases per million (10). Our findings demonstrated that the male/female spondylodiscitis rate complies with global data. It has been reported that the infectious spondylodiscitis is more common in females (male - female ratio 1.5–2:1) (11,12). Some studies showed that 56.7% of cases involved male patients (13). The reasons for male predominance in infectious spondylodiscitis remain unclear; reportedly a male predominance related mainly to gender-related differences in risk factor distribution, such as intravenous drug use, comorbidities, and prior interventions (14).

Spondylodiscitis has an increasing incidence by age, and with regard to all age groups, it occurs most frequently in patients >75 years of age (15). According to our study, the average age of patients with spondylodiscitis was lower than the average age presented in global data (15), which might be explained by

the predominance of brucellar spondylodiscitis in our cohort, a condition that more commonly affected younger individuals. Spondylodiscitis is characterized by nonspecific clinical symptoms in its early stage, such as mild fever, general malaise, weakness and weight loss, while pain and neurological symptoms typically appear later, also presented in our study. Similar to our results, available literature reports the lack of specificity of the symptoms in the initial phase of the disease, often with a delay of several weeks and up to six months in its diagnosis (2,15,16).

Laboratory findings indicating inflammation vary depending on the causative agent, which explains the wide range of the symptoms observed in our patients, comparable to findings in other studies (17). Spondylodiscitis Diagnosis and Treatment (SponDT) score, a tool for diagnosing spondylodiscitis, incorporates CRP level, pain level according to a numeric rating scale (NRS), and MRI stage of the disease according to Flamme. Based on the SponDT score, spondylodiscitis can be classified as severe, moderate and light/healed (18). The SponDT score was not utilized in our institution and thus not included in this study. Its potential application as a clinical tool may enable faster assessment of disease severity and stage, as well as better treatment planning in the future. Due to its simplicity, the SponDT score could serve as a valuable guide in future research (18).

Accurate etiological diagnosis is crucial for targeted antibiotic therapy. In our study, the etiological diagnosis was established in most cases. The most common causative agent in our sample was *Brucella species*, reflecting the endemic presence of brucellosis, which accounts for 21–48% of spinal infections in endemic areas (19)

Blood culture and serology are critical diagnostic techniques in infectious spondylodiscitis, as they enable precise identification of pathogens and detection of specific antibodies or antigens, allowing for adequate and targeted treatment. Pathogens can be detected in 40–70% of patients who have not previously undergone antibiotic treatment (20). Our results showed 51.7% of patients had positive blood cultures, which is consistent with previously published data.

The MRI is a preferable method for the diagnosis of spondylodiscitis. The sensitivity and specificity of MRI are 96% and 92%, respectively (21). The MRI remains the gold standard for diagnosing spondylodiscitis, although it does not aid in determining the exact etiology (22). The MRI was used not only for the diagnosis but also for monitoring therapeutic response. Cases involving adjacent structures, such as epidural, paravertebral, and psoas abscesses, were observed in this study and have been similarly reported in the literature (5,23,24).

Studies highlight the use of various antimicrobial drug classes for spondylodiscitis treatment based on blood culture and serology results, with surgical interventions performed in indicated cases (25,26). The length and course of conservative treatment for brucellar bone complications depend on both clinical monitoring and repeated MRI evaluations (9). Treatment optimization remains a challenge, and minimally invasive surgery should be considered alongside antibiotic treatment. Early surgical intervention is associated with reduced relapse and mortality risks (27). Indications for surgical treatment include failure of conservative therapy, mechanical instability, compression of neurological structures, and worsening of neurological deficits (28). In our study, no patients underwent surgical treatment or invasive diagnostic procedures.

Our study demonstrated one death related to sepsis. It is estimated that the global mortality rate for in-hospital-treated acute spondylodiscitis with sepsis (systemic inflammatory response syndrome – SIRS) is approximately 17%, while in other types of subacute/chronic spondylodiscitis it is up to 2% (29).

The limitations of this study are its retrospective nature and the small number of patients included. Only nine patients had pyogenic spondylodiscitis, and due to early antibiotic therapy in septic patients, fewer metastatic lesions were documented. Our study did not include patients with tuberculous spondylitis, as their diagnosis and treatment were not conducted in our Department, but was instead under the supervision of a pulmonologist. Despite these limitations, our findings show a favourable rate of recovery and support the effectiveness of conservative management in our patients.

In line with our aim, this study provides a comprehensive description of the clinical spectrum, etiological profile, and treatment approaches of infectious spondylodiscitis in a Bosnian cohort. The scientific novelty of our research is highlighting the predominance and outcomes of conservative treatment in a setting where invasive diagnostic procedures are limited showing brucellosis as an important etiological factor. Unlike many international studies that focus on surgical management and advanced microbiological diagnostics, our findings emphasize that careful clinical assessment, imaging, and tailored antimicrobial therapy can achieve good results even in resource-limited contexts.

In conclusion, infectious spondylodiscitis is often diagnosed late due to its nonspecific symptomatology. The endemic presence of brucellosis in certain regions highlights the epidemiological link between spondylodiscitis and this infection, which should be considered during diagnostic evaluations. Laboratory findings are less specific indicators in diagnosing spondylodiscitis, while blood culture and serological tests are critical for etiological diagnosis. The MRI remains the gold standard for diagnosing and monitoring spondylodiscitis. Treatment of infectious spondylodiscitis should primarily rely on antimicrobial drugs based on the etiological diagnosis, supplemented with surgical procedures in selected cases.

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TRANSPARENCY DECLARATION

Conflict of interest: None to declare.

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