ORIGINAL RESEARCH

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Evaluation of Patients Diagnosed with Spondylodiscitis

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Abstract

Objective

Spondylodiscitis is an infectious disease that affects the vertebral body, intervertebral disc, and/or adjacent paraspinal tissue, and it is a significant cause of morbidity, especially in older individuals. This study aims to evaluate cases of spondylodiscitis followed at Suleyman Demirel University Hospital.

Material and Method

Between January 2017 and December 2021, the medical records and electronic files of patients who began antimicrobial treatment with a diagnosis of spondylodiscitis at Suleyman Demirel University Hospital were retrospectively evaluated.

Results

A total of 33 patients were included in the study, consisting of 17 females and 16 males. The average age of the patients was 56.0 ± 13.6 years. Twenty patients (60.6%) were hospitalized, while 13 patients (39.4%) were followed as outpatients. Spinal surgery due to discopathy was performed in 9 cases (27.3%), and 4 of these patients had a history of recurrent surgical interventions. The most commonly affected region was the lumbar vertebrae (44.1%). The lumbosacral region (20.6%) and thoracolumbar region (14.7%) followed as the second and third most affected areas, respectively. Brucellosis complications were present in 14 cases (42.4%) of spondylodiscitis. Pyogenic microorganisms and tuberculosis were responsible for the remaining 11 (33,3%), and 2 (6%) patients respectively. In 11 patients (33.3.%), the causative microorganism was identified in tissue/abscess/blood cultures as methicillin-sensitive *Staphylococcus aureus* (3), methicillin-resistant coagulase-negative Staphylococcus (1), methicillin-resistant S. aureus (1), methicillin-sensitive coagulase-negative *Staphylococcus* (1), *Klebsiella pneumonia* (2), *Enterococcus faecalis* (2), *Acinetobacter spp.* (1), *Escherichia coli* (1). Staphylococcus aureus (12%) was the most common pathogen among pyogenic microorganisms. In one case, the identified pathogen was *Mycobacterium tuberculosis*. One of the patients was considered to have tuberculosis spondylodiscitis based on histopathological evaluation.

Conclusion

The fact that nearly half of spondylodiscitis cases observed in our hospital were complicated by brucellosis indicates the importance of evaluating patients presenting with back pain for brucellosis. Collaborative training programs with surgical specialities should be periodically repeated to prevent cases of spondylodiscitis that develop after spinal surgeries.

Keywords: Spondylodiscitis, brucellosis, *Staphylococcus aureus, Mycobacterium tuberculosis*

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Introduction

Spondylodiscitis is a serious and potentially debilitating infection affecting the vertebral body, intervertebral disc, and/or adjacent paraspinal tissue. This condition typically arises from the spread of infectious agents through the bloodstream or by direct extension from nearby infected tissues. The clinical presentation of spondylodiscitis can vary widely but commonly includes back pain that is often localized and may worsen with movement. Patients may also experience fever, chills, night sweats, and neurological symptoms such as radiculopathy or weakness if the infection extends to involve the spinal cord or nerve roots (1).

Spondylodiscitis is more commonly observed in individuals over the age of fifty and is more prevalent among males. It accounts for 5% of all osteomyelitis cases (2, 3). The aging population, use of intravascular devices, spinal implants, renal replacement therapy, diabetes, infective endocarditis, corticosteroid usage, and increased use of immunosuppressive therapies as well as increased access to health services and diagnostic methods have led to a rise in the number of cases diagnosed over the years (4).

Treatment of spondylodiscitis often requires a multidisciplinary approach involving infectious disease specialists, orthopedic surgeons, and neurosurgeons. Antibiotic therapy is the cornerstone of treatment and is usually administered intravenously for an extended duration, often ranging from 6 weeks to several months depending on the severity of the infection and the identified pathogen. In some cases, surgical intervention may be necessary for drainage of abscesses, debridement of infected tissues, or stabilization of the spine (5, 6).

Clinicians need to understand spondylodiscitis more thoroughly, and early detection and thorough assessment are crucial for improving patient outcomes and reducing complications. This study evaluated patients diagnosed with spondylodiscitis who were monitored and treated at our hospital's Department of Infectious Diseases and Clinical Microbiology.

Material and Method

The printed and electronic medical records of patients who began antimicrobial therapy due to a diagnosis of spondylodiscitis between January 2017 and December 2021 at Suleyman Demirel University were evaluated with the retrospective cross-sectional method.

Inclusion criteria:

1. Spondylodiscitis cases due to brucellosis, tuberculosis and pyogenic microorganisms

2. Cases with clinical and imaging findings of spondylodiscitis but no microbiological agent could be demonstrated and had clinical and laboratory improvement with antimicrobial therapy

3. Cases who had spondylodiscitis due to spinal surgery

Exclusion criteria

1. Cases under 18 years old

2. Cases with clinical and imaging findings of spondylodiscitis but no microbiological agent could be demonstrated and no response to antimicrobial therapy

Demographic characteristics, comorbid diseases, symptoms, duration of symptoms, history of hospitalization, history and dates of spinal surgery, microbiological examination results, imaging findings, and administered treatments were recorded. The diagnosis of vertebral osteomyelitis was established based on the presence of vertebral osteomyelitis findings on computed tomography or magnetic resonance imaging in patients with acute or chronic back pain, the detection of microbial growth in blood or tissue samples, or the histological presence of acute or chronic inflammation in vertebral tissue, or serological support for brucellosis diagnosis (7, 8).

“Blood cultures were processed with an automated microbial detection system (BacT/ALERT 3D, bioMérieux, France). Identification and antibiotic susceptibility tests of microorganisms were performed using an automated testing system (BD Phoenix, Becton Dickinson, USA). The Brucellacapt test (Vircell, Granada, Spain) was used to detect specific antibodies against Brucella infection. For the isolation and antimicrobial susceptibility test of Mycobacterium tuberculosis, M960 system (Becton Dickinson Microbiology System, Sparks, NV, USA)”.

For the diagnosis of implant-associated vertebral infection, one of the following criteria was utilized (7):

a) Clinical evidence of delayed wound healing, sinus tract formation, fistula formation, or purulent discharge at the implant site, with at least one positive finding of the 'probe to implant test.'
b) Histological evidence of inflammation at the implant site.

c) Microbiological evidence of significant growth (≥50 CFU/mL in two or more tissue samples or sonication fluid).

The diagnostic criteria for brucellosis, indicating that microbial growth in blood or tissue culture, or titers of 1/160 and above in the brucella capture test, are considered significant. Cases with lower titers are diagnosed through titer monitoring, considering clinical and epidemiological factors such as the history of consuming unpasteurized dairy products or engaging in animal husbandry (9-11).

Clinical response was categorized into three groups (12):

Complete response: Complete resolution of pain symptoms and normalization of acute phase parameters.

Partial response: Reduction of pain symptoms and decrease in acute phase parameters compared to baseline.

Non-response: Persistence of pain symptoms without improvement in acute phase parameters.

Statistical Analysis

Statistical analysis was performed by IBM SPSS Statistics 21.0. Statistical analysis included frequency and percentage for categorical variables, mean and standard deviation for continuous variables if distribution was appropriate, and median (minimum-maximum) values if distribution was not appropriate.

Results

A total of 33 patients were included in the study, comprising 17 females and 16 males. The mean age of the patients was 56.0 ± 13.6 years. Twenty patients (60.6%) were hospitalized, while 13 patients (39.4%) were followed up on an outpatient basis. The median duration of hospitalization for inpatients was 15 days (min 3, max 110), with a mean of 37.5 ± 27.6 days. Thirteen patients (39.4%) were referred to the neurosurgery department, 10 (30.3%) to the infectious diseases and clinical microbiology department, 5 (15.5%) to the physical therapy and rehabilitation department, and 5 (15.5%) to the rheumatology outpatient clinic. Eighteen patients (54.5%) had one or more comorbid diseases. Patients did not have a history of endocarditis or intravenous drug use; one patient was undergoing

Table 1 Complaints and comorbid diseases of patients followed with the diagnosis of spondylodiscitis at presentation.

Complaints	**n**	**%**
Back pain	26	57.8
Walking difficulty	8	17.8
Lower back pain	6	13.3
Fever	3	6.7
Neck pain	1	2.2
Pain in the hip and legs	1	2.2
Comorbidity		
Diabetes mellitus	8	24.2
Rheumatoid arthritis	6	18.2
Coronary artery disease	2	6.1
Chronic kidney failure	1	3.0
Heart failure	1	3.0
Duration of Complaint		
< 1 month	9	27.2
1-12 months	12	36.4
>12 months	12	36.4

hemodialysis treatment. Fifteen patients (55.4%) had a diagnosis of disc herniation. Spinal surgery due to trauma or discopathy before diagnosis was performed in 9 cases (27.3%), with 4 of these patients having a history of repeated surgical interventions. One patient had an implant-associated vertebral infection. The median duration of symptoms for patients was 70 days (min 3, max 7000), with the most common complaint on presentation being lower back pain, observed in 48.5% of cases. The presenting complaints of patients are shown in Table 1. At the time of diagnosis, the mean sedimentation rate was found to be 55.2 ± 33.2 mm/h (with a median value of 49, min: 3, max: 120), and the mean CRP level was 82.0 ± 76.3 mg/L (with a median value of 61, min: 3, max: 120). The most frequently affected region was the lumbar vertebrae, in 15 cases (44.1%). The lumbosacral (7; 20.6%) and thoracolumbar (5; 14.7%) regions ranked second and third, respectively. Brucellosis complications accounted for 14 cases (42.4%) of spondylodiscitis. Pyogenic microorganisms and tuberculosis were responsible for the remaining 11 (33,3%) and 2 (6%) patients respectively. No microbiological or serological evidence of the causative microorganism was obtained in seven patients. Tissue or abscess culture was performed in 16 out of 33 patients (48.5%) (Table 2). Among these, 11 patients (39.4%) had a total of 12 pyogenic microorganisms isolated, causing the infection. In 14 patients diagnosed with brucellosis-related spondylodiscitis, tissue/abscess culture was performed in 3 cases, with no growth detected in blood or tissue cultures. *Staphylococcus aureus* (12%) was the most common pathogen among pyogenic microorganisms. *Mycobacterium tuberculosis* was isolated as the causative agent in one case. In another case, a preliminary diagnosis of tuberculosis-related spondylodiscitis was made based on cytological examination of tissue samples, and a partial response to anti-tuberculosis treatment was observed. The clinical response to treatment based on the causative agent, surgical history, and duration of symptoms is shown in Table 3.

Discussion

In patients experiencing newly developed or aggravated back or neck pain accompanied by fever, undergoing hemodialysis, with recent bacteremia, endocarditis, intravenous drug use, elevated sedimentation rate and/or CRP levels, or presenting with new neurological deficits, suspicion of spondylodiscitis should arise (5). The incidence of spondylodiscitis increases with age, and it was reported to occur approximately twice as often in males (13). In this study, the mean age of spondylodiscitis cases was 56.0 ± 13.6 years, with a nearly equal distribution between females and

Table 2 Microorganisms Isolated in Patients Diagnosed with Spondylodiscitis

Causative Agents	Blood n	Tissue n	Blood and tissue n
Staphylococcus aureus	1	3	0
MSSA	1	2	0
MRSA	0	1	0
Coagulase-Negative Staphylococcus	1	1	0
MRCoNS	0	1	0
MSCoNS	1	0	0
Klebsiella pneumonia (ESBL +)	0	0	2
Enterococcus faecalis*	1	1	0
Acinetobacter spp.*	0	1	0
Escherichia coli (ESBL-)	0	0	1
Mycobacterium tuberculosis	0	1	0
TOTAL	3	7	3

*In one case, two causative agents were isolated. MSSA: Methicillin-Sensitive *Staphylococcus aureus*
MRCoNS: Methicillin-Resistant Coagulase-Negative *Staphylococcus* MRSA: Methicillin-Resistant S. aureus
MSCoNS: Methicillin-Sensitive Coagulase-Negative *Staphylococcus* ESBL: Extended-spectrum beta-lactamases

Table 3 Clinical Response to Treatment in Patients Diagnosed with Spondylodiscitis

	Full response (n)	Partial response (n)	No response (n)	Lost to follow-up (n)
Brucellosis (n=14)	5	6	1	2
Tuberculosis (n=2)	-	2*	0	0
Cases infected with pyogenic microorganisms (n=11)	5	4	0	2
Before diagnosis				
Disc herniation (n=13)	2	7	3	1
Vertebral surgery (n=9)	3	4	0	2
Invasive intervention/surgery for treatment				
Present (n=11)	4	6	-	1
Absent (n=22)	7	8	4	3
Duration of Symptoms				
<1 month (n=9)	5	3	0	1
1-12 months (n=12)	4	5	3	0
>12 months (n=12)	2	6	1	3

*One of these patients was considered to have tuberculosis spondylodiscitis based on histopathological evaluation. *Mycobacterium tuberculosis* was isolated as the causative agent in another case.

males. This could be attributed to approximately one-third of cases being associated with spinal surgery performed due to discopathy, and 42.4% being related to brucellosis. Prolonged stays in patients requiring hospitalization pose a significant burden for both patients and the healthcare system in the long term (14). The average duration of hospitalization among the cases included in our study was 37.5 ± 27.6 days. Among our cases, 69.7% had sought care at a clinic other than the infectious diseases department, with the neurosurgery clinic being the most common. This could be attributed to previous spinal surgeries or the common occurrence of discopathy.

In patients diagnosed with spondylodiscitis, the most common clinical symptom was localized pain in the infected disc area, which worsens with physical activity (5). The pain can persist and intensify over weeks or even months. In a study evaluating patients with spontaneous pyogenic vertebral osteomyelitis, the average duration of symptoms was found to be 48 ± 40 days (15). In our study, complaint duration was more than one month in 67.7% of cases. The higher incidence of involvement of the lumbar vertebrae explains the most common complaints being low back pain and/or walking difficulty. In a study conducted at a tertiary hospital in our country, Hatipoğlu et al. reported the most common complaints at presentation as low back pain (100%) and walking difficulty (40.9%) (16). Similarly, in our study, lower back pain was reported in 78.7% of cases, and walking difficulty in 24.2% of cases. In studies by Hamidi et al. and Kaya et al., low back pain was reported as the most frequent symptom in 90.2% and 90.1% of cases, respectively (17,18). Fever is not a common complaint in spondylodiscitis cases; in our series, only three cases reported high fever (Table 1).

In studies conducted in our country, the most affected site among patients with spondylodiscitis was reported to be the lumbar vertebrae, ranging from 60% to 86.3% (16-20). Farzan et al. noted in their recent spondylodiscitis studies that the lumbar region was the most commonly affected area (21). In our study, the most frequently affected region was the lumbar vertebrae, accounting for 44.1% (n: 15 cases) of cases. Spondylodiscitis, which can be seen as a musculoskeletal complication of brucellosis, usually involves the lumbar vertebrae. The predominance of disc herniation in this anatomical region in the

remaining cases in our study likely contributed to the diagnosis of discopathy and subsequent spinal surgery, which played a role in identifying involvement in this anatomical area.

In most patients, the infection is monomicrobial, with *Staphylococcus aureus* being the most common pathogen in over 50% of cases in developed countries according to the literature (4). In a study conducted in France, staphylococci were identified as the causative agent in 53% of spondylodiscitis cases (22). Other responsible microorganisms are streptococci, enterococci, coagulase-negative staphylococci, *Pseudomonas aeruginosa*, *Candida* spp., *Mycobacterium tuberculosis*, and *Brucella* spp. (1,4, 23). Gentile et al. analyzed 1756 patients and reported *Staphylococcus* spp., *M. tuberculosis*, and other bacteria as the causative agents in 40.3%, 30.9%, and 28.3% of cases, respectively (24). Among 212 patients with chronic kidney failure and spondylodiscitis, the most common organism found was *S. aureus* (18). Various studies conducted in our country have reported *Brucella* spp. as the causative agent for spondylodiscitis in proportions ranging from 19% to 42.6% (Table 4), (16-20). In our study, *Brucella* spp. was the most common agent, accounting for 42.2% of cases, followed by *S. aureus* at 12%. According to our findings, the incidence of brucellosis-related spondylodiscitis in our country is at the upper limit of the rates reported in studies. In regions where brucellosis is endemic, it is the most common cause of spondylodiscitis, accounting for approximately 50% of cases (25, 26). The province where our study was conducted is known as a highly endemic region for brucellosis, with an incidence of 24.2 per 100,000 individuals (27). The gold standard for diagnosis is the isolation of bacteria from sterile tissues and/or fluids. However, due to the slow growth and low isolation rate of Brucella spp., exposure history and serological methods are also used for diagnosis. Inoculation of tissue or bone biopsy samples into blood culture systems can significantly increase the isolation rate (28). Since the number of patients from whom bone or tissue samples could be obtained was limited in our study, culture positivity was not demonstrated in cases of brucellosis.

The diagnosis of spondylodiscitis can often be delayed by several months, initially misdiagnosed, and may progress to a degenerative process (5). Delayed diagnosis and consequently delayed treatment can lead to high morbidity. It can result in complications such as epidural or subdural abscess, meningitis, paraspinal abscess, compression of the spinal cord or nerve roots, empyema, or neurological symptoms. In the long term, residual neurological deficits, chronic back pain, and depression may occur (14, 15). In this study, complaint duration was more than one month in approximately three-quarters of cases and lasted longer than one year in more than one-third of cases. The rate for complete resolution of symptoms was higher in cases with a complaint duration of less than one month. However, due to the limited number of cases, statistical analysis could not be performed.

The data in this study should be interpreted in light of its limitations. Our study is completed in a single center and having a low number of cases, as well as the inability to isolate the microorganism in blood/tissue culture in patients diagnosed with brucellosis, limits the generalizability of our findings.

Conclusion

The fact that nearly half of the spondylodiscitis cases followed in our hospital are complications of brucellosis indicates the need for evaluation of brucellosis in patients presenting with back pain. “Pathogens such as *Brucella* spp. and M. tuberculosis are gaining importance again in today's world of increased

Table 4 Causes of Spondylodiscitis in Some Studies Conducted in Our Country

Study (Reference No.)	Pyogenic	Brucellosis	Tuberculosis
Hatipoğlu et al. (16)	12	8	2
Turunç et al. (20)	30	32	13
Mete et al. (19)	44	24	32
Hamidi et al. (17)	37	20	46
Kaya et al. (18)	153	138	52

interregional human mobility, and a multidisciplinary approach is required in consultation with microbiology, radiology and pathology departments in case of suspected spondylodiscitis." As the departments of physical therapy and rehabilitation and neurosurgery are the most likely places where patients with complaints of back pain may seek assistance, awareness should be increased among physicians in these specialities. To prevent cases of spondylodiscitis from developing after spinal surgeries, training programs should be periodically repeated in collaboration with surgical departments.

Conflict of Interest Statement
There are no conflicts of interest.

Ethical Approval
The study was approved by the Ethics Committee of Suleyman Demirel University Faculty of Medicine at a meeting on June 22, 2023, with decision number 10/127. The research was conducted by the Helsinki Declaration.

Consent to Participate and Publish
As the research was conducted retrospectively, there was no requirement for informed consent.

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Availability of Data and Materials
Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Authors Contributions
OÜ: Conceptualization; Formal analysis; Data curation; investigation; Methodology; Writing-original draft

MY: Conceptualization; Data curation; Writing; Investigation

GRY: Conceptualization; Formal analysis; Data curation; investigation; Methodology; Writing-review & editing

FZA : Supervision; Writing-review & editing

OK : Supervision; Writing-review & editing

ENT: Supervision; Writing-review & editing

All authors read and approved the final manuscript

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