ORIGINAL ARTICLE

Postoperative spondylodiscitis: Five-year, single-center retrospective analysis. Is it really postoperative?

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ABSTRACT

Introduction: Postoperative spondylodiscitis (POSD) is not uncommon. The incidence of POSD varies between 0.21–3.6% In this study, it was aimed to examine the clinical findings, diagnosis and treatment of postoperative spondylodiscitis (POSD).

Materials and Methods: Between September 2017 and October 2022, 37 patients were included in the study, who applied to the Infectious Diseases and Clinical Microbiology Clinic of the XXX Hospital and had POSD infection and were followed-up/treated as outpatients or inpatients. The following were examined: symptoms, physical examination findings, contrast-enhanced spinal MRI (magnetic resonance imaging) findings of the patients, laboratory findings, PPD (purified protein derivative) and QuantiFERON TB-Gold test and blood cultures. The antibiotics that were started and the clinical and radiological response of the patients to the treatment were evaluated.

Results: Of the patients 25 (67.6%) were female and 12 (32.3%) were male. The mean time to develop POSD after surgery was 44.8 months. In our study, we found that laboratory tests were not significant in diagnosing POSD other than C-reactive protein(CRP). Teicoplanin and ciprofloxacin were given to all patients except one patient with positive brucella slide and tube agglutination. With this treatment, clinical and radiological improvement was observed in 24 patients. The treatment of 13 patients, including the patient who was given Brucella treatment, was changed due to the lack of clinical and radiological improvement, and anti-tuberculosis treatment was started and recovery was achieved. The mean duration of the treatment was 3.5 months in the pyogenic POSD group and 9.5 months in the POSD patient group that recovered with anti-tuberculosis therapy.

Conclusion: It Should be kept in mind that in cases where the POSD patients do not benefit from empirical treatment, the causative agent may be an agent other than the common microorganisms, for example M. tuberculosis, and if the agent cannot be detected, finding the diagnosis from treatment is also an option.

KEYWORDS:
Postoperative spondylodiscitis; tuberculous spondylodiscitis; spinal infection; acute phase reactants; paravertebral abcess

INTRODUCTION

Spondylodiscitis (SD) is defined as infection of the vertebral body, intervertebral disc, and posterior vertebral arch Postoperative spondylodiscitis (POSD) is an infection of the vertebral bone, disc, and nucleus pulposus. The incidence of POSD varies between 0.21–3.6% and may cause serious sequelae The first discectomy surgery, performed approximately 100 years ago, is now one of the most frequently performed surgical procedures, and its frequency is steadily increasing.[2] The causes of POSD may include iatrogenic factors resulting from inadequate aseptic technique during surgery, as well as infections transmitted hematogenously or via contiguous spread.[2] The frequency of implant application in spinal surgery is increasing today, and the success rate of medical treatment alone without surgical intervention in implanted spondylodiscitis is relatively low.[3] Although the most common cause is Gram-positive cocci (especially Staphylococcus aureus), Gram-negative bacteria also play a role in the POSD infections. Fever, spinal pain, difficulty in walking, neurological symptoms (such as sensory loss and neurological deficits) may also be present.[4] Diagnosis is mainly based on clinical signs and symptoms and supported by laboratory tests and radiological imaging.[5] Leukocytosis, elevated C-reactive protein (CRP) and erythrocyte sedimentation rate(ESR) and positive blood cultures may be present.[4] It has been stated that Magnetic resonance imaging (MRI) has an important role in the diagnosis and differential diagnosis of postoperative spinal complications.[6] Surgical treatment is indicated if neurological disorders, spinal deformities, septic conditions or extensive abscess formations are present.[7] Antibiotic therapy in combination with spinal immobilization has been shown to produce good long-term results in the majority of patients. When the causative organism is determined, specific intravenous antibiotics for the causative agent should be administered followed by appropriate oral antibiotics. If the causative agent cannot be identified, broad-spectrum antibiotics with anti-staphylococcal coverage are recommended.[8] However, studies with POSD are often conducted in countries where infected tissue sampling is performed; this study may be useful in determining treatment protocols in hospitals where interventional biopsy is not performed, such as our centre.

In this study, it was aimed to examine the clinical findings, diagnosis and treatment of patients who applied to XXX Hospital Infectious Diseases and Clinical Microbiology clinic between September 2017 and October 2022 and had POSD

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infection and were followed up/treated as outpatients or inpatients.

MATERIALS AND METHODS

Between September 2017 and October 2022, 37 patients were included in the study, who applied to the Infectious Diseases and Clinical Microbiology clinic of the XXX Hospital and who developed POSD and were followed-up/treated as outpatients or inpatients. All patients had undergone vertebral surgery but had not undergone internal fixation. No tissue samples were taken from any patients except for two patients who underwent biopsy using an open surgical technique. The files of these patients were scanned retrospectively through the information processing system of our hospital. In the file screening, we examined the patients' complaints and physical examination findings, spinal MRI findings with contrast, routine blood tests before treatment, hemogram, ESR, CRP, procalcitonin, brucella slide and tube agglutination, purified protein derivative (PPD) and QuantiFERON TB-Gold test results and blood culture results. Monthly contrast-enhanced spinal MRIs of the patients were reviewed retrospectively, and radiological recovery times, and, if a change was made in the initial antibiotic therapy, the time and shape of the change were noted. Results with a Brucella serum tube agglutination test (SAT) of 1/160 and above and a PPD test of 15 mm and above were considered positive. With the exception of open biopsies performed on two patients in the postoperative period, the absence of discharge in the lumbar region of the patients and the non-performance of invasive biopsies, and consequently the inability to obtain wound cultures, are limiting factors in our study. No pathology other than chronic inflammation was detected in patients who underwent bone biopsy, and caseous necrosis was not observed. In these patients, the diagnosis of tuberculosis is presumptive based on treatment.

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki and was approved by the XXX University Non-Invasive Clinical Research Ethics Committee (Date: 12.04.2023, Resolution no: 2023/233).

RESULTS

All 37 patients with POSD included in the study, who were followed up, had a history of lumbar spine surgery. Operations were carried out in different centers and provinces, and there was no clustering in a single center. Of the patients included in the research, 25 (67.6%) were female and 12 (32.3%) were male. Their mean age was 52.8 (range: 35-71 years). The mean age of female patients was 56.5 (range: 35-75 years), while the mean age of men was 49.2 (range: 40-61 years). The mean time to develop pyogenic POSD after surgery was 44.8 months (range: 3 weeks-23 years). The mean time after surgery was found to be 40.6 months (range: 3 weeks-18 years) in the POSD group that recovered with anti-tuberculosis (anti-TBC) therapy.

All of the patients complained of severe limitation in crouching and right-left and prone-supine rotational movements while lying down. On physical examination, the main finding was lumbar tenderness and pain during leg internal rotations. Apart from this, fever in three patients, sweating in nine patients, and weight loss in one patient in the last six months, such as losing 5% or more of their weight, were observed.

At the time of diagnosis, 27 patients did not have any chronic disease. Six patients had hypertension (HT), two patients had diabetes mellitus (DM), and two patients had chronic obstructive pulmonary disease (COPD). Laboratory findings of the patients are given in Table I.

Blood cultures were taken from 30 of 37 patients included in the study. *Methicillin-susceptible coagulase-negative staphylococci* (MSCNS) developed in five patients, *methicillin-resistant coagulase-negative staphylococci* (MRCNS) in two patients, and *methicillin-resistant S. aureus* (MRSA) in two patients. There was no growth in the blood cultures of the other 21 patients.

In the initial treatment of the patients in our study, treatment for Brucella SD infection (doxycycline 2x100 mg tablet (tb), rifampicin 1x600 mg tb, streptomycin 1x1 g intramuscular (IM)) was initiated in one patient because the Brucella slide agglutination test was positive and the tube agglutination test was >1/160, and treatment for pyogenic POSD (teicoplanin 1x600 mg intravenous (IV) and ciprofloxacin 2x500 mg tb) was initiated in 36 patients. Since clinical and radiological improvement was observed in 24 patients (66.7%) with teicoplanin and ciprofloxacin treatment, the treatment was continued. In 12 patients (33.7%) who did not improve clinically and radiologically, treatment was changed and daptomycin 1x500 mg IV/linezolid 2x600 mg IV and meropenem 3x1 gr IV were started. Anti-TBC therapy (isoniazide 1x300 mg, rifampicin 1x600 mg, ethambutol 15-20 mg/kg, pyrazinamide 20-25 mg/kg, oral) was initiated in 12 patients who received this treatment due to lack of clinical and radiological response. The only patient who was treated for Brucella infection was treated by switching to anti-TB treatment due to no response to treatment. The initial treatments and the times of treatment change are shown in Table II. The mean duration of treatment was 3.5 months (range: 2-7 months) in the pyogenic POSD group and 9.5 months (range: 6-13 months) in the POSD patient group that recovered with anti-TBC therapy.

QuantiFERON TB-Gold test was performed on eight of 37 patients included in the study, and it was found to be positive in three patients and negative in five patients. There was no growth in the blood culture of all three patients with QuantiFERON TB-Gold test positive and it was observed that three patients recovered with the anti-TBC treatment. It was determined that the final treatment of only one of the five patients with QuantiFERON TB-Gold test negative was the anti-TBC treatment. PPD was found to be negative in three patients with QuantiFERON TB-Gold test positive. Of the 13 patients who achieved full cure with the anti-TBC treatment, four were PPD positive, eight were PPD negative, and one patient was PPD anergic. In our study, we found that laboratory tests other than CRP were not significant in diagnosing POSD ($p>0.05$).

When the contrast-enhanced lumbar MRIs of the patients in our study were evaluated, 11 patients had paravertebral soft tissue involvement, seven patients had abscesses (various sizes from phlegmon to 6 cm), and four patients had soft tissue involvement. Five of the patients with paravertebral involvement had pyogenic POSD, and six had POSD that improved with the anti-TBC therapy. One patient with POSD who recovered with the anti-TBC therapy had soft tissue involvement, one had phlegmon, and four had abscess greater than 1 cm. Two of the patients with pyogenic POSD had abscesses (1 and 3 cm), and three patients had soft tissue involvement.

DISCUSSION

POSD is a complication that develops following spinal disc surgery.[5] The incidence of postoperative discitis after lumbar discectomy has been reported to be 0.7% to 2.8%.[9] In one study, POSD developed in 47 (1%) of 4698 patients who underwent lumbar surgery. Spinal stiffness and fever were observed most frequently after low back and hip pain.[2] In another study, it was stated that fever was observed the most after lumbar pain.[10] Lumbar pain, difficulty in walking and fever were the most common findings in our study. Advanced age, immunosuppression, spinal trauma, DM, obesity, smoking, indwelling catheters, malnutrition, and prolonged hospital stay are risk factors for POSD. High infection rates have been observed in elderly patients and patients with spinal trauma.[2] The mean age of the patients included in our study was 52 and two patients had DM.

Gram-positive cocci (such as *S. aureus, Staphylococcus epidermidis*, and beta-hemolytic streptococci) are the most common pathogens. Gram-negative bacteria also play a role in POSD infections and may be associated with systemic disease and multi-system organ failure.[11] In a study, blood culture grew in four of 12 POSD cases, and *S. aureus* was detected in three and *Pseudomonas aeruginosa* in one.[5] In another study, according to the culture results of 20 POSD cases, the most common microorganism was *S. aureus* in three (42%) cases, and *Escherichia coli* (14.5%), *S. epidermidis* (14.5%), *Streptococcus viridans* and (14.5%) *Acinetobacter baumanii* (14.5%) each in one case.[12] In our study, unlike the literature, MSCNS was detected most frequently in five patients, MRCNS in two patients, and MRSA in two patients. It is a rare condition that the causative agent is *Mycobacterium tuberculosis* in patients who develop POSD. It was reported that a patient who had been treated for pulmonary tuberculosis 20 years ago and had a full recovery underwent an operation for lumbar disc herniation and that patient developed POSD 3 weeks later, and the anti-TBC treatment was initiated for the patient whose PCR test was positive for *Mycobacterium tuberculosis* in two of the vertebral biopsies performed for the second time, who did not respond to broad-spectrum antibiotic treatment, and the patient benefited from this treatment.[13] There are other case reports of tuberculous spondylodiscitis after lumbar spine surgery.[14,15] Vertebral sampling could not be performed on the patients included in our study, so histological and microbiological diagnosis or PCR test (polymerase chain reaction) could not be performed for the diagnosis of tuberculosis POSD. In cases where the agent cannot be detected in the treatment of POSD, it should be kept in mind that the agent may be *M. tuberculosis* when broad-spectrum antibiotics for possible agents are given in a sufficient time and no response is obtained.

While CRP is a predictable serum parameter in patients with spondylodiscitis, the leukocyte count is not specific.[16,17] Similar to leukocyte count, ESR is not thought to be useful as a definitive indicator for POSD.[18] Similarly, in our study, it was seen that CRP was significant in the diagnosis of POSD, while the leukocyte count and ESR were not significant in the diagnosis.

Direct graphs are usually the first diagnostic method in the diagnosis of POSD, but they are not sensitive for discitis. Computed tomography (CT), MR, and radionuclide imaging methods can be used for diagnosis.[8] On MRI, it is not easy to diagnose because changes caused by the postoperative inflammatory response at the level of the operated disc and bone marrow edema in the adjacent end-plates are frequently seen in postoperative patients, even in the absence of infection.[19,20] MRI is the most sensitive (93-96%) and specific (92.5-97%) method for the early detection of spondylodiscitis. It can differentiate between pyogenic discitis, neoplasia, and tuberculosis, allowing better identification of the paravertebral and epidural spaces. For patients for whom MRI is contraindicated, radioisotope scanning followed by CT with contrast is recommended. The earliest MRI abnormalities appear when edema and inflammatory cells infiltrate the vertebral body and disc space.[21] As MRI findings of POSD, it was stated that the signal intensity decreased on T1-weighted images in the disc space due to edema (Modic I changes) caused by inflammation and infection and that the signal intensity increased on T2-weighted images and decreased in the adjacent bone marrow on T1-weighted images after gadolinium injection.[2] In our study, MRI was used in the radiological diagnosis and follow-up of the patients, and abscess and paravertebral tissue involvement were also detected, apart from discitis.

Antibiotherapy and bed rest were reported to be effective treatment modalities for POSD without internal fixation, and surgical treatment was recommended in case this treatment failed.[23] It has been stated that surgical treatment using one-stage posterior debridement, fusion, and instrumentation followed by continuous closed irrigation and drainage may be an effective treatment option for POSD.[23] It has been determined that the agent-directed antibiotic given intravenously for 6 weeks and then orally for 6 weeks is effective. If the causative agent cannot be identified, antibiotics with broad-spectrum anti staphylococcal coverage are recommended.[8] In our study, teicoplanin and ciprofloxacin treatment was given in cases where no causative agent could be detected. While 24 patients benefited from this treatment, 12 patients received broad-spectrum antibiotics due to the lack of clinical and laboratory improvements, but the anti-TBC treatment was started because there was no improvement and our country is an endemic country in terms of tuberculosis. These patients showed clinical and radiological improvement with the anti-TBC treatment.

A limitation of our study is the inability to perform postoperative biopsies, which prevented histopathological diagnosis and tissue microorganism identification. Furthermore, due to the single-center nature of the study, the generalizability of the results is limited, and multicenter, prospective studies are needed. Another limitation of the study is that QuantiFERON TB-Gold test and PPD could not be performed on all patients.

CONCLUSION

In cases where the POSD patients do not benefit from empirical treatment, it should be considered that the causative agent may be other than common microorganisms, for example *M. tuberculosis* Since interventional procedures aimed at identifying the causative microorganisms are not performed in every center, we believe that diagnosis based on treatment could be considered as an alternative approach.

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