

Recommendations for diagnosis and treatment of spondylodiscitis

B.L. Fransen¹, E. de Visser¹, A. Lenting¹, G. Rodenburg², A.A. van Zwet³, E.H. Gisolf^{1*}

Department of ¹Orthopaedic Surgery, ²Internal Medicine, and ³Medical Microbiology and Medical Immunology, Rijnstate Hospital, Arnhem, the Netherlands, *corresponding author: tel.: +31 (0)88-0057750, fax: +31 (0)88-0056809, e-mail: jgisolf@rijnstate.nl

ABSTRACT

Background: Spondylodiscitis, also known as vertebral osteomyelitis, is a destructive disease with high morbidity and mortality. Diagnosis is often delayed because of the rarity of the disease and the fact that early symptoms are often non-specific. There are currently no national guidelines on the diagnosis and treatment of spondylodiscitis in the Netherlands.

Methods: We performed a single-centre retrospective cohort study examining 49 patients over 18 years of age treated for spondylodiscitis in a six-year time period.

Results: Mean age of patients was 69 years (range 40-89). Most patients underwent an MRI scan to confirm diagnosis (n=30). In 39 patients a microorganism was found, most commonly *Staphylococcus aureus* (n=14), *Streptococcus* species (n=11) and Gram-negative bacteria (n=11). All patients were treated with antibiotics. Thirty-seven patients received antibiotic treatment for at least six weeks, while 17 patients were treated for 90 days or longer. In 13 patients no adequate treatment was started until culture results were available. Eleven patients underwent surgery after their diagnosis. Two patients had a recurrence.

Conclusion: We recommend that, when considering spondylodiscitis as a possible diagnosis, all patients should undergo thorough physical examination, neurological screening, blood tests for infection and blood cultures. An MRI scan should be performed, followed by a PET-CT scan when results are inconclusive. Ideally a CT-guided biopsy is performed before treatment is started. Awaiting culture results all patients should receive broad-spectrum antibiotics. Targeting only Gram-positive microorganisms in empiric treatment will lead to a delay in adequate treatment in a substantial group of patients. A multidisciplinary approach is advocated.

KEYWORDS

Diagnosis, guideline, spondylodiscitis, treatment

INTRODUCTION

Spondylodiscitis is a rare but serious infection of the intervertebral disc with possibly devastating outcome. The peak incidence is in patients under 20 years of age and between 50 and 70 years of age. The incidence ranges from 0.4- 2.5 per 100,000 per year.^{1,3} Patients present with a variety of symptoms including back pain, fever, nausea, and weight loss. There is often a delay in diagnosis due to the nonspecific nature of symptoms.^{4,5}

Spondylodiscitis occurs secondary to a variety of causes, most notably bloodstream infections (e.g. *Staphylococcus aureus*) and after surgery.⁶ The most commonly found pathogen responsible for spondylodiscitis is *S. aureus*, but coagulase-negative staphylococci, *Streptococcus* species, *Pseudomonas aeruginosa*, *Escheria coli*, and fungi such as *Candida albicans* are also regularly found.^{2,5,6}

Diagnosis of spondylodiscitis is difficult. The diagnostic tools most often used are blood cultures, MRI scans, and vertebral biopsies.¹ MRI scan has proven to be the modality of choice for most physicians with high sensitivity even early in the disease process.⁷

Treatment regimens differ between hospitals. The main variation seems to be in choice, route of administering, and duration of antibiotic therapy.^{5,8,9} Evidence suggests that patients should be treated for at least six weeks with antibiotics and preferably 12 weeks.^{3,10} Due to the lack of randomised controlled trials there is still no high-level evidence on which treatment regimen provides the best outcome in patients with spondylodiscitis. Currently there is no nationwide protocol for spondylodiscitis in the Netherlands.

The aim of this study was to evaluate the treatment of spondylodiscitis in our hospital. We evaluated the diagnostic process, the treatment, and patient outcome to determine whether there are indications for a preferred treatment strategy.

MATERIALS & METHODS

A single-centre retrospective cohort study was performed in a high volume non-academic hospital. Data were collected of patients over 18 years admitted to the internal, neurology or orthopaedic department from 1 January 2007 until 31 March 2013. All patients were registered in the hospital registration system as having been diagnosed with spondylodiscitis. Patients were excluded if the diagnosis of spondylodiscitis was not confirmed either by characteristic imaging, surgical verification, a positive culture, or a good response to treatment.

Diagnosis of spondylodiscitis was defined by clinical findings and characteristic changes on magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography CT (PET-CT), a positive culture (blood, cerebrospinal fluid, disc, or another source), or a good response in patients with suspected spondylodiscitis to treatment either with or without a positive finding on imaging or culture.

Data were collected on start, finish and adjustments of antimicrobial treatment. Several patients also needed surgical intervention. Of these patients the type of surgery was registered and whether or not tissue was collected.

RESULTS

Study population

Data were collected from 78 patients who were encoded in the system as having spondylodiscitis. After examining files a total of 49 patients met the inclusion criteria. Of these patients 29 were male and 20 female. Mean age of the study population was 69 years, ranging from 40 to 89 years.

Most patients (n=20) had an infection in the lumbar intervertebral discs, nine patients in the thoracic disc, and five patients in the cervical disc. Fifteen patients had an infection in more than one segment.

Of the 49 patients, 17 had back problems in their medical history. Nine patients had spinal surgery previous to their episode of spondylodiscitis. In other patients no other focus of origin of the infection could be found.

Diagnosis

Radiology

MRI scan was most commonly used, in 30 patients. In four patients only a conventional X-ray was used (*table 1*). Two

Table 1. Radiology

| Technique | No of patients |
|-----------------------|----------------|
| MRI | 29 |
| MRI + X-ray + CT scan | 1 |
| PET scan | 12 |
| X-ray | 4 |
| CT scan | 3 |
| Total | 49 |

patients were only diagnosed by repeating the MRI scan. One patient had a positive lesion on a FDG-PET/CT scan, which was first diagnosed as a malignancy but after biopsy appeared to be infectious.

Bacteriology

Cultures were obtained from 44 patients: 31 blood cultures were taken, nine patients had material taken for biopsy, five patients underwent both a biopsy and had blood cultures taken, and for one patient a sputum sample was examined.

In 39 patients microorganisms were identified in the material obtained for bacteriological examination (*table 2*). Most of these (n=14) were *S. aureus*. Eleven patients had Gram-negative bacteria, and another 11 had a species of *Streptococcus*. In three patients a coagulase-negative staphylococci was seen. There were two patients with tuberculosis and one with a fungal infection (*C. albicans*).

Antibiotic treatment

Two patients who were diagnosed with tuberculosis were treated with tuberculostatics. Of the other 47 patients, there were data on the start and finish of antibiotic treatment of 44 patients. The treatment consisted of intravenous antibiotics and after a certain period an oral regimen. Eleven patients received only intravenous treatment and three patients were treated with oral antibiotics only. Thirty-seven patients were treated for a total of at least six weeks, 17 patients were treated for at least 90 days. The mean number of days that patients received antibiotic treatment are shown in *table 3*.

Table 2. Micro-organisms

| Pathogen | # of patients |
|-----------------------------------|--|
| <i>S. aureus</i> | 14 |
| Gram-negative bacteria | 11 |
| Streptococci | 11 |
| Coagulase-negative staphylococci | 3 |
| <i>Mycobacterium tuberculosis</i> | 2 |
| <i>Candida albicans</i> | 1 |
| Total | 42 (3 patients with 2 bacterial types) |

Table 3. Antibiotic treatment

| Duration | Median (days) | Minimum | Maximum |
|----------------------------------|---------------|---------|---------|
| Intravenous antibiotic treatment | 37 | 4 | 141 |
| Oral antibiotic treatment | 47 | 0 | 206 |
| Total antibiotic treatment | 89 | 4 | 222 |

From 42 patients there were data available on the number of days between start of antibiotic treatment and the start of the appropriate treatment for the specific micro-organism found in culture. Antibiotic treatment was adjusted as soon as the results of the Gram stain and culture were known. The initial treatment proved adequate in 29 patients. The remaining 13 patients had a median delay of adequate treatment of 3 days, ranging from 1-10 days.

Surgery

Eleven patients underwent surgery after their diagnosis of spondylodiscitis. In seven patients the indication for surgery was a poor response to initial treatment. In one patient a biopsy was performed because additional material for bacteriological examination was required, and three patients were operated on because of decreasing neurological functions. No patients received only surgical treatment.

Recurrence

Two patients had a recurrence of spondylodiscitis during the study period, both within six months after the initial diagnosis. One patient was adequately treated for three months with antibiotics before his recurrence one month after finishing his treatment. The second patient had a recurrence during treatment with oral antibiotics after a period of six weeks of intravenous antibiotics, but this recurrence was treated in another hospital.

DISCUSSION

A retrospective study was performed of 49 patients treated for spondylodiscitis in a high volume non-academic hospital over a period of over six years. Data were collected on diagnosis, culture, surgery and antibiotic treatment. The mean age of patients was 69 years. Only patients over 18 years of age were included because children with spondylodiscitis are referred to an academic hospital in our region. In other studies a peak incidence in (early) childhood is often found.^{1,6}

One of the usual predictors of spondylodiscitis is recent back surgery.^{5,8} However, just 17 patients had a history of back problems. Only nine of those had undergone back surgery prior to their diagnosis of spondylodiscitis. This indicates that even without recent back surgery, spondylo-

discitis should be considered as a possible diagnosis in patients with unexplained fever.^{1,4}

Initial diagnosis of spondylodiscitis is difficult due to the combined delaying factors of aspecific symptoms and the relative rarity of the disease. Almost all patients in the current study were diagnosed correctly using radiological methods. Our results suggest that as soon as there is a suspicion of spondylodiscitis, radiology can provide an indication whether the suspected diagnosis of spondylodiscitis is correct. Most patients underwent either an MRI scan or a PET-CT scan. Because of increasing availability and high sensitivity and specificity the first diagnostic method of choice is the MRI scan.¹¹

To provide adequate treatment of the microorganism it is essential that material for Gram stain and culture is collected prior to the start of antibiotic treatment. Blood cultures are an easy and effective way to determine pathogens.^{1,8} CT-guided biopsy of the intervertebral disc has been proven to be a helpful diagnostic method to determine the microorganism responsible for spondylodiscitis in patients in whom no microorganism is found in the blood cultures or who do not respond well to initial antibiotic treatment.¹²⁻¹⁴

In most cases there were cultures obtained to determine the pathogen responsible for the spondylodiscitis. There were seven patients in whom no material was obtained for culture. In several cases this was because antibiotic treatment had already been started, but in some patients there was no clear reason why culture was omitted from the diagnostic process.

One-third of patients were diagnosed as being infected by *S. aureus*. This is a lower percentage than found in the literature where over half of all patients had an infection with *S. aureus*,^{1,5,10} with percentages ranging from 15 to 84%.^{1,6} There were only two patients with spondylodiscitis caused by tuberculosis, which is also less than expected in developed countries when looking at the literature.¹

The antibiotics started were usually adequate for the most frequently found micro-organisms. There were 13 patients where no adequate treatment was started and where a switch to a different type of antibiotic, based on the results of the cultures, was necessary. Almost all patients were infected with *S. aureus*, Gram-negative bacteria or *Streptococcus* species. Especially these micro-organisms should be taken into consideration when starting antibiotic treatment before results from cultures are known.

During the period examined there was no nationwide protocol for the treatment of spondylodiscitis. All patients were treated with antibiotics. The median number of days that patients were treated with antibiotics was 87, which is largely consistent with the consensus that patients with spondylodiscitis should be treated for at least 6-12 weeks with adequate antibiotic therapy.^{3,10}

Surgical treatment of spondylodiscitis can be necessary when radiological imaging shows destruction of the vertebrae, a spinal abscess, deterioration of neurological functions, or when patients continue to deteriorate despite adequate antibiotic treatment.^{3,15} Eleven patients in our study underwent surgery. More than half of these patients did not have a good response to initial treatment with only antibiotics. A relapse of spondylodiscitis was found in two patients, which is consistent with other studies.³ Both these patients were treated with antibiotics and had not undergone surgery.

There were some limitations in our study. Firstly, this is a retrospective study that is descriptive in terms of treatment given. Also, there were no data collected on outcome in infection and function.

Based on the data collected and current literature we can make some recommendations. Spondylodiscitis should be considered as a possible diagnosis in all patients presenting with symptoms of a systemic infection. A thorough physical examination including a neurological screening should be performed followed by blood tests for infection and blood cultures. An MRI scan should be performed to determine the level and extent of the infection and to rule out other possible diagnoses. When there is doubt about the diagnosis a PET-CT scan can provide additional information. Whenever possible, a CT-guided biopsy should be performed to help determine the micro-organism responsible for the infection before starting antibiotic treatment. Patients should start with a broad-spectrum intravenous antibiotic awaiting further results from the cultures, since initial treatment for only *S. aureus* seems insufficient. A multidisciplinary approach by orthopaedic surgeons, infectiologists, microbiologists and neurologists is warranted. We are awaiting guidelines for diagnosis and treatment of spondylodiscitis.

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