With an incidence between 1:100,000 and 1:250,000, spondylodiscitis is rare, but is increasingly reported due to longer life expectancy, risk factors, and comorbidities, with HIV+ patients being at greater risk. We reviewed the literature on the diagnostic tools, and on the benefits and drawbacks of different treatments of spondylodiscitis in HIV+ positive patients. We discuss basic strategies and indications for surgery. Recently, the trend was toward early mobilization of patients after surgical treatment. Modern surgical and antibiotic treatment can prevent a recurrence in these patients. The decision to opt for conservative or surgical treatment should be made depending on the extent of infection and the responsible pathogen, without regard to HIV. However, these patients should be treated in a specialized hospital by an experienced interdisciplinary team of consultants.

**Keywords**: spondylodiscitis; HIV; immunodeficiency; acquired immune deficiency syndrome; CD-4 T-cell count.

**INTRODUCTION**

Although still relatively infrequent, spondylodiscitis is becoming more common due to an increasing susceptible population and better diagnostic tools (8). It may affect several anatomical structures and thus be described as spondylitis, discitis, spondylodiscitis, pyogenic facet arthropathy, epidural infections, meningitis, polyradiculopathy and myelitis (36). Frequently, at diagnosis, it cannot be determined exactly which anatomical structure was first infected since, as reported in literature, the first clinical manifestations arise between two to six months later (29). Early diagnosis and treatment improve the prognosis. Frequently, the patients suffer from unspecific back pain and are treated for degenerative disease of the spine.

Immunocompromised patients have a higher risk of developing spondylodiscitis (33). However, osteoarticular infections are relatively rare in HIV+ patients if intravenous drug abusers are excluded (1). Furthermore, in HIV+ patients, the lethality of musculoskeletal infections has been reported to be around 20% (38), and the incidence of spinal infections is significantly higher, even in non-intravenous drug users (39).
We will discuss here the different diagnostic and treatment options for spondylodiscitis in HIV+ patients. Furthermore, we address the question whether HIV impedes the usual treatment strategies.

**PATHOGENS AND DIAGNOSIS**

Endogenous and exogenous infection pathways must be differentiated. Endogenous infection, which is the usual case, occurs where a pathogenic agent spreads haematogenously. In the vascularized subchondral bone, it finds its way into the bone marrow of the vertebral body, close to the endplates and near the longitudinal ligament. Exogenous infection may occur following spine surgery, infiltration, or invasive diagnostic procedures (6). In addition, it is important to discriminate accurately between non-tuberculosis (non-specific) and tuberculosis (specific) spondylodiscitis. *Staphylococcus aureus* is the predominant bacterial agent in 20-84% of non-tuberculosis cases (22,30,40).

Tuberculosis is the most common cause of spinal infection worldwide and accounts for 9% to 46% of cases in developed countries, with skeletal involvement in 1% to 3%. The spine is involved in about half of these cases (8,34,37). In HIV+ patients, the infection pathway is mostly endogenous (35). Among 2519 patients, only 1% with vertebral osteomyelitis were HIV+ (10). Weinstein et al have reported spinal tuberculosis in about 35% of HIV+ patients with spondylodiscitis (39).

Clinical symptoms, especially in the early stage, are uncommon. The patient should be examined for infected lesions, and assessed for his or her neurological status. Symptoms include pain on heel strike and/or compression and percussion. The patient often feels pain when bending forward and returning to upright position.

The first diagnostic step should be a laboratory examination, including leucocyte count, erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP). In most reports, ESR is high in over 90% of cases, with mean values ranging from 43 mm/h to 87 mm/h (2,8), and also CRP in most cases. CRP is thought to be the best response marker (8,13) and leucocyte count the least useful.

In HIV+ patients, CD4 blood count is crucial in determining the clinical course of spondylodiscitis. A mild-to-moderate decrease (> 200 cells/µL) indicates discitis and/or osteomyelitis that responds to appropriate antibiotics. Patients with a larger decrease (50-200 cells/µL) are more prone to develop spinal tuberculosis, with a very low CD4 count (< 50 cells/µL) more epidural abscesses (39). A CD4 T-cell count less than 100 cells/µL increases the probability of mixed infections. In HIV+ patients with suspected spinal infection, CD4-T cell count, white blood cell count, ESR and CRP levels should be checked, in addition to blood cultures.

At first plain radiographs should be made; they have a sensitivity of 82%, a specificity of 57%, and an accuracy of 73% (20). However at this stage, they do not show any evidence of spondylodiscitis, but only minor changes, if any, such as endplate demineralization and/or irregularity (19,24,32). Later, the radiographs show how, as the infection progresses, it further destroys the vertebral body affecting the opposite end plate, eventually spreading through the anterior, lateral, and posterior surfaces. Although a paravertebral soft tissue mass with displacement of the surrounding structures may be seen, soft tissue contrast resolution is poor. If two neighbouring vertebral bodies are seen to be destroyed with a narrowed intervertebral disc, spondylodiscitis is the correct diagnosis (14,26) which can be best achieved using MRI.

In HIV+ patients, the physician must first distinguish between TB and pyogenic spondylitis in order to treat the specific type of infection. TB spondylitis manifests mainly as bone destruction with relative preservation of the disc, pyogenic spondylitis mainly as disc destruction (discitis) with mild-to-moderate peri-discal bone destruction. In TB, contrast enhancement is focal and heterogeneous, in the other case, relatively diffuse and homogenous. In addition, on the one side a paraspinal area of abnormal signal intensity is well-defined, on the other ill-defined with peri-discal rim enhancement. On the sagittal views, an intraosseous rim enhancement of the vertebra may occur (3).

In any case, injection of contrast medium is highly recommended during the procedure. In early stages of spondylodiscitis, even MRI, the gold stan-
Spinal infections are generally monomicrobial, frequently with a haematogenous source. Therefore, blood cultures are a simple and cost-effective method for identifying the pathogens. A positive culture can be expected in 40%-60% of clinically defined cases of pyogenic spondylodiscitis (8,28). The pathogen is often successfully identified not only in the acute phase of fever or in presence of sepsis, but also in clinically non-problematic cases of afebrile patients (23). Nevertheless, a high incidence of infective endocarditis (26%) has been reported during enterococcal and streptococcal spondylodiscitis. Routine echocardiography should be performed when these pathogens are suspected (21).

The pathogen can also be identified by percutaneous punch biopsy under anaesthesia, or CT-guided fine needle aspiration, possible in 40%-73% of the cases (25,31). Spinal biopsy leads to a direct change in management for 35% of patients, and is still worthwhile even if the patient has already been started on antibiotics. However, the pathogen can be identified more successfully prior to starting antibiotics (25). Otherwise, the treating physician should consider stopping this treatment for 2-3 days before the biopsy. Friedman et al. observed microbiological growth in 50% of cases after disc space biopsy in patients with spontaneous spondylodiscitis (7). Surgical sampling is the best technique to obtain biopsies to identify the pathogen, at best with two biopsies for histological and microbiological examination (18). In addition to culture, histologic examination of the specimen is helpful as it allows to discriminate between pyogenic and granulomatous origin of the disease. Regarding pathogen identification in HIV+ patients, the literature does not provide any specific recommendation.

TREATMENT

Conservative treatment

The existing literature offers no standardized guidelines as to the duration of intravenous antibiotic treatment. As a general rule, at least two to four weeks seem advisable to improve bioavailability; less than four weeks may lead to higher treatment failure as reported in observational studies (5,27). In addition to antibiotic treatment, it is necessary to immobilize the affected region of the spine e.g. through reclining orthoses that distribute stress over the unaffected segments and their joints, thus providing relief to the affected ventral column. Wearing orthoses, patients can be fully mobilized. In elderly patients, well-known pathologies related to bed rest must be taken into account, e.g. decubitus ulceration, deep vein thrombosis, pulmonary embolism, and pneumonia. However, at least six weeks’ bed rest is required in case of substantial defects of the anterior column or diseases affecting the lower lumbar or lumbosacral segments (15). In our study of HIV+ patients, only half of the conservatively treated patients wore a reclination brace, on average for 51 days. In addition, 4 operated patients also received such a brace. As their condition worsened under conservative treatment, 2 patients had to be operated (35).

Often the decision to operate is based on the patients’ general condition, the stage of HIV disease, and life expectancy. Still, many surgeons fear post-operative complications, such as wound infections...
Surgical treatment

I. Surgery aims to relieve compression of the spinal cord, or to drain epidural or paravertebral abscesses to improve spinal stability (16). Alternatives include dorsal instrumentation with pedicle screw-based systems (Fig. 2), either minimally invasive if no spinal decompression is required, or using open technique in combination with spinal canal decompression (Fig. 2). Surgery indications for spondylodiscitis are listed in table I.

HIV+ patients must be treated for spondylodiscitis in the same manner as other patients, with the objective, under appropriate pain management, to eradicate the underlying infection, to restore and preserve the spinal structure and stability, and to correct any neurological deficits. At present, due to the very heterogeneous patterns of the disease, no general treatment guidelines are available for spondylodiscitis, especially in combination with HIV infection.

Outcome

Excluding HIV-infected patients, spondylodiscitis has a mortality rate of less than 5%, ranging from 0 to 11%. Early mortality is related to uncontrolled sepsis (8). Previous studies suggest that the clinical presentation of spinal tuberculosis is similar in HIV+ and HIV- patients, with good outcomes of the mycobacterial disease. In our HIV+ population, the mortality rate is higher, with 5% of inpatients and 20% of outpatients (35). Weinstein et al reported an
diagnosis and treatment of spondylodiscitis in HIV-positive patients

To determine the clinical presentation and the outcome of spondylodiscitis in HIV+ patients according to treatment, we performed a national, multicenter, retrospective case series of HIV+ patients presenting with spondylodiscitis between 1991 and 2007. Twenty patients were included in the study with a mean age of 43.0 years. The gender ratio M:F was 2.3:1. On admission, 50% of the patients were in CDC stage C3. The CD4 T-cell count averaged 237.5/L. HIV had been diagnosed 8.5 years previously on average. Radiologically, paravertebral abscesses were seen in 80.0%, epidural abscesses in 33.3%, and psoas abscesses in 13.3% of the patients. The causative pathogen was identified in 75% of the cases (Table II). In 3 cases, mixed infections were present. Half of the patients underwent surgery, without wound infections or delay to healing. One patient died during inpatient admission. Eleven of the 19 patients completed an average follow-up of 13 months after discharge. During follow-up, 3 more patients died at an average of 45 months after discharge.

CONCLUSION

The incidence of spondylodiscitis is increasing due to factors such as the HIV epidemic, particularly in Sub-Saharan Africa, the large number of intravenous drug abusers, the currently widely used aspiration and catheter techniques, and the recurrence of tuberculosis in industrialized nations. Several weeks may elapse between the inception of symptoms and final diagnosis of spondylodiscitis. In principle, patients of all ages can contract spondylitis, but most likely 50 to 70 year-old patients.

In HIV+ patients, the peak age of disease lies much earlier: 10% are under 30 years of age when they first develop spondylitis. Worldwide, the estimated number of HIV+ patients is about 34 million, with an increasing tendency. In numerous regions of the world, 40% of new HIV infections are observed among the young population (15-24 years). Patients with any form of immunosuppression such as HIV have a significantly higher risk of developing spondylodiscitis.
Spondylodiscitis can be treated to complete recovery if it is diagnosed and treated early, using the appropriate basic remedies: immobilisation of the affected spine segments, antibiotic therapy and depending on the extent of the disease, debridement, decompression, and stabilisation. Surgery is indicated in case of neurological deficits, sepsis, instability, impending or established deformities, intraspinal space-occupying lesions, suspicion of malignancy, and failed conservative therapy. Surgery can be indicated if the patient suffers from uncontrollable pain and does not comply with conservative therapy. In HIV+ patients, spondylodiscitis is associated with a low CD4 T-cell count, and a high mortality. A CD4 T-cell count below 100/L increases the probability of mixed infections, but there is no correlation between a low CD4 T-cell count and infection by MOTT (Mycobacteria Other Than Tuberculosis). As morbidity is not higher among HIV+ patients, the decision to use conservative or surgical treatment or to stabilize the affected spinal segments through surgery should be made without regard to this HIV context. However, these patients should be treated in a specialized institution by an experienced team of consultants.

<table>
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<th>CD4/CD8-ratio</th>
<th>HIV-RNA</th>
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REFERENCES


