VOLUME 72 | ISSUE 1 | JANUARY - MARCH 2021

REVIEW ARTICLE

Current Concepts in Hematogenous Septic Spondylodiscitis

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ABSTRACT

Hematogenous Septic spondyloDiscitis (HSD) is a rare but serious infectious disease which affects in an increasing rate immuno-compromised patients. The most common clinical symptom in HSD is a constant and increasing nocturnal axial spinal pain, while consequently different degrees of residual neurological symptoms from nerve roots and/or spinal cord may appear. The most frequent causative agent is Staphylococcus Aureus followed by the second most common to be Gram(-) bacteria. Since the disease course is chronic and clinical symptoms are not specific, surgeons should be aware that the time between the onset of the infection and final diagnosis is prolonged. MRI is mostly used to investigate HSD, however F-18 FDGPET has been recently proved to be more accurate than MRI in the detection of HSD. A delayed HSD diagnosis potentially increases morbidity and mortality while the final diagnosis is mainly based on biopsy and blood culture results. Conservative treatment is the mainstay in cases with no residual neurological symptoms consisting of antibiotic therapy and immobilization. Surgical treatment is used in patients with neurological deficit, spinal instability or drug resistance, comprising of conventional open approaches such as anterior, posterior or combined and transcutaneous approaches. The use of metallic implants does not interfere with favorable outcome and recurrence rates. The overall mortality rate ranges from 1.5%-38%. Rates of disability of up to 31% have been reported with residual spinal dysfunction or persistent pain after recovery followed by spinal infection. The outcome of treatment is influenced by the type of infection, age, comorbidities and the degree of neurologic compromise before treatment.

KEY WORDS: Spine infections; Spondylitis; Spondylodiscitis; Hematogenous Spondylitis

Introduction

Hematogenous septic spinal infection consists of several pathologies such as spondylodiscitis, primary epidural abscess, pyogenic facet arthropathy, diskitis or spondylitis [1]. It is an uncommon disease with an estimated incidence of 0.2 to 2.4 cases per 100,000 people per year [1].

Hematogenous Septic sponyloDiscitis (HSD) is a relatively rare condition that makes up 2% to 7% of spinal infection cases. The incidence of HSD has been increased in the recent years mostly because of the prolonging of average age, malnutrition, immuno-suppression (AIDS, chemotherapy, diabetes mellitus, chronic renal failure, etc) [2]. Hospital in-

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fections nowadays are a common source of HSD, with 1/3 of these infections to be catheter-related, with higher mortality and relapsing rates [3].

Discussion

The main causative microorganisms include Gram(+) bacteria, especially Staphylococcus aureus, which are responsible for the 40-60% of the cases [1] and on the other hand Gram(-) bacilli for the 15–23% of the HSD cases [1]. Staphylococcus aureus was reported to be the main causative agent that promotes abscess formation [1, 4, 5-11]. MSSA is more likely to be associated with epidural abscess than Gram(-) bacilli [4, 6, 7, 10]. Enterococcal HSD is frequently (26%) associated with endocarditis, therefore, patients with enterococcal HSD should undergo a cardiac ultrasound.

In countries with an increased frequency of brucellosis, Brucella varies from 33% to 44% of HSD cases [1, 12].

Gram(-) bacteremia was much more common in the elderly than in younger patients mostly because of the increased urinary tract infection on elders [11]. Although most of the HSD are caused by a single organism, polymicrobial infection was reported by the 1-10% of the patients [13].

The clinical symptoms of HSD are non specific including axial spinal pain and paravertebral muscle spasm. The rate of patients that present with neurological involvement ranges from 10% to 50%. The reported delay between the onset of initial symptoms of HSD and the final diagnosis ranges from 2 to 6 months [3, 13].

Clinical manifestations of HSD in elderly or immuno-compromised patients may be associated with absence of localized symptoms [14]. The most common localization of HSD is the lumbar (49%), while the least common is the cervicothoracic spine (2%) [13].

Plain radiographs have low sensitivity in the early stages of HSD, as abnormalities usually are developed later on. CT-scans are sensitive in detecting signs of HSD but they do not demonstrate the soft tissue with high accuracy. Abnormalities in the CT-scans are visible in the first 2 weeks in about 50% of the patients. Magnetic resonance imaging (MRI) is the most sensitive for confirming an early HSD diagnosis and it possesses the highest importance in diagnostic procedure. With 96% sensitivity, 94% specificity and 92% accuracy, MRI can show details in anatomically pathological alterations [15, 16]. However, disadvantages of MRI contain artifacts due to metallic implants, occasional similarities between spondylodiscitis, degenerative disease [15-17] and reduced sensitivity in patients with short duration of symptoms [15-17]. A recent meta-analysis revealed that F-18 FDGPET has better diagnostic accuracy than MRI for the detection of HSD [18].

Increased ESR and CRP are common findings in greater than 90% of HSD cases. Leukocytosis occurs in <50% of the cases. CRP is superior to ESR in the evaluation of HSD as it rises more quickly and is less influenced by other plasma factors [3].

Blood cultures can be very useful in the diagnosis of HSD and present a positive identification in about 50% of the cases [3]. Biopsy provides positive cultures in >75% of the cases [3, 13] however, the proportion of HSD with negative culture result ranges from 21% to 34% [13]. If polymicrobial infection is suspected, biopsy is mandatory [3, 13].

False negative blood culture or biopsy results are frequently found in patients, who were treated with empirical antibiotics before microbiological diagnosis; therefore, a second biopsy should be performed when the initial culture results are negative [13].

Common complications of HSD are axial pain, instability, segmental kyphotic deformity, neurological impairment like radiculopathy and paraplegia, paravertebral or primary epidural abscess which is reported to occur at rates ranging from 5.7% to 29% [1] or secondary epidural abscess that is more frequent and ranges from 38% to 94.2% [3, 13] associated with significant morbidity and mortality [3, 13].

The management of HSD firstly includes the identification of the causative agent and antibiotics administration [19, 20]. Early treatment of HSD may decrease morbidity and mortality. Most of the uncomplicated HSD cases can be treated with immobilization and intravenous antibiotics. Most guidelines recommend 6-12 weeks of parenteral antibiotic treatment for HSD [20]. Optimal duration of parenteral antibiotic therapy and of subsequent oral ther-

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apy still remains unclear [20, 22-24].

Surgical indications include failure of conservative treatment, intractable axial pain, instability, neurological deficit and abscess formation. Anterior, posterior, or combined approaches for debridment, decompression and stabilization in single or 2-staged procedures have been described [25-30].

The most important advantages of the anterior procedure are that it does allow radical resection of the infectious focus (disc, endplates, abscess evacuation, etc) and does enable satisfactory interbody fusion. Subsequently, patients have rapid infection resolution, early and frequent bony fusions. Laminectomy has a limited role in the decompression of HSD because the pathology is located anteriorly in the vertebral body and thus a posterior decompression is difficult to access the lesion and it may also cause instability because the posterior elements will be removed; therefore it is contraindicated [1, 13, 25-30].

The anterior approach decreases the postoperative pain and provides early ambulation and protects posterior ligamentous structures. Thoracotomy provides a good exposure from T5 to T12, while the contralateral hemithorax must be chosen for patients, who had previous chest operation to prevent approaching related complications such as bleeding, atelectasis or pneumothorax [25]. However, some authors reported on a 55.5%-87% fusion rate via posterior approach surgery and instrumentation [13].

Restoration of the destructed anterior spinal column is paramount for both restoration of stability and infection healing through fusion. Most authors recommend a double approach including anterior debridement with vertebrectomy supplemented with posterior instrumentation and fusion. This combined surgery seems to be well tolerated by patients with comorbidities, who suffer from HSD and it results in pain reduction, faster spinal fusion, reduction of associated segmental kyphotic deformity and maintenance of correction with little loss of correction and early patient mobilization [13].

A quite recent study that systematically reviewed on 50 articles and 4173 patients showed that conservative management remains the first-line treatment of HSD justifying previous case series. Decompression with instrumented fusion was the most commonly performed intervention reported (79%), compared to decompression alone (22%). Combined with anterior and posterior approach was performed in 33% and staged surgery was performed in 26% of surgical patients. Repeated surgeries were necessary in 13% of patients among the surgery-specific series. This review concluded that surgery may be indicated: 1) for progressive pain 2) for persistent infection on imaging 3) for neurologic deficits. If surgery is required, reported literature shows potential for significant pain reduction, improved neurologic function and a high number of patients returning to a normal functional/work status [31].

Various autografts and allografts have been used to reconstruct the anterior column. Because of the complications and morbidity associated with harvesting iliac bone autografts and the recent enthusiastic outcomes with metallic implants, vertebral body replacement with titanium mesh cages with autogenous bone graft has emerged as a viable option for reconstructing a deficient anterior spinal column contributing this way to infection healing [13, 28, 30].

Although previously spine surgeons were reluctant to the instrumentation of an infected spine, because metallic implants may hinder the antimicrobial treatment, recent studies focusing on the issue of Titanium implants have shown the usefulness, stability, and safety with minimal recurrence rate of internal fixation in eradication of an active spinal infection [13, 28, 30].

Minimally invasive surgical techniques can be used to provide temporary stabilization in some cases that spinal instability occurred [26]. These techniques diminish the major surgical stress and provide early and safe mobilization avoiding complications related to immobilization of sick and elderly patients.

A recent retrospective study [27] concluded that mini-open anterior debridement and lumbar interbody fusion in combination with posterior percutaneous fixation via a modified ALIF approach results in little surgical trauma and less intraopera-

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tive blood loss, acceptable postoperative complications, and is effective and safe for the treatment of single-level lumbar pyogenic spondylodiscitis. This approach could be an alternative to the conventional open surgery.

The overall mortality rate of HSD patients ranged from 1.5% to 38% [13, 32]. The large variance in these reported mortality rates may be attributed to different follow-up periods, varying in-hospital 6-month or 1-year mortality rates, and different causative microorganisms such as drug-resistant bacteria [13, 33-36].

There is little published data regarding the long-term neurologic and functional outcome or quality of life, in patients with HSD, managed operatively or non-operatively. Rates of disability of up to 31% report on residual spinal dysfunction or persistent pain after recovery following spinal infection and diagnostic delay to be associated with poor prognostic outcome. Poor functional outcome following HSD is common at long-term follow up, even in patients with apparent full neurologic recovery. This suggests under-reporting of poor outcome in series using neurologic deficit solely in order to qualify poor outcome [33-36].

Conclusion

The incidence of HSD is progressively rising due to the availability of more efficient imaging and the increase in vulnerable patients (elderly, immune-compromised, etc). Although MRI is the most sensitive examination for confirming an early HSD diagnosis, recent research showed that F-18 FDGPET has higher diagnostic accuracy than MRI for the detection of HSD. There is still some controversy regarding the best treatment of HSD. Although the mainstay of treatment for HSD is long-term antibiotic therapy and bracing, surgical intervention is recommended in cases of complicated HSD (spinal instability with vertebral destruction, paravertebral and/or epidural abscess formation, and/or associated neurologic deficits). Minimally invasive surgical techniques have been successfully used to provide debridment of infection and stabilization, in some cases in elderly and immuno-suppressed patients who cannot withstand an open major surgery. Spinal decompression and instrumentation via anterior, posterior or combined approach is indicated in most of the patients with complications even those with mild or medium severity comorbidities. Moreover, the use of titanium instrumentation does not increase the risk of infection or resistance to antibiotics. High rates of mortality and disability have been reported in HSD patients with increased comorbidity and preoperatively existed neurologic impairment.

Conflicts of Interest

The authors declare no conflict of interest.

The authors declare that no funding has been received for this research.

The authors declare that the research was performed according to the ethical standards as described by the Declaration of Helsinki and that an informing statement consent for participation in the study was obtained from all subjects.

The authors declare that the Hospital Ethics Committee approved this research.

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