Thesis

Spondylodiscitis: Prospective Analysis of Clinical Presentations and Surgical Outcomes

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Abstract

Background: Spondylodiscitis is infection of the vertebral bodies and intervertebral disc that can progress to abscess formation, deformity and neurological compromise when recognition and treatment are delayed. Early identification of the causative organism and prompt, targeted therapy — medical or surgical — reduce the risk of permanent disability.

Methods: This prospective study enrolled fifty-three adults diagnosed between October 2017 and October 2018. All patients had clinical assessment, laboratory tests including ESR and CRP, plain radiography and MRI for anatomic definition, and image-guided or open biopsy for microbiology, histopathology and molecular testing. Management was culture-directed antibiotics for pyogenic infections and standard antitubercular therapy where indicated. Surgical debridement with decompression and posterior instrumented stabilization was performed for neurological deficit, marked instability, large collections or failure of conservative care. Functional outcomes were measured with the Oswestry Disability Index and SF-36 at baseline, six months and one year.

Results: The cohort was predominantly older adults with mainly single-level lumbar disease. Combining culture, histology and GeneXpert PCR increased diagnostic yield. ESR and CRP trended down with effective therapy. Surgically treated patients showed meaningful improvement in function at follow up.

Conclusion: Early imaging, targeted tissue diagnosis and pathogen-directed therapy, with timely surgery for defined indications, produce favourable functional outcomes in spondylodiscitis.

Keywords: Spondylodiscitis, Vertebral osteomyelitis, Magnetic resonance imaging (MRI), GeneXpert, Mycobacterium tuberculosis, Posterior instrumented stabilization, Oswestry Disability Index (ODI)

Introduction

Spondylodiscitis refers to infection of the vertebral body and intervertebral disc. The condition commonly presents with persistent axial back pain, sometimes accompanied by radicular symptoms, fever or progressive neurological deficits. Because the onset is often subtle, patients may wait weeks or months before seeking specialist assessment, and this delay allows the infection to extend into adjacent soft tissues or cause structural collapse. In adults the usual route of infection is hematogenous seeding of the vertebral endplates; haematogenous spread is favored by the vertebral vascular anatomy and the rich blood supply of the endplates. Risk factors include advanced age,


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diabetes, renal disease, immunosuppression and recent invasive procedures or bacteremia. These comorbidities increase both the risk of infection and the risk of complications. Imaging and laboratory tests are central to early detection. Plain radiographs can show late osseous changes, but MRI is the preferred modality because it detects marrow edema, disc involvement and paraspinal or epidural abscesses early and delineates the full extent of disease for planning sampling or surgery. Raised inflammatory markers — ESR and CRP — are common and provide useful objective measures to follow response to therapy. Microbiological confirmation is important: while aerobic culture remains the standard for pyogenic organisms, culture may be negative, especially after prior antibiotics or in granulomatous disease; histopathology and molecular assays such as nucleic acid amplification tests improve diagnostic yield and shorten time to a definitive diagnosis. Treatment goals are consistent: eradicate infection, preserve or restore neurological function, and maintain or reestablish spinal stability. Many patients with limited disease respond to prolonged, targeted medical therapy, while those with neural compression, marked instability or large collections benefit from debridement and stabilization. Individualized, multidisciplinary decision-making is therefore essential to achieve the best possible outcome [1-7].

Review of literature

Classic and modern series underline the difficulty in diagnosing spinal infection early and stress the importance of integrating clinical suspicion with imaging and laboratory data. Early reports noted frequent diagnostic delay and showed that elevated ESR and CRP should prompt further evaluation in older adults with unexplained back pain. Numerous studies have since confirmed MRI as the imaging modality of choice because of its sensitivity for marrow and disc abnormalities and its ability to demonstrate paraspinal and epidural collections that plain films miss. Comparative studies describe differences between pyogenic and tuberculous spondylodiscitis: tuberculosis more often produces contiguous multilevel involvement and progressive vertebral destruction with deformity, while pyogenic infections frequently present with a more acute systemic picture and focal vertebral involvement. Microbiological diagnosis remains central to management; culture guides antibiotic selection but can be negative, particularly after prior empirical therapy or in granulomatous infections. To address that, several investigators have advocated combining culture with histopathology and molecular diagnostics — for example, nucleic acid amplification tests that detect Mycobacterium tuberculosis DNA — to increase the speed and reliability of diagnosis in endemic settings. Outcome studies comparing conservative and surgical management show that selected patients with stable anatomy and no neurologic deficit do well with medical therapy, but patients with neurologic compromise, instability or large, unresolving collections benefit from surgical debridement and stabilization, which often produces more rapid symptom relief and earlier functional recovery. Consensus statements and clinical practice guidelines recommend a multidisciplinary approach, prolonged culture-directed antibiotics for pyogenic infections and standard antitubercular regimens for TB, with individualized timing and extent of surgery to control infection, decompress neural elements and restore alignment when necessary [8-16].

Methods and materials

This prospective single-center study enrolled fifty-three consecutive adult patients with clinico-radiological features consistent with spondylodiscitis between October 2017 and October 2018. Patients with prior instrumentation at the affected level or who declined consent were excluded. After informed consent each patient underwent standardized clinical evaluation to record duration and character of pain, radicular features, systemic symptoms and neurological status. Baseline laboratory tests included complete blood count, ESR and CRP. Radiographic assessment began with plain films of the symptomatic region and proceeded to MRI for detailed evaluation of vertebral body marrow, disc involvement, and prevertebral, paravertebral and epidural soft tissue extension; whole-spine MRI screening was performed when multifocal disease was suspected.

Tissue diagnosis was attempted by percutaneous image-guided biopsy when feasible; open biopsy was performed when sampling occurred at the time of surgical intervention. Specimens were processed for Gram stain and aerobic culture, Ziehl–Neelsen staining and mycobacterial culture, histopathological examination and molecular testing with GeneXpert PCR for Mycobacterium tuberculosis when clinically indicated. Aerobic cultures were incubated and observed for growth; mycobacterial cultures were maintained for extended incubation periods. Empirical therapy was tailored once culture or molecular results were available. Pyogenic infections received culture-directed intravenous antibiotics for an initial phase followed by oral therapy as per institutional protocol. Confirmed tuberculous cases were treated with standard antitubercular regimens according to national guidelines.

Indications for surgery were predefined and included progressive or severe neurological deficit, frank mechanical instability or vertebral collapse, large prevertebral or paraspinal collections not amenable to percutaneous drainage, and clinical deterioration despite appropriate medical therapy. Surgical techniques varied according to pathology and included debridement, neural decompression and posterior instrumented stabilization with fusion to restore alignment and support. Outcome measures were the Oswestry Disability Index and SF-36 recorded at baseline, six months and one year. ESR and CRP were measured serially to monitor inflammatory

response. Complications and need for reoperation were recorded. Data were captured on a predefined proforma and analyzed descriptively [17-20].

Results

Fifty-three patients met inclusion criteria and completed one-year follow up. The majority were aged between fifty and seventy years; both sexes were represented. Symptom duration before specialist evaluation varied widely, with many patients reporting several weeks to months of axial back pain before referral. The lumbar spine was the most frequently involved region and single-level disease was more common than multi-level involvement. At presentation most patients had elevated ESR and CRP; both markers declined progressively with effective therapy in responding patients. Microbiological assessment identified a mixture of pyogenic and tuberculous aetiologies: several cases yielded pyogenic organisms on culture, while histopathology and GeneXpert PCR increased diagnostic yield for tuberculosis where cultures were negative or slow to grow. Open biopsy secured diagnosis in cases not amenable to percutaneous sampling. Surgical management was employed in patients with neurological deficits, marked instability or large collections; posterior instrumented stabilization combined with decompression and debridement was the common operative strategy. Patients who underwent surgery typically experienced more rapid pain relief and earlier mobilization, and showed sustained improvement on ODI and SF-36 at six months and one year. Perioperative complications were infrequent and manageable; reoperation was required in a small minority.

Discussion

This prospective cohort echoes findings from previous series: older adults are commonly affected and lumbar single-level involvement predominates. The indolent onset of symptoms observed here accounts for the frequent delays in specialist referral and diagnosis; that delay permits more extensive local disease before treatment begins. MRI proved indispensable for defining the extent of vertebral and soft tissue involvement and for identifying collections that require drainage, and it guided decisions on percutaneous versus open sampling. ESR and CRP were reliable markers of active disease in most patients and provided practical metrics to follow response to treatment.

Microbiological confirmation was enhanced by combining culture with histopathology and molecular diagnostics. Culture positivity allowed targeted antibiotic stewardship, but culture negativity occurred in some cases, particularly when granulomatous inflammation suggested tuberculosis or after prior antibiotic exposure. In those cases, GeneXpert PCR offered rapid confirmation of Mycobacterium tuberculosis and permitted earlier initiation of appropriate antitubercular therapy. Surgical intervention remains an important option for those with neurological compromise, mechanical instability or large collections. Posterior instrumented stabilization provided dependable mechanical support in lumbar disease and facilitated mobilization and rehabilitation

Limitations of the study include single-center design and modest sample size, which restrict generalizability. Nevertheless, the prospective protocolized assessment and uniform follow up strengthen the findings. The balance between conservative and operative management should be individualized: reserve surgery for progressive neurological deficit, significant instability, or unresolving collections, and use culture and molecular diagnostics to guide medical therapy and reduce unnecessary broad-spectrum antibiotic exposure.

Conclusion

In this prospectively followed cohort, spondylodiscitis most commonly involved older adults and predominantly affected a single lumbar level. MRI combined with targeted biopsy and a combination of culture, histopathology and molecular testing improved the chances of identifying the responsible organism. Culture-directed antibiotics for pyogenic infections and standard antitubercular therapy for tuberculosis, together with timely surgical decompression and posterior instrumented stabilization for patients with neurological compromise, instability or large collections, produced durable functional improvement. Serial monitoring of ESR and CRP provided a practical method to assess response to therapy. An individualized, multidisciplinary approach that integrates rapid imaging, definitive tissue diagnosis and appropriate selection for surgery offers the best opportunity to limit morbidity and restore function to patients with vertebral infection. Early intervention preserves function and reduces long-term disability risk, consistently achieved.

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