RESEARCH PAPER

Atypical Presentation of Spinal Tuberculosis on MRI: A Diagnostic Challenge - A Case Report

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ABSTRACT

Spinal tuberculosis (TB), or Pott's spine, is the most common form of skeletal tuberculosis and classically demonstrates contiguous vertebral body involvement, intervertebral disc destruction, and paravertebral or epidural abscess formation on imaging. However, atypical manifestations are increasingly recognized and may closely mimic neoplastic, inflammatory, or other infectious conditions, thereby posing a significant diagnostic challenge. We present the case of a 42-year-old male who presented with insidious onset, chronic back pain without significant constitutional symptoms such as fever, weight loss, or night sweats. Neurological examination was unremarkable. Magnetic resonance imaging (MRI) of the spine revealed isolated involvement of the posterior elements, with preservation of vertebral bodies and intervertebral disc spaces, and no evidence of paravertebral abscess formation—features that were highly suggestive of a primary spinal neoplasm. Given the diagnostic uncertainty, further evaluation was undertaken. Laboratory investigations showed mildly elevated inflammatory markers, while definitive diagnosis was achieved through image-guided biopsy, which demonstrated granulomatous inflammation consistent with Mycobacterium tuberculosis. The patient was subsequently initiated on standard antitubercular therapy (ATT), resulting in significant clinical improvement and radiological resolution on follow-up. This case underscores the importance of maintaining a high index of suspicion for spinal tuberculosis, even in the absence of classical imaging findings. Recognition of atypical presentations, particularly isolated posterior element involvement, is essential to prevent misdiagnosis and inappropriate management. Correlation of radiological findings with clinical features and histopathological confirmation remains crucial for accurate diagnosis and timely initiation of therapy, ultimately improving patient outcomes.

Keywords: Spinal tuberculosis, atypical MRI, posterior element involvement, Pott's spine, radiodiagnosis.

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INTRODUCTION

Spinal tuberculosis (TB), also referred to as Pott's spine, represents the most common form of musculoskeletal tuberculosis and accounts for nearly 50% of all skeletal TB cases worldwide [1]. Despite advances in diagnostic modalities and public health measures, tuberculosis continues to pose a major health challenge, particularly in developing countries such as India, where the disease burden remains high due to socioeconomic factors, overcrowding, and limited access to early healthcare [2]. The spine is the most frequently involved site in skeletal TB, primarily due to its rich vascular supply, which facilitates hematogenous dissemination of Mycobacterium tuberculosis from a primary focus, often pulmonary in origin [3].

Classically, spinal TB involves the anterior elements of the vertebral column, especially the vertebral bodies and adjacent intervertebral discs. Magnetic resonance imaging (MRI), the modality of choice for early detection, typically demonstrates contiguous vertebral body destruction, reduction in disc height, endplate irregularity, and the presence of paravertebral or epidural abscesses [4]. These imaging features, along with clinical symptoms such as chronic back pain, low-grade fever, weight loss, and neurological deficits, often help in establishing a presumptive diagnosis [5]. If left untreated, the

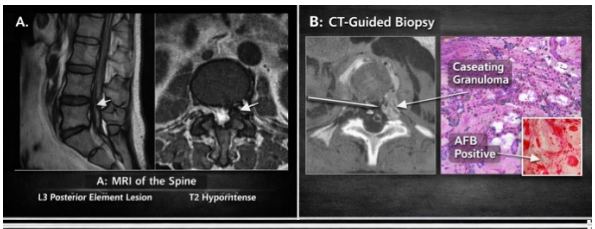
disease can progress to severe complications including spinal instability, kyphotic deformity, and irreversible neurological impairment due to spinal cord compression [6].

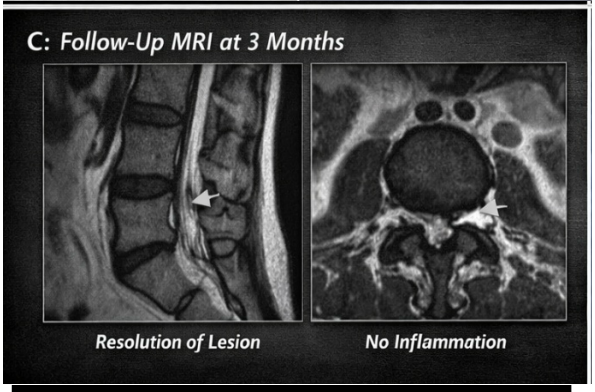
However, in recent years, there has been increasing recognition of atypical presentations of spinal TB, which can significantly complicate diagnosis. These atypical forms may include isolated involvement of posterior elements such as pedicles, laminae, and spinous processes; non-contiguous or "skip" lesions; preservation of intervertebral disc spaces; and absence of classical paraspinal abscess formation [7]. Such unusual imaging patterns often mimic other pathological conditions, particularly metastatic lesions, lymphoma, or primary bone tumors, leading to potential misdiagnosis and delay in appropriate treatment [8]. In some cases, patients may also lack the typical constitutional symptoms of tuberculosis, further adding to the diagnostic dilemma [9].

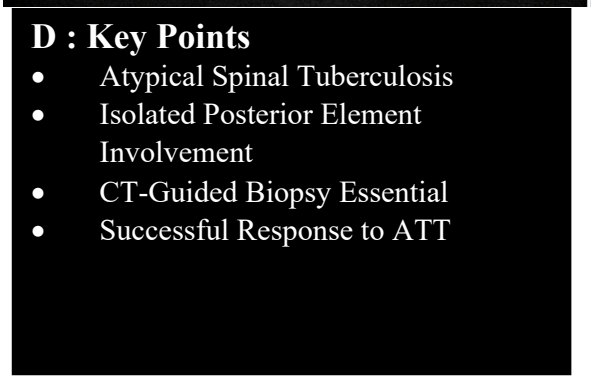
The differentiation of atypical spinal TB from neoplastic or other infectious etiologies is critical, as management strategies differ substantially. While tuberculosis is primarily treated with antitubercular therapy (ATT), neoplastic conditions may require surgical intervention, chemotherapy, or radiotherapy [10]. Therefore, a high index of suspicion, careful interpretation of imaging findings, and correlation with clinical, laboratory, and histopathological data are essential for accurate diagnosis.

Case Presentation

A 42-year-old male presented to the outpatient department of Maharishi Markandeswar Institute of Medical Sciences and Research, Mullana, with complaints of persistent lower back pain for a duration of three months. The pain was described as dull and aching in nature, with an insidious onset and gradual progression over time. It was predominantly localized to the lumbar region without significant radiation to the lower limbs. The patient reported that the pain was aggravated by physical activity, prolonged standing, and forward bending, while partial relief was achieved with rest and occasional use of over-the-counter analgesics. There was no history suggestive of acute injury or trauma preceding the onset of symptoms.







Importantly, the patient did not report any constitutional symptoms typically associated with infective etiologies, such as fever, unintentional weight loss, night sweats, or generalized malaise. There was also no history of prior tuberculosis, contact with a known TB patient, or any significant comorbid conditions. His appetite and bowel-bladder habits were normal, and there were no complaints suggestive of neurological involvement such as limb weakness, numbness, or bladder or bowel dysfunction.

On physical examination, the patient appeared stable and afebrile. Local examination of the spine revealed mild to moderate tenderness over the lower lumbar vertebrae, particularly on deep palpation. There was no visible deformity, swelling, or sinus formation. The range of motion of the lumbar spine was slightly restricted due to pain, especially during flexion and extension. Neurological examination of the lower limbs, including motor strength, sensory function, and deep tendon reflexes, was within normal limits, with no evidence of radiculopathy or spinal cord compression.

Baseline laboratory investigations demonstrated mildly elevated inflammatory markers, with increased

erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), suggesting an underlying inflammatory or infective process. Other hematological parameters were within normal limits. A chest radiograph was performed to assess for any primary pulmonary focus of tuberculosis; however, it did not reveal any abnormalities. Overall, the clinical picture was nonspecific, necessitating further imaging and diagnostic evaluation to determine the underlying cause.

Imaging Findings

Magnetic resonance imaging (MRI) of the lumbosacral spine was performed to further evaluate the underlying cause of the patient's persistent symptoms. The imaging revealed an unusual pattern of involvement characterized by isolated affection of the posterior elements of the L3 vertebra, specifically the lamina and spinous process. On signal analysis, the lesion appeared hypointense on T1-weighted images and hyperintense on T2-weighted and STIR sequences, indicating the presence of edema and inflammatory changes. A minimal adjacent soft tissue component was noted; however, it was not extensive and lacked the well-formed collection typically seen in infective pathologies.

Notably, there was no significant involvement of the vertebral body, which is the most common site of disease in classical spinal tuberculosis. The intervertebral disc spaces were well preserved, without any evidence of discitis or reduction in disc height. Additionally, there was no evidence of paravertebral or epidural abscess formation, which are hallmark imaging features often associated with tuberculous spondylitis. The spinal canal appeared adequate, and there were no signs of neural compression.

These imaging findings were distinctly atypical for spinal tuberculosis and deviated from the classical radiological presentation. Instead, the pattern of isolated posterior element involvement with preserved disc spaces and absence of abscess formation raised a strong suspicion of neoplastic etiology. Differential diagnoses considered at this stage included metastatic disease, particularly from an unknown primary, as well as primary bone tumors such as osteoid osteoma, osteoblastoma, or even lymphoma involving the posterior elements of the spine.

Given the nonspecific clinical presentation and the atypical imaging features, a definitive diagnosis could not be established based on MRI alone. Therefore, further diagnostic workup, including histopathological confirmation through biopsy, was deemed essential to differentiate between infective and neoplastic causes and to guide appropriate management.

Diagnostic Workup

In view of the atypical imaging features and the strong suspicion of a neoplastic process, a CT-guided biopsy of the L3 posterior element lesion was performed to obtain a definitive diagnosis. The procedure was carried out under aseptic precautions, and adequate tissue samples were obtained without complications. Histopathological examination of the specimen revealed well-formed granulomas composed of epithelioid cells, Langhans giant cells, and surrounding lymphocytic infiltration, along with areas of central caseating necrosis—findings highly suggestive of a tuberculous etiology.To further confirm the diagnosis, Ziehl–Neelsen staining was performed, which demonstrated the presence of acid-fast bacilli (AFB). This conclusively established the diagnosis of spinal tuberculosis involving the posterior elements of the L3 vertebra. The biopsy findings were crucial in differentiating the lesion from neoplastic conditions and allowed for timely initiation of appropriate antitubercular therapy.

Treatment and Follow-Up

Following confirmation of the diagnosis, the patient was initiated on standard antitubercular therapy (ATT) in accordance with national guidelines. The regimen was well tolerated, and the patient demonstrated noticeable clinical improvement within four weeks, particularly in the form of significant reduction in back pain and improved functional mobility. There were no new neurological symptoms during the course of treatment. On follow-up at three months, repeat MRI of the lumbosacral spine revealed marked regression of the lesion, with near-complete resolution of the previously noted inflammatory changes in the posterior elements of the L3 vertebra, confirming a favorable therapeutic response.

DISCUSSION

Spinal tuberculosis (TB) most commonly involves the anterior portion of the vertebral body, with subsequent spread to adjacent intervertebral discs and formation of paravertebral or epidural abscesses. This classical pattern has been well documented in the literature and often allows a confident radiological diagnosis [11]. However, with the increasing use of advanced imaging modalities such as MRI, a broader spectrum of atypical presentations is being recognized. These atypical forms may lack the

hallmark features of spinal TB, thereby posing a significant diagnostic challenge, particularly in regions where both infectious and neoplastic spinal pathologies are prevalent [12].

One such atypical presentation is isolated involvement of the posterior elements, which is considered rare and accounts for less than 10% of spinal TB cases. In the present case, the lesion was confined to the lamina and spinous process of the L3 vertebra, with complete sparing of the vertebral body and intervertebral disc. Similar findings were reported by Arora et al. [13], who described posterior element tuberculosis as an uncommon entity often misdiagnosed as a primary bone tumor. Likewise, a study by Sharma et al. [14] highlighted that posterior spinal TB frequently mimics neoplastic lesions due to its atypical location and lack of classical radiological signs.

The absence of disc involvement and paravertebral abscess in our case further contributed to the diagnostic dilemma. Traditionally, disc destruction is considered a key feature of spinal TB; however, early-stage disease or atypical variants may preserve disc spaces. This observation is consistent with the findings of Jain et al. [15], who emphasized that preserved intervertebral discs do not exclude tuberculosis, particularly in early or localized disease. Additionally, the lack of abscess formation, which is typically seen as a rim-enhancing collection on MRI, may lead clinicians to favor a neoplastic diagnosis. Ledermann et al. [16] also reported that atypical spinal infections can closely resemble malignant lesions, especially when classical imaging features are absent.

MRI remains the imaging modality of choice for evaluating suspected spinal TB due to its excellent soft tissue resolution and ability to detect early marrow changes. Classical TB lesions usually appear hypointense on T1-weighted images and hyperintense on T2-weighted sequences, often associated with abscess formation and vertebral collapse. However, as demonstrated in this case, atypical lesions may present with similar signal characteristics but without accompanying features such as disc involvement or abscess, thereby mimicking metastasis or lymphoma. According to Moorthy and Prabhu [17], MRI findings in atypical spinal TB can overlap significantly with neoplastic conditions, necessitating further diagnostic confirmation.

Given these challenges, histopathological examination remains the gold standard for definitive diagnosis. In our case, CT-guided biopsy revealed granulomatous inflammation with caseating necrosis and acid-fast bacilli, confirming tuberculosis. This approach is strongly supported by the work of Rasouli et al. [18], who emphasized the importance of tissue diagnosis in atypical or inconclusive cases. Early biopsy not only facilitates accurate diagnosis but also prevents inappropriate management, such as unnecessary surgical intervention or oncological treatment.

Timely initiation of antitubercular therapy (ATT) is crucial in achieving favorable outcomes. Our patient showed significant clinical and radiological improvement following ATT, consistent with observations by Rajasekaran et al. [19], who reported excellent outcomes with early medical management in spinal TB. Delayed diagnosis, on the other hand, may result in complications such as spinal instability, kyphotic deformity, and neurological deficits. As highlighted by Moon [20], early recognition and treatment are key determinants of prognosis in spinal tuberculosis.

CONCLUSION

Atypical presentations of spinal tuberculosis represent a significant diagnostic challenge, particularly when classical MRI features such as vertebral body destruction, disc involvement, and paravertebral abscess are absent. In such cases, the radiological appearance may closely resemble neoplastic conditions, including metastasis or primary spinal tumors, leading to potential misdiagnosis and delay in appropriate management. This is especially relevant in tuberculosis-endemic regions, where the disease burden remains high and variability in presentation is increasingly recognized. Therefore, both radiologists and clinicians must maintain a high index of suspicion when evaluating unusual spinal lesions. Careful correlation of imaging findings with clinical presentation and laboratory parameters is crucial. Most importantly, early tissue diagnosis through biopsy plays a pivotal role in establishing the correct diagnosis. Prompt identification and initiation of antitubercular therapy not only ensure favorable outcomes but also help prevent serious complications such as neurological deficits, spinal instability, and deformity.

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