# Navigating spinal tuberculosis: Clinical insights, social considerations, and future perspectives

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## Abstract
Spinal tuberculosis (TB), also known as Pott's disease, is a significant health concern with increasing global prevalence. This paper provides clinical insights, social considerations, and future perspectives on navigating spinal TB. We discuss the historical background, anatomy, pathophysiology, clinical manifestations, diagnosis, and management of spinal TB, including the challenges posed by drug resistance. Additionally, a retrospective observational case series of three patients with spinal TB is presented, highlighting diverse demographics, diagnostic challenges, treatment outcomes, and the impact of comorbidities. Despite encountering drug resistance and other challenges, successful management was achieved through individualized treatment regimens and comprehensive patient care the cases underscore the importance of early diagnosis, multi-modal diagnostic approaches, and tailored treatment strategies. Furthermore, we emphasize the social impact of spinal TB, including socioeconomic factors and lifestyle habits, and advocate for holistic patient care addressing medical and social determinants of health. Finally, we call for continued research to enhance understanding and management of spinal TB, alongside collaborative efforts to improve TB control programs.

**Keywords:** Spinal tuberculosis, pott spine, drug resistance TB

## Introduction
While spinal tuberculosis (TB) cases have historical roots dating back to ancient Egyptian mummies 5,000 years ago, Percival Pott documented the first modern case in 1779 [1]. Although spinal TB affects less than 1% of TB patients, its prevalence is increasing globally, posing a significant health concern [2, 3]. Also known as Pott's disease, spinal TB is the most common and perilous form of skeletal TB, constituting half of all skeletal TB cases. While the thoracolumbar junction is frequently affected, spinal TB can manifest in any part of the spine [5]. Additionally, neurologic complications arise in 10% to 43% of spinal TB cases [1]."

In recent times, the emergence of multi-drug resistant tuberculosis, increased occurrence of infection in immunocompromised individuals, enhanced precision in imaging techniques, and progress in spinal reconstruction methods have collectively influenced the treatment approach to Pott's disease [2, 6]."

Advanced imaging methods like magnetic resonance imaging (MRI) facilitate the prompt identification of spinal tuberculosis (TB), leading to earlier diagnosis and more effective treatment for a significant portion of patients before substantial neurological impairments emerge. Nonetheless, some patients may still present late with notable spinal deformities. Given the continual advancements in imaging technologies and evolving treatment approaches, along with the challenge of drug resistance necessitating innovative therapeutic strategies, ongoing reviews are essential to evaluate contemporary diagnostic techniques and treatment alternatives for this grave illness [1, 6].

## Overview: Anatomy of Spinal Tuberculosis [10]
**Vertebrae:** These are the individual bones that make up the spinal column. Spinal tuberculosis typically affects the thoracic spine (upper back) and the lumbar spine (lower back).

**Granuloma Capsules:** The most common site of tuberculosis (TB) granuloma capsules in the spine is in and around the vertebral discs.

**Spread of Infection:** M. tuberculosis spreads from person to person through the air. While tuberculosis in the lungs is highly contagious, tuberculosis affecting other areas of the body—including the spine—is not typically contagious. Once it passes from an infected person to another, it can spread from the lungs to other body parts, including the spine.

## Pathophysiology [7, 10]
1. Spinal tuberculosis presents in two main forms: the traditional spondylodiscitis and a more frequent variant known as spondylitis without disc involvement.
2. While the classic spinal TB involves both the vertebrae and the intervertebral disc, the atypical form primarily affects the vertebrae in adults, with disc involvement occurring as a secondary effect from adjacent vertebrae infections. In children, however, disc involvement can be a primary consequence due to the disc's vascularized nature.
3. Pott's disease, the tuberculosis affecting the spine, manifests as a combination of osteomyelitis and arthritis, often impacting multiple vertebrae. Typically, the anterior aspect of the vertebral body adjacent to the subchondral plate is affected.
4. Spinal TB can lead to various complications, including progressive bone destruction resulting in vertebral collapse and kyphosis, formation of cold abscesses due to infection spreading into nearby ligaments and soft

tissues, narrowing of the spinal canal by abscesses or granulation tissue, and direct invasion of the dura mater causing compression of the spinal cord and neurological impairments.

**Physiological Changes and Symptoms [8, 9]**
**Early Symptoms:** Vague symptoms include: Back pain, Muscle spasms, Stiffness.

**As the disease progresses, symptoms become more apparent:** Joint deformities or scoliosis (abnormal spine curvature), Swelling, Decreased range of motion, Ulcers, Swollen lymph nodes, Cold abscesses (pockets of pus)

**Neurological Impact:** Spinal tuberculosis can put pressure on the spinal cord and nerves exiting the spine, leading to neurological symptoms such as: Weakness in the legs, Numbness, Tingling, Paralysis

**Typical TB Symptoms:** Only about 1 in 3 people with bone tuberculosis (including spinal TB) exhibit typical TB symptoms, which may include: Decreased appetite, Low-grade fever (usually at night), Weight loss, Chills, Weakness, Fatigue [3]

**Diagnosis:** Differentiating spinal tuberculosis from pyogenic and fungal vertebral infections, as well as primary and metastatic spinal tumors, can be challenging based solely on clinical and imaging findings. Clinical history of TB, positive skin test (though less reliable in endemic areas), and elevated ESR can aid in diagnosis. Biopsy, especially with DNA amplification techniques like PCR, is valuable for accurate diagnosis. While culturing organisms is slow and sometimes inaccurate, it remains useful. In cases where no organism is cultured despite multiple attempts, mycobacterial or fungal infections should be considered.

CT provides detailed bone information, while MRI assesses soft tissue involvement and abscesses. Specific imaging features like bony destruction, anterior wedging, and abscess formation aid in diagnosis. MRI, with its ability to detect epidural granulomatous tissue and tuberculoma, is more accurate than plain radiographs.
Spinal TB can be distinguished from pyogenic discitis by bony destruction with preserved intervertebral discs and heterogeneous enhancement. Image-guided biopsy is recommended if differentiation is uncertain, with a high diagnostic yield in most cases."
**Management:** Historically, spinal TB was managed through rest, decreased weight bearing, and general hygienic measures. Surgical approaches included aspiration, drainage, and various approaches for debridement and fusion. Today, systemic anti-tuberculosis medications, careful debridement, and spinal stability reconstruction are key. Management is broadly divided into lesions with and without neurological complications. Medical therapy is preferred for those without, while a combination of medical and surgical treatments is recommended for those with. Laminectomy may be necessary for posterior complex disease. Early diagnosis and treatment are crucial for preventing severe kyphosis.
Multidrug-resistant tuberculosis (MDR-TB) presents a global health concern, affecting 3% of new cases and 12% of retreatment cases. Diagnosis hinges on resistance to

rifampicin and isoniazid, with additional drug resistance denoted by resistance to other drugs. Signs of MDR-TB include lack of clinical improvement despite treatment, new lesions, or increased bone destruction. Treatment typically involves a combination of six antituberculosis drugs for 24 months, per WHO recommendations. Close monitoring for adverse reactions is essential due to the drugs' potential side effects. Surgical intervention may be necessary for diagnosis confirmation and bacterial load reduction. Successful outcomes depend on clinical and radiological improvements, limited drug resistance, and regimen stability throughout treatment.
Spinal tuberculosis (TB), also known as Pott's disease, is a serious infection that requires careful clinical, radiological, and neurological assessment for proper management. Spinal tuberculosis (TB) can be graded clinically, radiologically, and neurologically to assess its severity and guide treatment.

**Here's a brief overview**
**Clinical Evaluation:** Clinical assessment involves checking for symptoms like back pain, fever, night sweats, and weight loss. The presence of a cold abscess or spinal deformity may also be noted.

**Radiological Evaluation:** Imaging plays a crucial role in diagnosing spinal TB. MRI is the most common modality used, revealing patterns such as paradiscal, central, anterior subligamentous, and posterior types of spinal TB [11]. It helps in differentiating spinal TB from other conditions like pyogenic spondylitis and metastasis. CT scans and PET CT are also used for diagnosis and monitoring the response to treatment [11, 12].

**Neurological Evaluation:** Neurological status is assessed based on the presence of any neurological deficit due to compression of neural structures. This includes checking for motor and sensory deficits, as well as autonomic dysfunctions [15].

**Comprehensive Spinal TB Score (CSTS):** The CSTS is used to guide treatment decisions. It includes components like pain, kyphosis angle, vertebral destruction, and neurological status. A score classification of less than 5.5 suggests conservative management, between 5.5-6.5 indicates a need for conservative or operative management, and greater than 6.5 typically requires operative management [13, 14]

These grading systems help clinicians determine the appropriate treatment approach, which may include anti-TB medications, surgical intervention, and supportive care to manage symptoms and prevent complications. Treatment goals aim to eradicate the infection, relieve symptoms, prevent deformities, and preserve neurological function.

**Methods and Materials**
A Retrospective Observational Study

**Case Series**
1. 18 yrs. Female history of severe low backache mostly in lying down position, pain more in the early morning. Diagnosis suspected on X rays spine and after MRI spine with CT guided biopsy done, Gibbus Dorsal lumbar spine Histopathological report shows

Granuloma with caseating central necrosis, GenXpert test done on specimen shows MTB detected with Rifampicin resistance, All oral longer regime BDQ, Lfx, Lnz, Cs, and Cfx started after pre- treatment evaluation and regular monitoring done, patient symptoms improved with weight gain of 4kgs and after 19 months of treatment stopped AKT.

2. Patient 16 yrs old female pain in lower lumbar spine Histopathological report shows Granuloma with caseating central necrosis Genxpert test done MTB detected with no Rifampicin resistance. After 9 months AKT for Drug sensitive patient AKT stopped

3. 53 yrs old male patient history of cough and breathing problem with both legs was not able to move personal history alcoholic and smoker, MRI dorso spinal with involvement of intervertebral disc and cold abscess, interventional surgery done with specimen shows MTB detected with Rifampicin Isoniazid and Fluoroquinolone resistance. AKT started with all oral longer regime BDQ, DLM Lnz Cs and Cfx after 24 months of AKT stopped.

## Discussion

The case series presents three patients with different demographic profiles, clinical presentations, and treatment outcomes, all diagnosed with tuberculosis (TB) involving the spine.

**18-year-old Female:** She presented with severe low backache, especially in the lying down position, with pain exacerbation in the early morning. The diagnosis of spinal TB was suspected based on imaging findings and confirmed through biopsy and GenXpert testing, which revealed MTB with Rifampicin resistance. She was started on a combination of drugs including BDQ, Lfx, Lnz, Cs, and Cfx. With regular monitoring, her symptoms improved, and she gained weight. After 19 months of treatment, AKT was stopped, indicating successful management of drug-resistant spinal TB.

**16-year-old Female:** Similar to the first case, this patient presented with lower lumbar spine pain. The diagnosis was confirmed through histopathological examination and GenXpert testing, which revealed MTB without Rifampicin resistance. She was treated with AKT for 9 months and subsequently stopped, indicating successful management of drug-sensitive spinal TB.

**53-year-old Male:** This patient presented with cough, breathing difficulty, and spinal involvement detected through MRI. The patient had a history of alcoholism and smoking. Interventional surgery was performed, and the specimen revealed MTB with resistance to Rifampicin, Isoniazid, and Fluoroquinolone. He was started on a combination of drugs including BDQ, DLM, Lnz, Cs, and Cfx. After 24 months of treatment, AKT was stopped, indicating successful management despite the challenges posed by drug resistance.

**Diverse Demographics:** The cases demonstrate TB's ability to affect individuals across different age groups and genders, highlighting the importance of considering TB as a differential diagnosis in patients presenting with back pain, regardless of age or sex.

**Diagnostic Challenges:** Diagnosis relied on a combination of clinical suspicion, imaging, histopathological examination, and molecular testing (GenXpert), emphasizing the importance of a multi-modal approach for accurate diagnosis, especially in cases with atypical presentations or drug resistance.

**Treatment Success Despite Challenges:** Despite encountering drug resistance in one case, all patients showed improvement with appropriate treatment regimens tailored to their specific needs. This underscores the significance of individualized treatment approaches guided by drug susceptibility testing and regular monitoring to ensure treatment efficacy and minimize adverse effects.

**Comorbidity Impact:** The presence of comorbidities such as alcoholism and smoking in one case highlights the need for comprehensive patient care, addressing not only TB but also underlying risk factors that may impact treatment outcomes.

In short, the case series underscores the importance of early diagnosis, individualized treatment regimens, and comprehensive patient care in effectively managing spinal TB across diverse patient populations.

## Conclusion

In conclusion, the presented case series highlights the diverse clinical presentations and treatment outcomes of spinal tuberculosis (TB) across different demographics. Despite encountering challenges such as drug resistance and comorbidities, the successful management of these cases underscores the importance of a multi-modal diagnostic approach, individualized treatment regimens guided by drug susceptibility testing, and comprehensive patient care. Early diagnosis, prompt initiation of appropriate treatment, and regular monitoring are crucial in achieving favorable outcomes in patients with spinal TB. These cases emphasize the need for continued vigilance and a holistic approach to address TB, ensuring optimal outcomes and quality of life for affected individuals.

## Message

**Clinical:** Early recognition of spinal TB is crucial, especially in patients presenting with back pain, as it can mimic other conditions. Utilizing a combination of imaging studies, histopathological examination, and molecular testing (such as GenXpert) can aid in accurate diagnosis and timely initiation of treatment. Individualized treatment regimens guided by drug susceptibility testing and regular monitoring are essential for achieving favorable outcomes, even in cases of drug resistance.

**Social:** Spinal TB can affect individuals across different demographics and may be influenced by socioeconomic factors, lifestyle habits, and comorbidities such as alcoholism and smoking. Comprehensive patient care should address not only the medical aspects of TB treatment but also social determinants of health, including access to healthcare, housing conditions, and social support networks. Public health initiatives aimed at raising awareness, promoting early detection, and improving access to TB care can help mitigate the social impact of spinal TB and reduce disease burden.

**Prospective:** Continued research is needed to further understand the epidemiology, pathogenesis, and optimal management strategies for spinal TB, particularly in the context of emerging drug resistance and co-infections such as HIV. Advances in diagnostic techniques, including point-of-care testing and novel biomarkers, hold promise for improving early detection and treatment monitoring. Collaborative efforts between healthcare providers, researchers, policymakers, and community stakeholders are essential for developing and implementing comprehensive TB control programs that address both clinical and social determinants of health.

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