



# Spinal Tuberculosis – A Case Report

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## Abstract

Tuberculosis is the main cause of morbidity and mortality in tropical, developing countries where the access to running water and primary healthcare is difficult. Spinal tuberculosis constitutes 15% of cases of extra pulmonary tuberculosis and as many as 50% of cases of tuberculosis with osseous-articular involvement. Paraplegia is the most severe complication of spinal tuberculosis. A relatively rapid diagnosis facilitates a faster implementation of appropriate treatment and may prevent disability. In patients with anterior spinal tuberculosis and higher grades of paraplegia presented during physical examination, with the compression on the spinal cord confirmed with MRI or computed tomography, surgery is the treatment of choice. MRI is the most sensitive imaging technique for diagnosis of spinal tuberculosis, which usually shows deformity of the spine, vertebral body and adjacent intervertebral disk damage and cold abscess in surrounding tissues.

## Introduction

Tuberculosis is the main cause of morbidity and mortality in tropical, developing countries where the access to running water and primary healthcare is difficult. The factors which increase the risk of becoming infected with tuberculosis include: Poverty, overpopulation, illiteracy, malnutrition, alcoholism, drug addiction, diabetes, immunosuppressive therapy and HIV infection [1]. The disease affects people regardless of sex and age. The highest percentage of cases reported in 2018 was observed in men older than 15 years (57%), women (32%), and children below 15 years of age (11%). A total of 8.6% cases of tuberculosis were observed in individuals infected with HIV. It is estimated that the risk of developing tuberculosis is 20-37-fold higher in HIV-infected individuals compared to HIV-negative ones. The majority of cases were reported in Southeast Asia (44%), Africa (24%), and the Western Pacific (18%). The following 8 countries are responsible for 2/3 of the global incidence: India (27%), China (9%), Indonesia (8%), the Philippines (6%), Pakistan (6%), Nigeria (4%), Bangladesh (4%), and South Africa (3%) [2].

Spinal Tuberculosis (STB) constitutes approx. 15% of cases of extra pulmonary tuberculosis (2% of all tuberculosis cases) [3]. It accounts for as many as 50% of cases of tuberculosis with osseous-articular involvement, with the hip joint and knee being the subsequent most common ones [4]. A relatively rapid diagnosis facilitates the early implementation of suitable treatment, which may prevent disability in a patient: Spine deformity and progressive compression on the spinal cord, and, what follows, limb paralysis. Tuberculosis is caused in people by *Mycobacterium tuberculosis* bacteria, and markedly less frequently by *Mycobacterium bovis* or BCG. The infection spreads through the blood or lymph. It most commonly originates from the primary focus in the lungs (50% to 60% of cases of tuberculosis with osseous-articular involvement) [5]. Tuberculosis with osseous-articular involvement is almost always a manifestation of systemic tuberculosis with the primary focus usually being located in the lungs or in the urogenital system. However, in the majority of cases (80%) the focus is difficult to find [6]. We present a case of a young man with non-traumatic spinal fracture, afebrile, anorexic, with progressive general weakness, body weight loss which raised the suspicion of tuberculosis. The pathological masses adjacent to the spine visualized in MRI were found to be classic cold abscesses.

## Case Presentation

A patient (P.U.P.), male (36 y.o.), an immigrant from India, the resident of Poland for 2 years, was admitted to the Department of Neuroorthopedics, Masovian Rehabilitation Center, Poland, with the diagnosis of a pathological fracture of a thoracic vertebra (Th12) and lower limb paralysis. The patient gave a 2-month history of gradually increasing back and lumbar pain treated by a General Practitioner with analgesics. Due to the lack of improvement a spine radiograph was performed and showed the fracture of Th12 vertebra (Figure 1). The patient reported no previous injury. A Jewett

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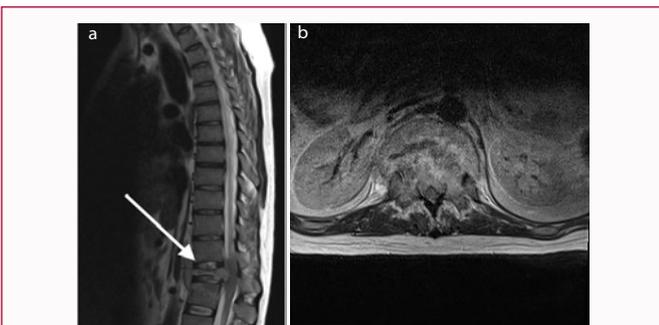
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**Figure 1:** AP and lateral radiograph shows a reduction in the height of Th12 vertebral body.



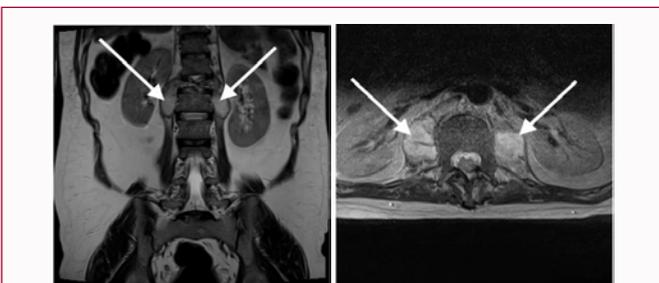
**Figure 4:** A-P chest radiograph with the patient in a recumbent position – no abnormalities detected.



**Figure 2:** MRI of the spine: sagittal (a) and transverse (b) view revealed the destruction of Th12 vertebral body and the compression of pathological tissue on the spinal cord; a pathological mass inferior to the anterior longitudinal ligament, anterior to the vertebral body (a).



**Figure 5:** Lateral and A-P radiograph views after Th12 laminectomy and the transpedicular stabilization of Th10-Th11-L1-L2.



**Figure 3:** Coronal and transverse view of MRI revealed 2 cold encapsulated abscesses on both sides of the spine located at the level of L1 inferior to the parietal peritoneum.

brace was ordered for ambulation, rest and lying position. The pain gradually increased and for several days prior to the admission the patient had been experiencing lower limb numbness and progressive paralysis which made the patient unable to walk and caused difficulty defecating. Imaging diagnostics was complemented with Magnetic Resonance (MRI) which confirmed the pathological fracture of Th12 with a pathological mass in the spinal canal causing its narrowing and compression on the spinal cord (Figure 2). MRI also revealed laterally located encapsulated abscesses on both sides of the spine. The abscesses moved caudally at the level of L1 vertebral body (Figure 3). The patient was afebrile and reported no chills. He only complained of general weakness, anorexia, somnolence, and apathy and body weight loss. On clinical examination the patient was in a supine position. We noted the atrophy of lower limb muscles (the patient was able to move the feet). The muscle strength of the dynamic structures of the feet was 3, knees – 2, hips – 2 according to the *Lovett scale*. The laboratory tests of peripheral blood showed the increased parameters

of inflammation: CRP 44.2 mg/l (reference range: 0.00 to 5.00) and ESR 70 mm/h (reference range: 0 to 12). Chest radiograph showed no abnormalities in the lungs (Figure 4). The patient was qualified for surgical treatment. Transpedicular stabilization was performed with 2 screws introduced into 2 vertebrae above and below the fracture and connected with rods. Then, laminectomy was performed (Figure 5). The pathological tissue was evacuated from the spinal canal and the meningeal sac was exposed. Material was sampled for a histopathological examination, and to perform cultures for aerobic and anaerobic bacteria, and fungi. Moreover, material was sampled to be subjected to genetic and biological testing for tuberculosis. The fragments of the fractured vertebral body were removed. A surgical scoop was used to collect odorless fluid for the above mentioned tests and the remaining fluid collection was drained with suction on both sides of the vertebral body. After collecting material for a culture test, the patient was administered an intravenous antibiotic (Syntarpen). Streptomycin (powder) was used topically on the wound. A drain was left in and the wound was closed with surgical sutures. Postoperatively, the patient was treated with intravenous antibiotics (Syntarpen at a dose of 6 g × 2 g). The patient remained afebrile and the wound healed. Control tests performed 5 days later showed no decreasing tendency of the inflammation: ESR was 70 mm/h and CRP level increased to 111.5 mg/l. After obtaining sterile cultures of the wound material the antibiotic was discontinued. The histopathological examination revealed epithelioid cell granulomas with multinucleated Langhans giant cells and caseous necrosis among bone trabecula and the fragments of the articular cartilage. The microscopic picture was consistent with specific granulomatous spondylodiscitis. The differential diagnosis should firstly comprise spinal tuberculosis, and also a fungal infection or brucellosis.

**Table 1:** The stages of anterior spinal tuberculosis.

Stage	Description	Clinicoradiological features	Usual duration
I	Stage of implantation, incipient stage or pre destructive stage	Dull back pain with muscle spasm in the back. Straightening of the spine or loss of curve	<3 months
II	Stage of early destruction	Diminished disk space, paradiscal erosion kyphosis <10° (K1)	2-4 months
III	Stage of advanced destruction and collapse	2 or more vertebral involvement with collapse. Kyphosis 11° to 60° (K2) or gibbus >60° (K3)	3-9 months
IV	Stage of neurological involvement	Stage III or IV with 4 grades of paraplegia	Variable
V	Stage of residual deformity and aftermath	Kyphosis K1, K2, K3, disease active locally grumbling, reactivated or healed	>3-5 years

**Table 2:** The classification of paraplegia in spinal tuberculosis.

Grade of paraplegia	Complaints/symptoms		Examination/neurological deficit		
	Weakness	Walking	Motor	Sensory	Autonomic
1.	Negligible or weakness appearing after exercise	Able to walk without support	Extensor plantar ± brisk ankle jerks muscle power grade IV to V	-	-
2.	Mild or Feels weakness	Able to walk with support	Motor weakness, brisk tendon jerks, ill sustained muscle clonus, muscle power grade III	Sensory dulling and paresthesia	-
3.	Moderate or weakness is more marked	Not able to walk Confined to bed Can move limbs	Brisk tendon jerks, sustained muscle clonus, muscle power grade I to II	Hypoesthetic and anesthetic patches	May be present
4.	Severe or complete loss of power and control	Not able to move limbs even in bed	a) Paraplegia in extension, power grade 0 b) Paraplegia in flexion, power grade 0, flaccid paralysis	Total loss	Complete loss of bladder and bowel control and incontinence

Staining to test for microorganisms was ordered. The microbiological examination of wound material, the bacterioscopy of acid-fast bacilli, fluorescent staining method, was positive. The conventional method was used to test for *Mycobacterium sp.* The result was positive after 3 weeks of incubation: The number of colonies yielded was (++) , the material was cultured in the Lowenstein-Jensen medium. Middlebrook medium was used to test drug susceptibility. After 25 days the test showed the susceptibility of *Mycobacterium tuberculosis complex* to streptomycin, isoniazid, rifampicin, ethambutol and pyrazinamide. The direct smear revealed no genetic material of *Mycobacterium tuberculosis complex*. Clinically, after the surgery the patient's general condition and mood improved and he regained his appetite. After the oral administration of lactulose the patient emptied his bowels normally, but he needed a Foley catheter in the urinary bladder. Bedside rehabilitation was conducted. It included passive and active exercises with assistance, and rotor exercises in bed. A week later the patient started using a wheelchair. Ambulation started several days later and the patient walked with assistance and using handrails. His gait was insufficient due to the marked paresis of the gluteal muscles and the quadriceps femoris, he was unable to stabilize the pelvis or to lock the knees. The patient was diagnosed with spinal tuberculosis and referred for further treatment at the Institute of Tuberculosis and Lung Diseases. We obtained information that the patient used a walker with assistance, was incontinent and was still treated.

## Discussion

*Mycobacterium tuberculosis Bacilli* have been common in the environment for a long time. In the 18<sup>th</sup> century an English surgeon, *Percievall Pott*, a member of the Royal Society of London, first described a tuberculous spinal inflammation with a kyphotic deformity. Hence, the name of the condition – *Pott disease* [7]. The first information concerning the disease, i.e. characteristic lesions in the skeleton, was obtained basing on research on human remains dated back to Neolith. However, gene amplification through the PCR method revealed the DNA of *Mycobacterium bovis* belonging to the MTB complex in the remains dated back to the Iron Age obtained from the cemetery of

Aymyrylg in South Siberia. Those remains were considered the first evidence of *Pott disease* caused by *mycobacteria* in human remains. Pulmonary and extra pulmonary tuberculosis, including spinal tuberculosis, was even detected in Egyptian mummies dated 3400 BC [8]. In the past tuberculosis was considered a childhood disease, but it changed in the 1970s with common vaccination programs which almost eradicated it in the pediatric population. The World Health Organization (WHO) has been publishing a global report on tuberculosis annually since 1997. The reports include the assessment of the development of the disease worldwide. The latest report published in 2019 included data concerning 2018: Approx. 10 million new infections and about 1.2 million deaths in individuals who were HIV carriers [2]. The pathological process in the spine is most commonly located in the vertebral bodies (90% to 95%) – the anterior type, or, very rarely, in the posterior arches (5% to 10%) – the posterior type [9]. The richly vascularized structure of the cancellous bone with slow blood flow in the vertebral bodies promotes the implantation of tubercle bacilli. Furthermore, Batson paravertebral venous system has no valves, so the blood may flow freely and transport the tubercle bacilli in both directions depending on the pressure within the chest and the abdominal cavity [6]. Lesions are most commonly located in the lower thoracic vertebrae (75%) and upper lumbar vertebrae [10]. A typical pathological focus involves two adjacent vertebrae and the intervertebral disc. A cold abscess is typically visible in radiography, as a result of tubercle bacilli entering the neighboring soft tissues. It may result in the spread of the pathological process, fistula formation and the infiltration of other vertebrae.

In the presented case, the patient had anterior spinal tuberculosis, which is considerably more common. Moreover, the last thoracic vertebra was involved in our patient, which is also a typical location. MRI revealed characteristic cold abscesses. According to Kumar K., based on the correlation between the clinical picture and radiographic findings, the anterior form of tuberculosis is divided into 5 stages [11] (Table 1). The anterior form of spinal tuberculosis is typically associated with anterior spinal cord compression. Therefore, motor nerve fibers are destroyed first, as they are located anteriorly to sensory

fibers in the spinal cord. The destruction of sensory fibers occurs at a later stage of the disease. As regards posterior spinal tuberculosis, with the compression of the posterior part of the spinal cord, the motor fibers are, paradoxically, also destroyed during the first stage. It is due a higher sensitivity of those fibers to compression. Sensory fibers are more prone to ischemia-related injuries. The compression of neural structures in the thoracic and lumbar segments leads to paresis, and, finally, lower limb paralysis. The risk of developing neurological deficits in patients with anterior spinal tuberculosis ranges from 23% to 76% [12]. In 1967 Hodgson published a paper, where paraplegia occurring in the course of tuberculosis was classified into two groups: Paraplegia in patients with the active disease (early-onset paraplegia) and paraplegia in convalescents (late-onset paraplegia). The former requires the immediate introduction of active treatment is associated with more favorable prognosis, while the latter may occur even after 20 to 30 years after tuberculosis infection and is usually associated with permanent spine deformities [13]. According to Kumar K. paraplegia occurring in the course of spinal tuberculosis was divided into 4 grades depending on the degree of paresis and locomotor capabilities [11] (Table 2). Basing on the correlation between the clinical picture and radiographic findings, the present patient may be classified as phase IV of anterior tuberculosis with the 3<sup>rd</sup> grade of paraplegia. Patients presenting with grade 1 or 2 of paraplegia on physical examination are qualified for conservative treatment, which includes long-lasting multidrug antibiotic therapy. Such management is recommended due to the inflammatory character of the compression on the neural structures which may successfully resolve after suitable antibiotic therapy is introduced. In these cases the diagnosis should be made by performing needle biopsy from the affected site, which is the gold standard. Conversely, a surgery is the treatment of choice in patients with anterior spinal tuberculosis and grade 3 or 4 of paraplegia confirmed during physical examination, with the compression on the spinal cord confirmed with MRI or computed tomography. The other indication of surgery is: Severe kyphosis with gibbus, wide cold abscess or lack of response to conservative treatment. The decompression of the spinal cord through extended laminectomy, the removal of pathological tissues and transpedicular stabilization of the spine is a common method used in such cases. Targeted antibiotic therapy should be introduced after obtaining a positive tuberculosis test [14]. According to the recommendations of the British Medical Research Center a combination therapy including antimicrobials, i.e. Rifampicin, Isoniazid, Pyrazinamide, Ethambutol <RIPE>, should be continued for 6 to 9 months in patients with spinal tuberculosis. The toxicity of those drugs should be constantly monitored. The operative treatment in the present patient prevented the progression of the disease. The patient requires long lasting rehabilitation whose result is uncertain, because of his preoperative neurological deficits, i.e. lower limb paresis and incontinence. The time between the occurrence of the first symptoms and the final diagnosis was about 3 months in this patient.

## Conclusion

Primary tuberculosis with osseo-articular involvement, including the spine, is a rare phenomenon. The radiographic confirmation of a non-traumatic spinal fracture in a young healthy man should always

be treated as a pathological fracture. In such cases the diagnostic work-up should also include MRI or CT imaging. Imaging studies help determine whether the fracture is accompanied by abnormal masses, assess the fluid cisterns, other vertebrae and the width of the spinal canal, and whether there is a risk of developing paralysis or paresis. Early diagnosis facilitates the introduction of suitable surgical treatment. It needs to be remembered that material should be sampled intraoperatively not only for cultures for bacteria and fungi and histopathological examination, but also for the microbiological diagnostics of tuberculosis. In such cases a surgery is not the first stage of treatment. Further treatment is introduced basing on the obtained results of intraoperative sample testing. Such management may prevent the occurrence of paresis and disability. The presented case of a young man, an immigrant from India, with non-traumatic spinal fracture, afebrile, anorexic, with progressive general weakness, body weight loss should instantly raise the suspicion of tuberculosis. The described pathological masses adjacent to the spine were classic cold abscesses which are typical of the disease.

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