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Exploring Thoracolumbar Pott's Disease in the Immunocompetent; Institutional Experience Over a Decade and Comprehensive Literature Review

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ABSTRACT

Background: The presentation of Pott's has a wide variation and an insidious onset, which makes timely accurate diagnosis quite challenging. **Objective:** To review Pott's cases to enhance the disease management and fill the literature gap regarding the approach to Pott's disease. **Methods:** A descriptive observational retrospective hospital-based study conducted from 2007 to 2022 at KFHU. 346 patients who were diagnosed with TB were reviewed thoroughly. Only 13 cases were labeled as Pott's disease based on imaging or microbiology testing and hence were included in this study, and other TB pulmonary and extrapulmonary cases were excluded. **Results:** In our analysis of 13 cases of Pott's disease, we observed a significant male predominance (69.23%) and diverse symptoms, with back pain (69.2%) being most prevalent among our patients. Lumbar involvement was the most frequently observed site (38.4%), and diagnoses were made through microbiology (69.2%) or clinical/radiological means (30.8%). Acid-fast bacilli (AFB) culture testing exhibited a positivity rate of 61.5%, while TB-PCR showed positive results in 57.1%. Imaging studies revealed vertebral lesions (90.9% CT, 81.8% MRI), abscesses (54.5% CT, 81.8% MRI), and spondylodiscitis (18.2% CT, 54.5% MRI). Treatment, administered in 92.3% of cases, involved the use of Isoniazid, Rifampicin, and Ethambutol. Surgical interventions, though less frequent, encompassed various procedures. Outcomes demonstrated a notable high cure rate of 84.9%, with a 15.4% incidence of cases experiencing loss of follow-up. **Conclusion:** The high cure rate of 84.9% accentuates the effectiveness of early diagnosis and comprehensive treatment strategies that combine medical and surgical interventions when necessary.

Keywords: Pott's disese, Extrapulmonary TB, back pain, Acid-fast bacilli (AFB), Cure rate.

1. BACKGROUND

TB affects roughly one-quarter of the world's population. In 2021, 10.6 million people were infected with TB, equating to 134 cases per 100000 people (1). It is caused by Mycobacterium tuberculosis complex, most commonly by Mycobacterium tuberculosis. It is a slow-growing fastidious, aerobic bacillus. The primary site of infections can be in the lungs, mediastinum lymph nodes, and other viscera. The hematogenous dissemination of the bacillus from a primary focus can cause a secondary Spinal infection (2). Spinal tuberculosis was first described in 1779 by Percival Pott, hence the name "Pott's disease." TB of the spine (Pott's) is one of the oldest manifested diseases of humankind and recently showed a substantial resurgence in developed nations, which imposes a challenge to the global community (1, 2). Extra-pulmonary TB accounts for 3% of the incidence, among which 10% are attributed to TB of the skeleton, and spinal TB was the commonest site, which accounts for 50% of skeletal cases. Nevertheless, the most involved site is the thoracolumbar junction, whereas the cervical spine is the least affected (2). The presentation of Pott's has a wide variation and an insidious onset, which makes timely accurate diagnosis quite challenging. Moreover, diagnostic modalities for

Pott's have major obstacles. Once Pott's is suspected, imaging will be ordered, but plain radiographs have a low specificity in diagnosing Pott's in the early presentation. In addition, it is well known that MRI is superior to plain radiographs; however, it cannot differentiate Pott's from pyogenic vertebral osteomyelitis. Another point worth mentioning is that while the definitive diagnosis of Pott's relies on isolation and identification of the pathogen, it has a high false negative result, as the recent literature illustrates (3). Recent research has been focusing on the expression of lipopolysaccharide-binding- protein (LBP), and it might be a promising potential Pott's biomarker (4). Early treatment is key for Pott's prognosis; the mainstay treatment of the disease is medical, with a course of 4 anti-TB agents over two months of the intensive phase followed by two agents over seven months of a continuation phase. Whereas surgical interventions are preserved for certain indications, including the presence of neurological deficits, cold or large abscess, severe kyphosis (> 40 degrees), spinal instability, and compression or failure of medical management. Techniques of these interventions vary depending on the case, from a posterior debridement or decompression and fusion, followed by simultaneous or sequential anterior fusion with instrumentation, to a posterior or anterior decompression and fusion with bone autografts (5, 6). Despite understanding the basic concepts of Pott's, the literature remains deficient regarding a clear pathway in approaching the disease. Therefore, this study aims to review Pott's cases in King Fahad Hospital of the University (KFUH) to fill the literature gap concerning the clinical presentation, investigations, and therapeutic approach to Pott's disease.

2. OBJECTIVE

This study aims to review Pott's cases in a significant academic institution to enhance the disease management and fill the literature gap concerning clinical presentation, investigations, and therapeutic approach to Pott's disease.

3. MATERIAL AND METHODS

The institutional research ethics approval was granted by Imam Abdulrahman bin Faisal university (IRB-2023-01-400). A descriptive observational retrospective hospital-based study was conducted from 2007 to 2022 at KFUH, where patients diagnosed with Pott's disease were included. The medical record of 346 patients of both genders who were diagnosed with TB and following up at KFHU were collected from the infectious disease department archives. Furthermore, the data were reviewed thoroughly, and only 13 cases were labeled as Pott's disease based on imaging or microbiology testing and hence were included in this study; all other TB pulmonary and extrapulmonary cases were excluded. An Excel sheet was filled with the required data, including gender, nationality, symptoms, signs, imaging, laboratory, comorbidities, medical management, and surgical management.

Statistical Analysis

The data were analyzed using the software program Statistical Packages for Software Sciences (SPSS) version 26 (Armonk, New York, IBM Corporation, USA). Descriptive statistics were given as numbers and percentages (%) for all categorical variables. Values were considered significant with a p-value of less than 0.05.

4. RESULTS

The analysis included 13 Pott's cases where the majority were males (69.23%) and 10 (75.9%) were Saudi citizens. The mean age of the patients was found to be 38.5 ± 15.1 years. The comorbidity analysis showed that Diabetes Mellitus was reported in 2 cases (15.4%), while Hepatitis C Virus (HCV), Chronic Liver Disease, and hypertension each occurred in 1 case (7.7%).

Clinical Presentation

The most prevalent symptom was back pain, observed in 9 cases (69.2%), with spine tenderness noted in 4 cases (30.8%), followed by loss of weight in 4 cases (30.8%), night sweating in 4 cases (30.8%) And fever in 3 cases (23.1%). Notably, neurological manifestations were present in (46.15%) of the cases, including loss of sensation in 3 cases (23.1%), lower limb weakness in 2 cases (15.4%), muscle hypotrophy in 1 case (7.7%), and urinary incontinence in another case (7.7%). (Table 1).

		N out of total	%
Symptoms and Signs	Back pain	9	69.2
	Fever	3	23.1
	Loss of weight	4	30.8
	Night Sweating	4	30.8
	Other symptoms	7	53.8
	Spine tenderness	4	30.8
	Neurological manifestations:	7	53.9
	Urinary incontinence	1	7.7
	Loss of sensation	3	23.1
	Lower limb weakness	2	15.4
	Muscle hypotrophy	1	7.7

Table 1. Clinical signs and symptoms seen in spine TB cases

		N	%
Plain X-ray	Not Done	2	15.4
	Done	11	84.6
Plain X-ray findings (N=11)	Vertebral lesions	4	36.4
	Disk space narrowing	3	27.3
	Vertebral destruction	1	9.1
Computed Topography (CT)	Not Done	2	15.4
	Done	11	84.6
CT findings (n=11)	Vertebral lesions	10	90.9
	Spondylodiscitis	2	18.2
	Collection/Abscess	6	54.5
MRI	Not Done	2	15.4
	Done	11	84.6
MRI findings (n=11)	Vertebral lesions	10	90.9
	Spondylodiscitis	6	54.5
	Collection/Abscess	9	81.8
	Soft tissue swelling	7	63.6
	Spinal cord compression	3	27.3

Table 2. Radiological findings

Concerning the pattern of vertebral involvement, the lumbar region was most frequently affected, noted in 5 .cases (38.4%), followed closely by thoracic and thoracolumbar pattern involvement in 4 cases each (30.7% and 30.7%). In 1 case (7.7%), additional Sacral involvement was observed, while cervical regions showed no reported cases.

Diagnosis

In terms of the diagnostic method, 69.2% of the cases were diagnosed microbiologically, and treatment was initiated based on microbiology results, while 30.8% were diagnosed based on clinical and radiological findings. However, two cases from the latter group later underwent further microbiological confirmation.

In the analysis of acid-fast bacilli (AFB) strain testing among individuals with Pott's, the study included 10 cases, representing 76.9%. One case within this subset demonstrated a positive AFB strain (10%). All 13 cases (100%) in the study underwent AFB culture testing and yielded positive results in 8 cases, indicating a positivity rate of 61.5%. TB-PCR testing was conducted in 7 cases (53.8%) of the total cases and revealed a positive TB-PCR in 4 cases (57.1%).

Plain X-ray examinations was done in all 11 cases (84.6%), where Vertebral lesions were identified in 4 cases (36.4%), disk space narrowing in 3 cases (27.3%), and vertebral destruction in 1 case (9.1%). Computed tomography (CT) examinations were done in all 11 cases (84.6%), where vertebral lesions were present in 10 cases (90.9%), spondylodiscitis was identified in 2 cases (18.2%) and collection/abscess was noted in 6 cases (54.5%). About 11 cases (84.6%) underwent Magnetic resonance imaging (MRI) examinations, vertebral lesions, collection/abscess, and spondylodiscitis were common findings, occurring in 90.9%, 81.8%, and 54.5% of the cases, respectively. Soft tissue swelling and spinal cord compression were also noted in 63.6% and 27.3% of the examined cases, respectively (Table 2).

Management

In the realm of treatment employed for individuals with Pott's, medical treatment was widespread, with high percentages for Isoniazid (INH), Rifampicin, and Ethambutol, all administered in 92.3% of cases, while Pyrazinamide was used in 69.2% of cases. Only few cases required additional use of Moxifloxacin, Levofloxacin, Amikacin, Linezolid, or Streptomycin with percentages less than 23%. Regarding drainage, aspiration or biopsy procedures, CT-guided aspiration and biopsy were the most prevalent (53.8%), followed by various other drainage methods. Surgical interventions, albeit less common, included corpectomy, posterior decompression with wide laminectomy, posterior instrumentation with pedicle screws and rods, laminectomy for benign spinal tumor, T2 vertebra fixation, and laminectomy with cleaning of epidural abscess with internal fixation, each accounting for 7.7% of cases. Outcomes revealed a high cure rate of 84.9%, while 15.4% of cases experienced loss of follow-up.

5. DISCUSSION

Clinical Presentation

Pott's disease can impact individuals of all age groups, but it is more frequently observed in young and middle-aged adults. In developing nations, it predominantly affects children and young adults, while in contrast, in developed countries, it tends to be more prevalent among the elderly. Furthermore, the incidence of Pott's disease does not exhibit gender-based variation, occurring similarly in both males and females (7). A total of 13 cases were enrolled in our study, (69.23%) were males, and (30.77%) were females. Similarly, more cases of males were seen in a cross-sectional study with a total of 43 cases by Ibrahim et al., which showed 55.8% were males and 44.2% were females. In regard to the age range considered in our study, it exhibited substantial diversity, spanning from 22 to 65 years, compared to Ibrahim et al., the age mainly ranged between 30 to 40 years (8). On top of that, Vaishnav et al., published a retrospective study among 100 patients; likewise, 64% were males, and 36% were females. Furthermore, the occurrence of the disease was most notable during the third and fourth decades of life, a pattern consistent with the findings of Ibrahim et al (5-8).

The challenge in identifying Pott's stems from its wide-ranging clinical manifestations. The signs and symptoms can vary depending on whether the affected spine region is cervical, thoracic, or lumbar (3). As part of our analysis, back pain was the prevailing symptom, affecting 69.2% of all cases. Constitutional symptoms, such as fever, night sweats, and weight loss, were reported in 23.1%, 26.66%, and 26.66% of the cases, respectively. In addition, neurological manifestations were reported in 53.9%. Our findings align with Glassman et al., who have authored a literature review that provides insight into Pott's disease. It is noted in their review that in the initial phases of the disease, the primary manifestation typically involves back pain. The second most frequently encountered clinical presentation is associated with neurological deficits. Constitutional symptoms, such as fever, weight loss, and night sweats, are comparatively less common (3). Moreover, several other studies align with our research, with back pain emerging as the most frequently reported symptom in cases of Pott's while the prevalence of constitutional symptoms and neurological deficits exhibited some variability compared to our results.

Thoracolumbar Pott's

Pott's disease most commonly afflicts the lower thoracic and upper lumbar regions of the spine (thoracolumbar) as demonstrated by the literature where in a study by Etedal the thoracic spine was the most affected area, as well as in another done by Shou-Hsin Su the lumbar spine was the most affected (8, 9) Accordingly, our study showed that the thoracolumbar spine was the most involved. This predilection can be attributed to various anatomical factors; this region is susceptible to microtrauma due to its nature which may facilitate the seeding of the bacteria. Moreover, the proximity to the lungs and the intraabdominal organs makes it more vul-

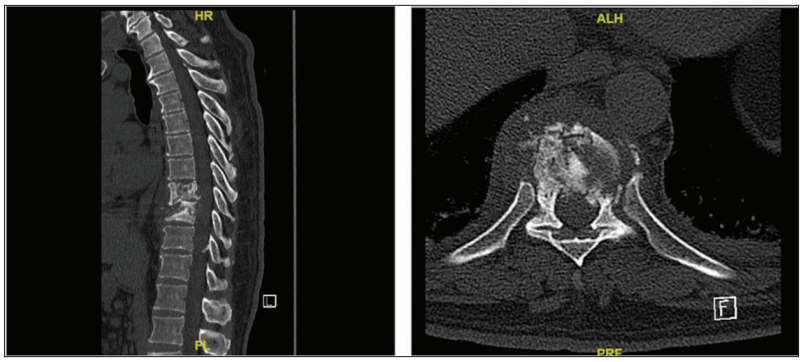

Figure 1. Sagittal and Axial view CT scan of a Pott's patient showing Significant bone destruction and complete loss of intervertebral disc space height of T8-T9

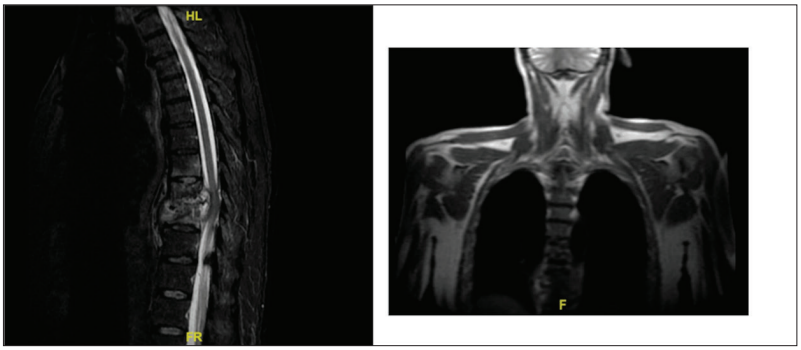

Figure 2. Sagittal and coronal MRI of the spine showing destruction of the T8-T9 disc space associated T8-T9 vertebral bodies compression and spinal canal stenosis with mild cord compression.

nerable to direct spread from the TB primary lesion as well as hematogenous spread (1).

Diagnosis

Imaging modalities - X-ray, CT, and MRI - in early presentation of Pott's patients plays a pivotal role in diagnosing Pott's disease, providing crucial insights into the spinal involvement and aiding in the assessment of associated complications (10). In our study, only 36.3% demonstrated findings on X-ray, including lesions on the affected vertebrae in 4 cases, intervertebral disk space narrowing in 3 cases, and 1 case of vertebral destruction. Whereas 63.63% of the X-rays were unremarkable.

The X-ray findings of Pott's disease in the literature is parallel with our study. Demineralization, paravertebral abscess, and disk space narrowing with anterior wedging and angulation were the findings in a review by Natali (11). and Additionally, Rivas Garcia's review demonstrated that the initial observations on X-ray scans included radiolucency and blurring of plate boundaries. Sclerosis, ankylosis, vertebral wedging, and collapse are present in the later stages of the disease (12). The low specificity of X-ray in identifying Pott's was demonstrated in the literature as the detection of radiolucent lesions requires at least 30% of bone mineral loss (3), which mandates further assessment by other radiological modalities.

In terms of CT scans, many studies in the literature highlighted the superiority of CT scan compared to X-ray in early detection of vertebral damage as it provides a more comprehensive view of the extent of the bony lesions, the bony and ligamental alterations, as well as the presence of paraspinal abscesses, involvement of joints, impact on the posterior spinal column, and the overall regional stability (7, 11, 12). Among our patients that CT assessed, 90.9% demonstrated some changes, where ten patients showed vertebral destruction, six revealed fluid collection or abscess, and two had spondylodiscitis (Figure 1).

According to several studies, MRI is the preferred modality to assess Pott's disease due to its high sensitivity and specificity. It can help assess soft tissue involvement, spinal cord compression, or concurrent spinal arachnoiditis (11). Hence, when there is suspicion of spondylitis, it is advisable to undergo MRI, as early diagnosis can help prevent serious spinal or neurological complications (12).

As for our findings, MRI identified vertebral changes in 100% of the cases. The findings included vertebral destruction or lesions in ten cases, spondylodiscitis in six cases, collections or abscesses in nine cases, and spinal cord compression in three cases (Figure 2).

In a study conducted by Ibrahim et al, encompassing a total of 43 cases, the findings indicated that the diagnosis was established using MRI of the spine in 29 patients (67.4%), MRI of the brain in 14 patients (32.6%), and sputum testing in only 10 patients (23.3%) (8). This is contrary to our study, where the majority (69.23%) were diagnosed based on microbiological testing and only (30.7%) were based on imaging.

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In a case review conducted by Wang., it was determined that while it is a reasonable approach to seek bacteriological confirmation in cases of Pott's disease, clinical symptoms and plain radiographs should be relied upon when bacteriological tests yield negative results due to their notable likelihood of producing false negative (13). Furthermore, Glassman I et al analysis revealed that the rate of positive microbiological findings in samples taken from the vertebrae and paravertebral regions did not exceed 36%, which can be clarified by the observation made by Pandita et al., who noted that, unlike pulmonary tuberculosis, the population of bacilli in tissue biopsy samples from extrapulmonary sites is considerably lower due to the bacteria's paucibacillary state in less oxygenated osseous tissue. This explains the limited effectiveness of microscopic examinations in diagnosing spinal tuberculosis (3, 14). The microscopic detection of

acid-fast bacilli (AFB) stain testing is known to have a sensitivity ranging from 25% to 75% and a high specificity of 99%. On the other hand, the Polymerase Chain Reaction (PCR) test can provide results in as early as 90 minutes and boasts a sensitivity of 95.6% and specificity of 96.2%. This expedited diagnostic capability can aid in avoiding delays in diagnosis and treatment initiation, thereby reducing the risk of subsequent complications (7).

New Testing of Spinal TB in the Literature:

As mentioned earlier, conventional microbiological testing has a limited positivity rate of 36%, resulting in a significant number of false negatives (3). Recent research has focused on finding more sensitive biomarkers. Traditionally, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) have been used as spinal tuberculosis biomarkers, but they are not always reliable due to their nonspecific nature (2). Mann et al. investigated 19 biomarkers and found that, along with CRP, fibrinogen, Interferon gamma (IFN-γ), Neural cell adhesion molecule (NCAM), and ferritin were the best at differentiating spinal TB from musculoskeletal back pain (15). Recent research aims to reduce diagnostic uncertainty by identifying more precise individual biomarkers and combinations. In 2022, Lou et al. found that lipopolysaccharide-binding protein (LBP) was significantly elevated in peripheral blood samples of 100 spinal TB patients, with a positive correlation with ESR and CRP levels, suggesting LBP may be a promising spinal TB biomarker (4). Moreover, the Xpert MTB/RIF method offers rapid and accurate molecular diagnosis for TB. Studies support its use in extrapulmonary TB, with high sensitivity and specificity reported by Vadwai et al. and Tortoli et al. Integrating Xpert MTB/RIF could accelerate diagnosis and treatment initiation (16, 17).

Medical Management

Multidrug therapy is the primary treatment for Pott's disease, regardless of its severity. The standard first-line regimen consists of four drugs: rifampicin, isoniazid, ethambutol, and pyrazinamide. These are initially administered for two months, followed by a continuation of rifampicin and isoniazid for an additional 6 to 18 months, depending on the individual case (18). Various studies have demonstrated the effectiveness of medical treatment in achieving good results without the need for surgical intervention. For instance, among the 49 patients studied by Valsalan, 63.4% achieved excellent outcomes (18). In addition, among the 70 patients studied by Nene et al., 98% had successful outcomes through conservative treatment (19). Similarly, in the Bakhash A. study, 85% of the 26 patients exhibited complete improvement solely through medical treatment, without surgical intervention (20). In all three studies, surgery was only reserved for cases with specific indications, such as persistent pain, progressive neurological deficits, increased abscess size, or worsening kyphosis. The results from our study align with this trend, indicating that 69.23% of our patients were effectively managed through conservative measures, and the circumstances necessitating surgery were relatively infrequent. This observation suggests that surgical intervention is often unnecessary for most of Pott's patients.

In summary, for uncomplicated Pott's, the evidence suggests that it can be successfully addressed as a medical condition primarily managed by chemotherapy. In cases of complicated tuberculosis, the combination of medical therapy and surgery should be considered to yield the best outcomes. This highlights a significant shift towards a reduced need for surgical intervention in the management of spinal tuberculosis, emphasizing a preference for medical treatment.

5.6 Surgical Management:

Contemporary surgical intervention is less frequently required due to the increasing recognition of the efficacy of chemotherapy. However, it remains a valuable option in specific cases, which are carefully selected based on certain criteria. These criteria encompass situations such as the necessity for a biopsy, the presence of abscesses causing symptoms due to pressure and being unresponsive to 3-6 months of anti-TB medications, the persistence or exacerbation of neurological deficits, spinal column instability, and the presence of severe kyphotic deformities exceeding 60 degrees (18). In our study, the need for surgical treatment arose in only four out of thirteen patients, accounting for 30% of the cases. All four of these patients exhibited vertebral destruction, and three of them presented with neurological signs and symptoms and with kyphotic deformity. In a similar vein, a study conducted by Etedal Ibrahim found that all 43 patients received antituberculosis drugs, and surgery was deemed necessary in just eight of them, representing 18.6% of the cases (7). In the context of spinal tuberculosis, the selection of a surgical approach involves consideration of three main options: anterior, posterior, and a combined approach. The literature offers varying perspectives on the most suitable approach for managing this condition.

6. CONCLUSION

This study explored the clinical presentation, diagnostic methods, and treatment approaches for Pott's disease. The findings highlight the characteristics of Pott's disease, including its insidious onset, prevalent back pain, and diverse neurological manifestations. The study emphasizes the importance of early diagnosis and comprehensive treatment. Medical treatment with anti-TB drugs is effective for most cases, reducing the need for surgery. Surgical intervention is reserved for severe cases with significant complications. This study supports a preference for conservative management and highlights the need for improved diagnostic methods and treatment strategies. The high cure rate of 84.9% underscores the effectiveness of timely and appropriate management of Pott's disease.

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