PULMONARY AND SPINAL TUBERCULOSIS IN AN 8-YEAR-OLD BOY: A CASE REPORT

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Abstract

Tuberculosis in children is difficult to diagnose. We report a case of an immunocompetent child with persistent back pain and kyphotic deformity, without respiratory symptoms, and no contact with tuberculosis patients. Imaging shows evidence of thoracic vertebral destruction and dense consolidation in the right upper lobe. Tuberculin skin test, Quantiferon TB Gold, and Xpert MTB/RIF Ultra yielded positive results for *Mycobacterium tuberculosis* infection. The patient was started on and completed one year of antituberculosis therapy, with recovery shown in chest radiograph and a reduction in the static kyphosis angle.

Keywords*:* Spinal Tuberculosis, Pott's Disease, Pulmonary Tuberculosis, Tuberculosis in Children

Introduction

Tuberculosis is a communicable disease caused by *Mycobacterium tuberculosis*. It is a major global public health concern, with significant morbidity and mortality rates. The disease is primarily transmitted via the respiratory route when small infected droplets are aerosolised from infected individuals (1). If left untreated, the mortality rate can reach up to 50%. However, with current recommended treatment, about 85% of patients can be cured (2). Approximately 11% of new cases occur in children, and the mortality rate for children with TB is reported to be 11% in HIV-negative and 14% in HIV-positive patients (2). Pulmonary tuberculosis remains the most frequent type of tuberculosis, with a persistent cough as the commonest symptom. We highlight a case of disseminated tuberculosis involving the pulmonary and the spine, which presented to us with spinal deformity, without the typical respiratory complaint despite significant lung involvement, and the challenges in reaching the diagnosis.

Case report

An 8-year-old boy with a background history of well-controlled asthma was initially referred to our centre with a complaint of back pain for four months.

He experienced vague throbbing pain over the upper back with aggravation upon movement. His father noticed that he started to develop a hunching posture and refused to bend forward during walking and climbing stairs, as the child attributed it to the pain. He was otherwise ambulating unassisted.

Throughout the pain, he experienced no motor weakness or sensory deficit. During the first one month of pain, they visited a general practitioner for the complaint. An X-ray of the spine was done, and subsequently, he was discharged as the imaging was reported to be normal. Unfortunately, the pain persisted and gradually worsened, especially over the last one month prior to this visit.

The patient denied prolonged cough, unexplained fever, weight loss, or appetite loss. He also denied contact with tuberculosis patients or patients with prolonged cough. As for the control of his asthma, he was on a metered-dose inhaler (MDI) Budesonide, taking two puffs twice per day and a rescue MDI of salbutamol, taking two puffs. He required the rescue puffs a week prior to presentation to us. Otherwise, his symptoms were well controlled according to the GINA assessment of symptom control. He was up-to-date on his vaccination schedule, including BCG.

The physical examination showed normal vitals. The child was afebrile, not in overt respiratory distress, and normotensive. A BCG scar was present, and a solitary lymph node was palpable over the left anterior triangle of the neck. Examination of the midthoracic spine revealed gibbus deformity with tenderness. There were no skin changes

observed. Respiratory examination showed dull percussion over the right upper zone, with reduced air entry. There were no obvious crepitations or rhonchi on auscultation. Cardiovascular and gastrointestinal examination were unremarkable. Cranial nerve examination was also unremarkable; there was normal tone, no deficit in both sensory and motor functions, and reflexes were normal.

The chest radiograph showed right upper lobe consolidation and loss of the vertebral body at the level of T8. The Spine X-ray showed total loss of the body of T8 and reduced height of the body of T9.

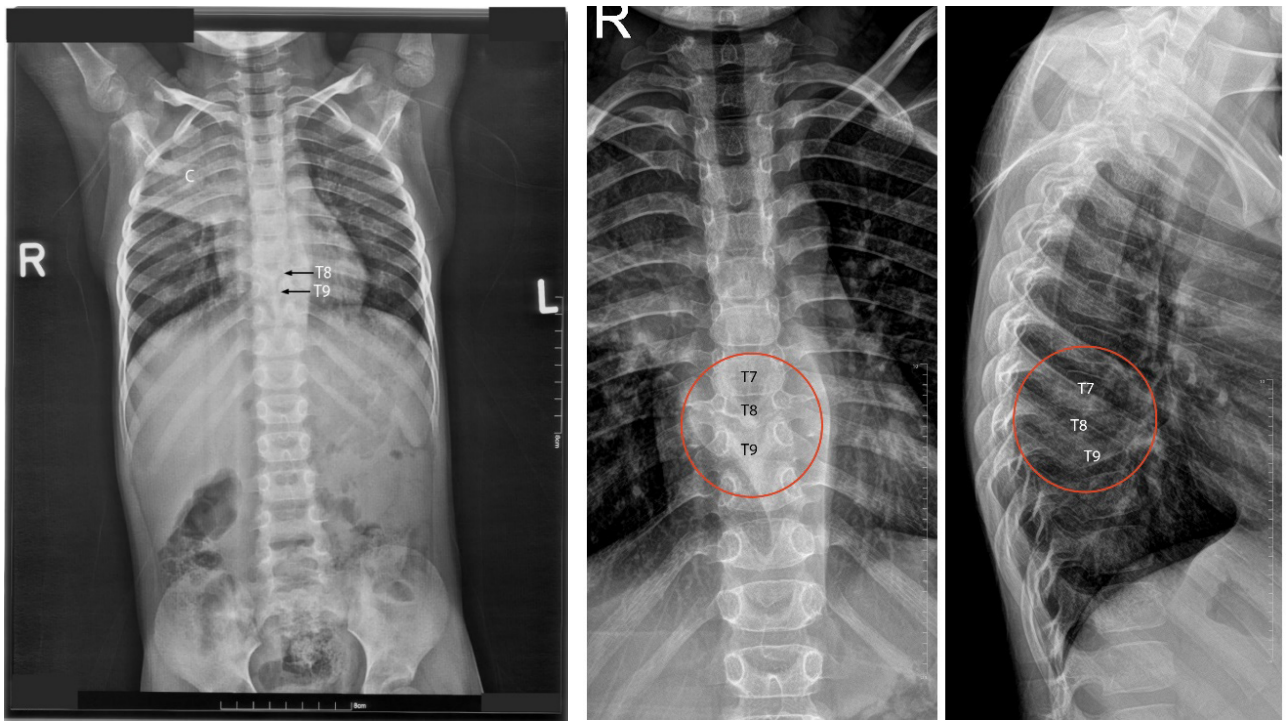

Figure 1: The first radiograph investigation of the patient shows right upper lobe consolidation (C) and loss of vertebral body at T8 and T9.

A CT scan of the Thorax revealed dense consolidation at the anterior segment of the right upper lung with air bronchograms, along with subcarinal and paratracheal nodal enlargement measuring up to 1.8cm. The bone window of the same CT showed gibbus deformity of the thoracic spine with destruction of the T8 and partial destruction of the T9 vertebral bodies, associated with a prominent paraspinal and intraspinal soft tissue mass.

The patient subsequently underwent a whole spine MRI, which revealed destruction of the T8 vertebral body and a reduction in the height of the T9 vertebral body, along with erosion of the superior endplate and the anterosuperior and posterosuperior corners of T9. The intervertebral disc space of T8/T9 was narrowed with a loss of normal signal intensity. Additionally, there was an enhancing anterior and posterior longitudinal subligamentous collection extending from the level of T7-T9, leading to compression of the spinal cord and spinal canal stenosis at the level of T8/T9. However, the spinal cord signal intensity was normal. The radiological impressions from the study suggest features consistent with tuberculous spondylodiscitis, accompanied by an anterior and posterior subligamentous collection causing spinal canal stenosis.

Haematological examination shows an elevated Erythrocyte Sedimentation Rate and elevated C-Reactive Protein. The full blood count was normal. The Tuberculin Skin Test (TST) was positive, with a 25mm induration. The patient did not produce sputum, but three samples of gastric lavage aspirate were negative for Acid Fast Bacilli stain. The Gastric lavage sample was sent for MTB Polymerase Chain Reaction, but it yielded negative results. Fortunately, the diagnosis was aided by a positive Interferon Gamma Release Assay (IGRA) Quantiferon TB Gold result, as well as a gastric lavage sample for Xpert MTB/RIF Ultra. After eight weeks, the results from the culture and sensitivity test were negative for *Mycobacterium tuberculosis*.

The patient was diagnosed with both smear-negative pulmonary tuberculosis and spinal tuberculosis. The treatment plan included a year-long antituberculosis therapy consisting of two months of intensive phase medication that included Ethambutol, Isoniazid, Rifampicin,

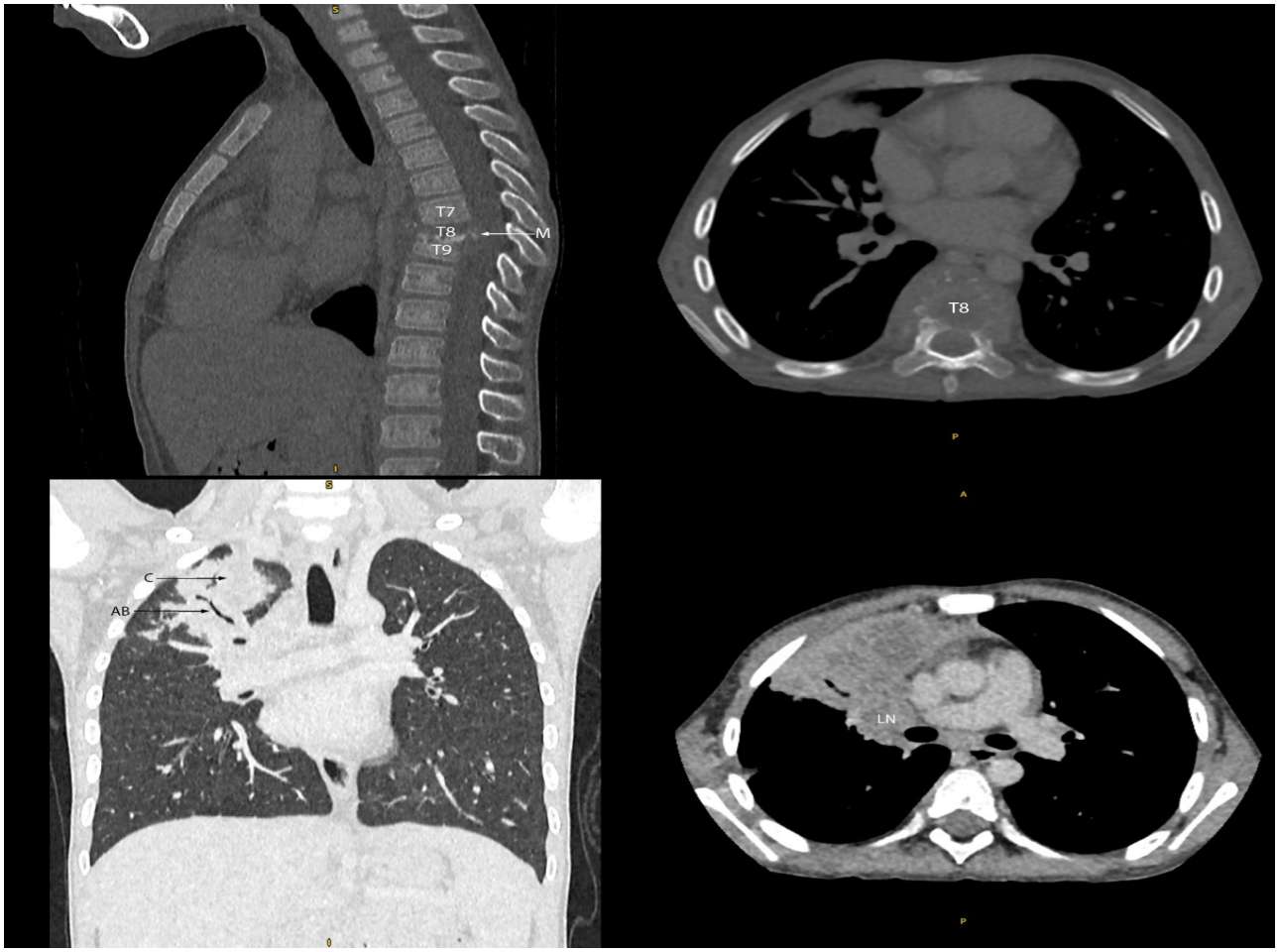

Figure 2: CT Thorax shows dense consolidation in the anterior segment of the right upper lung with air bronchograms (AB) with enlarged lymph nodes (LN). There is also gibbus formation and destruction of the T8 and T9 vertebral bodies, associated with a paraspinal soft tissue mass (M).

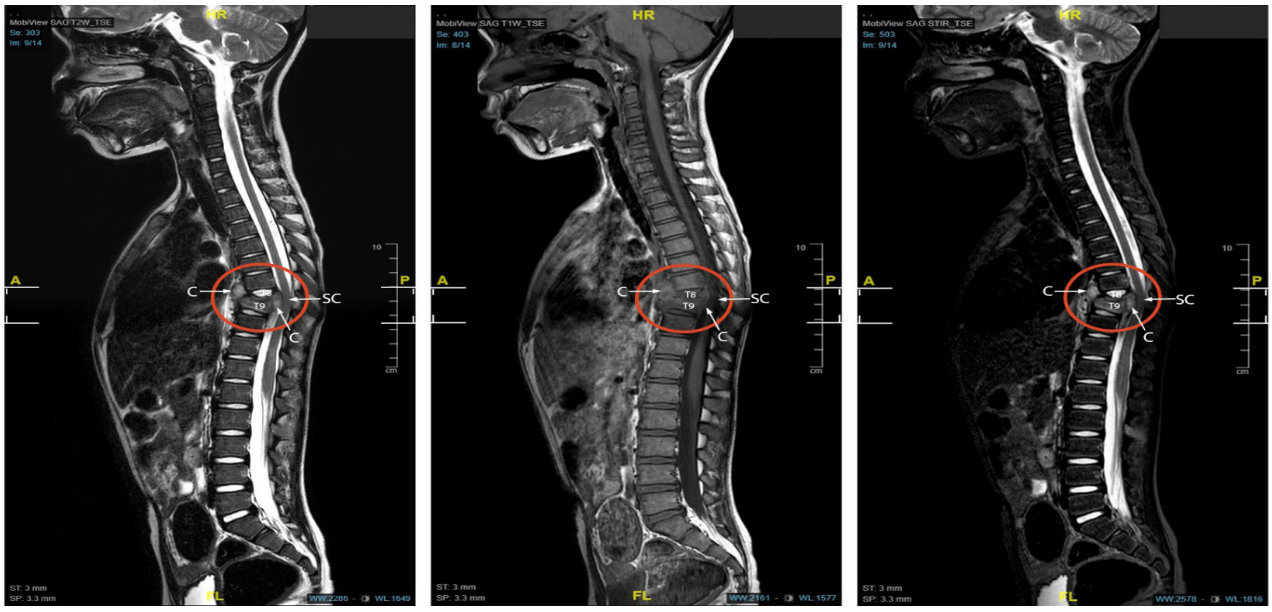

Figure 3: MRI of the whole spine reveals total destruction of T8 vertebral body with loss of vertebral height causing gibbus deformity, and reduction of T9 vertebral body height with superior endplate erosion, with intervertebral disc space of T8/T9 narrowed. Anterior and posterior subligamentous collection seen (labelled as C), with posterior collection seen compressing the spinal cord (labelled as SC) resulting in spinal canal stenosis.

and Pyrazinamide. This was followed by ten months of maintenance therapy with Isoniazid and Rifampicin. The patient was also considered for a biopsy of the lymph node and lung biopsy due to the possibility of lymphoma. However, the patient showed positive progress after starting the antituberculosis treatment, and his pain resolved, and the lymph node shrank. Consequently, the biopsy was deferred, and the patient completed the antituberculosis therapy. The patient was also prescribed a body brace. After the therapy, a repeated CT Thoracolumbar spine showed the resolution of the subligamentous collection, with persistent kyphosis and a gibbus deformity of 52-degree angulation, and the chest radiograph showed improvement. Throughout follow-up, the patient was asymptomatic, the neurological examination was normal, and the kyphosis angle was nonprogressive. Therefore, the treatment plan is currently non-operative with serial follow-up.

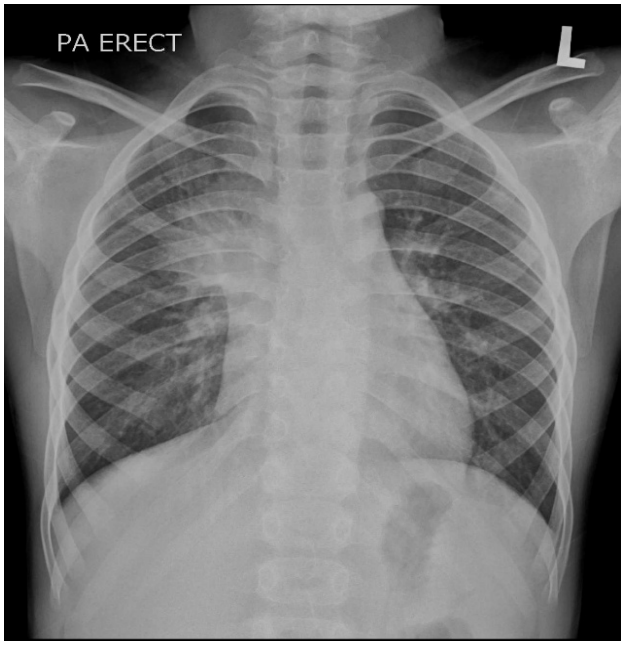

Figure 4: A follow-up chest radiograph after completion of one year of antituberculosis treatment, shows improvement of right upper lobe consolidation.

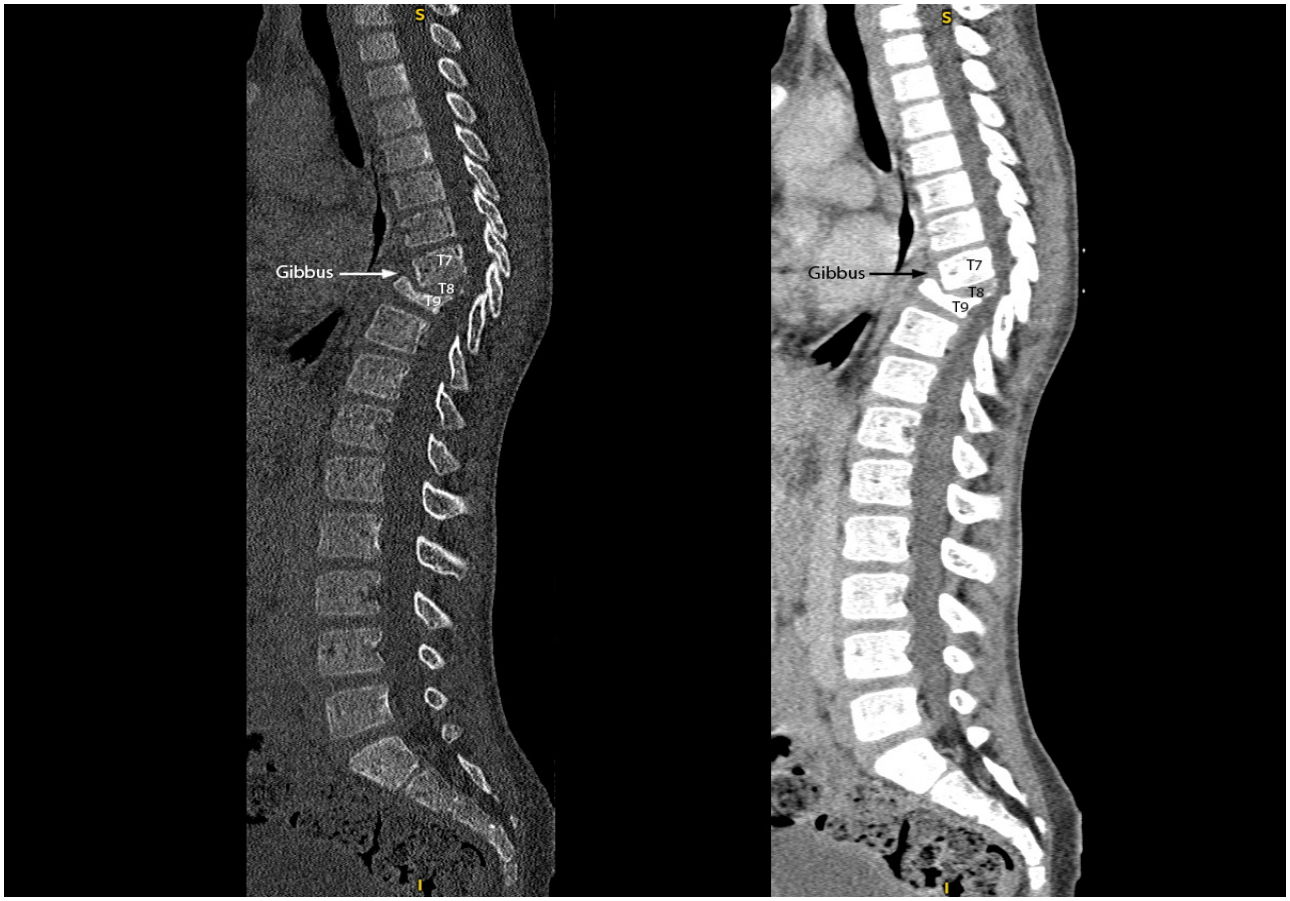

Figure 5: CECT Thoraco-lumbar after completion of one year of antituberculosis treatment, shows thoracolumbar kyphosis resulting in a sharp angulation (Gibbus deformity of 52 degrees) with reduced vertebral height of T9 and a narrowed bony spinal canal at the gibbus deformity level. Previously seen anterior and posterior longitudinal subligamentous collection are no longer visible.

Discussion

Tuberculosis is a significant public health issue in Malaysia, with a notable 11% of cases occurring in children worldwide. This disease presents a considerable challenge to global health, particularly in developing countries.

Pulmonary tuberculosis is the most prevalent form of tuberculosis in children. Its primary symptom is a persistent cough or wheeze that remains unresponsive to treatment (3). This symptom is often accompanied by fever and weight loss. However, some children with primary or latent tuberculosis may remain asymptomatic. Surprisingly, despite the absence of prolonged coughing and contact with a tuberculosis patient, our patient's imaging showed an enlarged lymph node with dense consolidation in the right upper lung. This presentation reflects that children aged 5 to 10 years can exhibit radiographically apparent yet clinically silent pulmonary tuberculosis (4). Additionally, a previous study shows that routine chest radiographs in asymptomatic children with positive TST and/or IGRA can identify a small but significant proportion of cases with pulmonary tuberculosis, even in the absence of clinical symptoms. The study shows that 2.6% (95% CI 0/9% to 5.5%) of children with positive TST and/or IGRA had chest X-ray finding suggestive of active tuberculosis, thus leading to redirection of treatment from latent to active pulmonary tuberculosis (5).

Spinal tuberculosis is an ancient disease. It has been identified in mummies from the Egyptian dynasty. It was first described by Sir Percival Pott in 1782 and subsequently named after him as Pott's Disease (6). The disease occurs when the bone is infected by *Mycobacterium tuberculosis,* manifesting as an extrapulmonary, post-primary form of tuberculosis. The incidence varies, with reports indicating 10-35% of cases involving extrapulmonary disease (7). Typically affecting the lower thoracic and upper lumbar regions, the disease spreads haematogenously from the artery-rich anterior aspect of intervertebral joints to the area behind the anterior ligament, spreading vertically to adjacent vertebra and the intervertebral space. Ultimately, vertebra collapse compromises the structure of the spine and spinal canal (8). Typical symptoms of the disease are non-specific, with the most common symptoms being localised pain that worsens over weeks to months, sometimes associated with muscle spasm and rigidity. In some cases, patients may exhibit erect posturing and Alderman's gait, while constitutional symptoms present in less than 40% of cases (9).

Delay in diagnosis is common in spinal tuberculosis. In developed countries, the mean duration of symptoms before diagnosis has been reported to be 11 months, with a mean of three reassessments before considering referral to an appropriate centre (10). In contrast to developing countries, the disease is suspected on the ground of clinical presentation and radiographs. Unfortunately, symptoms are most often vague, and early plain radiographs often appear normal, leading to delayed diagnosis and initiation of treatment. This delay is associated with an increased frequency of structural and neurological complications (11). Neurological complications occur in up to 50% of patients, with 10-27% developing paraplegia and tetraplegia. Additionally, kyphosis and gibbus formation are almost always present, and in developing children, these deformities continue to worsen even after the lesion has healed (12). Our patient experienced spinal deformity but did not develop any neurological issues and remained stable throughout the follow-up period after completing antituberculosis chemotherapy. Currently, the patient is under close monitoring for the progression of kyphosis and gibbus formation, as well as the potential development of neurological symptoms. If necessary, operative intervention may be considered (13).

Managing spinal tuberculosis in children is a challenge due to delayed diagnosis and treatment. Furthermore, back pain is an uncommon complaint among children who visit the emergency department, accounting for less than 0.4% of visits in a one-year study conducted at a single centre (14), with the commonest diagnosis being benign, nonspecific musculoskeletal pain or minor trauma. However, if a child presents with systemic complaints such as fever, constitutional symptoms, prolonged and severe pain that hampers daily activities, the attending clinician should consider more serious diagnoses (15).

Diagnosing tuberculosis in children is usually done clinically, and laboratory confirmation may not always be possible due to the paucibacillary nature of the disease in children (7). Obtaining sputum for acid fast-bacilli smear and culture is challenging as many children have difficulty to expectorate (16), hence early morning gastric aspirate has become a common method for collecting samples (17). Unfortunately, these samples often yield low results (7), as was the case with our patient whose all three early morning gastric aspirate samples were negative for acid-fast bacilli smear and culture. However, a rapid molecular study (Xpert MTB/RIF Ultra) produced a positive result, which aided in the diagnosis and initiation of treatment. The World Health Organization recommends using this molecular study to aid in the diagnosis of tuberculosis in children under 10 years old and has endorsed the test since 2010 (18). The study has a varying sensitivity depending on the specimen used for analysis, but its specificity is generally higher among all types of specimens analysed (18). A meta-analysis shows comparable sensitivity and specificity of Xpert MTB/RIF Ultra using sputum (sensitivity of 0.95 [95% CI 0.91-0.98], specificity of 0.96 [95% CI 0.93-0.98]), gastric juice (sensitivity 0.94 [95% CI 0.84-0.98], specificity of 0.96 [95% CI 0.93-0.98]), and bronchoalveolar lavage fluid (sensitivity of 0.88 [95% CI 0.79-0.96], specificity of 0.94 [95% CI 0.90-0.97]) for the diagnosis of pulmonary tuberculosis, surpassing stool and biopsy samples (19).

In most cases, spinal tuberculosis can be treated conservatively using antituberculosis drugs. The optimal duration of therapy for treatment for musculoskeletal TB in uncertain. The current Malaysia guideline recommends a treatment duration of 6-9 months for bone or joint

tuberculosis (2EHRZ/4-7HR) (16). The American Thoracic Society, Centres for Disease Control and Prevention, and Infectious Diseases Society of America also recommend 6-9 months regimens, with some experts extending the treatment to 12 months in the setting of extensive orthopaedic hardware (20). The World Health Organization recommends a treatment duration of 12 months for osteoarticular tuberculosis in children (21). However, if the condition causes spinal deformity, pain, or neurological issues, surgical intervention may be required (22).

Children's spine is at a higher risk of damage because most of the bone is cartilaginous and the involvement of the growth plate in many cases makes residual kyphosis unavoidable. Severe kyphosis of more than a 60^0 angle occurs in about 3-5% of cases, leading to spinal cord compression with the risk of late-onset paraplegia, secondary cardio-respiratory problems, and psychological problems in a growing child. Therefore, the prevention of debilitating deformity is one of the aims of treatment (23). With the availability of potent antituberculosis treatment, timely diagnosis and initiation of treatment may prevent the debilitating complications of spinal deformity.

Conclusion

Managing tuberculosis in children is challenging due to the varying types of symptoms and difficulty in identifying the pathogen. Spinal tuberculosis cases often present late, with deformities already established. Nonetheless, early treatment can minimise the resulting damage. The use of rapid molecular tests can improve detection, aiding in early diagnosis and prompt initiation of treatment.

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Competing interest

There is no conflict of interest regarding the publication of this case report.

Informed consent

The authors confirm that informed consent was obtained from the patient's guardian (father) for the publication of the case and the images.

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