PRIMARY STERNAL TUBERCULOSIS: A CASE REPORT AND LITERATURE REVIEW

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Abstract. *Mycobacterium tuberculosis* can infect multiple organs and may rarely cause osteomyelitis of the sternum. We report a patient with primary sternal tuberculosis who presented with a chest wall mass. A core needle biopsy confirmed the diagnosis of tuberculosis. We review the literature regarding tuberculous osteomyelitis of the sternum.

Keywords: tuberculosis, bone destruction, cold abscess, imaging

INTRODUCTION

Primary sternal tuberculosis (TB) is a rare; its incidence has been reported to be < 1% of TB osteomyelitis cases even in endemic countries (Sharma *et al*, 2005; Khan *et al*, 2007). One study reported the incidence of sternal TB osteomyelitis to be 0.05% out of 4,000 patients with TB (Davies *et al*, 1984). Several studies recommended computed tomography (CT) or magnetic resonance imaging (MRI) to evaluate sternal TB osteomyelitis (Khan *et al*, 2007; Vasa *et al*, 2009; Grover *et al*, 2011; Singal *et al*, 2011). We report a case of primary sternal TB and review the literature regarding imaging used to diagnose this disease.

CASE REPORT

A 40-year-old female presented to Songklanagarind Hospital, Songkhla, Thailand with a 3 month history of a slowly growing painless midline mass in the upper chest wall. She had no previous treatment of the mass. She had a history of low-grade fever and 5 kg weight loss. She had no history of diabetes mellitus, hypertension, human immunodeficiency virus (HIV) infection, TB or TB contacts. She stated she took over the counter medicines from the pharmacy for minor illnesses but denied of prior use of steroids. She belonged to a large family with limited economic resources. She took care of her grandmother who was bedridden from acute stroke.

On the physical examination, she was a thin with a body mass index of 16 kg/m^2. She was worried about having malignancy. She had a 3.0 x 2.0 cm hard, irregular, slightly tender mass in the lower manubrium. The skin overlying the mass was normal appearing without edema or erythematous and no draining sinus tracts. Her lungs were clear to auscultation. She had no enlarged lymph nodes and the rest

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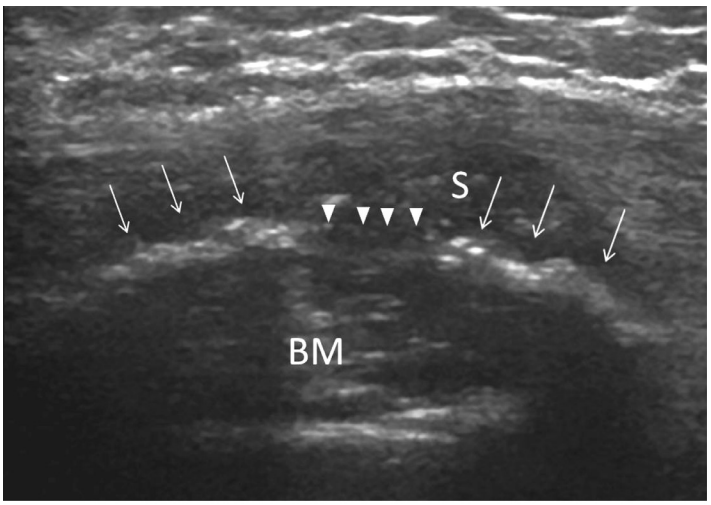

Fig 1–Sonogram of sternum depicting cortical irregularity (arrows) and bone destruction (arrowheads). An accompanying soft tissue lesion was detected (S) with abnormal echogenicity of the subjacent marrow cavity (BM).

of her exam was unremarkable.

On laboratory examination, her complete blood count was normal and her anti-HIV test was negative. Her C-reactive protein was 0.8 mg/dl (reference value being < 0.6 mg/dl). Her blood calcium was 11.0 mg/dl (normal value at our hospital is 8.1 to 10.4 mg/dl) and her corrected calcium level was 11.8 mg/dl. A posteroanterior (PA) chest radiograph was normal appearing with no obvious lymphadenopathy. A chest wall sonogram showed bone destruction of the lower part of the manubrium with soft tissue thickening (Fig 1). A computed tomography (CT) scan of the chest showed focal destruction of the manubrium associated with an enhancing soft tissue lesion in the marrow cavity and pre-manubrial region (Fig 2) with normal appearing lungs and no lymphadenopathy.

Based on the clinical and imaging findings, infection and metastatic and primary bone malignancy were in the differential diagnosis. An ultrasound-guided core needle biopsy was performed and two pieces of whitish tissue (1.5 cm and 2.0 cm in length) were obtained. The histology showed granulomatous infiltration with epithelioid and Langhans giant cells consistent with TB (Fig 3). An acid-fast bacillus stain and Grocott's methenamine silver stains of the tissue were negative. The patient was treated with a four drug anti-TB regimen of isoniazid, rifampicin, ethambutol and pyrazinamide. Her condition improved at one and three month follow-up visits but she was the lost to follow-up.

DISCUSSION

TB is a major health problem worldwide. The burden of TB is highest in Asia and Africa: the World Health Organization (2012) estimates 60% of the global TB cases occured in Southeast Asia and the Western Pacific and 24% occured in Africa during 2012. Osteoarticular TB accounts for 1% to 3% of patients with TB and isolated sternal TB comprises less than 1% of tubercular osteomyelitis cases (Sharma *et al*, 2005; Khan *et al*, 2007). Sternal TB was first reported by Vaughn in 1918 (Vaughn, 1918). Since then, most literature on this condition has originated from India and is confined to isolated case reports. A large case series report from India found the incidence of sternal TB to be 1.4% among 980 cases of osteoarticular TB (Tuli and Sinha, 1969).

The pathogenesis of primary sternal TB is thought to be a late complication of pulmonary TB (Kato *et al*, 2000) or a reactivation of a latent focus of primary

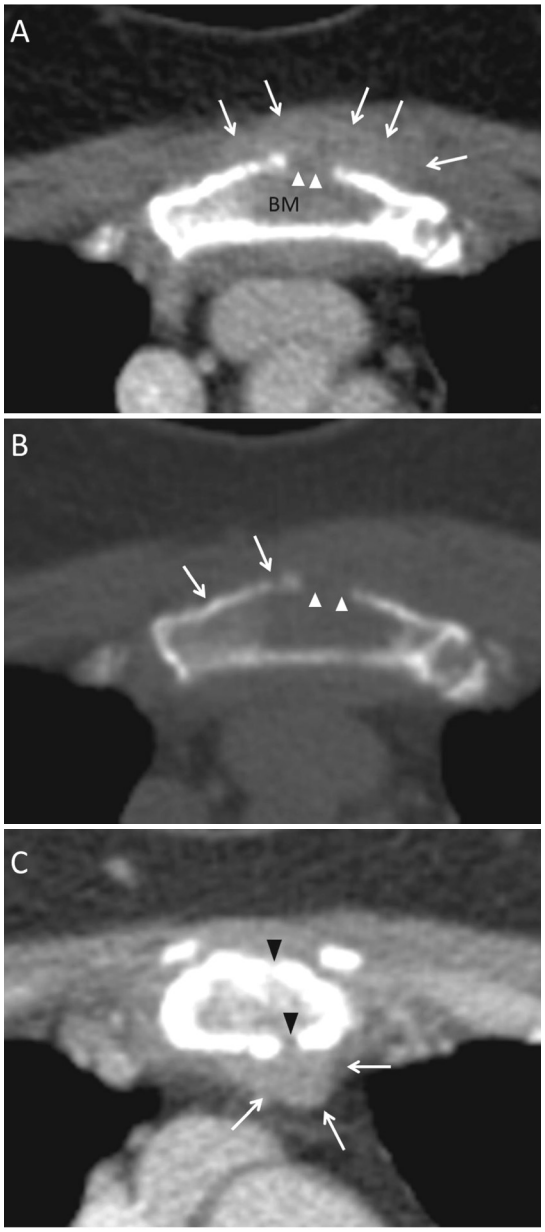

Fig 2–Computed tomography of the chest focused on the sternal lesion. Soft tissue (A) and bone (B) windows of the mid-sternal level showing focal cortical destruction (arrowheads), cortical irregularity (arrows in B) and an enhanced soft tissue mass (arrows in A). (C) A soft-tissue window at the lower-sternal level showing cortical destruction anteriorly and posteriorly (arrowheads) with an enhanced soft tissue mass extending posteriorly to the retrosternal region (arrows).

TB formed during hematogenous or lymphatic dissemination (Fadiran *et al*, 1999). Direct extension from adjacent mediastinal lymph nodes has also been reported (Bohl and Janner, 1999). A common clinical presentation is a tender anterior chest wall mass with or without a draining sinus tract. The differential diagnoses of sternal TB includes pyogenic osteomyelitis and malignancy.

Several imaging modalities have been used to evaluate sternal TB (Table 1). A PA chest radiograph is an initial investigative tool and is usually normal, but the lateral view can be abnormal, showing bone sclerosis and/or destruction (Khan *et al*, 2007; Sharma *et al*, 2005). However, a conventional chest radiograph is neither sensitive nor specific for sternal TB (Shah *et al*, 2000). Sonography may show a hypoechoic mass associated with bone destruction with or without a sinus tract (Singal *et al*, 2011) as in the present study. Sometimes, a hypoechoic collection (cold abscess) may be detected on sonography (Grover *et al*, 2011).

A CT scan has been reported to be the best modality to detect boney abnormalities, such as osteolytic and sclerotic lesions (Sharma *et al*, 2005; Grover *et al*, 2011; Singal *et al*, 2011). However, a CT scan may not detect soft tissue involvement very well. Soft tissue involvement may be better evaluated after intravenous contrast enhancement, as was seen in our case. Ring enhancement, suggesting a cold abscess, has been reported on CT scan (Morris *et al*, 2004). An MRI is the best modality to detect marrow involvement, particularly with a marrow replacing lesion (Khan

Table 1
Summary of sternal TB literature review.

Author (year)	Number of cases	Chest radiography results	Sonogram results	CT scan results	MRI results	TB diagnostic method
Khan *et al* (2007)	14	57.1% sclerosis with minimal periosteal reaction (lateral view).	NA	NA	Marrow edema of sternum, enhancement after contrast media injection.	Histopathology (11 cases). Positive PCR test (3 cases).
Singal *et al* (2011)	1	Normal (PA view), irregular erosion with a fuzzy anterior cortex (lateral view).	Sinus tract extending to the sternal area with erosion of cortex.	Sinus tract, erosion of cortex with thickened and inflamed overlying soft tissue.	NA	Histopathology
Grover *et al* (2011)	3	33% osteolytic lesion with adjacent soft tissue swelling (lateral view).	NA	100% sternal destruction and sclerosis with associated soft tissue involvement.	NA	Histopathology (2 cases). Positive AFB smear (1 case).
Vasa *et al* (2009)	1	Normal (PA and lateral views).	NA	Mixed sclerosis and lucency with a peripheral, enhanced, hypodense soft tissue mass (abscess).	NA	Histopathology
The present case (2013)	1	Normal (PA view).	Soft tissue mass with fracture of manubrium.	Bone destruction with enhancing soft tissue lesion in marrow cavity and pre-manubrial region.	NA	Histopathology

TB, tuberculosis; CT, computed tomography; MRI, magnetic resonance imaging; PA, posteroanterior; PCR, polymerase chain reaction; AFB, acid-fast bacillus; NA, not available.

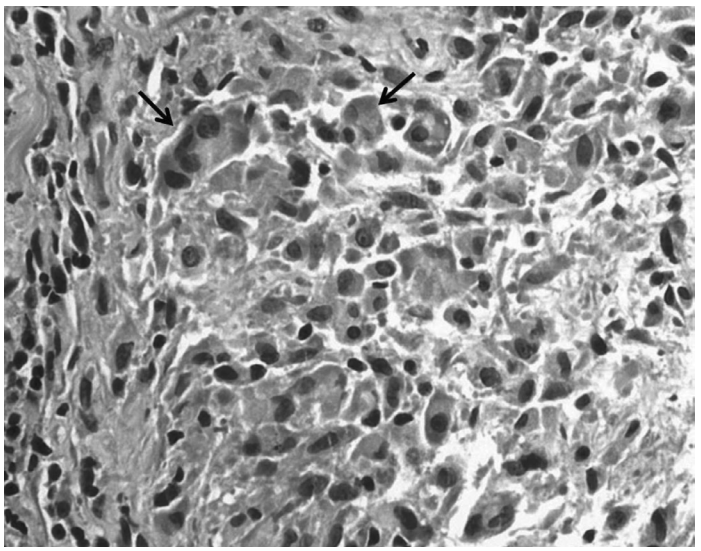

Fig 3–Histology of a biopsy specimen from the sternal lesion showing granulomatous infiltration of epithelioid cells and Langhans giant cells (arrows) (x100, hematoxylin and eosin).

et al, 2007). An MRI is better at evaluating soft-tissue involvement than a CT scan. MRI findings in sternal TB show low-intensity enhancement of the marrow on the T1-weighted image and bright-intensity enhancement of the marrow on the T2-weighted image and enhancement on the T1-weighted image after gadolinium injection (Shah *et al*, 2000). Similar to the enhanced CT scan, the ring enhancement on the MRI suggests a cold abscess.

Pyogenic bacteria more commonly destroy cartilage because of proteolytic enzymes, in contrast to TB which generally preserves cartilage (Vasa *et al*, 2009). After reviewing a number of studies in the literature (Sharma *et al*, 2005; Khan *et al*, 2007; Vasa *et al*, 2009; Grover *et al*, 2011; Singal *et al*, 2011), we found no specific imaging studies recommended to diagnose sternal TB. One finding that suggests sternal TB is a cold abscess. A cold abscess is an abscess that forms without signs of inflammation. Morris *et al* (2004) conducted a retrospective study of CT scans from 14 patients with chest wall TB and reported cold abscesses were found in all of them. However, Grover *et al* (2011) found only 50% of cold abscesses could be detected on sonogram or CT scan in 12 patients with chest wall TB. The specificity of using a cold abscess to diagnose sternal TB is unknown. Finding a cold abscess suggests sternal TB, but it is not found in all cases. Therefore, histological and microbiological examinations are still necessary to diagnose sternal TB and differentiate it from other conditions, such as pyogenic osteomyelitis and malignancy.

In summary, primary sternal TB is rare. The history, physical examination and imaging findings are not specific enough to diagnose sternal TB; biopsy and appropriate histology and microbiology are required. However, sternal TB needs to be included in the differential diagnosis of a sternal mass with abnormal radiological findings of bone destructions, especially if a cold abscess is detected. A needle aspiration biopsy should be performed to give a definitive diagnosis.

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