## **Research Article**

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# Sternal tuberculous osteomyelitis: a series of four cases

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#### **ABSTRACT**

Tuberculous osteomyelitis of sternum presenting as an acute swelling over chest is a rare entity accounting for less than 7% cases even in countries with endemic tuberculous disease. We herein report four such cases which were diagnosed by CT scan showing lytic lesion of sternum. Tuberculous osteomyelitis of sternum is rare and therefore differential diagnosis of chest wall mass must be considered. A series of four patients suffering from tuberculosis of the sternum with a mean follow-up of 2 yr is presented. All were treated with antituberculous therapy. All showed good healing.

Keywords: Sternum, Tuberculosis, Antitubercular treatment

#### INTRODUCTION

Sternal Tuberculous Osteomyelitis is exceedingly rare form of extrapulmonary TB.<sup>1</sup> Tuberculous involvement of the sternum is rarer even in countries where tuberculosis is highly prevalent<sup>2</sup> and falls under the differential diagnosis for chest wall masses. Management involves standard antituberculous therapy with antibiotics similar to treating other forms of extrapulmonary TB, as well as consideration of surgical intervention depending on the extent of osteomyelitis. Primary sternal osteomyelitis accounts for approximately 0.3% of all types of osteomyelitis.<sup>3</sup> Approximately 60% to 80% of skeletal TB cases involve the spine or weight-bearing joints, while the sternum is involved in approximately 1% of cases.<sup>4,5</sup>

Tuberculosis (TB) continues to be a major international problem, particularly in less developed countries, with an estimated global case fatality rate of 13% in 2007. The World Health Organization estimated that there were 13.7 million prevalent cases of TB infection worldwide, with each year bringing about 9.27 million new cases, 44% of which are new smear-positive cases. <sup>6</sup> The total number of

global cases is still increasing in absolute terms as a result of population growth, but the number of incident cases per capita is declining. Despite reductions in the global burden of TB, 37% of smear-positive TB cases are not being treated, more than 90% of multidrug resistant TB (MDR-TB) are not being diagnosed and treated, the majority of HIV-positive TB patients do not know their HIV status, and those who do are not yet accessing antiretroviral therapy.<sup>7</sup>

TB can disseminate hematogenously to almost every organ after a primary infection or reactivation of latent foci, occurring more commonly in an immunodeficient patient. The pathogenesis and source of latent foci and subsequent routes of dissemination are incompletely understood, but the reported theories include spread as a late complication of pulmonary tuberculosis, reactivation of latent foci formed during hematogenous or lymphatic dissemination of primary tuberculosis, or direct extension from mediastinal lymph nodes.<sup>8</sup>

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skeletal TB cases involve the spine or weight-bearing joints, while the sternum is involved in approximately 1% of cases.<sup>4,5</sup>

#### **METHODS**

This prospective study was carried out at our institute between January 2013 and feburary 2015. It aimed to describe the epidemiological characteristics; diagnosis and treatment of sternal tuberculosis, and all patients with a suspected tuberculous lesion of the sternum were included. Patients with sternoclavicular or sternocostal lesions and those who had surgical intervention for sternal lesions were excluded. In our study we evaluated only those patients with pure sternal involvement. A thorough clinical history, including past exposure and local contacts was taken, and a careful clinical examination was performed in all patients. All patients underwent haematological testing, including erythrocyte sedimentation rate (ESR). Anteroposterior and lateral radiographs of the chest, focused on the sternum, were taken in all cases. In patients with clinical symptoms and signs but repeatedly normal radiographs, CT scans were performed. Closed core biopsy was performed in patients with an obvious lesion on plain radiography in order to obtain a histopathological diagnosis. A diagnosis of tuberculosis was made on the basis of characteristic tuberculous histopathology or a positive culture for Mycobacterium tuberculosis, and/or a positive smear for acid-fast bacilli. Patients with a positive culture were tested for drug sensitivity to all first- and second-line drugs. Only after positive histopathological report/culture, patients were treated with antituberculous therapy. The standard protocol at our centre involves using four drugs (rifampicin, isoniazid, pyrazinamide and ethambutol) for four months, three drugs (rifampicin, isoniazid and ethambutol) for the subsequent three months, and two drugs (rifampicin, isoniazid) for a final 11 months. The patients were followed up on a monthly basis for a minimum of 1 year.

#### **RESULTS**

A total of 4 patients (3 females and 1 male) were found to have sternal tuberculosis. Their mean age was 32 years (15 to 55yr). Pain localised to the sternum (4 patients) and swelling (4 patients) were the most common symptoms. All patients presenting with a swelling had a frank cold abscess with intact superficial skin (Fig. 1). A history of tuberculosis was obtained in one patient (30 yr female). No one had a history of previous treatment for tuberculosis .Plain radiographs revealed the lesion in one out of four patients (25%) (Fig. 2). The most common radiological finding was sclerosis with minimal periosteal reaction on the lateral radiograph. CT scan illustrates ill defined cortical irregularities in anterior margin of manubrium sterni extending to costochondral junction. Articular irregularities are also seen, with isodense to hypodense pocket of collection anterior to sternum and around sternochondral joint (Fig 3). The manubrium sterni was involved in two patients (50%), the body of the sternum in one

(25%) patient. Isolated xiphisternal involvement was not seen in any patient. There were two patients with a raised ESR (> 20 mm in the first hour), one with raised TLC count, rest although the other haematological tests were within normal limits in all patients. HIV tests were negative in all cases. A positive culture for M. tuberculosis was found in one patient only (25%) and no tuberculous bacilli were seen by Ziehl-Neelsen staining in other patients. All patients were treated conservatively with multidrug antituberculous therapy as per hospital guidelines. There was complete clinical recovery in 3 (75%) patients within 13 month period of therapy (Fig 4), with one patient just completed 9m of therapy with good response. None of these patients immunocompromised. Cold abscesses completely resolved within four months of starting treatment. None of them required surgical debridement, they recovered fully with first-line anti-tuberculous therapy and additional streptomycin injection was used in one out of four patients for two months duration. Radiological healing lagged behind clinical recovery by a mean of 3.2 months (2 to 6). Radiologic lytic areas healed with sclerosis, but no change was seen in the sclerotic lesions.



Figure 1: 15 year old boy presenting with frank cold abscess over the sternum.



Figure 2: Plain roentgenogram chest showing sternal involvement in a 38 yr male.





Figure 3: CT Scan chest showed tubercular sternal involvement in a 53 y old female patient without pleural and lung parenchymal involvement (A,B). Cold abscess can be seen anterior to sternum with sternal erosion with involvement of sternochondral joint. (A).

### DISSCUSSION

Sternal TB osteomyelitis presents with clinical manifestations similar to other forms of osteoarticular TB disease, including soft tissue swelling, which is the most common symptom, seen in 81% of patients with sternal TB; bone pain and swelling; erythema, warmth and tenderness; enlarged regional lymph nodes; bone deformity or fracture; or a draining abscess or sinus. Constitutional symptoms are less commonly seen, but include malaise, fever, night sweats or weight loss. Inflammatory markers such as erythrocyte sedimentation rate, C-reactive protein lactate dehydrogenase and white blood cell count are almost universally elevated.<sup>3,9</sup> More than 70% of cases of sternal TB osteomyelitis have an abnormal tuberculin skin test result. Chest radiographs are normal in approximately 70% of these cases, and approximately 40% have evidence of TB in sites other than the sternum, with the lymphatic system being the most common.3,9

Tuberculosis is endemic in India. In a series of 980 patients with osteoarticular tuberculosis, 14 (1.4%) had sternal lesions, although advanced imaging modalities such as MRI were not used in these patients. <sup>10</sup> Nearly one third of these patients had detectable tuberculous lesions in the lungs. In a more recent study by Davies et al<sup>4</sup> only

two cases of tuberculosis of the sternum were found in the 4000 cases. The higher incidence in females may be accounted for by the close working environments in rural areas and by the low levels of nutrition.





Figure 4: CT confirmation of complete healing of sternal tuberculosis (A,B) after 18 months of antitubercular treatment in same patient as in figure 3. No surgical debridement was required except initial drainage of cold abscess.

The differential diagnosis of chest wall masses with or without discharging sinuses should be considered which includes pyogenic infections (ie, Staphylococcus or Streptococcus species), malignancy (lymphoma or metastatic breast, lung or prostate cancer), Brodie's abscess and granulomatous lesions (sarcoidosis, Mycobacterium species, or fungal infections from Coccidioides, Histoplasma, Blastomyces Cryptococcus). 11 Pyogenic sternal infections are more fulminant and often present with prominent constitutional symptoms. In contrast, TB of the sternum can present with an indolent, painless course without constitutional symptoms, or sometimes with a more aggressive course causing painful bone destruction with constitutional symptoms. In Martini and Cuahe's<sup>12</sup> case series, they found 81% of TB osteomyelitis cases had a sinus formation and 43% of these had a superadded pyogenic infection, which was usually caused by Staphylococcus aureus. This superadded infection could lead to misdiagnosis, and could explain the more aggressive phase of the disease<sup>12</sup>

Bone pain that does not respond to analgesic medications is characteristic of an infection like TB or a neoplasm, so

appropriate imaging with CT or MRI should be pursued when plain radiographs are normal. 11 Clinical symptoms may precede radiological changes, which are varied depending on the progression of osteomyelitis and include osteoporosis, osteopenia, bone lysis, sclerosis, periostitis or pathological fracture. Plain radiographs are often normal, but CT shows the extent of bone and joint destruction. MRI delineates abscesses better in the soft tissues, and highlights bone marrow involvement. A three phase bone scan has high sensitivity and specificity for osteomyelitis, but gives less anatomic detail and does not indicate the cause of infection. 8,12,13 Gallium scans can be useful in showing other involved organs, but are also nonspecific with regard to the cause of infection and extent of damage. 14

A needle aspiration or excisional biopsy is mandatory for histopathological diagnosis of sternal osteomyelitis, because radiological findings cannot differentiate the cause of osteomyelitis, and sometimes may even appear neoplastic. The frequency of positive cultures is similar between both types of biopsies with approximately 85% showing acid-fast bacilli, but excisional biopsies are more likely to demonstrate granulomata and acid-fast bacilli. The biopsy or aspirate can be soft or friable, with whitish-grey debris resembling clumped cheesy material typical for caseous necrosis, which is very suggestive of TB. Polymerase chain reaction and nucleic acid probes are now available for more rapid identification of mycobacteria not readily seen by microscope. Mycobacterial sensitivities on cultures should always be done due to the increasing incidence of MDR-TB. 12,15

ATT is the mainstay of treatment for sternal TB osteomyelitis currently. Although there is no consensus guideline to the precise regimen and duration for sternal TB, extrapulmonary TB is generally treated with a six to nine month regimen (two months of isoniazid, rifampicin, pyrazinamide and ethambutol, followed by four to seven months of isoniazid and rifampicin), unless the organisms are known or highly suspected to be resistant to these first-line drugs. 16 Extended therapy may be required for osteoarticular TB disease, delayed treatment response or drug resistance. Directly observed therapy is strongly recommended to better ensure medication compliance. 7,17 According to various published regimens, treatment can be continued up to 1.5 years after the first signs of clinical response, which can be seen in the first two to six months for sternal TB disease. These regimens consist of combinations of rifampicin, isoniazid, pyrazinamide and ethambutol for the first two to four months, followed by maintenance therapy with isoniazid and rifampicin, ethambutol for next 3m and isoniazid and rifampicin for next 1 yr.<sup>3,9,13,17</sup> Variations in regimens depend on clinical response, side effects, and culture and sensitivity results. Clinical response precedes radiographic response, and the pain often resolves anywhere from two to six months before radiographic findings.<sup>13</sup>

Many authors report surgical debridement to be essential to prevent recurrence or formation of a draining sinus. <sup>18,19</sup> They believe early drainage and complete debridement of necrotic material, which may include sternectomy, concomitant with ATT should be the mainstay of treatment; however, there are no formally defined surgical indications in the literature.

#### **CONCLUSION**

A proper history and physical examination are the keys to forming an appropriate differential diagnosis. Despite sternal TB's long, indolent course and ability to cause extensive osteomyelitis, ATT alone has succeeded in relieving the patient's symptoms and proper selection of patients for surgery must be done on case to case basis.

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