A series of 14 patients suffering from tuberculosis of the sternum with a mean follow-up of 2.8 years (2 to 3.6) is presented. All were treated with antitubercular therapy: ten with primary therapy, two needed second-line therapy, and two required surgery (debridement). All showed complete healing and no evidence of recurrence at the last follow-up. MRI was useful in making the diagnosis at an early stage because atypical presentations resulting from HIV have become more common. Early adequate treatment with multidrug antitubercular therapy avoided the need for surgery in 12 of our 14 patients.

Tuberculosis of the sternum is rare and the literature concerning it is sparse.\(^1\)\(^-\)\(^3\) It accounts for less than 1\% of cases of musculoskeletal tuberculosis.\(^4\) Diagnosis is difficult and is often delayed because of subtle presentation and lack of awareness. MRI may be useful in the early stages and in atypical presentations.

Patients and Methods
This prospective study was carried out at our institute between July 2001 and August 2006. 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. We wanted to evaluate 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 data were recorded on a standard form. All patients underwent haematological testing, including erythrocyte sedimentation rate (ESR). Following informed consent, all patients were tested for HIV by the enzyme-linked immunosorbent assay (ELISA) screening test (ERBA LISA HIV 1+2; Transasia Bio-medical Ltd, Daman, India). 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, MR and CT scans were performed. Closed core biopsy was performed in patients with an obvious lesion on plain radiography, and CT-guided core biopsy in those with normal plain radiographs, 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. To detect *M. tuberculosis* in patients with equivocal biopsy results, polymerase chain reaction (PCR) was used. Patients with a positive culture were tested for drug sensitivity to all first- and second-line drugs. All 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 for the subsequent three months, and two drugs (rifampin, isoniazid) for a final 11 months. Surgical treatment was undertaken in patients where no response to drug therapy was seen in the first six months, or in whom the lesion progressed despite adequate treatment. The patients were followed up on a monthly basis for a minimum of two years.

Results
A total of 14 patients (eight female and six male) were found to have sternal tuberculosis. Their mean age was 26.8 years (9 to 62). Pain localised to the sternum (14 patients) and swelling (eight patients) were the most common symptoms. Two of the eight patients presenting with a swelling had a frank cold abscess, and superficial ulceration of the skin was seen in a further two patients (Fig. 1). A
history of tuberculosis was obtained in four patients. Two had pulmonary tuberculosis, one had vertebral tuberculosis and one had multifocal skeletal tuberculosis; all had been previously treated with multidrug chemotherapy. Plain radiographs revealed the lesion in only eight of the 14 patients (57.1%). The most common radiological finding was sclerosis with minimal periosteal reaction on the lateral radiograph. MRI performed in six patients (42.8%) with normal radiographs showed bone marrow oedema of the sternum (Fig. 2), and enhancement was seen on gadolinium contrast-enhanced MRI. A peri-sternal soft-tissue collection was seen in four patients (28.5%). The manubrium sterni was involved in five patients (35.7%), the body of the sternum in eight (57.1%), and the whole sternum in one (7.2%). Isolated xiphisternal involvement was not seen in any patient. There were six patients (42.8%) with a raised ESR (> 20 mm in the first hour), although the other haematological tests were within normal limits in all patients. HIV tests were negative in all cases. Characteristic tuberculous histopathology was seen in 11 patients (78.5%) and the PCR was positive in three patients (21.4%) with equivocal histopathological reports. A positive culture for M. tuberculosis was found in six patients only (42.8%) and no tuberculous bacilli were seen by Ziehl-Neelsen staining in any patient. All patients were treated conservatively with standard multidrug antituberculous therapy. There was complete clinical recovery in ten (71.4%) patients within an 18-month period of therapy. We found two patients (14.2%) to have multidrug-resistant tuberculosis. They responded to second-line anti-tuberculous therapy consisting of streptomycin, ethionamide, ofloxacin, pyrizinamide and ethambutol for six months, followed by ethionamide, ofloxacin, pyrizinamide and ethambutol for a further 14 months. None of these patients were immunocompromised. Cold abscesses completely resolved within four months of starting treatment. Surgical debridement was
required in two patients (14.2%), who recovered fully with first-line anti-tuberculous therapy. There was one patient with advanced disease who had a pectus excavatum deformity of the chest and one who had a hypertrophic scar after surgical intervention. Radiological healing lagged behind clinical recovery by a mean of 3.2 months (2 to 6). Radiologically lytic areas healed with sclerosis, but no change was seen in the sclerotic lesions. Patients were followed up for a mean of 2.8 years (2 to 3.6). No recurrences were seen in the follow-up period.

Discussion

Tuberculous involvement of the sternum leading to osteomyelitis is rare, even in countries where tuberculosis is endemic. It may be seen as a late complication of pulmonary tuberculosis, or as reactivation of latent loci formed during haematogenous or lymphatic dissemination of primary tuberculosis. Direct extension from mediastinal lymph nodes has also been described. Unlike pyogenic sternal infections, which are characterised by a more rapid and fulminant course, a tuberculous lesion of the sternum usually presents insidiously as swelling and pain over the bone. As a result of the increase in HIV seropositivity, atypical presentations of tuberculosis are becoming more common in our practice.

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. Nearly one third of these patients had detectable tuberculous lesions in the lungs. In a more recent study by Davies et al only two cases of tuberculous of the sternum were found in the 4000 cases. Healed tuberculous lesions were seen in four (28.5%) patients in our series. Classically, the disease is seen in young adults, although cases in children have been reported. Although most of our patients were in their second and third decade of life, three were children. The higher incidence in females may be accounted for by the close working environments in rural areas and by the low levels of nutrition.

The clinical features of the disease are subtle and often difficult to detect in the early stages. Radiological changes lag behind clinical symptoms. A high degree of suspicion, is therefore, necessary to make an early diagnosis.

We would therefore recommend conservative treatment with adequate antituberculous drugs as the treatment of choice in sternal tuberculosis. A larger study with longer follow-up would be necessary to clearly establish the indications for surgery in this condition.

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References


