Introduction

Pleural tuberculosis is not a common feature of primary pulmonary tuberculosis in children. It is seen in about 10% of all new tuberculous infections and the frequency is higher in adolescents and adults than young children [1–4]. However, recognition of this disease in children is important because delayed or inappropriate treatment can cause extensive lung damage and serious extrapulmonary complications. It can also be the reservoir from which future cases will emerge.

The application of CT to the evaluation of abnormalities of the chest in children has been rapidly expanding due to its ability to display transverse anatomy and characterize tissues [5]. The CT findings of pleural tuberculosis have been described previously but mainly in adults with post-primary tuberculosis [6, 7].
We retrospectively reviewed the chest CT scans, chest radiographs, and medical records of 11 patients with complicated pleural tuberculosis to describe the CT features and to define the use of CT in this condition.

Materials and methods

Over an 8-year period (1987–1994), 31 children with pleural tuberculosis were treated at our institution and 11 consecutive patients who underwent CT formed the basis of this study. There were six boys and five girls, 2–14 years of age (mean, 9 years). During the same period, 281 children with tuberculosis were treated at our institution; the frequency of pleural tuberculosis was 11 % (31/281). CT was obtained 1–6 days after chest radiography to evaluate persistent pleural thickening despite antituberculous therapy in six patients and to evaluate a mass-like lesion detected on plain radiographs in five.

The other 20 patients not included in this study had a non-loculated pleural effusion on plain radiographs and the pleural lesions cleared promptly with appropriate therapy.

The diagnosis of pleural tuberculosis was established by surgical excision of a chronic loculated effusion or an empyema in four patients, by pleural biopsy in four patients and by sputum or pleural fluid culture in three patients. A tuberculin skin test with 5 TU of purified protein derivative showed an area of induration of 10 mm or greater in all patients. All but one patient had a history of diagnosed and treated tuberculosis at the time of CT scanning.

Five patients underwent follow-up CT at 3–7 months because of incomplete resolution of the disease despite antituberculous therapy. In one of the five patients, two follow-up CT scans were obtained after 7 and 17 months.

CT scans and chest radiographs were analysed by two radiologists with regard to pleural lesions, parenchymal lesions, lymphadenopathy and chest wall lesions. Medical records were reviewed to ascertain how the additional information provided by CT altered clinical management.

Results

Pleural lesions were seen in all patients. More than one location was involved in five patients (45 %) and in two patients (18 %) the entire pleural space was involved. The lesions were unilateral in seven (right-sided in four and left-sided in three) and bilateral in four.

Pleural thickening was seen in all 11 patients. The thickness was 1–5 mm in seven patients and over 5 mm in four (Fig. 1). Calcification of the thickened pleura was seen in four patients. Enhancement of the thickened pleura was seen in ten patients (91 %) and in five, both the visceral and parietal pleura enhanced. In four patients, septal enhancement was also seen (Fig. 2). Low-density fluid collections were seen in nine patients (82 %) and in two of these patients, CT revealed fluid within the calcified pleural lesions.

In five patients with a mass-like lesion on plain radiographs, CT showed a low-density pleural mass with peripheral enhancement in four patients (Fig. 2) and a calcified pleural mass with a low-density centre in one (Fig. 3). The mass was lenticular in three patients and round in two. The mass had a well-defined interface with lung in all patients. Adjacent or remote pleural thickening was seen in four patients.

CT demonstrated parenchymal abnormalities on the same side as the pleural lesion in all 11 patients and on the opposite side in four. There was a parenchymal nodule in five patients, air-space consolidation in four (Fig. 1) and segmental or lobar atelectasis in two. Hilar or mediastinal adenopathy was seen in four patients (36 %) (Fig. 1) and three of these patients had low-density nodes with peripheral enhancement. Increased attenuation of the extrapleural fat was seen in three patients. In one patient, CT showed vertebral and chest wall tuberculosis seen as a low-density soft-tissue mass with rim enhancement and bone destruction.

In one patient with diffuse thickening and enhancement of the entire pleural space, follow-up CT after 17 months showed localisation of the pleural lesion with central fluid and enhancement of the pleura (Fig. 1). In three patients with loculated effusion, complete resolution was seen in one patient and residual pleural thickening was seen in two. In one patient with a calcified paracardiac mass, the size of the lesion decreased but the low-density feature of the mass persisted on follow-up CT at 6 months.

In five patients (45 %), CT provided information that altered clinical management. Antituberculous therapy was started before bacteriological confirmation in one patient with clinically suspected tuberculosis. The diagnosis of tuberculosis was suggested after CT revealed low-attenuation nodes with rim enhancement in this patient. Surgical intervention was performed in four patients with fluid within a calcified fibrothorax (n = 3) and chest wall tuberculosis (n = 1) that were seen only on CT.

Discussion

Tuberculous effusion is frequently self-limiting and generally clears promptly with appropriate therapy. Uncomplicated cases of pleural tuberculosis have rarely been studied with CT but CT is highly efficient at confirming the presence of a lesion and determining its precise location and extent [8]. CT can reveal parenchymal foci abutting the pleura and mediastinal lymphadenitis in these patients [6, 7]. Although the pulmonary lesion is seldom seen on plain radiographs, single or multiple lung foci are always found on pathological examination [9]. In our study, CT demonstrated parenchymal abnormalities on the same side as pleural lesions in all patients. Tuberculous lymph nodes typically have central areas of low density and rim enhancement [10]. In HIV-positive patients, findings of low-attenuation