

# Imaging findings of congenital tuberculosis in three infants

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## ABSTRACT

**Congenital tuberculosis is a rare entity and diagnosis is usually delayed due to the nonspecific nature of the signs and symptoms. Imaging studies facilitate the early diagnosis of the disease and institution of appropriate therapy. We describe three cases of congenital tuberculosis along with the imaging features. Imaging findings of the chest included multiple pulmonary nodules, consolidation with cavitation, extensive bronchopneumonia and necrotic mediastinal adenopathy. Abdominal imaging findings included hepatomegaly with or without splenomegaly, multiple focal lesions in the spleen and retroperitoneal lymphadenopathy.**

**Keywords: chest radiograph, computed tomography, congenital tuberculosis, tuberculosis**

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## INTRODUCTION

Congenital tuberculosis is rare, in spite of tuberculosis being a common infection worldwide, with around 300 cases reported in literature.<sup>(1)</sup> With an increase in the number of multidrug resistant tuberculosis and human immunodeficiency virus (HIV) cases, there is a resurgence of tuberculosis in women of reproductive age and in their offspring.<sup>(2-4)</sup> The diagnosis of congenital tuberculosis can only be confirmed if both the tuberculous nature of the lesion and the antenatal origin of the infection can be proven.<sup>(5)</sup> Diagnosis is often delayed because of the nonspecific nature of the presenting signs and symptoms. The early diagnosis of congenital tuberculosis is important because the outcome is invariably poor in the absence of early institution of antituberculous therapy. As most cases of congenital tuberculosis were reported in the pre-chemotherapy era, mainly the clinical and pathological features have been described and little attention was paid towards the radiological features. We report three cases of congenital tuberculosis, with emphasis on the imaging findings.

## CASE REPORTS

### Case 1

An 85-day-old male child presented with low-grade fever and respiratory distress from the third day of life. There was

also history of diarrhoea since birth, irritability and poor feeding. The child was born to a second gravida mother, a result of a spontaneous conception with birth weight of 2.7 kg. There was history of a prolonged jaundice in the neonatal period. On examination, the child was pale and malnourished with a weight of 3.8 kg (expected 5.6 kg) and his respiratory rate was 76/min with intercostal and subcostal retractions. There was no cyanosis or superficial lymphadenopathy. Systemic examination revealed bilateral lung crepitations with hepatosplenomegaly. Laboratory evaluation showed haemoglobin of 8.8 g/dL, total leucocyte count of 12,800/mm<sup>3</sup> with 70% neutrophils. Liver function tests were abnormal with total bilirubin of 3 mg/dL (direct 1.8 mg/dL) and elevated liver enzymes (SGOT 168 IU/L, SGPT 176 IU/L).

Chest radiograph showed multiple bilateral pulmonary nodules with widened right paratracheal stripe (Fig. 1a). Abdominal ultrasonography (US) showed hepatosplenomegaly with multiple hypoechoic foci in the spleen; however, no focal lesions were identified in liver. Contrast-enhanced computed tomography (CT) revealed multiple well-defined pulmonary nodules and enlarged necrotic nodes in mediastinum with rim enhancement (Figs. 1b & c). CT of the abdomen confirmed the US findings and also demonstrated enlarged nodes in the para-aortic area (Fig. 1d). Gaseous distension of small bowel loops was also noted (Fig. 1d).

Mantoux test was non-reactive. Gastric aspirate for acid-fast bacilli (AFB) was positive on three occasions. Specimen obtained from liver biopsy showed multiple caseous granulomatous lesions with AFB. Family survey for tuberculosis showed calcified right hilar nodes on the mother's chest radiograph, although she was asymptomatic and had never been treated for tuberculosis. Her sputum examination for AFB was negative on three occasions. She declined endometrial biopsy. The child was started on anti-tuberculous drugs. There was improvement in the form of improved weight gain, decreasing irritability and gradual decline in respiratory distress.

### Case 2

A 60-day-old male child presented with history of fever, irritability, cough and respiratory distress from the sixth day of life. There was also a history of poor feeding and poor weight gain. The child had been given BCG vaccination at birth, but there was no scar

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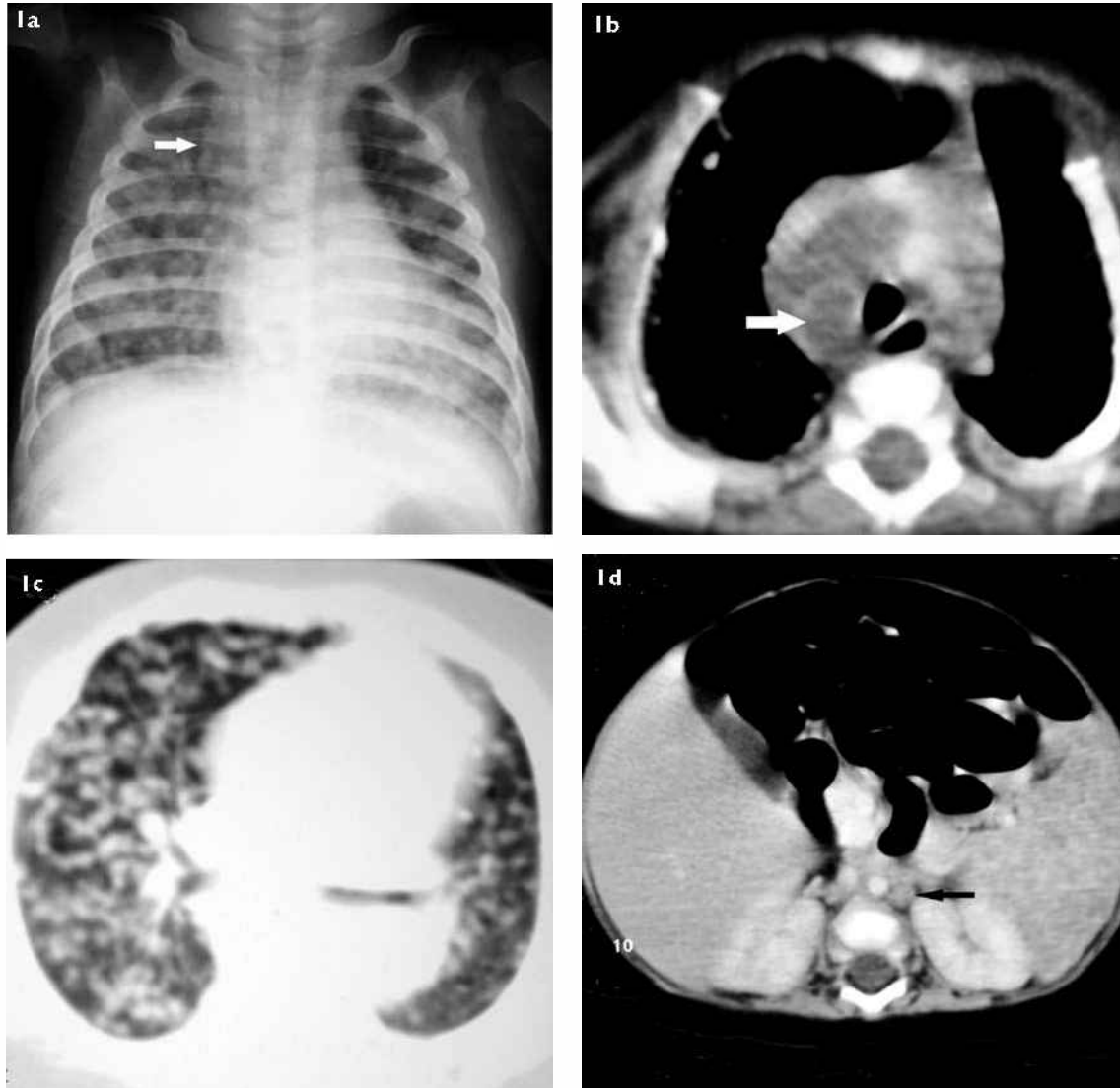
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**Fig. 1** (a) Chest radiograph shows multiple nodules in bilateral lung fields and widening of right paratracheal stripe (arrow). (b) Contrast-enhanced CT image shows multiple large mediastinal nodes with central necrosis and rim enhancement (arrow). (c) Contrast-enhanced CT image (lung window) shows multiple pulmonary nodules. (d) CT image of abdomen shows hepatosplenomegaly with multiple hypodense lesions in the spleen and paraaortic adenopathy (small arrow).

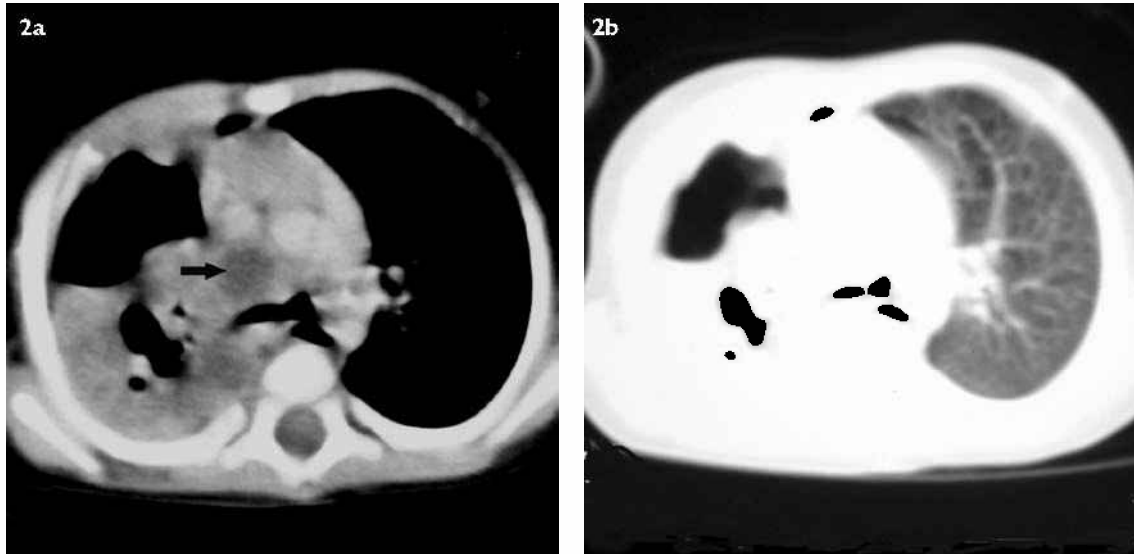
formation. The child had a low birth weight of 2.4 kg. On examination, he was pale with a weight of 3.2 kg (expected 5.4 kg). There was respiratory distress with cyanosis requiring oxygen supplementation to maintain saturation. Chest examination revealed bilateral crepitations (right side more than left) and bilateral diffuse rhonchi. The liver was enlarged 4 cm below the costal margin with a span of 6 cm, soft in consistency, but the spleen was not palpable. Haemoglobin was 7.1 g/dL, total leucocyte count was  $11,200/\text{mm}^3$  and platelet count was  $1.67 \times 10^6/\text{ml}$ . Liver function tests were normal and Mantoux test was non-reactive. Gastric aspirate and endotracheal secretion revealed the presence of AFB.

The chest radiograph showed a consolidation in the right upper zone with scattered infiltrates in the bilateral lung fields. Abdominal US showed only mild hepatomegaly. Contrast-enhanced CT revealed consolidation in the right upper lobe with large areas of cavitations (Figs. 2a

& b). Patchy air space opacities in both lung fields and enlarged necrotic mediastinal nodes were also noted. The family survey was negative for tuberculosis. The infant's mother was asymptomatic and her chest radiograph was normal. However, after the diagnosis of tuberculosis in her infant, she was evaluated for genital tuberculosis. An endometrial biopsy revealed AFB and culture was positive for *Mycobacterium tuberculosis*. The infant showed no significant improvement even after institution of anti-tuberculous therapy and succumbed to illness on the 16th day of hospitalisation.

### Case 3

A 45-day-old female child was admitted with a history of fever and cough since birth with respiratory distress for two weeks. The child had a birth weight of 2.6 kg, and weight of 3.3 kg at 45 days of age (expected 4.8 kg). On examination, the child was tachypnoeic with a



**Fig. 2** (a) Contrast-enhanced CT image shows consolidation in the right upper lobe and enlarged necrotic mediastinal nodes. (b) CT image (lung window) shows a large area of cavitation inside the consolidated lung.

respiratory rate of 80/min, and had chest retractions. Systemic examination showed decreased air entry on the right side with crepitations in bilateral lung fields and hepatosplenomegaly. Gastric aspirate was positive for AFB. Her chest radiograph and CT revealed extensive bilateral bronchopneumonia (Figs. 3a–c). US showed hepatosplenomegaly without any focal lesion. The infant's mother was investigated, and her chest radiograph revealed the presence of fibronodular opacities in the right upper zone suggestive of pulmonary tuberculosis, and sputum was positive for AFB. Endometrial biopsy from the mother also revealed AFB. The infant started improving after institution of the antituberculous drugs and was discharged.

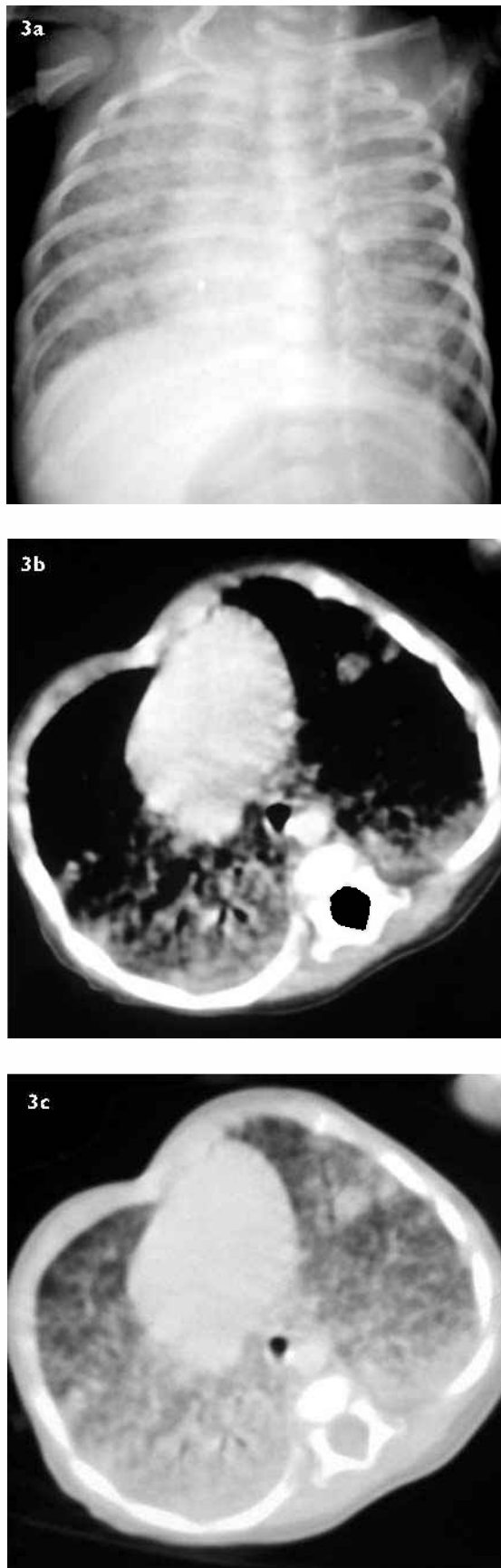
## DISCUSSION

Tuberculous bacilli may be transmitted from an infected mother to the foetus by the transplacental route forming a primary complex in the infant's liver with secondary haematogenous spread, or by aspiration or ingestion of infected amniotic fluid, leading to a primary focus in the infant's lung or gastrointestinal tract.<sup>(6,7)</sup> The liver and lung are the two most commonly-involved sites in congenital tuberculosis. Beitzke described diagnostic criteria for congenital tuberculosis in 1935. These included isolation of *Mycobacterium tuberculosis* from the infant and one of the following: lesions in the first few days of life, presentation of a primary complex in the liver, or exclusion of postnatal exposure by separation of the infant from the mother and other potential sources of tuberculosis at birth.<sup>(8)</sup> In current practice, these criteria are rarely fulfilled, as these require mostly review of autopsy material.

To increase sensitivity of antemortem diagnosis of congenital tuberculosis, Cantwell et al proposed revised criteria in 1994.<sup>(9)</sup> These included proven tuberculous

lesions in infants and at least one of the following: lesion in the first week of life, demonstration of caseating hepatic granulomas not necessarily a primary hepatic complex, confirmation of tuberculosis in the placenta or maternal genital tract, and exclusion of postnatal transmission after contact investigation. However, differentiating congenital tuberculosis from early postnatally-acquired tuberculosis is mainly of epidemiological importance, as the modes of presentation, treatment and immediate prognosis of tuberculosis do not differ significantly.<sup>(6)</sup> All our cases fulfilled the revised diagnostic criteria. As the presenting signs and symptoms related to congenital tuberculosis are nonspecific, early diagnosis is difficult and requires a high index of suspicion. These include respiratory distress, fever, hepatosplenomegaly, poor feeding, lethargy, and irritability.<sup>(6,9)</sup> Less frequent presenting findings include lymphadenopathy, abdominal distention, failure to thrive, ear discharge, seizure, skin rash, jaundice and bloody diarrhoea. Hepatomegaly with or without splenomegaly is commonly reported and was also noted in our cases.<sup>(6,9,10)</sup>

In the pre-chemotherapy era, diagnosis of congenital tuberculosis usually required an open surgical procedure or autopsy for demonstration of primary complex.<sup>(9)</sup> However, nowadays, most cases are diagnosed by detecting the presence of AFB and positive mycobacterial culture from gastric aspirates, endotracheal aspirates, cerebrospinal fluid, or biopsy tissue. Since caseation is rarely seen in postnatally-acquired tuberculosis with hepatic granuloma, the presence of caseating hepatic granulomas suggest the diagnosis of congenital tuberculosis on the basis of liver biopsy findings alone.<sup>(9)</sup> In one of our cases, multiple caseous granuloma were identified in the liver biopsy specimen, suggesting the congenital mode of transmission. Presence of maternal tuberculosis is an important clue in diagnosis; however in many cases, the mother can



**Fig. 3** (a) Chest radiograph shows extensive reticulonodular infiltrates in bilateral lung fields. (b & c) CT images show multiple ill-defined pulmonary nodules which are coalescing to form an area of consolidation in the dependent portion.

be asymptomatic and diagnosed only after detection of tuberculosis in the infant.<sup>(6)</sup> Genital tuberculosis has been demonstrated in almost all mothers who have undergone appropriate clinical testing, forming an important criterion for the diagnosis of congenital tuberculosis.<sup>(6,9)</sup> Two mothers in our reported cases tested positive for genital tuberculosis, while one mother declined endometrial biopsy.

Imaging techniques, namely radiography, US and CT, along with imaging-guided tissue sampling, facilitates rapid diagnosis and early institution of chemotherapy. Many infants with congenital tuberculosis have abnormal chest radiographs with variable findings, depending on the route of infection and time course of the disease.<sup>(5)</sup> Radiographical changes include a miliary or interstitial pattern in cases with haematogenous spread. Findings vary from patchy bronchopneumonia to diffuse air space disease in infections acquired due to aspiration of infected material.<sup>(5)</sup> Early in the course of disease, the chest radiograph may be normal, with profound radiological abnormalities developing later. Chotpitayasunondh and Sangtawesin reviewed radiographical findings in nine cases of congenital tuberculosis, revealing bronchopneumonia in 66.7%, a miliary pattern in 33.3% and multiple cystic lesions in 11.1% of cases.<sup>(11)</sup> Recently, multiple pulmonary nodules have been described in two cases of congenital tuberculosis by Chen and Shih, which have not been reported earlier.<sup>(10)</sup> In one of their cases, pulmonary nodules showed central hypodensity and peripheral rim enhancement on CT, which corresponded to caseating necrosis in a biopsy specimen. Hilar and mediastinal adenopathy are also commonly reported. Imaging findings in our cases included multiple nodular lesions, consolidation with cavitation and extensive bronchopneumonia. Necrotic mediastinal nodes were seen in two patients.

Abdominal imaging findings include hepatosplenomegaly, multiple focal lesions in the liver and spleen, necrotic retroperitoneal or intra-abdominal lymphadenopathy and ascites.<sup>(10,12)</sup> Hepatomegaly, with or without splenomegaly, was seen in all our cases. Focal splenic lesions and paraaortic adenopathy was noted in the first case. Calcifications in the liver and spleen can also be seen after institution of chemotherapy.<sup>(5)</sup> Kondo et al described periportal hypodensity in addition to pulmonary infiltrates, mediastinal and abdominal lymphadenopathy on CT images in three cases of congenital tuberculosis.<sup>(13)</sup> The presenting symptoms and signs are non-specific, and hence it is difficult to make the diagnosis of congenital tuberculosis based only on clinical background. One should suspect congenital tuberculosis in (1) any neonate presenting with persistent pneumonia or fever and hepatosplenomegaly, with other common causes ruled out; and (2) in a child with non-specific symptoms born

to a mother suffering from tuberculosis. CT is a useful diagnostic technique as it shows parenchymal lesions and lymphadenopathy better and earlier than chest radiography. In addition, CT is also useful to detect complications of tuberculosis. Frequent imaging findings of congenital tuberculosis are miliary or interstitial pattern, bronchopneumonia, air space consolidation and multiple nodules. Hilar and mediastinal adenopathy with central necrosis are also commonly seen.

To conclude, we presented three cases of congenital tuberculosis with different radiological patterns. The diagnosis of congenital tuberculosis should be considered in any infant with intermittent fever and hepatosplenomegaly, especially in populations where tuberculosis is prevalent. Early imaging can be helpful in suggesting this diagnosis, in view of the nonspecific presenting signs and symptoms of the disease.

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