Pediatric Primary Tuberculosis complicated by a Bronchopneumonia

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History

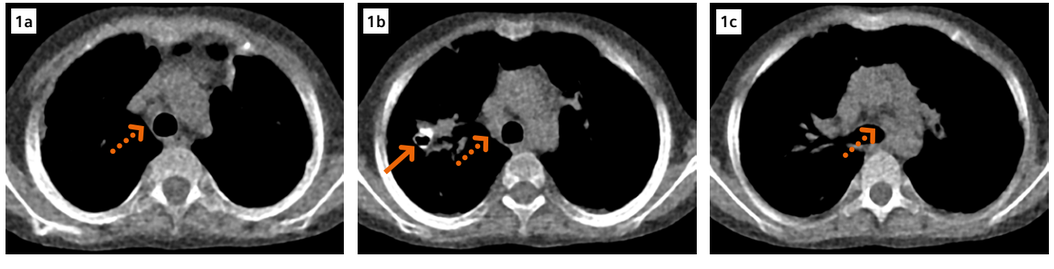
An 11-year-old boy, complaining of paroxysmal cough with occasional phlegm, shortness of breath, chest tightness and pain within the past 10 days, was hospitalized. He was in poor physical health and had a history of hypertension, bronchopneumonia, idiopathic pulmonary fibrosis and primary tuberculosis. The physical examination revealed expiratory dyspnea with bilateral coarse breath sounds and extensive rale in the right lung. A CT chest examination was requested for further evaluation.

Diagnosis

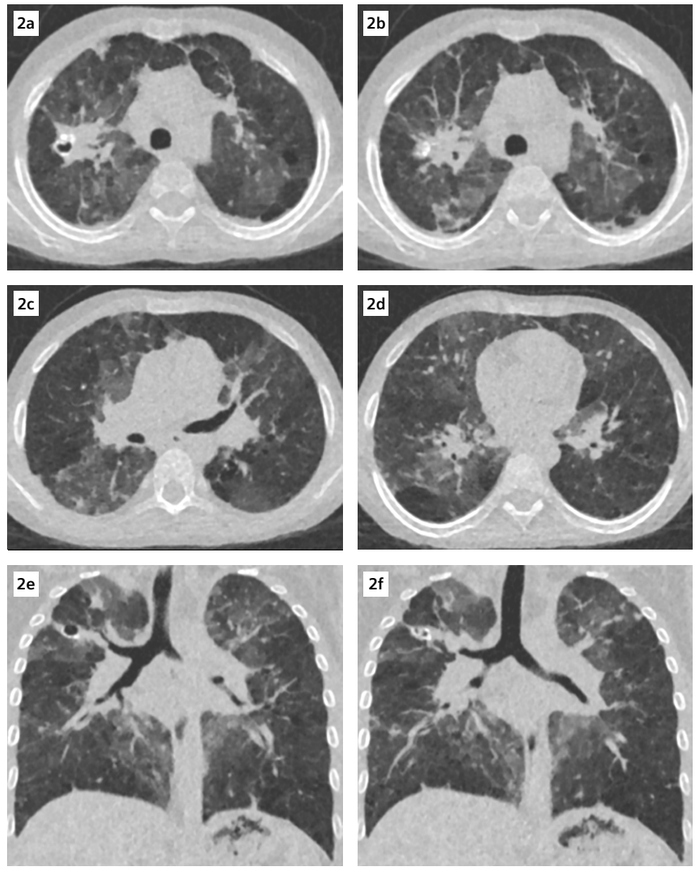
CT images revealed bilateral inhomogenous pulmonary densities showing geographical ground glass opacities (GGOs), areas of hyperinflation and bronchial wall thickening. An area of consolidation with blurred margins and an air bronchogram sign was revealed in the apical segment of the right upper lobe. Here a cavity measuring 0.8 × 0.5 mm in size, with peripheral calcifications, was found. Other calcified foci in both lungs were also visualized. Multiple enlarged lymph nodes were seen in the mediastinum. There was no sign of pleural effusion. A diagnosis of primary tuberculosis complicated by a bronchopneumonia was suspected and a treatment with antituberculous drugs and antibiotics was planned.

Comments

CT imaging plays a key role in pediatric pulmonary infections. A standard chest radiography lacks specificity. An initial scan is generally performed to make an accurate diagnosis and follow up scans are often required to monitor treatment results. Therefore, optimization of the radiation dose delivered in each scan is of particular importance. In this case, standard dose reduction techniques, such as CARE Dose 4D (automatic controlled tube current modulation) and ADMIRE (Advanced Modeled Iterative Reconstruction) were applied. Additionally, an advanced technique, Selective Photon Shield (SPS), featuring two special tin filters applied to both tubes, was adopted. The filters optimize the X-ray spectrum and significantly improve the air/soft tissue contrast. A total effective dose of only 0.026 mSv was achieved, this being within the dose range of a standard X-ray examination. Another highlight is the unique ultrafast scanning mode, the "Turbo Flash mode". We used this to complete the chest scan, since the patient was unable to cooperate due to dyspnea, in only 0.43 s achiving excellent diagnostic image quality. The combination of SPS and "Turbo Flash mode" has great potential for routinely performed ultra-low dose pediatric CT scans of the lungs. ●



1 **Axial views with mediastinum window show multiple enlarged lymph nodes (dotted arrows) and an area of consolidation in which a cavity, with peripheral calcifications, is found in the apical segment of the right upper lobe (arrow, Fig. 1b).**



2 **Axial (Figs. 2a–2d) and coronal (Figs. 2e–2f) views with lung window show bilateral geographical GGOs, areas of hyperinflation and bronchial wall thickening. An area of consolidation with air bronchogram sign is seen in the apical segment of the right upper lobe, in which a cavity, with peripheral calcifications, is found.**

Examination Protocol

Scanner	SOMATOM Force
Scan area	Thorax
Scan mode	Turbo Flash
Scan length	219 mm
Scan direction	Cranio-caudal
Scan time	0.43 s
Tube voltage	100 / Sn100 kV
Effective mAs	10 mAs
Dose modulation	CARE Dose4D
$CTDI_{vol}$	0.04 mGy
DLP	0.9 mGy cm
Effective dose	0.026 mSv*
Rotation time	0.25 s
Pitch	2
Slice collimation	192 × 0.6 mm
Slice width	1 mm
Reconstruction increment	0.7 mm
Reconstruction kernel	BI57 / Br40 ADMIRE 3

*Estimated by applying a conversion factor of 0.013, and an additional factor of 2.2 converting the reported DLP (32 cm) into the DLP (16 cm).