Pulmonary tuberculosis with multiple cavitary lesions in immunocompetent infants: a rare presentation in growth today in Rio de Janeiro, Brazil.

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Learning objectives

The purpose of this exhibit is analysis findings in computed tomography of immunocompetent children aged up to 36 months with tuberculosis, in particular the assessment of multiple cavitations and other lesions that mimic bacterial infectious disease or congenital malformation.

Background

- Tuberculosis remains an important cause of morbidity and mortality worldwide and children constitute one of the high risk groups in the resurgence of this disease. Among children younger than 5 years are the highest risk for pulmonary tuberculosis.
- Pulmonary disease in this group has some differences from those observed in older children. Infants are more symptomatic and has a greater propensity to systemic complications such as meningitis and miliary tuberculosis, hence the importance of early diagnosis and rapid institution of effective treatment.
- Chest radiographs and history of contact with sick adults are essential for diagnosis, but CT has advantages over radiographs in these patients, and can detect the disease in those in which the radiograph is normal or not diagnostic because they are definitely similar in any other respiratory infectious case.
- As pulmonary tuberculosis in infants is manifested differently from that observed in older children, being more symptomatic and at increased risk for systemic complications such as meningitis and miliary tuberculosis, and may also purchase these complications before the skin tests are positive, the use CT is faster diagnosis, to clarify the pathogenesis and promote the acquisition of additional information not acquired through the chest radiographs.
- The frequent finding of excavations in the CT scans of infants with tuberculosis in two hospital departments of radiology has led us to undertake this work for reviewing the radiological findings in this age group, examining its prevalence and trying to correlate with pathogenesis.
- Retrospective observational study from January 2004 to January 2010, thirteen (13) confirmed cases of tuberculosis in patients aged between 2 and 36 months, two public institutions in the State of Rio de Janeiro: Instituto Fernandes Figueira (IFF) - FIOCRUZ-Rio de Janeiro and the Antonio Pedro University Hospital (HUAP)/Federal Fluminense University (UFF), Niterói, Rio de Janeiro, Brazil.
- All patients had prior chest radiographs and computed tomography was performed for diagnosis and assessment of complications.
• The examinations were performed on helical computed tomography (ProspeedR /GE) and AsteionR/Toshiba) through volumetric and axial acquisition with a collimation of 5 mm after iodinated contrast administered intravenously to evaluate the mediastinum and slices of 1 mm thick and 8-12mm range, with high resolution technique (HRCT) for evaluation of lung parenchyma.
• The parameters of kVp and mAs were adjusted following the ALARA principles, with the range of 30-80 mA and 120kVp.
• In cases where there was need for sedation was performed with the same oral solution of chloral hydrate to 16%, 80mg/kg/dose.
• We analyzed all the radiological findings in computed tomography, described as Brazilian literature. The studies were reviewed by two radiologists independently, and discordant results were resolved by consensus. The cases of immunocompromised by AIDS, lymphoproliferative disease and use of immunosuppressive drugs were purposely excluded.
• The diagnosis of pulmonary tuberculosis in these children was established in some by culture or positive bacteriological findings in bronchopulmonary lavage (mostly) or stomach, and presumptive diagnosis by a combination of respiratory symptoms, tuberculin skin test (PPD) positive and contact with family with pulmonary tuberculosis.
• The treatment however was instituted immediately after the radiological diagnosis by CT, which reduced the potential complications.

**Imaging findings OR Procedure details**

**Imaging findings:**

• A total of thirteen cases studied radiological findings were multiple and varied and were bilateral in 100% of cases.
• The evolution for the cavitation of the parenchyma, which in our group represented 50% of cases, was associated with radiological findings of pneumonic consolidation and dissemination intrabronchial, which are derived from disease progression from the focus Ghon (FIG. 1).
• This finding is different from the cavitation in older kids and adults. There is usually a primary infection and develops into a calcified nodule, which does not occur in infants.
• The direct hematogenous spread, showed miliary nodules in approximately 8% (FIG.2) and may even extend to other organs like the brain, which in our group represented 30.7% (four patients), who had tuberculous meningitis (FIG. 3).
• With findings of pulmonary parenchymal involvement, we found 11 cases (84.6%) with lobar consolidation, seven cases (53.8%) with atelectasis and
one case associated exclusively with subsegmental atelectasis, beyond the findings of mediastinal and pleural lesions (FIG. 4).

• According to literature, the lymphadenopathy were present in 100% of cases, this is the main radiological finding in this age group (FIG. 5).
• We had four patients with lymph node calcifications and three patients with direct bronchial compression by enlarged lymph nodes (FIG. 6).
• The frequency of involvement of right paratracheal lymph node was seen in 100% of cases, pre-tracheal involvement was noted in 9 patients (75%) and infracarinal in 8 patients (66.6%) (FIG.7).
• Air trapping was present in 9 patients (75%), but with segmental or lobar distribution, affecting more than one lobe in only two patients (16.6%). (FIG. 8).
• Likewise the airspace nodules were present in 3 patients and affects two lobar segments in only one patient.
• We had no cases of nodules larger than 2mm as reported in the literature, with only one case of miliary nodules.
• We found 7 cases (53.8%) with cavitary lesions: one with multiple blebs confined to one lobe, and small contralateral lobe cavitation (FIG. 9,10,11), another case with thin-walled cysts distributed diffusely. Three cases of cavities in between lobar consolidation and one case of cavitary lesion and retractile opacities with signs of chronic lung disease (bronchiolectasis) in infants 6 months old.
• The early and adequate treatment of tuberculosis with cavities, causes the improvement of radiological findings with the disappearance of lesions (FIG. 12,13).

Images for this section:

Fig. 1: Infant female age 8 months. Cavitated areas with consolidation in right lower lobe.
Fig. 2: Infant male, age 5 months. Diffuse micronodular infiltrates with consolidation in the middle third of right lung and cavities in correspondence. Thin-walled cavitary lesion in the left lower lobe and a small area of consolidation with cavitary lesion in the right lower.
**Fig. 3:** Same patient in Fig 2, showing mediastinal lymphadenopathy and tuberculous meningitis, characterized by enhancement in the basal cisterns and hydrocephalus on CT scan of the brain.

**Fig. 4:** Retractile linear opacities and traction bronchiectasis in the right upper lobe. Airspace nodules in upper lobes. Mediastinal and hilar lymphadenopathy, pressing gently the lower lobe bronchus, without compromising the corresponding lobe.
**Fig. 5:** Infant female, age 12 months. Consolidation with atelectasis, areas of honeycombing in the periphery and cavitation in the middle third of the right lung, lower lobe apical segment; also showing right paratracheal lymphadenopathy.

**Fig. 6:** Infant male, age 3 months. Condensation with cavitary lesion in the right lower lobe and calcified lymph nodes.
**Fig. 7:** Mediastinal and right hilar lymphadenopathy with calcifications.

**Fig. 8:** Male infants, age 5 months. Airspace nodules, atelectasis and air trapping areas.
**Fig. 9:** Infant female, age 3 months. Multiple cavitary lesions in the right lower lobe. Pneumonic consolidation in the left lower lobe. CT: 10/06/2005.

**Fig. 10:** Same case as Figure 9: Reconstructions in the coronal and sagittal planes showing cavitary lesions in the right lower lobe. It was suggested a diagnosis of cystic adenomatoid malformation, but...
Fig. 11: Same patient: coronal and axial images with mediastinal window, demonstrating the right paratracheal lymphadenopathy and infra-carinal. It took us to consider tuberculosis.
**Fig. 12:** Same patient fig. 9: CT performed 2 months after starting specific treatment, showing extensive area of parenchymal consolidation in the right lower lobe, showing no more cavity lesions.

**Fig. 13:** Same patient fig.9: CT performed 5 months after the initial examination, still in treatment but showed significant reduction in the right lower lobe consolidation.
Conclusion

- The imaging findings in children under 36 months of age with tuberculosis reflect his poor immune response, unable to contain the primary infection.
- Computed tomography has a crucial role for the diagnosis of tuberculosis and may be suggested early in doubtful cases and appropriate specific therapy instituted as soon as possible in order to complete healing of lung lesions, minimizing or even avoiding systemic complications.
- The general radiologist, a specialist in pediatrics, and pediatricians should be aware of the finding of the lesions described in immunocompetent infants and correlate the findings of chest radiography with CT, where needed.
- With the increasing prevalence of tuberculosis today, it is necessary that the radiologist are aware of the finding of cavitary lesions in immunocompetent infants with tuberculosis and the possibility of disappearance of these lesions and improvement of other associated findings with adequate specific therapy.

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