Advances in Imaging Chest Tuberculosis: Blurring of Differences Between Children and Adults

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• Radiological classification

ROLE OF IMAGING

If there was a reliable, cheap, and fast clinical test to diagnose tuberculosis (TB), then imaging would probably be relegated to looking for complications and providing alternative diagnoses in nonresponders. As things stand however, current clinical signs and tests for diagnosing TB do not do the job well enough, cheaply enough, or quickly enough and imaging continues to play a role in the diagnosis and management of TB. Sputum microscopy (and culture) is specific for diagnosis and may be widely available, however, a large proportion of patients, and children in particular, are found to be smear-negative. Imaging remains useful for diagnosis, detection of complications, monitoring response to therapy, and for evaluating outcome.

Diagnosis using imaging is difficult for several reasons: changing patterns of disease; effects of human immunodeficiency virus (HIV) coinfection and AIDS[1]; inability to identify drug resistance; nonspecific radiographic signs[1]; subjective interpretation with inter- and intraobserver variability of readers[1–3]; possibility of a normal radiograph[1]; problems distinguishing active from inactive disease and infection from disease; imaging is also expensive and often unavailable; radiography is subject to variable quality in technique.

HAS OUR THINKING CHANGED?

The traditional classification of TB into primary and postprimary (reactivation TB) should be avoided[4] as the pathologic differences between these and the corresponding classic imaging patterns characterizing disease in adults and children have blurred. The age-related distinction has changed because primary infection can occur at any age (especially in countries with low TB incidence)[5]; because of exogenous reinfection in endemic areas[4,6–8]; cavitation occurring within 6 months of initial infection (reducing its status as indicator of reactivation),[4] and because HIV infection results in atypical patterns of disease. A radiological classification of disease is more appropriate.

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RADIOLOGICAL CLASSIFICATION

- Lymph node TB (gangliopulmonary TB)
- Air-space parenchymal TB (consolidation)
- Tuberculoma
- Miliary TB
- Cavities
- Pleural TB
- Fibrosis and destruction

ADDITIONAL FACTORS

Various situations requires different information from the image reader and in turn require more information to be supplied to the reader for an insightful and meaningful interpretation: drug resistance requires the reader to give information on the presence and location of cavities and progression or stability of radiographic findings; HIV coinfection requires a different level of suspicion and a specific differential diagnosis depending on the combination of radiographic findings and clinical information (eg, CD4 count); complications of TB should be looked for, depending on the clinical presentation and previous imaging findings; treatment centers require comment on activity and whether findings indicate infection or disease, which affects management.

NATIONAL OR PROGRAM POLICY

The role, influence, and level of imaging depend on various factors within each country, project, and setting, and may even vary according to current universal attitude or personal experience of individuals. These variations are influenced by the incidence of TB in a community or the world at large, geography, socioeconomic factors, the age of patients, HIV coinfection, drug resistance, and philosophy of the program managers. There are currently active programs that use imaging because: it is mandatory to screen the general population[2]; smear microscopy and culture are unavailable; of the predominant number of smear-negative patients suspected of having TB[1], HIV-infected patients require exclusion of active TB before initiation of highly active antiretroviral therapy (HAART); radiographs are useful to guide a change, continuation, or termination of treatment in patients with drug-resistant TB; only the tuberculin skin test is positive in a patient without symptoms; at the end of treatment it is useful to predict relapse of disease.[9] More advanced programs use: computed tomography (CT) when radiographs are normal or equivocal but there are symptoms of TB; multidetector CT with multiplanar reconstruction in an attempt to replace bronchoscopy in complicated lymphobronchial TB[10]; ultrasound to diagnose TB lymphadenopathy in children; magnetic resonance imaging (MRI) to detect and differentiate TB lymphadenopathy from other causes of mediastinal widening; positron emission tomography (PET) to differentiate solitary nodules of TB (tuberculoma) from other causes such as malignancy.[11] Conversely, there is no or little use of radiography when services are unavailable, expensive, require referral elsewhere, are poorly performed or interpreted, or when other more specific tests are proving successful.

DIFFERENCES IN IMAGING CHILDREN AND ADULTS

Children are different in size, anatomy, and physiology from adults. The thymus for example confounds interpretation of the mediastinal width on radiographs. Children are also imaged with a different technique to adults (anteroposterior (AP) instead of posteroanterior (PA) with different settings), provide opportunities for alternative imaging (imaging the mediastinum using ultrasound), and require significant considerations with regard to radiation dose.

IMAGING FINDINGS

Lymph Node TB (Gangliopulmonary TB)

TB lymph nodes in the mediastinum and hilar regions drain a primary parenchymal focus of

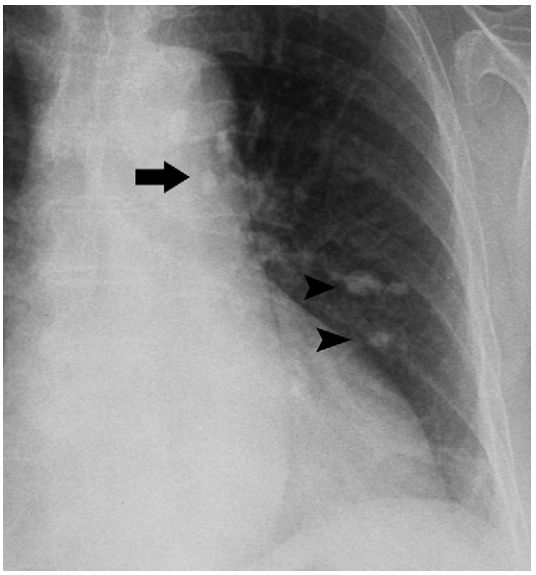

Fig. 1. Calcified Ghon (Ranke) complex. Plain radiograph (detailed view of the left hilum and left lower lobe). Note the presence of multiple calcified parenchymal foci in the lingula and calcified lymph nodes at the left hilum (*arrowhead*) and aortopulmonary window (*black arrow*).