New Diagnostic Tools for Childhood Tuberculosis – Digital Chest X-ray

Child and Adolescent Tuberculosis Working Group
24th October 2018

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Outline

• Advantages of digital chest x-ray
• CAD4TB
• Limitations of chest x-ray
• Other radiology
• Research Priorities
Vs.
Advantages of digital chest x-ray

- Remote reading
- Quality
- Manipulation
- Storage
- Research
Computer-Aided Detection of Pulmonary Pathology in Pediatric Chest Radiographs

André Mouton¹, Richard D. Pitcher², and Tania S. Douglas¹
Value of chest X-ray in TB diagnosis in HIV-infected children living in resource-limited countries: the ANRS 12229-PAANTHER 01 study

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Table 3  Diagnostic accuracy of CXR features as determined by final consensus (case-control subanalysis)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Sensitivity* n/N (%) (95% CI)</th>
<th>Specificity* n/N (%) (95% CI)</th>
<th>ODA %</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CXR consistent with TB</td>
<td>35/49 (71.4) (58.8–84.1)</td>
<td>74/148 (50.0) (41.9–58.1)</td>
<td>55.3</td>
<td>0.0089</td>
</tr>
<tr>
<td>Agreement on presence and site of:*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghon focus</td>
<td>0/51 (0.0–7.0)</td>
<td>150/151 (99.3) (98.0–100.0)</td>
<td>74.3</td>
<td>1.0000</td>
</tr>
<tr>
<td>Alveolar opacities</td>
<td>21/50 (42.0) (28.3–55.7)</td>
<td>97/150 (64.7) (57.0–72.3)</td>
<td>59.0</td>
<td>0.3978</td>
</tr>
<tr>
<td>Miliary</td>
<td>6/51 (11.8) (2.9–20.6)</td>
<td>149/151 (98.7) (96.9–100.0)</td>
<td>76.7</td>
<td>0.0037</td>
</tr>
<tr>
<td>Nodular opacities</td>
<td>9/51 (17.6) (7.2–28.1)</td>
<td>143/151 (94.7) (91.1–98.3)</td>
<td>75.2</td>
<td>0.0155</td>
</tr>
<tr>
<td>Excavation</td>
<td>2/51 (3.9) (0.0–9.2)</td>
<td>150/151 (99.3) (98.0–100.0)</td>
<td>75.2</td>
<td>0.1576</td>
</tr>
<tr>
<td>Paratracheal lymph nodes</td>
<td>3/51 (5.9) (0.0–12.3)</td>
<td>145/151 (96.0) (92.9–99.1)</td>
<td>73.3</td>
<td>0.6947</td>
</tr>
<tr>
<td>Peri-hilar lymph nodes</td>
<td>19/50 (38.0) (24.5–51.5)</td>
<td>106/151 (70.2) (62.9–77.5)</td>
<td>62.2</td>
<td>0.2808</td>
</tr>
<tr>
<td>Tracheal compression</td>
<td>1/51 (2.0) (0.0–5.8)</td>
<td>150/150 (100) (97.6–100.0)</td>
<td>75.1</td>
<td>0.2537</td>
</tr>
<tr>
<td>Bronchial compression</td>
<td>0/51 (0.0–7.0)</td>
<td>147/150 (98.0) (95.8–100.0)</td>
<td>73.1</td>
<td>0.5725</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>3/51 (5.9) (0.0–12.3)</td>
<td>145/151 (96.0) (92.9–99.1)</td>
<td>73.3</td>
<td>0.6947</td>
</tr>
<tr>
<td>Gibbus</td>
<td>0/51 (0.0–7.0)</td>
<td>151/151 (100) (97.6–100.0)</td>
<td>74.8</td>
<td>NA</td>
</tr>
</tbody>
</table>

* Excluding missing values.

CXR = chest radiograph; CI = confidence interval; ODA = overall diagnostic accuracy; TB = tuberculosis.
Child does not have TB

Child has TB

Characteristic features of something other than TB

Characteristic features of TB

Features that could be TB or something else
Is the CXR readable?

- Yes
- No

Is the CXR normal?

- Yes
- No

Are there characteristic features of TB?

- Yes
- No

CXR might be helpful

CXR does not help
A semi-automatic technique to quantify complex tuberculous lung lesions on $^{18}$F-fluorodeoxyglucose positron emission tomography/computerised tomography images


Fig. 1 3D rendered anterior view of fused $^{18}$F-FDG-PET-CT scan, performed at diagnosis on a patient with sputum culture positive pulmonary tuberculosis. It shows a wide distribution of lesions with complex morphology, including a large cavity in the left upper lobe with surrounding nodular infiltrates and patches of consolidation in the left lower lobe.
Chest ultrasound compared to chest X-ray for pediatric pulmonary tuberculosis

Charlotte C. Heuvelings MD¹,² ⓔ | Sabine Bélard PhD¹,²,³,⁴ | Savvas Andronikou PhD²,⁵ | Henrique Lederman PhD⁶,⁷ | Halvani Moodley MMED⁸ | Martin P. Grobusch FRCP¹ | Heather J. Zar PhD²

Utility of Point-of-care Ultrasound in Children With Pulmonary Tuberculosis

Sabine Bélard, MD, *†‡ § Charlotte C. Heuvelings, MD, *† Ebrahim Banderker, FC Rad Diag (SA), ¶ Lindy Bateman, MB ChB, * Tom Heller, MD, || Savvas Andronikou, PhD, *** Lesley Workman, MPH, * Martin P. Grobusch, FRCP, † and Heather J. Zar, PhD*
Priorities

• SOP/consensus statement to guide conduct, storage and interpretation of digital CXR in children
• Identify characteristics on CXR that are associated with TB
• Identify best ways of using CXR for clinical care
• Identify best ways of using CXR in research
• Increase evidence for CAD CXR in children
• Improve experience in other imaging modalities