Normal and Pitfalls in Pediatric Chest Radiographs

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PITFALLS IN CHEST RADIOGRAPHS

Airway

Intrathoracic structures

Skeletal

Extrinsic to the lung

Technical Error

Technical Errors
A 3 year old boy with acute dyspnea 1 day

Hyperlucent One Lung

- Pneumothorax ?
- Emphysema  ?
- Lung hypoplasia  ?
- Foreign body obstruction ?
Rotation

- Symmetrical ribs and the medial border of the clavicles
- Longer posterior ribs
a 4 hour baby girl with meconium peritonitis

a 3 month old boy
Congenital lobar over-inflation of right lung
a 3 month old girl with wheezing

Right lung hypoplasia
A 2 year old boy dyspnea for 2 days

Left lateral decubitus

Right lateral decubitus

Left main bronchial obstruction
Foreign Body Aspiration

Abstract
In our series of 400 Chinese children with foreign body aspiration (FBA), 343 cases were evaluated by fluoroscopy and/or plain chest X-rays before endoscopic removal of the foreign bodies. The majority of the foreign bodies (FBs) were organic (378/400, 94.5 per cent). The results showed that mainstem bronchial foreign bodies were diagnosed correctly in 68 per cent of cases compared with 65 per cent correct diagnoses with segmental bronchial foreign bodies, but only 22 per cent correct diagnoses with tracheal, and 0 per cent correct diagnosis in those with laryngeal foreign bodies. Eighty per cent (32/40) of the children with laryngotracheal FBs had normal X-ray findings, whereas 67.7 per cent (205/303) of the children with bronchial FBs had abnormal chest X-ray findings. The most common positive radiological signs in the children with tracheobronchial FBs were obstructive emphysema (131/213, 62 per cent) and mediastinal shift (117/213, 55 per cent). The incidence of major complications was related not only to the size of the foreign body and its location but also the duration since aspiration. The most common types of bronchial obstructions by airway FBs are discussed.

<table>
<thead>
<tr>
<th>TABLE V</th>
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</thead>
<tbody>
<tr>
<td>POSITIVE X-RAY FINDINGS IN 213 CASES WITH FOREIGN BODY ASPIRATION</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site of foreign bodies</th>
<th>Trachea (N=8)</th>
<th>Main bronchi (N=160)</th>
<th>Segmental bronchi (N=45)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>X-ray findings</strong></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>Obstructive emphysema</td>
<td>4 (2)</td>
<td>106 (50)</td>
<td>21 (10)</td>
<td>131 (62)</td>
</tr>
<tr>
<td>Mediastinal shift</td>
<td>4 (2)</td>
<td>94 (44)</td>
<td>19 (9)</td>
<td>117 (55)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2 (1)</td>
<td>35 (16)</td>
<td>19 (9)</td>
<td>56 (26)</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>0 (0)</td>
<td>24 (11)</td>
<td>15 (7)</td>
<td>39 (18)</td>
</tr>
<tr>
<td>Radiopaque object</td>
<td>0 (0)</td>
<td>5 (2)</td>
<td>2 (1)</td>
<td>7 (3)</td>
</tr>
</tbody>
</table>

*More than one of these positive findings were present in some cases.*

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Poor Inspiration

- Interstitial pneumonia
- Pulmonary edema
- Cardiomegaly
- Mediastinal mass
A 3 month old boy post operative CHD worsening pulmonary edema??

Tetralogy of Fallot?
Lordosis

- Round cardiac apex ➔ RVH
- Prominent perihilar bronchovascular markings
- Horizontal or upturned anterior ribs

Additional Lateral View

- Assess cardiomegaly
- Determine location and confirm pulmonary nodule on frontal view
- Clarify number & position of FB
- Evaluate LN and pulmonary hilum
Pulmonary AVM

Airways
Airways

- Tracheal buckling simulating extrinsic compression by a mass
- Neck flexion simulating retropharyngeal soft tissue thickening
Prevertebral soft tissue thickening?

a 1-year old girl with neck stiffness

Prevertebral soft tissue thickening?
Atypical presentation of Kawasaki disease in young infants

Retropharyngeal fluid/abscess


a 3 - year boy with snoring
Lateral Neck

- Prominent normal lymphoid tissue
- Over diagnosis of airway masses
- Significant enlargement ↔ airway obliteration
- Considered immune deficiency > 6 months

Intrathoracic Structures
Mediastinal mass?

- Most frequent pitfall
- Located in prevascular space
- Large at birth
- Less prominent in older children
- Never displace mediastinum

Thymus
Thymus

- Unilateral / bilateral
- Wavy margin
- Cardio-thymic notch
- Thymic sail sign

water density
wavy sign

Thymic sail sign
Thymus

- **Rebound** thymic hyperplasia
- **Ectopic location**: posterior mediastinum/retrocaval position
- Above sternum during respiration / crying
- US or CT or MRI

A 7 year old boy
NHL stage II complete treatment

11/12/2009

17/03/2010  19/7/2010
Thymus VS Mediastinal mass ??

2-month-old girl with fever and coughing

Posterior Mediastinal Extension

Key Point!: contiguous with normal thymus
Confluence of the pulmonary veins at right paraspinal region

- Prominent normal MPA in adolescent girls
- Post stenotic dilatation in PS
a 10 year old boy – contacted TB

Normal Pulmonary Vascular Structures

- Confluence of the pulmonary veins at right paraspinal region
- Prominent normal MPA in adolescent girls
- Post stenotic dilatation in PS
a - 18 year old girl – check up

Ductus bump

A baby boy 2nd DOL
**Ductus Bump**

- Transient limited to newborn
- Prominent aortic knob
- Distended PA and DA
- The most prominent on 2nd or 3rd DOL

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**Extrinsic to the Lungs**
Asymmetrical breast development

Pneumonia?

Neonatal incubator access port
Right pleural effusion?

Pneumothorax?
Performed portable in ICU

Misinterpreted as pneumothorax

Pleural line – distinct, curvilinear parallel lateral chest wall

Skin fold – indistinct and random course

Skin Fold

Skeleton
Simulating abnormalities to the inexperienced observers

Mediastinal mass?
Sternal Ossification Centers

- Not fused in infants and young children
- Slightly oblique
- Manubrial ossification center: mistaken for a mediastinal mass or foreign body

a 8 month old girl
CHARGE association
Incomplete Ossification

- Caudal – Cranial posterior spinal fusion
- Thoracic posterior spinal elements 1st year
- Cervical spinal elements 2nd-3rd year
- Lack of clinical finding or pathologic widening of spinal canal
Enlarged cervical spinal canal 6-12 months
Bone in bone appearance

OSTEOPETROSIS?
• Younger than 2 months
• Will diminish with time

Axially oriented cleft??
Vertebral Notch

- Young infants
- Noted in lateral projection
- Anterior notch – sinusoid blood space
- Posterior notch – penetrating arteries and veins

avulsions fracture??
Partial Ossification

- Early ossified cartilaginous ring epiphysis at 12 years
- Mimic avulsion fracture

Prominent intertubercular groove
**Prominent Intertubercular Groove**

- Tendon of long head of biceps tendon
- Simulate periosteal reaction or focal bony erosion
- Bilateral and symmetrical
Joint Vacuum

- Immobilization
- Glenohumeral joint
- Intra-articular nitrogen gas

Congenital Bony Anomalies
• Narrow AP dimension
• Cardiomegaly
• Obscured right heart border
• Relatively vertical orientation of anterior ribs
Ribs

- Bulbuous cartilaginous anterior rib ends
- Misleading calcified mass or expansile rib

Take Home Points

- Technical factors, un-cooperative patients, external factors
- Normal structures and immature skeleton
- Prevent misinterpretation
- Repeated radiographs, additional views or other advanced imaging