Chronic Lung Disease in the Context of Infectious Disease

Lisa Maleche Obimbo
Professor of Paediatrics & Respiratory Medicine, Dept of Paediatrics, University of Nairobi
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What is Chronic Lung Disease?

Varied clinical definitions across studies:

- Respiratory symptoms persisting ≥ 3 months
  - cough, wheeze
  - breathlessness - Medical Research Council (MRC) breathlessness score >1

- Abnormal respiratory exam – presence of any of the following:
  - Tachypnoea
  - Finger clubbing
  - Hypoxia at rest or after exercise
  - Abnormal chest exam
Causes of CLD in Children

• Infections
• Recurrent aspiration
• Inhalation of toxic chemicals
• Extreme prematurity – bronchopulmonary dysplasia
• Congenital disorders
Pneumonia before age 7 yr damages lungs, damage persists into adulthood. 1958 European Cohort

| TABLE 4. Adjusted Differences in the Results of Spirometry before Albuterol Treatment between Subjects with and Those without a History of Pneumonia by the Age of Seven Years. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| CATEGORY                        | NO. OF SUBJECTS | NO. OF SUBJECTS | DIFFERENCE IN FEV₁,* | P VALUE | DIFFERENCE IN FVC,* | P VALUE | DIFFERENCE IN FEV₁:FVC,* | P VALUE |
|                                 | WITHOUT A HISTORY | WITH A HISTORY | milliliters |                  | milliliters |                  | percent |                  |
| All subjects                    | 1199            | 193             | -102±73     | 0.006            | -173±70     | 0.001            | +0.9±1.0 | 0.09             |
| Men                             | 611             | 84              | -106±126    | 0.10             | -171±135    | 0.01             | +0.7±1.5 | 0.35             |
| Women                           | 588             | 109             | -98±81      | 0.02             | -171±89     | <0.001           | +1.0±1.4 | 0.14             |
| Never wheezed                   | 275             | 57              | -155±122    | 0.01             | -197±152    | 0.01             | +0.3±1.5 | 0.67             |
| Past wheezing                   | 489             | 62              | -41±128     | 0.53             | -75±147     | 0.32             | +0.3±1.6 | 0.69             |
| Current wheezing                | 435             | 74              | -119±133    | 0.08             | -267±128    | <0.001           | +2.0±2.0 | 0.04             |
| Basic model†                    | 1003            | 148             | -89±81      | 0.03             | -155±87     | <0.001           | +0.8±1.1 | 0.18             |
| Fully adjusted model‡           | 1003            | 148             | -92±82      | 0.03             | -159±88     | <0.001           | +0.8±1.1 | 0.18             |

Ian D.A. Johnston et al. NEJM 1998

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Impact of LRTI on Lung Function in African Infants (S African study 2017)

- 648 children enrolled at birth lower SES S. Africa
- Lung function checked at birth, 6 and 12 mths
- Documented any episode of pneumonia

Babies who had pneumonia had worse lung function by 12 mth
- Higher resting RR
- Smaller tidal volume

Gray, Turkovic, Willemse, et al. AJRCCM 2017
Bronchiolitis Obliterans
“Obliterative bronchiolitis”

- Rare but severe disease
- Aetiology – severe viral bronchiol
- Pathology in terminal bronchioles

**Risk factors**

- Type of virus
- Severity of acute viral LRTI

Bronchiolitis Obliterans Clinical Presentation

Initial illness classic bronchiolitis – fever, wheeze, cough, DIB, +/- crackles

Protracted persisting symptoms after resolution of infection.
• Wheeze & dyspnea persist weeks to months
• Spirometry- Fixed obstruction

Silvia Onoda Tomikawa*, Review BO in children. Intractable and Rare Diseases Research 2015

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Imaging – CXR, HRCT

- **CXR** – normal or hyperinflation
- **HRCT**
  - Mosaicism
  - Thickened blocked bronchioles

**Table 2. HRCT findings in children with BO**

<table>
<thead>
<tr>
<th>HRCT findings (n = 40)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosaic pattern of perfusion</td>
<td>29 (72.5)</td>
</tr>
<tr>
<td>Bronchial wall thickening</td>
<td>18 (45)</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>16 (40)</td>
</tr>
<tr>
<td>Alveolar filling</td>
<td>12 (30)</td>
</tr>
<tr>
<td>Bronchiectasis</td>
<td>11 (27.5)</td>
</tr>
<tr>
<td>Hyperinflation</td>
<td>5 (12.5)</td>
</tr>
<tr>
<td>Air trapping</td>
<td>5 (12.5)</td>
</tr>
<tr>
<td>Swyer-James-MacLeod syndrome</td>
<td>1 (2.5)</td>
</tr>
</tbody>
</table>

Silvia Onoda Tomikawa*, Review BO in children. Intractable and Rare Diseases Research 2015
Bronchiolitis Obliterans – Treatment

*We are still figuring it out*…

- Corticosteroids
- Established BO
  - Try ICS
  - Inhaled anticholinergics
  - SABA (in atopic subset)
  - Oxygen support when required
- Prevention of exacerbations
- Treat infections
- Vaccination – influenza, ? RSV
- Optimize nutrition
- Natural history – prognosis…
Bronchiectasis – “bronchi widening”

**Damaged Bronchial tree**
- Severe or repeated injury causes the following changes in walls of bronchi:
- Bronchial wall weakened, collapsible
- Fibrosis & thickening of bronchial wall
- Chronically inflamed, much mucous secretions
- Damaged mucosa and bronchial epithelium – poor ciliary function, poor mucous clearance, poor immunity

**Other changes resulting from abnormal airways**
- Blockage – atelectasis and/or emphysema
- Chronic inflammation in adjacent lung parenchyma – fibrosis
- Bronchial vasculature hypertrophy
Bronchiectasis

Infectious Causes
• Recurrent severe bacterial pneumonia
• Severe tuberculosis
• Persistent bacterial bronchitis (PBB)
• Underlying risk factors for recurrent or severe prolonged lung infections

Other underlying diseases that predispose to recurrent airway damage
• Foreign body aspiration
• Congenital abnormalities of airways
Bronchiectasis

Clinical Presentation
• Persistent cough (90%)
• Majority – wet cough productive (older kids expectorate)
• Sputum usually purulent (distinguish from asthma)
• Hemoptysis rare (erosion blood vessel)
• Extensive dx – breathlessness

Infections cause exacerbations of symptoms and new symptoms
• Fever
• Pleuritic chest pain
• Worsening dyspnea

Physical Exam
• Crackles – in affected portions of lung
• Wheeze rare (~10%)
• Finger clubbing (~50%)
• Extensive dx – dyspnea, hypoxia

Overall – they present to paediatrician as child with “recurrent pneumonia which responds slowly to antibiotic treatment"
Bronchiectasis - Imaging

Dilated airways with thickened walls
- Tram-track (railway track)
- Ring shadows
- Peribronchial fibrosis

Other findings
- Linear atelectasis
- Air trapping
- Fibrosed lung tissue

Rt Lower lobe bronchiectasis, fibrosis
Bronchiectasis - Imaging

Dilated airways with thickened walls
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Other findings
- Linear atelectasis
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- Fibrosed lung tissue

Rt lower lobe bronchiectasis. Early changes left lung
Investigating Chronic Lung Disease

• Clinical assessment – hx, physical exam
• Oximetry
• Exercise test
• Lung function tests – spirometry
• Imaging – CXR, HRCT
• Sputum – other infective screens, specific assays.
• Inflammatory markers
• INVESTIGATE FOR UNDERLYING CAUSE
Principles of Managing CLD

• Chest physio – clean out the lung!
• Prevent infections – vaccines, antimicrobial prophylaxis
• Treat acute infective exacerbations aggressively – broad spectrum antibiotics, if severe parenteral and culture guided.
• Supplemental Oxygen support where needed
• Optimise nutrition – macronutrient and micronutrient

• Surgery - Localised bronchiectasis causing severe recurrent morbidity
THANK YOU!!
ASANTENI!!