Flexible Bronchoscopy in Children
What’s Old, What’s new and as always, what is the purpose?

Dr Mark Rosenthal
Royal Brompton Hospital, London, UK
"A toy for a six-year-old boy? Certainly, Ma'am — conventional or nuclear?"
What you really need is a……

- Good reason
- Good anaesthesetist
- Good team
- Good equipment
Adults and Children: Similarities and differences

<table>
<thead>
<tr>
<th>Differences</th>
<th>Same</th>
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<tbody>
<tr>
<td>Greater range of anaesthetic techniques and instruments</td>
<td>Basic anatomy</td>
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<tr>
<td>Greater manual challenge (510g)</td>
<td>Need to secure airway at all times</td>
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<tr>
<td>Greater range of pathology</td>
<td>Endobronchial and brush biopsy and lavage techniques</td>
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<tr>
<td>TBB rarely done</td>
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The Reason

• Is this the **only** and **best** way to make the diagnosis?
• Will an answer change management?
• Are you sure the bronch will not endanger the symptomatic child
• “It is better to have a live diagnostic problem than a dead diagnosis!”
"A toy for a six-year-old boy? Certainly, Ma'am — conventional or nuclear?"
The Reason

• **Diagnostic**
  - Upper airway – malacia, clefts, adenoids
  - Lower airway – Anatomy, malacia, narrowings (internal/external), microbiology, cellularity.
  - Problematic Severe Asthma
  - Biopsy (endobronchial, transbronchial, needle)

• **Therapeutic**
  - Mucus plugging
  - NOT foreign body
  - Assisting Intubation
Paediatric FOB at RBH

• All children receive general anaesthesia, dedicated Consultant-run lists

• Team approach to assessment and procedure

• Preterm– 17 yrs, any weight

• Day-case and in-patient / PICU procedures

• Rolling audit of complications, database of > 1500 procedures

• High risk groups
  – Wt < 10Kg (?)
  – Upper airway abnormalities / obstruction
  – CHD, PHT
Anaesthesia for FOB: Always General Anaesthesia

**Inhalational**
- Sevoflurane
- Non-pungent
- Non-irritant
- No cardiovascular effects
- Rapid induction and emergence

**Intravenous**
- Propofol
- Titrate effects
- Rapid induction and emergence
- Apnoea
- Hypotension
- Irritant
Sizes (mm):

Paediatric: 4.9, 4.0 (2mm channels)
3.6, 2.8 (1.2mm Channel)
BAL, Bx, Brush)

Neonatal: 2.2 (Look only)
Airway management

Face mask

- Upper and lower airway
- Airway dynamics
- Atraumatic
- No distortion
- No airway protection

Technically the most challenging!
Airway management

Laryngeal mask airway

- Guides scope
- Especially if multiple passes needed
- No use above vocal cords
- Useful if UAO e.g. large tongue
- Atraumatic
- Cough / laryngospasm an issue
Advantage- Microbiology without contamination from above

Disadvantage- Increased airway obstruction and reduced size of scope
Diffuse bilateral shadowing in an immunocompromised child
Silver stain – Pneumocystis Jerovici Pneumonia (PCP)
Pre-procedure Assessment

- WHAT IS THE REASON?
  - Airway examination, difficult intubation
  - OSA or other comorbidity
  - Procedure requirements, including multiple procedures
  - Fasting and pre-medication
  - Risk assessment for recovery requirements
    - PICU?
Severe late damage post-intubation
Hugely overinflated right lung with displacement of the mediastinum
CT – massive over-inflation of right lung
Recurrent ‘Pneumonia’

• 6 year old girl, FTNVD

• Age 3: admitted with left lower lobe consolidation, given ivabs

• Several subsequent admissions with consolidation in the same place, never febrile

• Referred to RBH, clinically very well
Spindle Cell Tumour
What caused the Symptoms?

• 15/12 old girl with 4 months of cough intermittently

• Admitted centrally cyanosed on one occasion, never ventilated

• Poor response to therapy

• CXR, CT scan, bronchoscopy:
Bronchoscopic Investigations

- Bronchoalveolar lavage. For example: A) The child with Cystic fibrosis not doing well but has persistently negative cough swab. B) The well child usually <5 years with the persistently wet cough.

- Brush biopsy. Suspected TB or evaluation of problem asthma

- Endobronchial biopsy. Suspected TB or evaluation of problem severe asthma

- Transbronchial biopsy. Confined to diagnosis of Chronic rejection or obliterateartive bronchiolitis

- Needle Biopsy. TB or ?tumours
Endobronchial Tuberculosis:

Eroding lymph nodes
Giant cell granulomas
# Endobronchial biopsy - technique

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<th>2 mm forceps</th>
<th>1.2 mm forceps</th>
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<td>Easy to perform</td>
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<td>$\geq 4$ mm scope</td>
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- Good sample
- Easy to perform
- $\geq 4$ mm scope
- Disposable best
- 3 years & above

- Sample smaller
- Technically difficult
- 2.8 & 3.6 mm scope
- Non-disposable
Success rate
Regamey et al, Chest 2007

- **n=165 children**
  - median age 6½ yrs, youngest 2 months
  - 67 CF, 34 wheeze/asthma, 64 chronic resp symptoms

- At least 1 evaluable biopsy in 72% (<4 yrs - 57%)
- 2 vs 1 mm forceps - 93% vs 57%  
- Disposable better than reusable
- Need at least 2 biopsies
- Learning curve
- No complications
Is airway wall biopsy in children safe?

**Safety and ethics of bronchoscopy and endobronchial biopsy in difficult asthma**

D Payne, S A McKenzie, S Stacey, D Misra, E Haxby, A Bush

N=47

**Safety of endobronchial biopsy in 170 children with chronic respiratory symptoms**

P S Salva, C Theroux, D Schwartz

N=170

**The safety and quality of endobronchial biopsy in children under five years old**


N=33

**Safety of Endobronchial Biopsy in Children With Cystic Fibrosis**

A. Molina-Teran, T.N. Hilliard, S. Saglani, E. Haxby, M. Scallan, A. Bush, and J.C. Davies

N=42
Quality of biopsies in children

epithelium

smooth muscle

glands

Regamey et al., Chest 2007

Quality of biopsies in children
TBB: Indications

• Lung transplant rejection/surveillance
  – Unequivocal

• chILD syndrome
  – Only if specific histological patterns likely to be identified

• Distal airway inflammation
  – Adults and research only
Transbronchial biopsy - risks

• **Pneumothorax**: 1-3%
  – Risk increased if patient is ventilated, or right middle lobe or lingula is biopsied

• **Bleeding**: very common, but rarely needs intervention
  – Risk probably increased if abnormal coagulation
The Diagnostic Value and Safety of Transbronchial Needle Aspiration Biopsy in Children With Mediastinal Lymphadenopathy

P. Goussard, MMed (Paed), R.P. Gie, FCP (Paed), S. Kling, FCP (Paed), E.D. Nel, MMed (Paed), M. Louw, MMed (Anat Path), P.T. Schubert, FCPPath (Anat), D. Rhode, FCP (Paed), A. Vanker, FCP (Paed), and S. Andronikou, PhD
30 patients enrolled

2 patients TBNA discontinued*

28 TBNA

Results

7 exclusive diagnosis
- MTB culture positive (n=3)
- ZN positive (n=2)
- Histology positive (n=2)

11 no diagnosis

10 contribution to diagnosis
- MTB culture positive (n=7)
- ZN positive (n=2)
- Histology positive (n=1)

* Due to safety concerns

Fig. 5. Flow diagram: Patient selection and results.
Endobronchial Ultrasound in Pediatric Pulmonology

Daniel P. Steinfeldt, MB, BS,¹⁺ Danielle Wurzel, MB, BS,²,³
Louis B. Irving, MB, BS,¹ and Sarath C. Ranganathan, PhD²,³,⁴
Two types: a) Radial probe where the 1.2 USS is passed through sheath (1.7mm) to the site suspected on CT. So can use 4mm scope. Probe removed and biopsy tools inserted to take sample. In reality won’t reach anything in children<12 years plus no real time imaging. Requires fluoroscopy
b) Linear Probe Ultrasound. Realtime but needs 6.9mm scope

Fig. 5. Linear probe EBUS with balloon filled with saline and with dedicated 22-gauge needle in biopsy position. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]
Paediatric Flexible Bronchoscopy and Research.

Role in problem severe asthma when ALL the basics have been attended to but without sufficient benefit

Adherence
Cigarettes
Allergens
Psychology
Mucosal and Luminal Cytology

No correlation between the two: which matters?

*Lex et al, BlueJ 2006; 174: 1286-91*
So Far in Asthma......

• We have carefully defined our complete ignorance more accurately!
What you really need is a……

- Good reason
- Good anaesthetist
- Good team
- Good equipment
Thank you for listening!