



Flexible Bronchoscopy in Neonatal ICU

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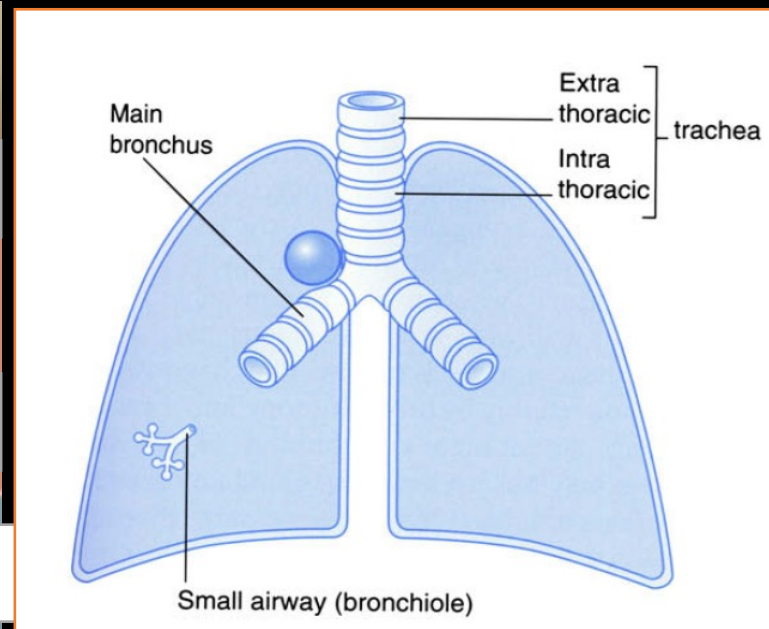
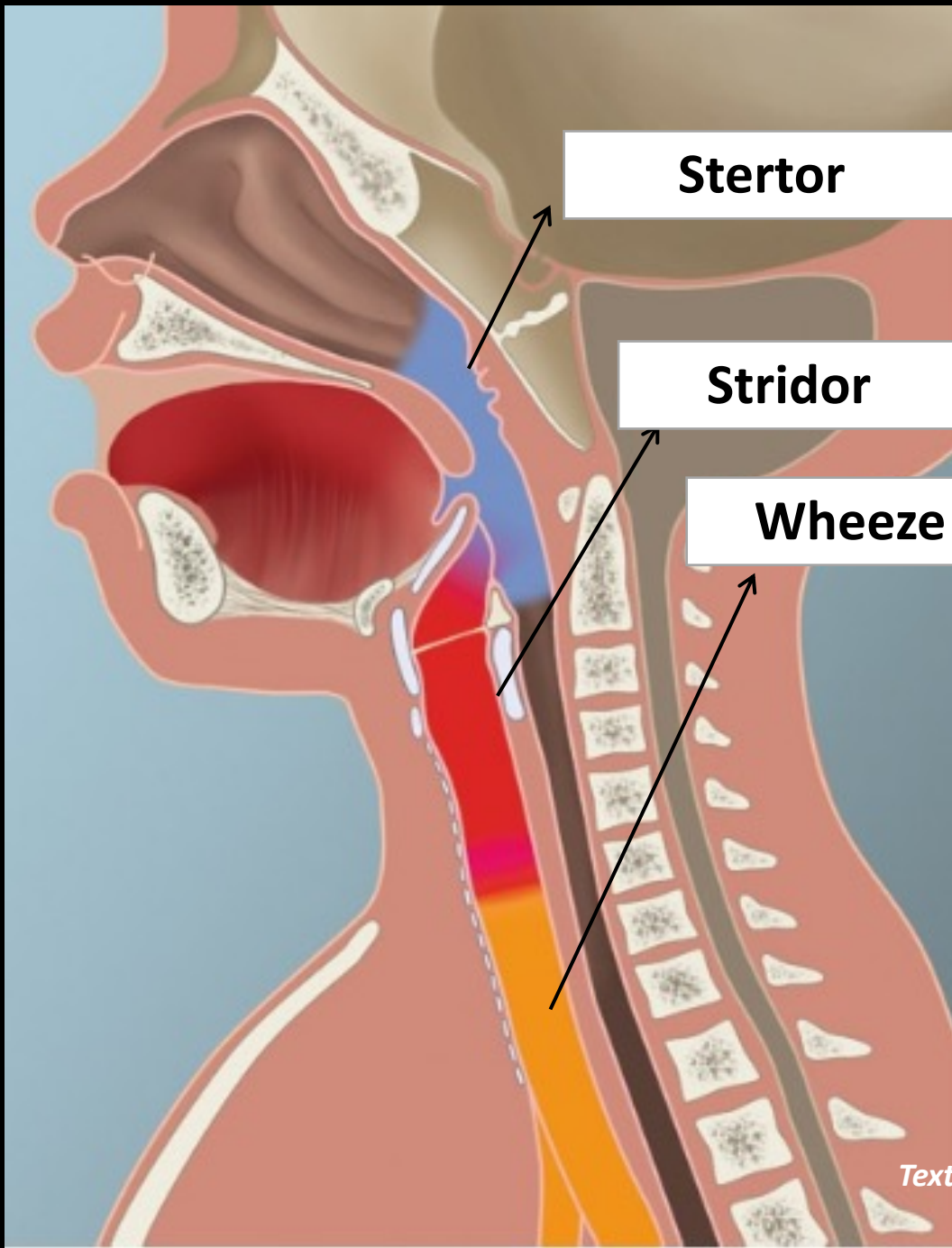
Formerly Assistant Professor Kalawati Saran Children's Hospital

CHILDREN'S CHEST CLINIC

112-A, FF, Rishabh Tower, Karkarduma Community Center, Opp Karkarduma Metro Station, Delhi-92

Outline...

- When?
- What equipment?
- Sedation
- Procedure itself. Any differences?
- Complications



Rattles
Grunt

Case

- 2m boy
- Birth weight 3 kg
- Referred for evaluation of Noisy breathing
 - Started around 1-2 weeks after birth
 - Mainly heard when active
 - Feeding well
- Inspiratory stridor with no retractions
- Current weight 5 kg

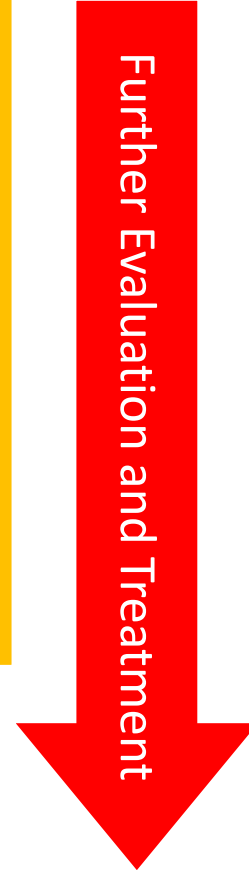
Key Questions in CLINICAL PRACTICE

- Am I comfortable saying that this STRIDOR is secondary to a LARYNGOMALACIA?
- Should I refer this child for a BRONCHOSCOPY?
- When should I refer a child with STRIDOR for BRONCHOSCOPY?



Happy
Stridor

With
RED
FLAGS



- 1 month old baby
- Stridor since last 20-25 days
- Severe Inspiratory retractions





Sex : Age :
D.O.Birth :

30/10/2019
14:36:46

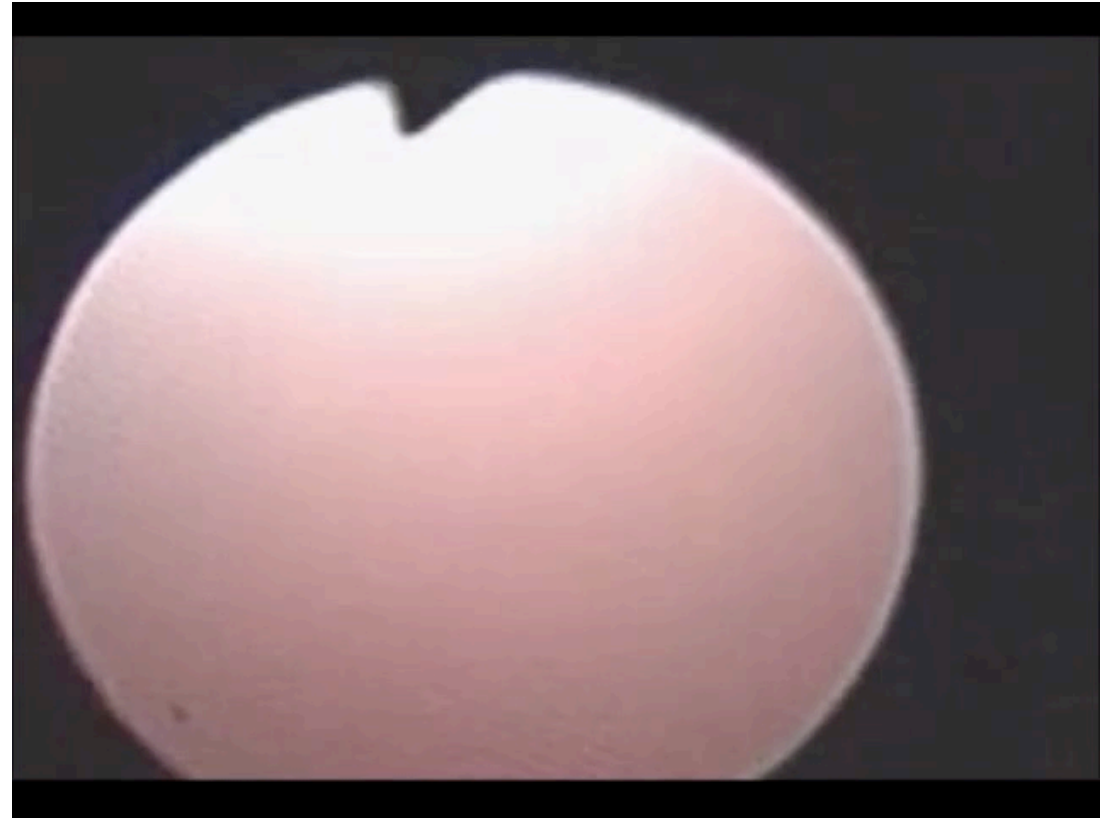
Cr: N Ex: 1



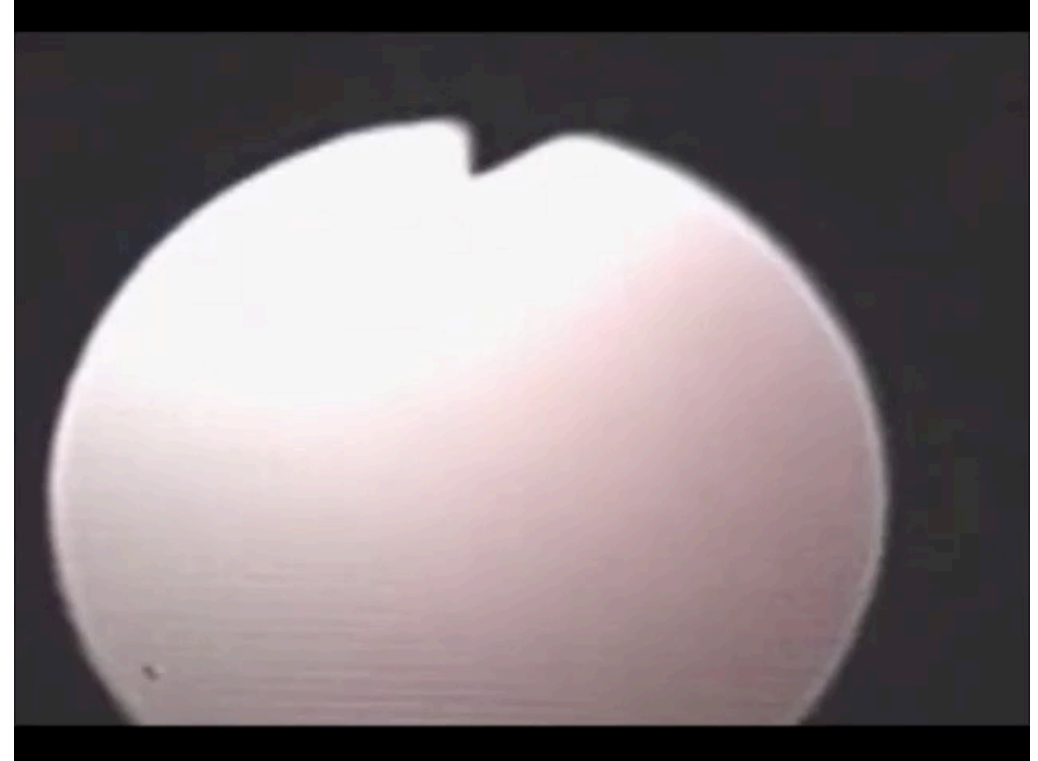
Stridor with Red Flag Signs

- Stridor since birth
- Associated with Retractions
- Expiratory component
- Biphasic stridor
- Monophonic wheeze
- Persisting/worsening beyond 6-9 months

- 2 m/boy
 - Noisy breathing since birth
 - No significant RD noted
 - Feeding well
- Currently:
 - Fever, cough, cold followed by Fast breathing
 - Wheezing
 - Bronchiolitis
- Problem:
 - Stridor increased
 - RD persisting >10 days
 - Persisting oxygen requirement



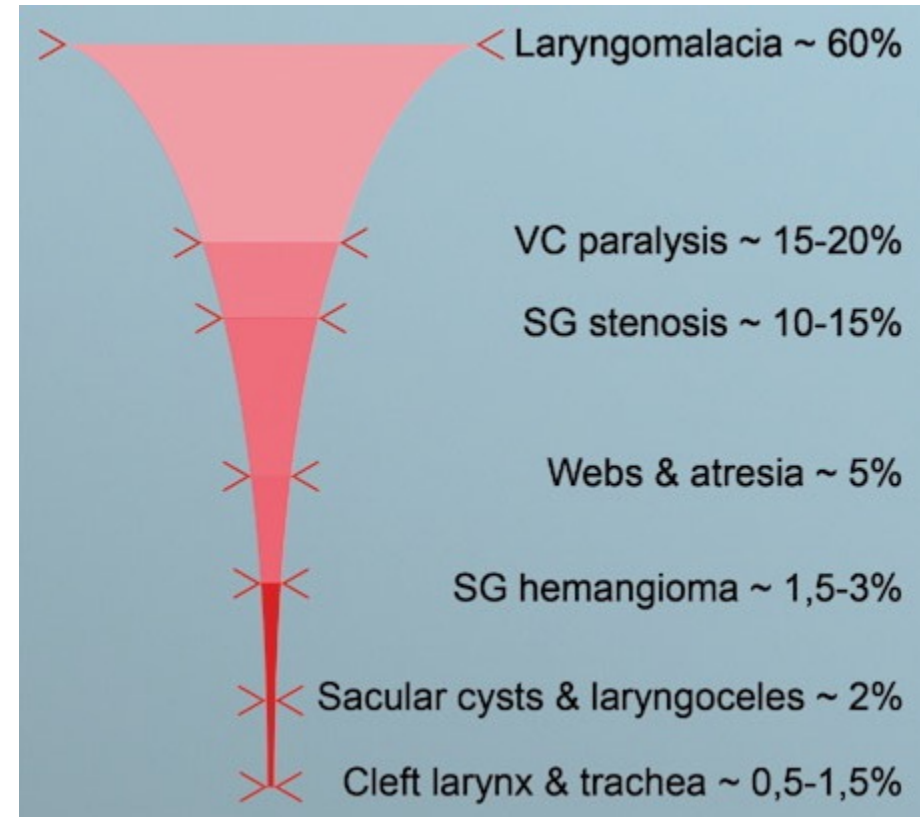
- 7 m/boy
- Stridor since first month of life
- Has a FOB in 4th month suggestive of LARYNOMALACIA (no images and Videos)
- Admitted with Bronchiolitis
- Current Issue:
 - RD Persisting beyond 12 days
 - Already received steroids and ADR nebs
 - Persisting oxygen requirement



Congenital Anomalies

The prevalence of congenital airway anomalies has been estimated to range between 1 in 10,000 and 1 in 50,000 live births

Some children may present with more than one airway anomaly



Post OP TEF repair with STRIDOR with RED FLAGS



Stridor: Persistent Acquired

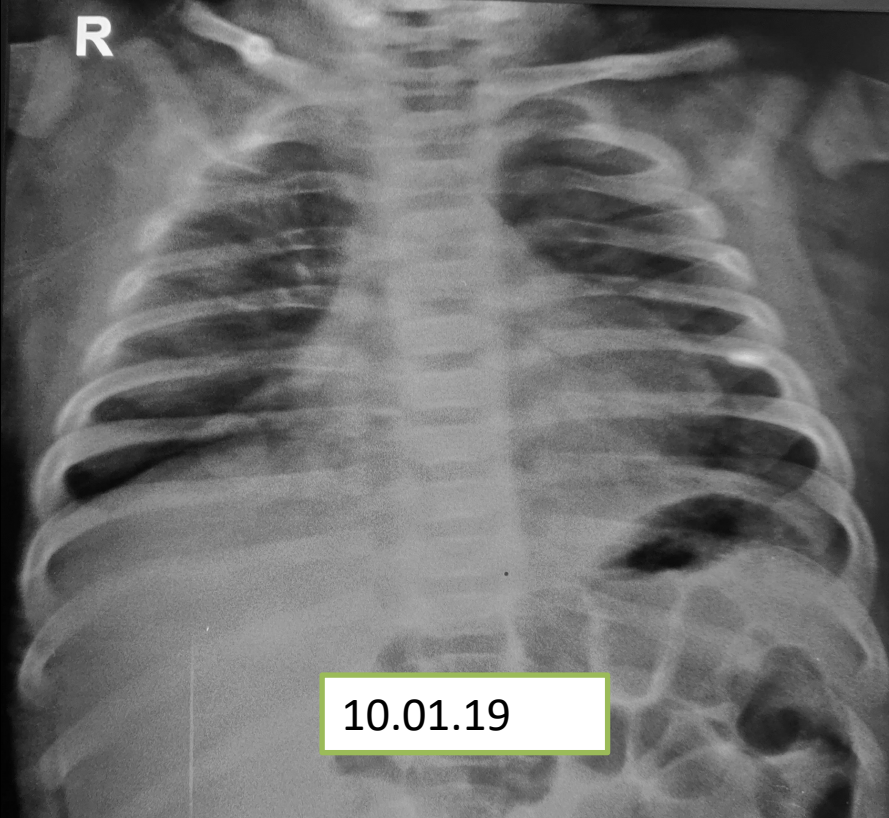
- **Nasopharynx**
 - Adenoid Hypertrophy
- **Glottis**
 - Vocal Cord Paralysis
 - Post Intubation Laryngeal Webs
- **Subglottis:**
 - Post Intubation Subglottic Stenosis
 - Hemangiomas
- **Laryngeal Trauma**
- **Respiratory Papillomatosis**

Case history

- 3 m old boy
- h/o noisy breathing since 1st week of life
- Treated with nebs
- Admitted at 1 month:
 - Developed URI/increasing RD
 - Improved but noisy breathing persisting
 - Received IV Meropenam from OPD for another 10 days
- Again URI with increased RD

Examination

- Weight: 6 kg (birth wt 2.8 kg)
- No dysmorphism
- CVS: Normal
- Chest: Bilateral wheezing



Diagnostic Flexible Bronchoscopy

Z Age :
D.O.Birth :
29/08/2018
10:13:59

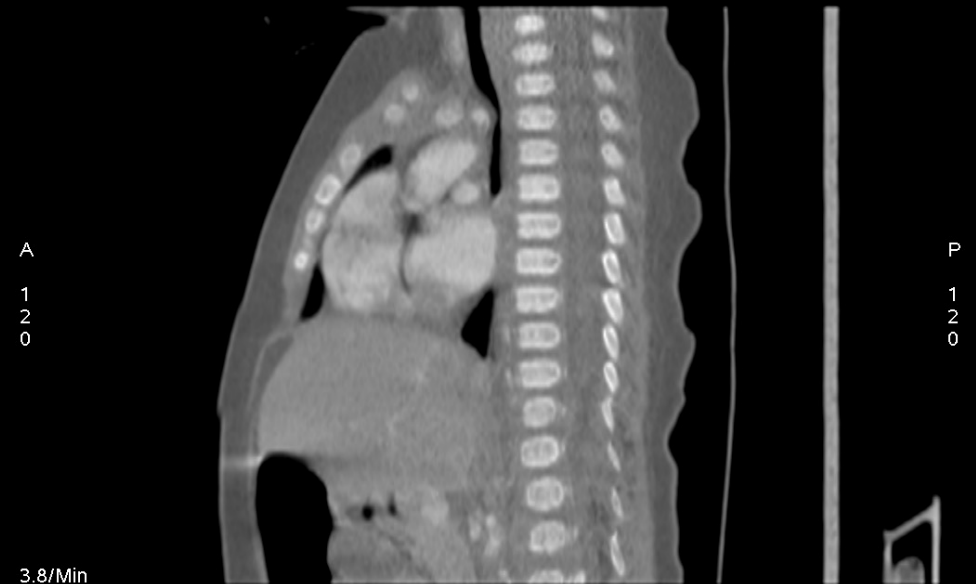
Ct: N Ex: 3

Comment :



5.0/MIP
DFOV 24.0cm
STND/+

Ex: Feb 08 2019



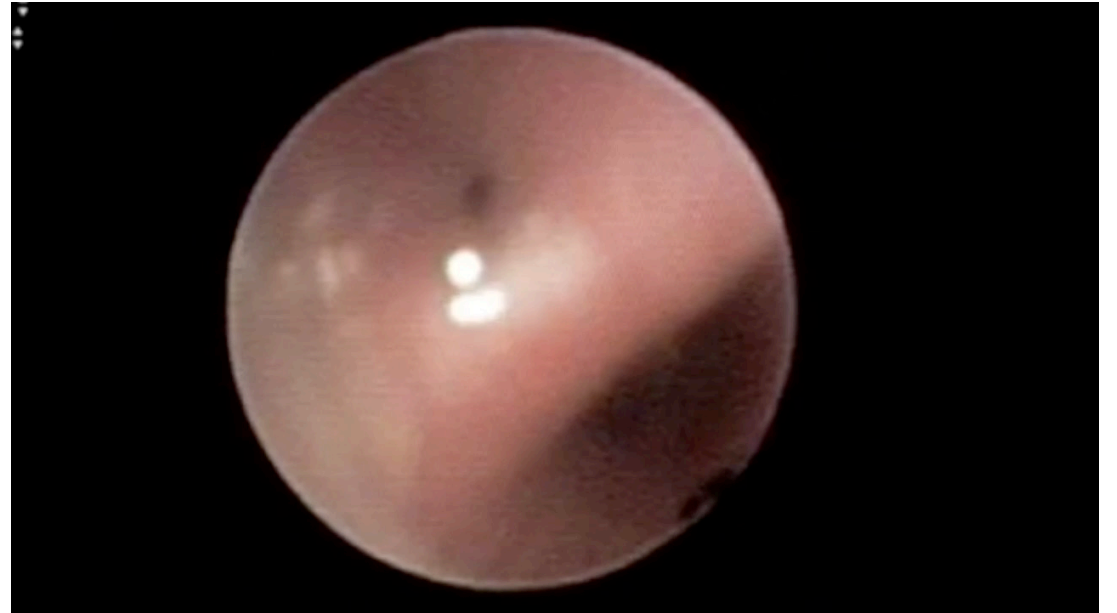
3.8/Min

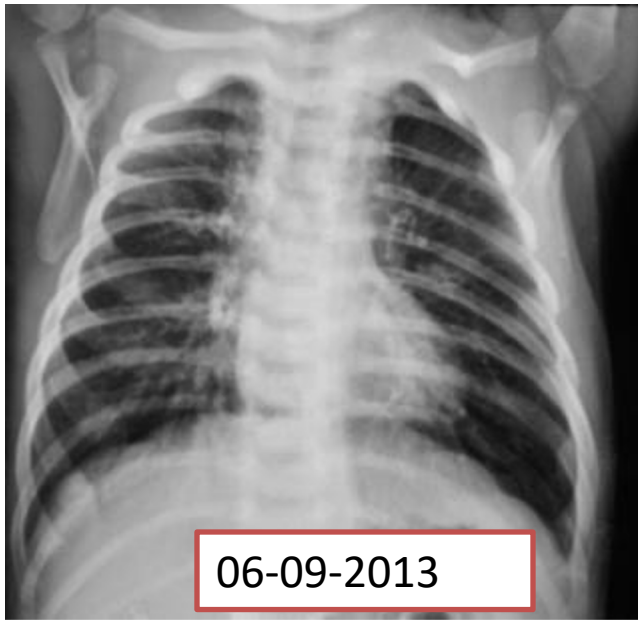
1.2mm 1.375:1/1.2sp

W = 1319 L = 66

Mimickers or Atypical Wheezers

- **Infections**
 - Recurrent LRTI, PBB, CSLD, Bronchiectasis
 - TB
 - Chronic rhino-sinusitis, adenoid hypertrophy
 - Bronchiolitis Obliterans
- **Congenital problems**
 - Tracheobronchomalacia
 - CF, BPD, PCD
 - Immune deficiency
 - Airway compression: Vascular or Non Vascular (lymph node, tumor, cardiomegaly)
 - H type TEF
- **Mechanical Problems**
 - GERD
 - Foreign Body aspirations





45 d boy

- Persistent Cough since birth
- FB X 1 month
- No fever

• Exam:

Weight 2.5 kg (birth wt 2.5kg)

No clubbing

Bilateral wheezing and
conducted sounds



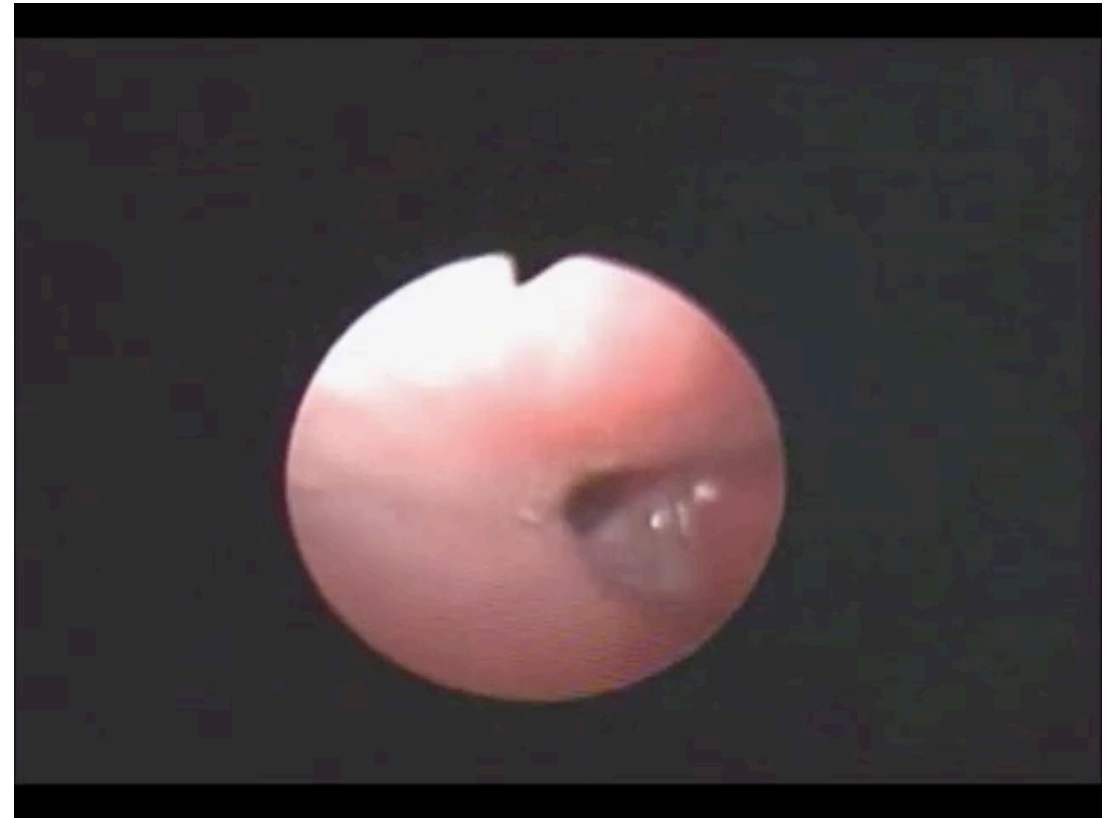
Bronchoscopy/BAL 19-09-2013

- Thick muco-purulent secretions in bilateral bronchial tree
- RML atelectasis
- BAL pyogenic C/S- *Pseudomonas aeruginosa*

Blood gas: metabolic alkalosis
Sweat Chloride: 37/67
Delta 508 positive

Extubation failure

- Post operative case of recurrent TEF
- Extubation failure



- 2 m boy
- Case of IVH secondary to late onset HDN
- Ventilated for 14 d
- Extubation failure
- D/L done by ENT
- Diagnosed as subglottic stenosis;
Tracheostomy done
- Oxygen requirement persisting



- 2 m baby
- Referred from Sirsa for extubation failure



Indications of Bronchoscopy in NICU

Diagnostic

- Evaluation of abnormal sounds: wheezing, stridor
- Persistent Radiological Opacity /Pneumonia
- Suspected ILD

Therapeutic

- Acute Atelectasis
- Bronchoscopic intubation

Therapeutic Bronchoscopy: Advanced

- Foreign Body Extraction
- Approach to Mediastinal LN
 - Conventional TBNA
 - EBUS
- Transbronchial Lung Biopsy
 - Forceps
 - Cryobiopsy
- Whole lung lavage
- Airway work (tracheobronchial stenosis/malacia):
 - Balloon Dilatation
 - Dealing with growths and granulations
 - Placement of Tracheal/Bronchial Stents

How do you say that
Bronchoscopy
was useful or will be useful?

Outcome measures

The success of the procedure is classified as

- **Diagnostic**- if it provided a diagnosis unobtainable by other reasonable means;
- **Contributory**- if it either ruled out a mimic or differential diagnosis thus preventing further investigation/unnecessary treatment or if it suggested a diagnosis or specific therapy.
- **Non contributory**- if FOB findings did not change diagnosis or treatment.

The Effects of Flexible Bronchoscopy on Mechanical Ventilation in a Pediatric Lung Model*

*Danny Hsia, MD; Robert M. DiBlasi, RRT-NPS; Peter Richardson, PhD;
David Crotwell, RRT-NPS; Jason Debley, MD, MPH;
and Edward Carter, MD, FCCP*

Primum Non Nocere

How To Cause Chaos With a Bronchoscope in the ICU

Chevalier Jackson, the father figure of bronchoscopy, once famously remarked that if doubt existed whether a bronchoscopy should be performed, then a bronchoscopy ought to be performed. Had he the opportunity to perform fiberoptic bronchoscopy in pediatric and neonatal ICUs, he may well have sung a different song. The performance of a bronchoscopy is deceptively easy: the patient is

[Bush A. Paediatr Respir Rev. 2003 Mar;4\(1\):67-73.](#)

Is it safe?

Table 1. Differences between patient populations undergoing FFB in the ICU and undergoing FFB as outpatients

	Patients in the ICU	Outpatients
Clinical status	serious or critical	stable
Type of problem	often multisystem	primarily respiratory
Respiratory status	insufficiency or failure	stable or insufficiency
Haemodynamic status	labile	stable
Ventilation	usually mechanical	usually spontaneous breathing
Intubation/tracheostomy	usually yes	usually no

Patho-physiological effects of Bronchoscopy

- *Increase in airway resistance (R_{aw})*
- *Decrease in lung compliance*
- *Effects on gas exchange*
- *Cardiovascular effects*

Practical considerations & precautions

- *Sedation and pain control*
- *Muscle relaxation*
- *Coagulation status*
- *Ventilatory management*

Size of bronchoscope

Table 2. Tracheal size, recommended ETT size and estimated increase in airway resistance (R)

Age group	Average tracheal size (AP/transverse diameter) ¹ mm	ETT size (diameter) mm	Bronchoscope diameter mm
Preterm newborn	~2.5–3.5	2.0–3.0	2.2
0–24 months (term)	5.3±1.0/6.4±1.2	3.5–4.5	2.2 2.8
2–4 years	7.4±0.8/8.1±0.7	4.5–5.5	2.8 3.8
4–8 years	8.0±0.6 to 9.2±1.1/ 9.0±0.9 to 9.3±0.8	5.5–6.5	2.8 3.8 4.9
8–18 years ³	10.5±0.5 to 13.7±1.7/ 10.7±0.6 to 14.0±1.2	6.5–8.0	2.8 3.8 4.9 5.5

Take home messages....

- Flexible bronchoscopy makes an important contribution to patient management in PICU & NICU
- Bronchoscopist must be aware of the patho-physiological changes in ventilated children
- Proper sized equipment is necessary

It is an important tool for a pulmonologist to reach to a diagnosis: may help to rule in or rule out a diagnosis

Acknowledgements

NICU Consultants

Fellows, Staff & Bronchoscopy technicians

Specialty Services

Respiratory Services

- Pediatric/Neonatal Flexible Bronchoscopy
- Flexible bronchoscopic foreign body extraction
- Spirometry, Diffusion, Lung Volumes
- Impulse Oscillometry
- Sweat Chloride
- Video-fluoroscopic evaluation of swallow
- GER scans

Allergy Services

- Skin Prick Testing
- Oral Food Challenges
- Drug Challenges

Sleep Services

- Pediatric Cardiorespiratory Sleep Study
- Pediatric Polysomnography
- NIV Titration Studies
- Multiple Sleep Latency Testing (MSLT)



BLK SuperSpecialty Hospital

- Pusa Road New Delhi 05
- Timings: Mon to Sat: 10 am-12 noon

Max Patparganj

- Timings: Monday & Thursday: 2-4 pm

Children's Chest Clinic

- 112-A, FF, Rishabh Tower, Karkarduma Community Center, Delhi-92
- Timings:
Mon to Friday 5.30-7.30 pm
Saturday: 4-6 pm

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