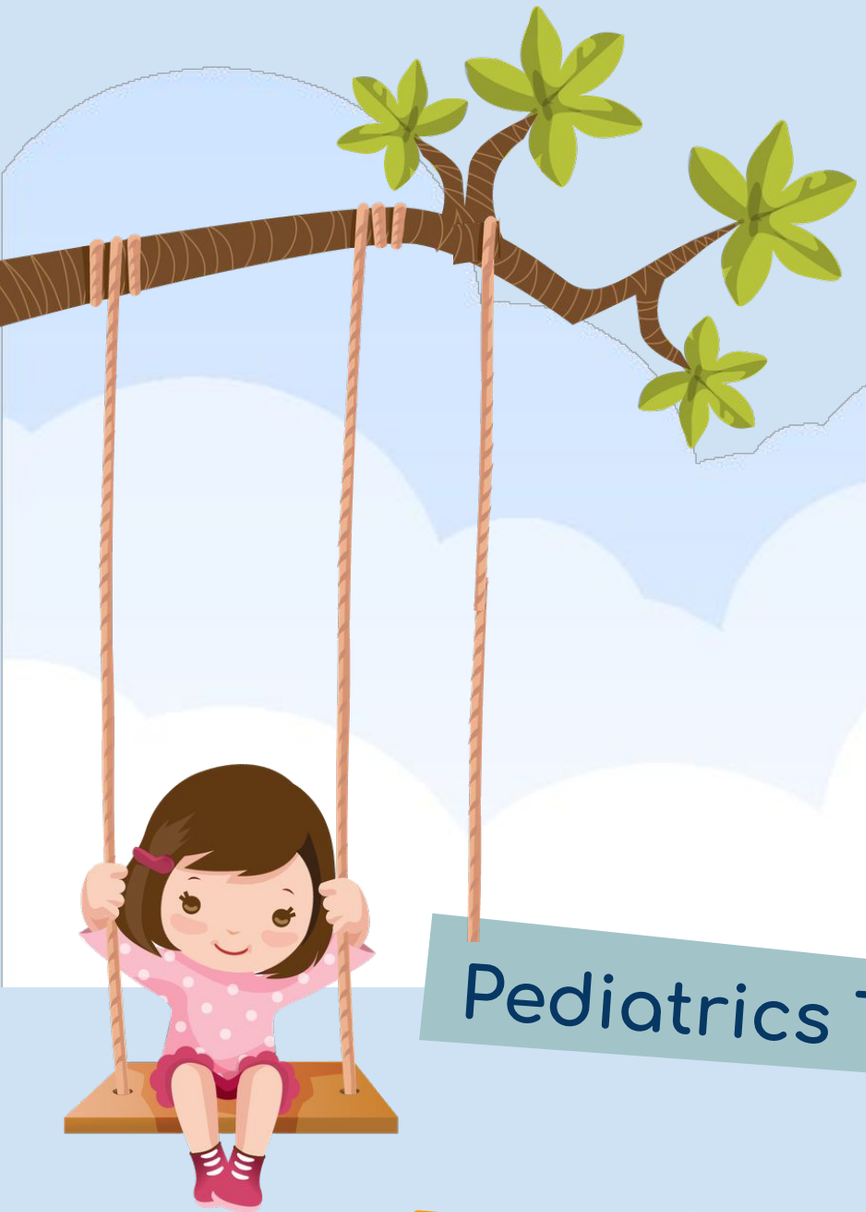

Pediatrics TeamWork 437

Respiratory Infections

Done by:

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Team Leader:

Aseel Badukhon

Notes | Previous Notes | Book | Important!

Overview

Respiratory tract infection in children

- To know how common this problem in pediatric medicine.
- How to differentiate between upper respiratory tract infection and lower respiratory tract infection.
- To know epiglottitis in details (History, physical examination, etiology, differential diagnosis, management).
- To know the pneumonia (bacterial vs viral)

MANAGEMENT OF COMMUNITY ACQUIRED PNEUMONIA IN CHILDREN

- Clinical features (How do children with CAP present?) community acquired pneumonia
- Etiology - Causes of CAP (virus, bacterial, atypical organism) does the etiology alter by age.
- Investigations.
- Severity assessment
- Managements
- Complications of CAP pneumonia (pneumatocele necrotizing pneumonia)

Pulmonary TB

- Local Epidemiology vs. inherited epidemiology
- Diagnosis, Intervention, managements,
- How to approach children with PPD (children and family)

Introduction

- Children have about 6 respiratory infection per year (normal)
- They are the the greatest of all causes of medical morbidity in pediatrics.
- Majority of acute respiratory infections are URTI but infection of lower respiratory tract are sufficiently frequent to pose almost daily problems for clinician caring for children
- Large number of different microorganisms are capable of infecting the lower respiratory tract produces several respiratory syndromes and illnesses.

Etiology of URTIs

- **Viral**: Influenza, Parainfluenza,RSV,Rhinovirus,Entero, Corona, Measles, Varicella, Adeno, EBV,CMV, Herpes
- **Mycoplasma**: M. pneumoniae School age kids
- **Rickettsia**: Coxiella burnetii (Q fever)
- **Chlamydia**
- **Bacterial**: staph, H flu Pneumococcus
- **Fungi**: Candida, Histoplasma, Aspergillus
- **Parasites**: Pneumocystis carinii, Toxoplasmosis

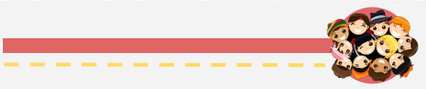
- Staph. A is Very bad in children less than a year, it destroys all the lung
- H. Flu not seen a lot after vaccines (atypical infection)
- Pneumococcus is the most common cause of pneumonia in all age groups
- Fungi & parasites are common in immunocompromised children

The doctor went through them

Table 13.2. Common causes of upper airway obstruction in children.

Anatomic	
Altered level of consciousness (airway muscle laxity)	Secondary to anesthesia and ICU
Postextubation airway obstruction	
Tonsillar hypertrophy	
Subglottic stenosis (acquired or congenital)	
Macroglossia	Hypothyroidism & mucopolysaccharides
Vocal cord paralysis	Any lesions on the vocal cords & post aggressive intubation
External or internal compression	
Tumor	
Hemangioma	
Hematoma	
Cyst	
Papilloma	
Vascular rings and slings	
Infectious	
Laryngotracheobronchitis (croup)	
Peritonsillar abscess	
Retropharyngeal abscess	
Bacterial tracheitis	
Supraglottitis (epiglottitis)	
Infectious mononucleosis	
Miscellaneous	
Postextubation airway obstruction	
Angioedema	
Foreign body aspiration	
Airway trauma	

Upper airway obstruction illness



Causes

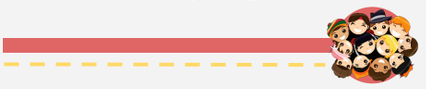
Non-infectious

- Foreign body
- Trauma
- Angioneurotic edema
- Hypocalcemic tetany
- Caustic burns

Infectious

- Epiglottis
- -Laryngotracheobronchitis (Croup)
- Bacterial tracheitis
- Diphtheria
- Retropharyngeal abscess
- Peritonsillar abscess

Acute Epiglottitis



- Life- threatening condition characterized by upper airway inflammation and obstruction.
- Infection of epiglottis and supraglottic structures
- High risk of death (7%)
- Most common in male (ration of 2.5 to 1).
- may occur at any age.
- Age incidence 2-7 Y
- Vulnerable population include lower immunity
  - infants less than 12 months
  - elderly more than 85 years old
- **Caused by almost always H.Influenzae type B(HIB) 90%**
- No seasonal predilection in incidence of epiglottitis (Croup: more in fall and winter)
- Risk factors:
  - Absence of immunization against HIB
  - Immunocompromised state
  - Smoking

You can see it now a days in pt who didn't take vaccine

Pathology

Life threatening

Direct invasion by HIB

↓

Cellulitis with marked edema of the epiglottis, aryepiglottic folds, ventricular band and arytenoid.

↓

Edema increase the epiglottis curls posteriorly and inferiorly

↓

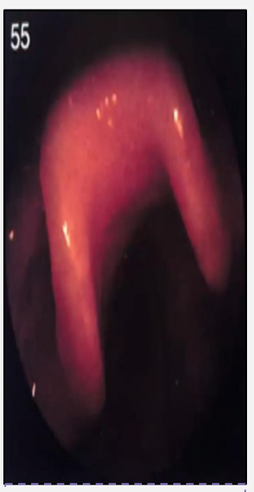
Airway obstruction

(Inspiration tend to draw the inflamed supraglottic ring into the laryngeal inlet)

Clinical features

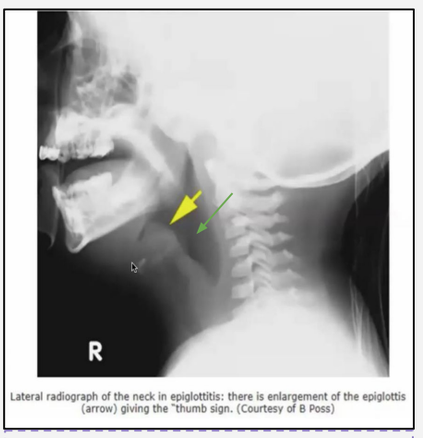
- Sore throat, followed by Odynophagia accompanied by drooling, retching and difficulty breathing
- Voice is not hoarse but speech is muffled
- Cough is not croupy
- Stridor
- Marked Fever (38.8-40C)
- Child assuming posture that maximize the increase in diameter of the obstructed airway/ Sitting & leaning forward with hyperextension of the neck and protrusion of the chin)
- Lateral Neck: Thumb sign (in OSCE) this atypical the x-ray should not be done

If you see a child like this in the ER it is Epiglottis until proven otherwise



Normal

Inflamed epiglottis, inlet is almost obstructed



Lateral radiograph of the neck in epiglottitis: there is enlargement of the epiglottis (arrow) giving the "thumb sign. (Courtesy of B Poss)

- **Thumb sign imp**
- X-ray is not done routinely, only when the case is atypical
- green arrow: air is not going down

Treatment

No investigation is done

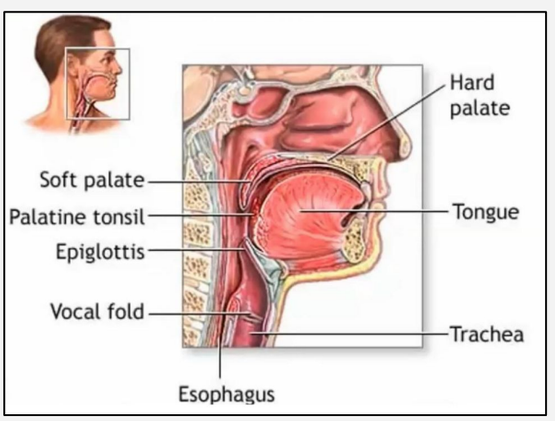
- **Avoid stimulation of the child.** This includes radiographs, drawing bloods, starting IV until secure airway established don't do x-ray

Stabilization first then intubation

- Emergency Intubation: Elective* nasopharyngeal** intubation (ETT 0.5mm smaller than that required is recommended)
- I.V Cefuroxime or cefotaxime for 7 days Second or third generation cephalosporins
- **NO** steroid
- **Criteria for extubation:**
  - Afebrile
  - Swallowing comfortable

*** B.C emergency crush the odontoid fold**

**** Not oropharyngeal B.C its uncuffed so the child will remove it**



CROUP

- Age: 6 months - 3 years
- More in fall winter and spring
- URI (Rhinorrhea, **Mild to moderate fever**)
- **Progress to inspiratory stridor, hoarseness and croupy cough**
- Rib cage and abdominal asynchrony occurs as the condition deteriorates RED FLAG this is a sign that he will have respiratory failure soon
- Most children have mild disease
- Last 7-14 days
- Among children admitted with croup less than 1% require intubation
- Lateral neck X-ray: Narrowing of subglottic area OSCE

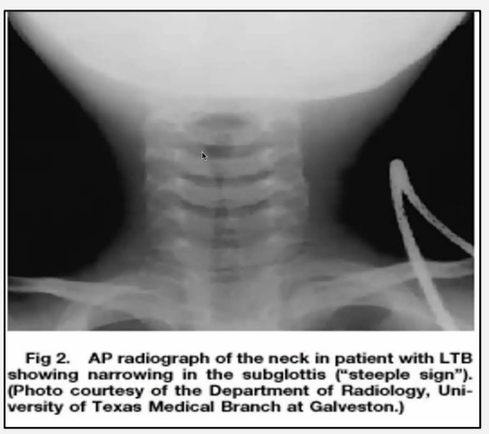


Fig 2. AP radiograph of the neck in patient with LTB showing narrowing in the subglottis ("steeple sign"). (Photo courtesy of the Department of Radiology, University of Texas Medical Branch at Galveston.)

Steeple or Rat tail sign, X-ray is not usually done it's a clinical diagnosis but know it for the exam
Q: 6 months old child come with respiratory stridor and low grade fever this is his x-ray

Etiology

- Parainfluenza most common
  - Parainfluenza 1 (most common)
  - Parainfluenza 2 (less frequent)
  - Parainfluenza 3 (less common)
- Influenza
- RSV
- Adeno, rhino, entero,herpes
- M Pneumoniae if other family member have it

Treatment

- Moist air
- Oxygen
- IV fluid
- **Steroid therapy:** IM,PO, Inhalation (suppression of the local inflammatory reaction, shrinking of lymphoid swelling and reduction in capillary permeability) Mainstay of treatment IM: in the thigh
  - 0.6mg/kg IM
- Aerosols: Recemic epi.: increase the airway diameter within 30 mints, however the effect is short lived lasting for 2 hours Beware or rebound phenomenon (in two hours) observe for 2 hrs before discharge

Imp. For MCQs and OSCE

Know how to differentiate between them

Already took them in ENT, you're expected to know them

TABLE 13.3. Infectious causes of upper airway obstruction.

	Croup	Epiglottitis	Bacterial tracheitis	Retropharyngeal abscess
Onset	Gradual Viral prodrome 1–7 days	Rapid onset 6–12 hr	Viral prodrome followed by rapid deterioration	Viral prodrome followed by rapid deterioration
Typical age at onset	6 months to 4 years	2–8 years	6 months to 8 years	<5 years
Seasonal occurrence	Late fall to winter	Throughout the year	Fall to winter	Throughout the year
Causative agents	Parainfluenza, respiratory syncytial virus, influenza A	*Haemophilus influenzae* type b (classically), *Streptococcus pneumoniae*, GABHS	*Staphylococcus aureus* (classically), GABHS, *Streptococcus pneumoniae*	Anaerobic bacteria, GABHS, *Staphylococcus aureus*
Pathology	Subglottic edema	Inflammatory edema of supraglottis	Thick, mucopurulent, membranou stracheal secretions	Abscess formation in the deep cervical fascia
Fever	Low-grade	High fever	High fever	High fever
Cough	"Barking" or "seal-like"	None	Usually absent	Usually absent
Sore throat	None	Severe	None	Severe
Drooling	None	Frequent	None	Frequent
Posture	Any position	Sitting forward,mouth open, neck extended ("tripod position")	Any position	Sitting forward, mouth open, neck extended ("tripod position")
Voice	Normal or hoarse	Muffled	Normal or hoarse	Muffled
Appearance	Nontoxic	Toxic	Toxic	Toxic

Note: GABHS, group A β-hemolytic *Streptococcus*.

Signs and Symptoms of MERS

- Fever > 38C (100.4F)
- Cough
- Shortness of breath
- Malaise
- Vomiting
- Diarrhea
- Pneumonia
- Incubation period about 5.2 days but can range up to 14 days
- Symptoms range from mild - severe
- Mean age: 56

PNEUMONIA

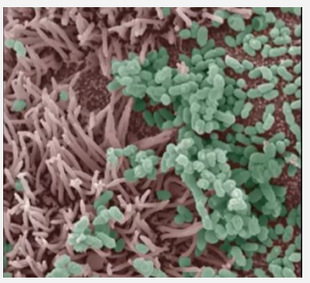
Factor relating to the etiology:

Host normal or compromised | Age preterm babies | Season viral in the winter, bacterial in the summer | Environment: animate (human and animals) and inanimate

For your information

Innate immunity in the lung is truly amazing. The lung has ~100 square meters of surface area (roughly the size of a tennis court) and is directly exposed to the outside environment with every breath we take. Despite this, the lower airway is normally sterile. There are many levels of innate immunity that keep the lung free of pathogens, including

- filtering in the upper airways
- mucociliary clearance **Causes primary ciliary dyskinesia**
- antimicrobial factors



Etiology

Bacterial	S. pneumonia, H flu, Staph, GAS, TB
Viral	RSV, parainfl (1,2,3), Inf, adeno, rhino especially type C, entero
Immunocompromised	Broader spectrum of etiological agents: fungi, gram negative bacilli, pneumocystis carinii. anaerobes, CMV Very strange organisms

Most Common Causes of Pneumonia in Immunocompetent and Immunocompromised Children over 1 month of Age

	Immunocompetent	Immunocompromised
Bacterial	• Streptococcus pneumonia • Haemophilus influenzae • Staphylococcus aureus • Group A Streprococci • Bordetella pertussis • Moraxella catarrhalis • Yersinia pestis • Pasteurella multocida • Brucella spp. • Francisella tularensis • Neisseria meningitidis • Salmonella spp.	• Pseudomonas spp. • Enterobacteriaceae • Legionella pneumophilia • Nocardia spp. • Rhodococcus equi • Actinomyces spp. • Anaerobic bacteria • Enterococcus spp.
Bacteria- like agents	• Mycoplasma pneumonia • Chlamydia pneumonia • Chlamydia trachomatis • Chlamydia psittaci • Coxiella burnetii	-

Bronchiolitis

VIRAL PNEUMONIA

Viral pneumonia = Bronchiolitis

Most common cause of LRTI, RSV, parainfl (1,2,3), inf, adeno, rhino, entero
Know RSV Bronchiolitis from A-Z it's very important

Treatment:

- Difficult to distinguish from bacterial pneumonia.
- Oxygenation and ventilator assistance in severe cases.

Clinical case

- January... ahmed 1 months...
- An older brother with an upper respiratory tract infection
- 3 days of rhinorrhoea and cough accompanied by low grade fever.
- Admitted to the Emergency Department for an episode of apnea with mild respiratory distress with retractions and reduced oral intake of fluid (<50%) need an admission in the last 12 hrs.

Classical case of bronchiolitis

Clinical definition

- The diagnosis of bronchiolitis is a clinical one based on typical history and findings on physical examination.
- Clinicians in different countries use different criteria to diagnose acute bronchiolitis.

The definition

- A consensus guidelines panel reported a 90% consensus on the definition of bronchiolitis as a seasonal viral illness characterized by **fever**, **nasal discharge** and **dry**, **wheezy cough**.
- On examination there are fine respiratory crackles and / on high pitched expiratory wheeze.

Bronchiolitis definition

American:

1. Age <24 months
2. Signs of viral infection + wheeze

European:

1. Age <12 months
2. Signs of viral infection + widespread crackles +/- wheeze

Overview

- Lower respiratory tract infection in children <24 months of age.
- It involves large and small airways
  - tracheobronchitis, bronchiolitis and alveolar and interstitial lung involvement (pneumonia).
- Etiology:
  - **Viral**: RSV Respiratory syncytial virus, the most common cause ; adenovirus (3,7,21) if these strains infect the child (or adult) they will destroy the lung (broncholitis obliterans) and he will need a transplant influenza; , parainfluenza (3); rhinovirus; mumps.
  - **Others**: Mycoplasma pneumoniae
- RSV season?
  - Ubiquitous throughout the world
  - Seasonal outbreaks
    - Temperate Northern hemisphere السعودية: November to April, peak January or February
    - Temperate Southern hemisphere استراليا : May to September, peak May, June or July
    - Tropical Climates: rainy season
    - In Saudi Arabia RSV appears in November and the seasonal peak occurs during Jan. & Feb.

C/P

- Usually in mid-winter
- Fever, rhinitis, cough, dyspnea poor feeding and vomiting.

P/E

- Tachypnea, chest retractions and wheezing
- Mild conj. and otitis media.

CXR

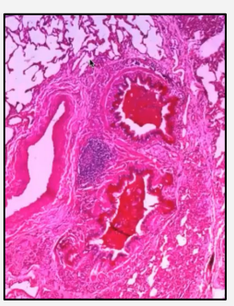
Non-specific, air trapping, atelectasis, and consolidation.

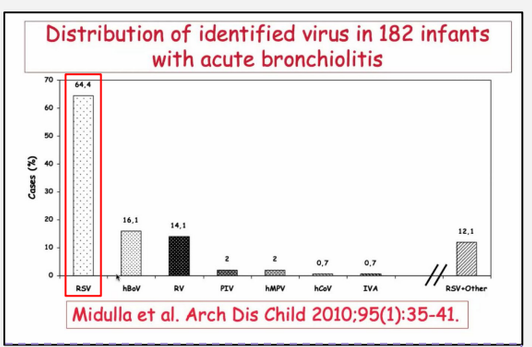
Clinical manifestations

- Exposure to children or adults with a respiratory viral infection.
- The initial symptoms are rhinorrhoea, cough and sometimes low grade fever. In 18% of cases the first clinical symptom could be episodes of apnoea one of indication of ICU admission.
- With the relief of fever the child manifests tachypnoea, retractions, **nasal flaring**, rales and hypoxemia
- Dehydration and metabolic acidosis.
- Syndrome of inappropriate secretion of antidiuretic hormone is common with severe respiratory distress that's why we use ⅔ of maintenance.
- It is a dynamic disease and its clinical characteristics can quickly change

Pathophysiology

- Upper -> lower airways
- Peribronchiolar mononuclear infiltration
- Epithelial necrosis
- Airway plugging
- Hyperinflation, atelectasis, V/Q mismatching
- Hypoxemia, work of breathing





RSV is number 1

Pathology:

Inflammation of small bronchi and bronchioles, sloughing of resp. ciliated epi.

↓

The bronchioles are plugged with fibrin and mucus

↓

bronchial obstruction

↓

increase work of breathing + V/Q mismatching

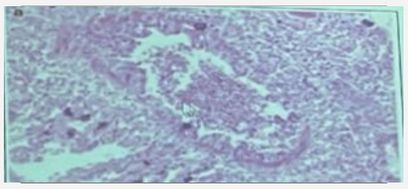
↓

hypoxemia

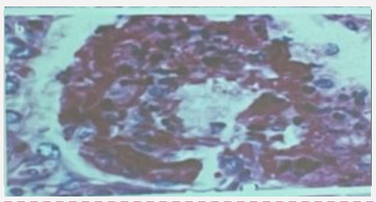
CO, retention is uncommon, but if present it may lead to assisted ventilation. It may lead to death

Pathogenesis know it for OSCE

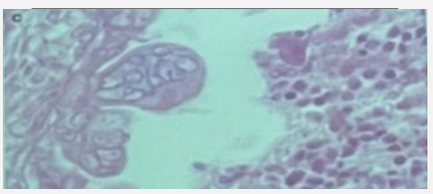
- Mechanical occlusion of terminal and respiratory bronchiole with mucus, fibrin, epithelial cells and inflammatory cells.
- Effects of the immunological reaction and of inflammatory mediators.



Medium-size airway intraluminal cell fragments composed of dead epithelium, inflammatory cells and amorphous debris

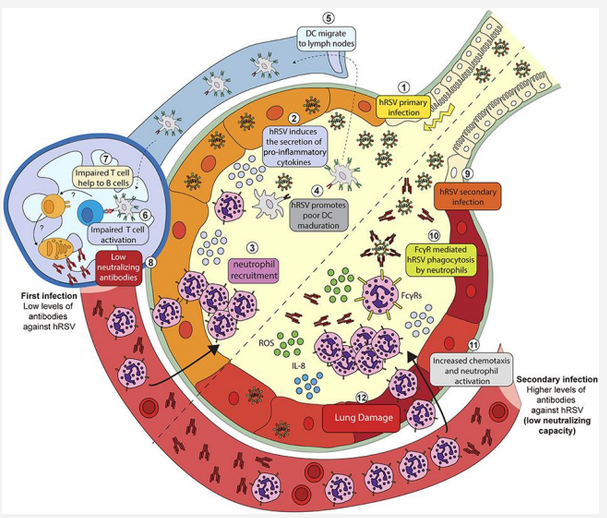


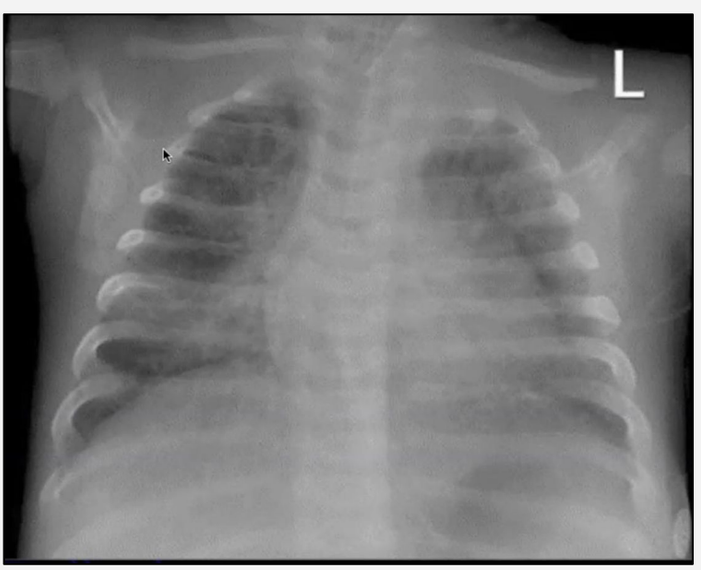
Intraluminal debris includes mucus, fibrin, epithelial cells and inflammatory cells.



Intrabronchiolar syncytia adjacent to intraluminal cellular debris

- Exposure to RSV first to an innate immunoregulatory cascade beginning with airway responses from cells constitutively present in airways. (Innate immune response)
- These cells release a variety of mediators, which recruit circulating monocytes, N cells and granulocytes that participate in the inflammatory response. (Adaptive immune response)





RSV bronchitis

Consolidation + atelectasis + hyperinflated lung (wide space between the ribs)

Air bronchogram

Complications

Atelectasis | Apnea because they get tired, they have small muscles and respiratory failure | Bronch obliterans (esp. with adeno 1, 2, 3, 7 , 21) | myocarditis

- **Majority:** Mild to moderate disease lasting 3-10 days, 2% require hospitalization; of those 3-7% develop respiratory failure and 1% die.
- **High risk:** Children with Cardiopulmonary disease (e.g. BPD bronchopulmonary dysplasia, CF, VSD), immune deficiency and neonates.

Risk factors for severity

- Prematurity
- Low birth weight
- Age less than 6-12 weeks
- Chronic pulmonary disease
- Hemodynamically significant cardiac disease CHF
- Immunodeficiency
- Neurologic disease
- Anatomical defects of the airways Laryngotracheomalacia,tracheoesophageal fistula

Environmental risk factors

- Older siblings primary infection to baby
- Concurrent birth siblings
- Native American heritage
- Passive smoke exposure
- Household crowding
- Child care attendance
- High altitude

Indications for hospitalization

- Prematurity
- Age <3 months
- Apnoea
- Severe underlying conditions
- Poor feeding (less than 50%) Not feeding because of respiratory distress
- Respiratory distress (RR > 60/min, nasal flaring, retractions) and cyanosis
- Oxygen saturation <92%

Phase of illness should be considered in the decision for timing of review or admission to hospital

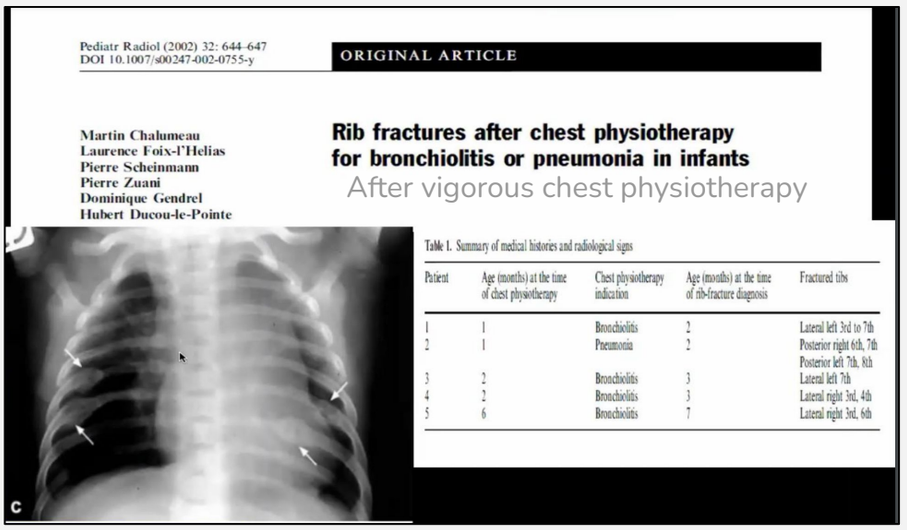
Treatment

- Admit: if sig respiratory distress, dehydration, underlying disease.
- 02 sat, CXR, NP aspirate. Oxygen, IPPV (apnea, fatigue) IV fluid
- BD: 30% respond to salbutamol.
- Steroids: not recommended.
- Ribvirin The only antiviral for RSV : for RSV, Inf A & B to high risk group, given nebulization 12-18 hr/day for 3-7 days
- Recemic epi: Not used anymore

- X-ray (if needed): Look for atelectasis or secondary infection
- Aspirate: to know if they have additional organisms (other than RSV)

Case report

Prophylaxis for high risk patients, (CHF, CF, Immunodeficiency, preterm babies)



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ORIGINAL ARTICLE

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Rib fractures after chest physiotherapy for bronchiolitis or pneumonia in infants

After vigorous chest physiotherapy

Table 1. Summary of medical histories and radiological signs

Patient	Age (months) at the time of chest physiotherapy	Chest physiotherapy indication	Age (months) at the time of rib-fracture diagnosis	Fractured ribs
1	1	Bronchiolitis	2	Lateral left 3rd to 7th
2	1	Pneumonia	2	Posterior right 6th, 7th Posterior left 7th, 8th
3	2	Bronchiolitis	3	Lateral left 7th
4	2	Bronchiolitis	3	Lateral right 3rd, 4th
5	6	Bronchiolitis	7	Lateral right 3rd, 6th

c

TABLE 1

Prophylaxis with Palivizumab or RSV-IG*— Categories of Risk

Infants and children less than two years of age with known CLD who required medical therapy for CLD within six months of the anticipated start of the RSV season.

Preterm infants born at 28 weeks of estimated gestational age or earlier may benefit from prophylaxis during their first RSV season, whenever that occurs during the first year of life, even if CLD is not present.

Preterm infants born at 29 to 32 weeks of estimated gestational age or earlier may benefit from prophylaxis during their first RSV season, whenever that occurs during the first six months of life, even if CLD is not present.

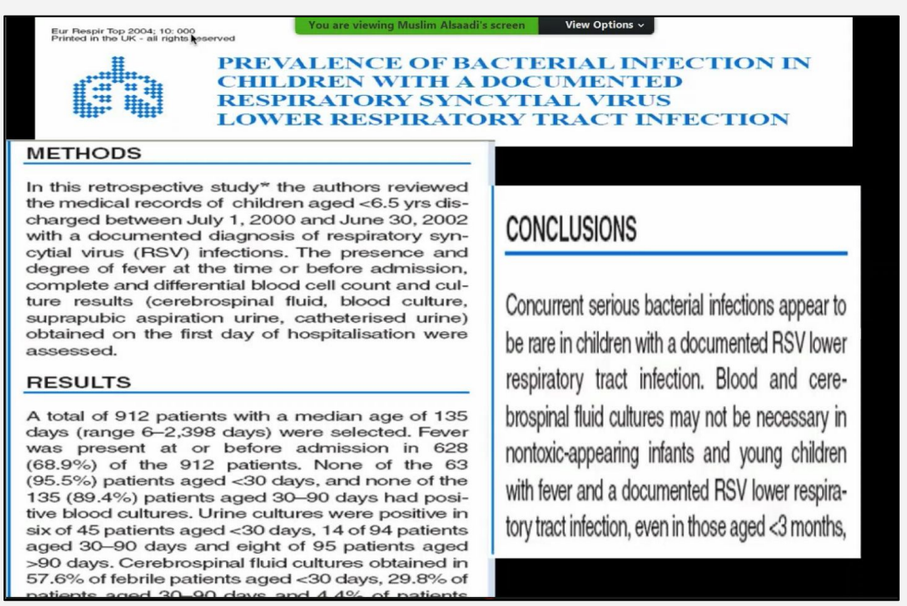
Infants born at 32 to 35 weeks of estimated gestational age must have two of the following risk factors to be candidates for prophylaxis: attendance at a child-care center, school-aged siblings, exposure to environmental pollution, abnormalities of the airways, or severe neuromuscular problems.

RSV-IG = intravenous RSV immune globulin (RespiGam); CLD = chronic lung disease; RSV = respiratory syncytial virus.

**—RSV-IG is contraindicated in children with cyanotic congenital*

Prevention of spread

- In hospital :
  - Meticulous infection control Isaacs D. Arch Dis Child 66,p226;1991
- At home:
  - Immunization? No vaccines available Only monoclonal antibodies
    - Formalin inactivated-> worse disease
    - Heat inactivated?
  - Passive immunity?
    - RSV-IG
    - Palivizimub For high risk, before winter, expensive (each dose 3000SR)



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PREVALENCE OF BACTERIAL INFECTION IN CHILDREN WITH A DOCUMENTED RESPIRATORY SYNCYTIAL VIRUS LOWER RESPIRATORY TRACT INFECTION

METHODS

In this retrospective study* the authors reviewed the medical records of children aged <6.5 yrs discharged between July 1, 2000 and June 30, 2002 with a documented diagnosis of respiratory syncytial virus (RSV) infections. The presence and degree of fever at the time or before admission, complete and differential blood cell count and culture results (cerebrospinal fluid, blood culture, suprapubic aspiration urine, catheterised urine) obtained on the first day of hospitalisation were assessed.

RESULTS

A total of 912 patients with a median age of 135 days (range 6–2,398 days) were selected. Fever was present at or before admission in 628 (68.9%) of the 912 patients. None of the 63 (95.5%) patients aged <30 days, and none of the 135 (89.4%) patients aged 30–90 days had positive blood cultures. Urine cultures were positive in six of 45 patients aged <30 days, 14 of 94 patients aged 30–90 days and eight of 95 patients aged >90 days. Cerebrospinal fluid cultures obtained in 57.6% of febrile patients aged <30 days, 29.8% of patients aged 30–90 days and 4.4% of patients

CONCLUSIONS

Concurrent serious bacterial infections appear to be rare in children with a documented RSV lower respiratory tract infection. Blood and cerebrospinal fluid cultures may not be necessary in nontoxic-appearing infants and young children with fever and a documented RSV lower respiratory tract infection, even in those aged <3 months,

Discharge criteria

- Oxygen saturation stably remains ›90-94%
- Absence of respiratory distress
- Adequately oral intake to prevent (>75% of usual intake) to prevent dehydration
- Adequate parental care and family education very imp

Mycoplasma pneumonia

- Peak incidence 5-15 year (account for 75% of pneumonia in this age group)
- C/P: Insidious onset of fever, headache and sore throat followed by dry cough that can last for months.
- **Other organs:** Meningoencephalitis, carditis, migratory arthralgia and arthritis, hemolytic anemia, +ve coomb's and cold agglutinins. All can be caused by mycoplasma infection
- Investigations:
  - CXR: Not specific, unilateral or bilateral disease, 20% has pleural effusion
  - CBC: WBC is usually normal WBCs normal or slightly high
  - Cold agglutinin > 1:64
  - Serology: 4 fold increase in CFT
- **Treatment:** Erythromycin, may not alter the duration or sequela (may decrease the duration of cough).
  Treatment: macrolides for 10 days

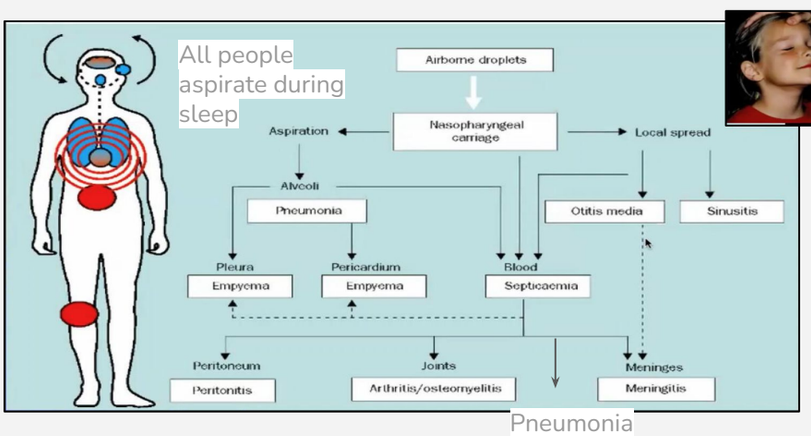
Bacterial pneumonia

Etiology

Very imp (even for OSCE). For antibiotics choice

- **Neonatal period** 1 month: GBS, listeria monocytogenes and gram -ve bacilli
- **After neonatal period:** S pneumoniae, H. flu type B, staph. Aureus, GAS.
- Mycoplasma is quite common **>5y.**
- **After age of 4 - 5 years:** S. pneumoniae and mycoplasma responsible for the majority of cases.

Bacterial adhesion and invasion:
- Streptococcus pneumoniae



Pneumonia

The doctor went through it

Pathology

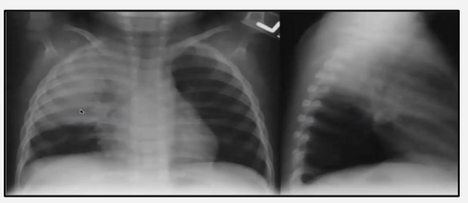
1. Normally the resp. tract is sterile below the vocal cords.
2. Pneumonia result from asp. Of pathogen to lower resp. tract.
3. Concurrent viral infection aid this process (present in 30-50% of cases) esp. RSV, because of a lot of mucus measles and influenza.

C/P

- Fever
- Chills
- Cough
- chest and abdominal Pain
- Younger infants less specific symptom and signs they don't complain

Diagnosis

Right upper lobe



- CBC - dif, cold agglutinin **WBCs very high 30-40,000**
- CXR **Lobar/bronchopneumonia**
- Blood culture, sputum in older children **Blood culture 30% positive (septicemia)**

Treatment

1. Adequate oxygenation.
2. Depends on severity and age oral if mild, sever need admission + IV ABx: Ampi or amoxacillin (10-30% of H flu are resistance) cefuroxime 75- 100 mg/kg/day Augmentin if resistant to amoxicillin
3. Older child: Pen or macrolides =>erythro (clarythromycine or zithromax)

- Child with RUL pneumonia, he will need antibiotics for longer periods (14 days) because if he doesn't take them orally the infection will spread
- Killing an infection in the lung is difficult because it's difficult to penetrate
- if the child cannot take the ABx or not complaint you need to admit him

What are the indications for referral and admission to hospital?

- Significant tachycardia for level of fever (values to define tachycardia vary with age and with temperature
- Prolonged central capillary refill time >2 s
- Difficulty in breathing
- Intermittent apnea, grunting
- Not feeding
- Chronic conditions (eg, congenital heart disease, chronic lung disease of prematurity, chronic respiratory conditions leading to infection such as cystic fibrosis, bronchiectasis, immune deficiency).

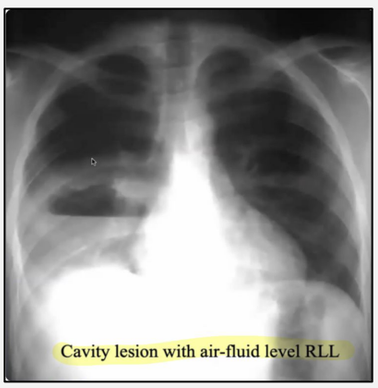
Features of severe disease in an older child include:

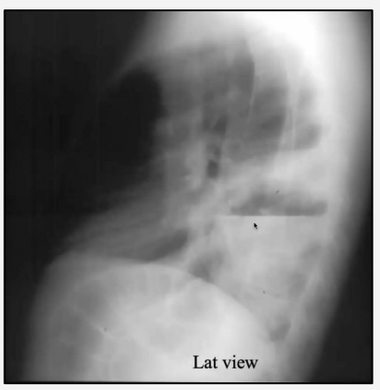
- Oxygen saturation <92%, cyanosis
- Respiratory rate >50 breaths/min
- Significant tachycardia for level of fever (values to define Tachycardia vary with age and with temperature
- Prolonged central capillary refill time >2 s
- Difficulty in breathing; grunting
- Signs of dehydration
- chronic conditions (eg, congenital heart disease, chronic lung disease of prematurity, chronic respiratory conditions leading to infection such as cystic fibrosis, bronchiectasis, immune deficiency).

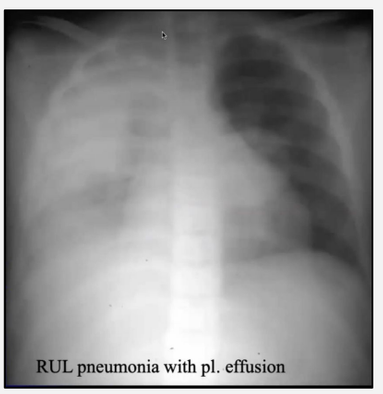
Complications

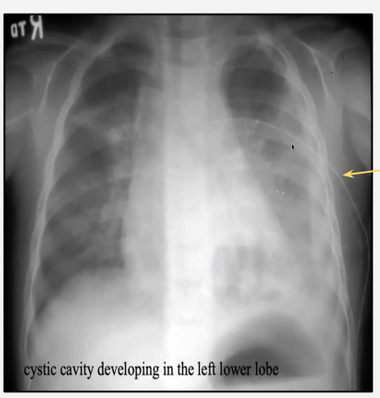
Parapneumonic effusion	- Esp. with S. aureus, H flu, S pneumoniae. Can be thin transudate or thick exudates (empyema) - Send pl fluid for cell count, glucose, protein, pH, LDH and culture. - Empyema WBC > 15,000/mm3, protein >3 g/dl, pH <7.2 **- Management**: ABX + drainage, recovery is slow, fever continue for 1 - 2 weeks. **- Pleural tap: Usually exudate** (revise light criteria please!!) **- Empyema: treatment for 6-8 weeks IV antibiotics**
Pneumatoceles	- Thin wall cavity - complicate 40% of staph pneumonia - unusual with other types - Usually asymptomatic unless rupture pneumothorax or pyothorax With sports - Resolve spontaneously within 3 months
Lung abscess	- Esp in aspiration pneumonia in mentally retarded children. - Esp. in the dependent portion of the lung. - Growth: mixed anaerobic bacteria - **Treatment**: Pen G, clinda or flagyl.
Septicemia and metastatic infection	- Children can present with symptoms and signs of pneumonia but also have features of systemic infection. - Children with septicemia and pneumonia are likely to require high dependency or intensive care management. - Metastatic infection can rarely occur as a result of the septicemia associated with pneumonia. - Osteomyelitis or septic arthritis should be considered, particularly with S aureus infections.

Hemolytic uraemic syndrome *Don't forget to read about HUS in general (this is a common peds topic!!!!!!)*	- S pneumoniae is a rare cause of haemolytic uraemic syndrome. - A recent case series found that, of 43 cases of pneumococcal haemolytic uremic syndrome, 35 presented with pneumonia and 23 presented with empyema. Although a rare complication. - in cases with pallor, profound anemia and anuria "renal shutdown", this should be considered.

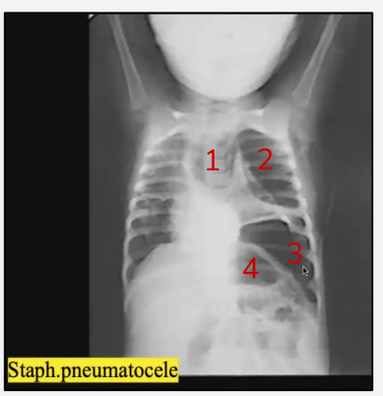








Chest tube



4 cysts

Right Effusion, air bronchogram

Eaten lung, takes time to recover (3,4 months

The predisposing factors to necrotizing pneumonia include

- Congenital cysts
- Sequestrations
- Bronchiectasis
- Neurological disorders
- Immunodeficiency

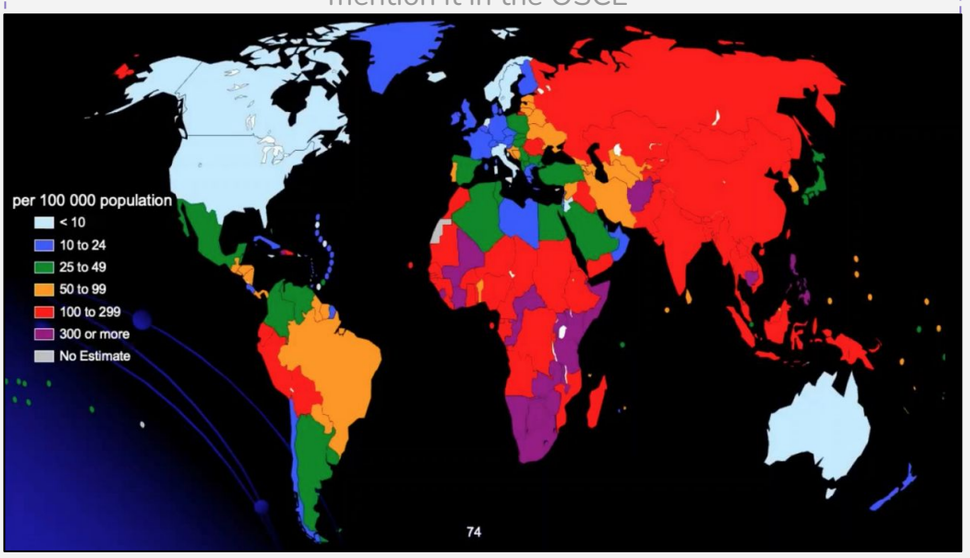
Certain serotypes of pneumococcal disease are more likely to lead to necrotizing pneumonia and abscess formation than others

- S aureus with Pantone Valentine leukocidin toxin can lead to severe lung necrosis with a high risk of mortality

TUBERCULOSIS

- The vast majority of childhood TB occur in children **< 4 y usually after exposure to an infected adults. (i.e. children infected with TB always have an adult with active TB in their environment).**
- Transmission is by droplet nuclei
- Its distribution is worldwide
- Multi-drug resistance has emerged as an important clinical problem direct observed therapy is needed
- Infection in patients with HIV infection initially lead to increases in the number of cases
- Adults with cavity harbor a great no. of bacilli for long time. They become non- infectious 2 weeks after therapy.
- Children with primary TB are rarely infectious, TB bacilli are sparse, but they are the long term reservoir of infection in the population.

TB always is a differential to pneumonia in a child you have to mention it in the OSCE



Etiology

- Mycobacterium tuberculosis & M. bovis Culture takes 4-6 w, sensitivity another 4 w.
- Radiometric methods, detection & sensitivity 4-10 d.
- By DNA proves detection within 2 hrs.

Problems in the diagnosis of TB

Active disease

M. tuberculosis is difficult to isolate: even with good microbiological facilities, the bacillus is recovered in only 50-60% of cases

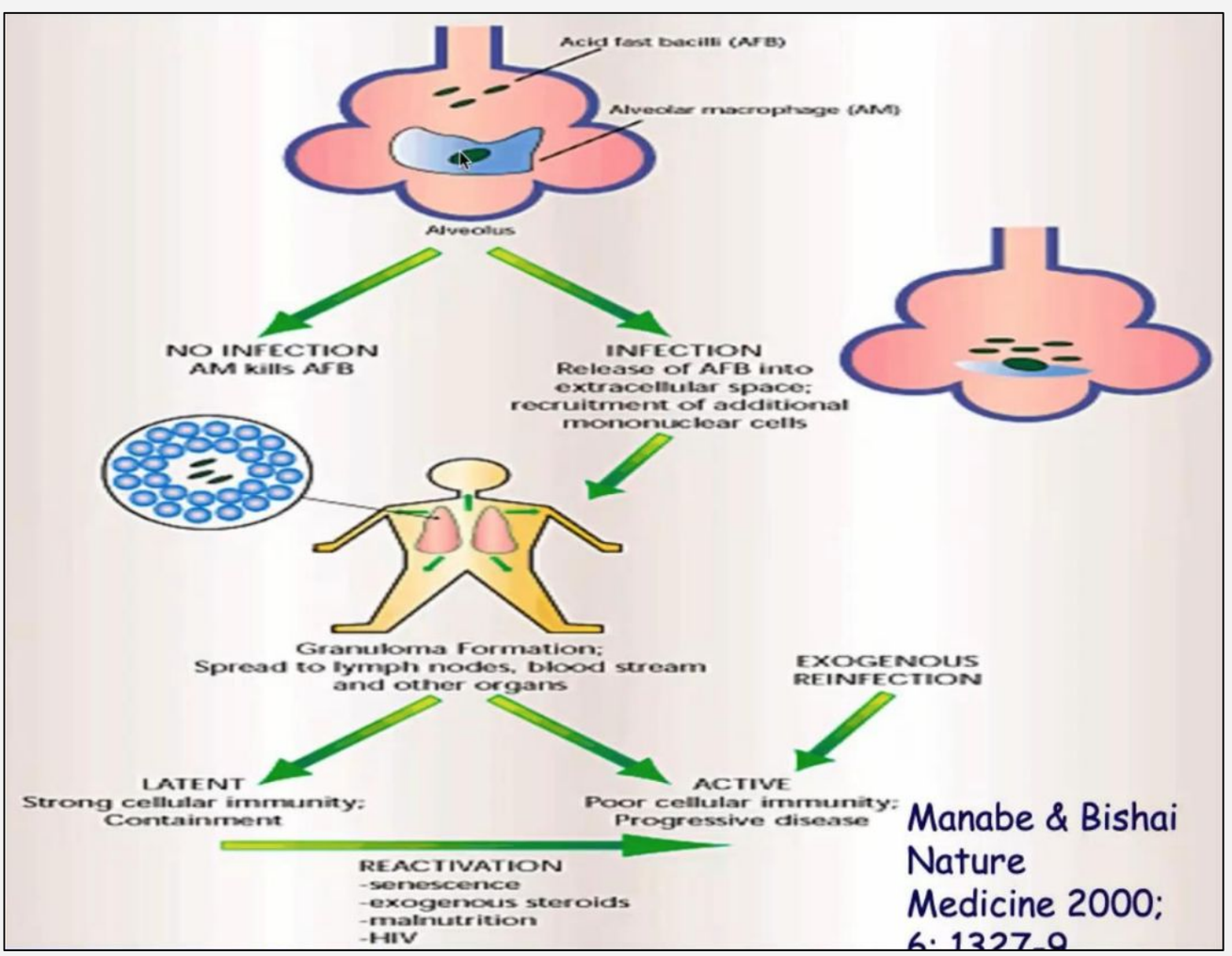
Latent infection

M. tuberculosis cannot be cultured from latently infected individuals: no gold standard

Clinical manifestations

- Insidious onset
- Weight loss
- Anorexia
- Fever
- Hepatosplenomegaly
- Headache almost always = meningitis
- Abdominal pain and tenderness usually = peritonitis
- Skin and eye tubercles (Tuberculous Uveitis)

PPD	- ve in 30%
CXR	May be characteristic



Smear examination diagnosis

- Strongly consider TB in patients with smears containing acid-fast bacilli (AFB)
- Results should be available within 24 hours of specimen collection
- Presumptive diagnosis of TB
- Sensitivity 5-10000 bacilli/ml speciment

Risk factors for TB in children

- Most children acquire infection from adults, thus the epidemiology of TB in children follows that of adults
- The distribution of TB in children is a marker of recent ongoing transmission in the community
- The diagnosis of TB is difficult in children, and children are usually not infectious
- This underlines the importance of contact tracing

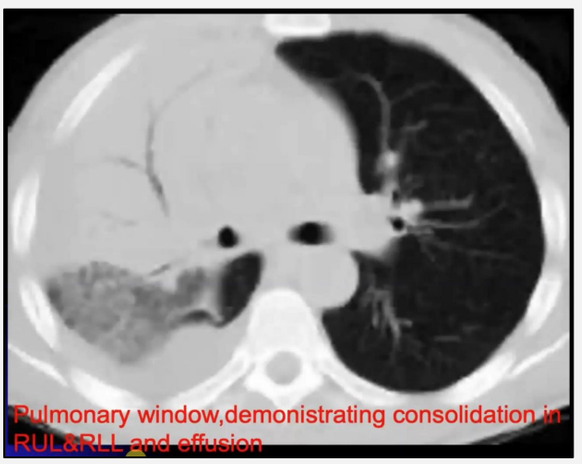
Bacteriologic confirmation

- Problematic in children
  - Pauci-bacillary disease, often poor yield
  - NB! BUT still do culture if possible
- **Which specimen to collect?**
  - Gastric aspirate (fasting, early morning)
    - Induced sputum / Assisted sputum
    - Broncho-alveolar lavage
    - String test
  - Fine needle aspiration or excision biopsy **Not incision biopsy**

Timetable of disease after primary infection in children	
3-8 weeks	- TST response - Hypersensitivity reactions - Erythema nodosum
1-3 months	- Hematogenous spread (meningitis and miliary in infants)
3-7 months	- Bronchial disease (< 5 years) - Pleural effusions (>5 years)
1-3 years	- Osteo-articular disease - Calcifications - Adult-type disease
>3 years	- Reactivation

BCG

- BCG vaccination is effective against severe forms of TB (meningitis and miliary TB)
- TB testing is not required before BCG vaccination in young children
- BCG can be used as a diagnostic test for TB (Koch phenomenon)
- Complications are rare and are not more common in TB patients (10371 / 1.5 billion BCG)
- BCG vaccination is not recommended in HIV-positive children



TB can't be differentiated from other pneumonia You have to rule it out

Complications

Most occur in the 1st year.

- **Miliary TB & TB meningitis:** not later than 3-6 mo. after initial infection.
- **Endobronchial TB:** within 9 mo.
- **Bones or joints:** within 1 y.
- **Renal:** 5-25 y.
- Secondary reactivation.

Suggested criteria for diagnosis of TB in children (Suspected/probable)

Any three of the following:

1. History of contact with an adult with suspected or proven
2. Symptoms and signs of TB such as persistent fever, cough, ,weight loss, failure to thrive, anorexia, respiratory distress, decreased breath sounds, rales on chest examination, lymphadenopathy, etc.
3. Positive Mantoux or PPD more than 10 mm of indurations Not redness
4. Chest radiographic Findings such as an infiltrate or Lymphadenopathy

Confirmed:

- A positive AFB smear or culture of gastric aspirate or other body Fluid OR
- Histological Findings consistent with TB

Treatment

First line

- NH
- Rifampin
- Pyrazinamide
- Ethambutol
- Streptomycin

You have to know the side effects of these medications like hepatitis, change in urine color and vision

Second line

- Para-aminosalicylic acid
- Ethionamide
- Caperomycin
- Kanamycin
- Cylcoserine

- INH + rifampin X 9 mos. Will cure 98%.
- Shorter courses (6 mos.) using more drugs; INH, rifampin and pyrazinamide for 2 mos. followed by 4 mos. of INH and rifampin.

The 9 mos. approach is the one recommended for children. The course is 9 months in children not 6 months

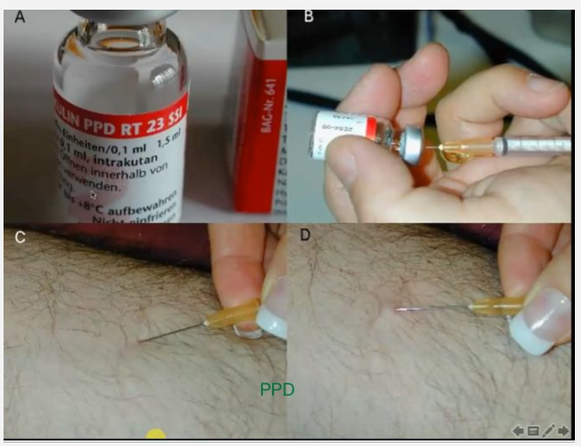
- **STEROIDS**
  - Use only with anti-TB med not alone indicated in:
    1. TB meningitis and increased ICP due to brainstem inflam and resultant HC.
    2. Endobronchial TB => collapse or air trapping.
    3. Miliary TB with pericarditis, pleural effusion or peritonitis.

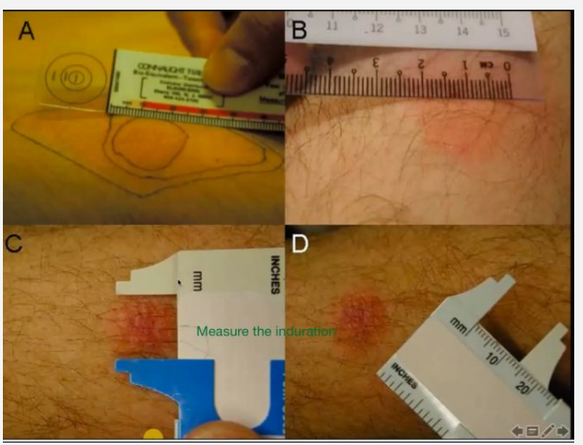
Treatment of latent TB infection

- Regimens
  - INH 6 months (since 1965)
  - RIF + PYR 2 months
  - RIF + INH 3 months (France and Britain)
  - (RIF 4 months)
  - (CDC trial with a long acting RIF: rifapentine)
- INH recommended worldwide
  - efficacy 93%
- A shorter and safer regimen would increase and physician acceptance and patient adherence

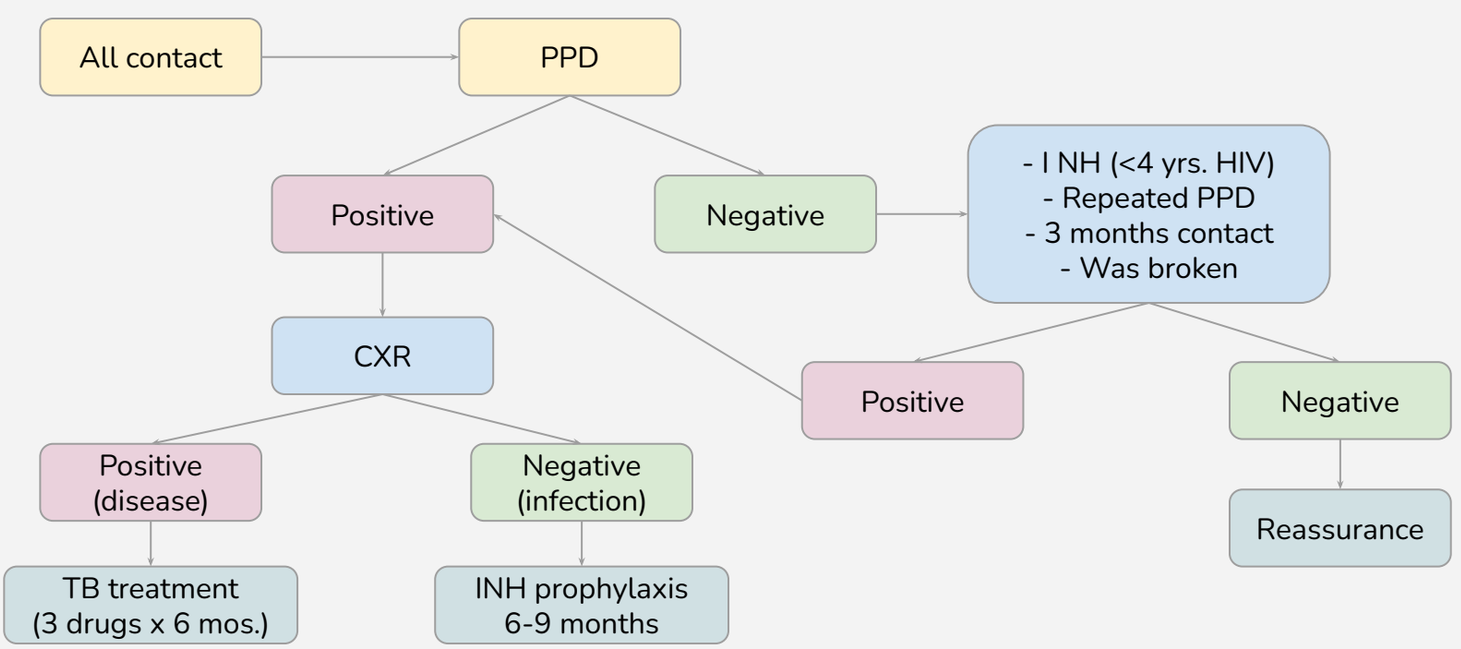
- Isoniazid is safe for latent TB infection

Adverse effects	Number (%)	Events per 1000 patients completing treatment
Hepatotoxicity	10 (0.3)	4
Rash	130 (3.4)	54
Itching (no rash)	117 (3.1)	48
Nausea, vomiting	131 (3.5)	54
Abdominal pain	176 (4.6)	73
Headache	338 (9)	140
parasthesias	177 (4.7)	73
Dizziness	17 (0.4)	7





Treatment of contact



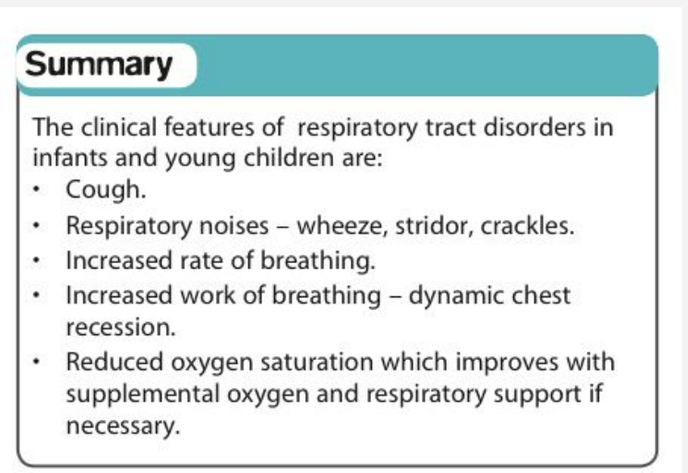
Conclusion

- TB remains a permanent threat
- Importance of contact tracing and treatment adherence
- Future perspectives
    - Improved efficacy of TB vaccination
    - Improved diagnosis of TB infection (ELISPOT)
    - Shorter treatment for latent TB infection (and TB): new drugs

Book!

- **Chest recession:** it is an important indicator of increased work of breathing. In children, when the work of breathing increases, the breathing pattern becomes abdominal (see-sawing of chest and abdomen) due to weak chest wall muscles and strong diaphragm. This is not seen in adults.
- **Impending respiratory failure is suggested by:**

- Cyanosis persistent grunting
- Reduced oxygen saturation despite oxygen therapy
- Rising pCO2 on blood gas
- Exhaustion, confusion, reduced conscious level



Summary

The clinical features of respiratory tract disorders in infants and young children are:

- Cough.
- Respiratory noises – wheeze, stridor, crackles.
- Increased rate of breathing.
- Increased work of breathing – dynamic chest recession.
- Reduced oxygen saturation which improves with supplemental oxygen and respiratory support if necessary.

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Upper respiratory tract infections

The common cold (coryza)	-The most common infection of childhood -Classical features: mucopurulent nasal discharge and nasal blockage. -The most common pathogens are viruses (rhinovirus, coronavirus, RSV -Self limiting (paracetamol/ ibuprofen for pain if any) -Cough may persist for up to 4 weeks after a common cold
Sore throat (pharyngitis & tonsillitis)	-Commonly is viral origin (adenovirus, enterovirus, rhinovirus) -They may develop also lymphadenopathy (tender) -Tonsillitis: inflamed tonsils often with purulent exudate and maybe caused by group A beta hemolytic streptococci and EBV -Marked constitutional symptoms are more common with bacterial infection (headache, apathy and abdominal pain) -Can we differentiate clinically between viral or bact infection? **NO** -Countries with high incidences of rheumatic fever or children with high risk of severe infection need antibiotics to eradicate beta hemolytic streptococci. Unable to swallow solids or liquids require hospital admissions for IV fluids -Amoxicillin is **BEST AVOIDED** as it may cause a widespread maculopapular rash if the tonsillitis is due to infectious mononucleosis **(IMPORTANT!!!)** **-Indications of tonsillectomy:** **1.**Recurrent tonsillitis (7 or more episodes of significant sore throat in the preceding 12 months or 5 or more episodes in each of the two previous years, or 3 or more episodes in each of the previous three years) **2.**Complications (e.g. peritonsillar abscess - quinsy. Sleep disordered breathing e.g. OSA)
Acute otitis media	-Children and infants are prone to AOM because their *Eustachian tubes are short, horizontal and function poorly* -It is most common at 6-12 months of age -Most children will have at least one episode -It causes earache and fever -Every child with a fever should have their tympanic membranes examined -**Otoscopic findings:** tympanic membrane is bright red and bulging with loss of the normal light reflection. There could acute perforation of eardrum with pus visible in the external canal -**Pathogens:** RSV, rhinovirus, pneumococcus, Haemophilus influenzae and Moraxella catarrhalis -**Complications:** mastoiditis and meningitis (refer to ENT lecture if you want to recall complications) -Antibiotics marginally shorten the duration of pain but no effect on preventing hearing loss -Pain should be treated with regular analgesia and may be required for up to a week -Recurrent otitis media can lead to otitis media with effusion (usually asymptomatic apart from possible decreased hearing, eardrum is dull and retracted often with visible fluid level. It may resolve spontaneously, but may cause conductive hearing loss and interfere with normal speech development). If hearing doesn't improve surgery may be considered with insertion of tympanostomy tubes.
Sinusitis	-It may occur with viral URTIs -There could be secondary bacterial infection, with pain and tenderness over the cheek from infection of the maxillary sinus -Frontal sinus doesn't develop until late childhood so frontal sinusitis is uncommon in first decade of life -Antibiotics (if bacterial) and analgesia are used for acute sinusitis

- **URTIs may cause:** difficulty in feeding in infants as their noses are blocked and this obstructs breathing, febrile seizures
- Hospital admission may be required if feeding and fluid intake is inadequate

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Upper airway obstruction

- Fixed partial airway obstruction leads to stridor (the most common cause is viral laryngotracheobronchitis “croup”). **Other causes of stridor are:**

Common causes

Viral laryngotracheobronchitis (‘croup’)

Foreign body

Rare causes

Laryngeal oedema (anaphylaxis and recurrent croup)

Inhalation of smoke and hot fumes in fires

Trauma to the throat

Retropharyngeal abscess

Bacterial tracheitis or epiglottitis

Severe lymph node swelling (malignancy, tuberculosis, infectious mononucleosis, measles)

Hypocalcaemia

Vocal cord dysfunction

Diphtheria (exceedingly rare)

-Acute stridor with atypical features or a poor response to treatment , you should consider other causes

-Abrupt onset of stridor without infection consider anaphylaxis or inhaled foreign body

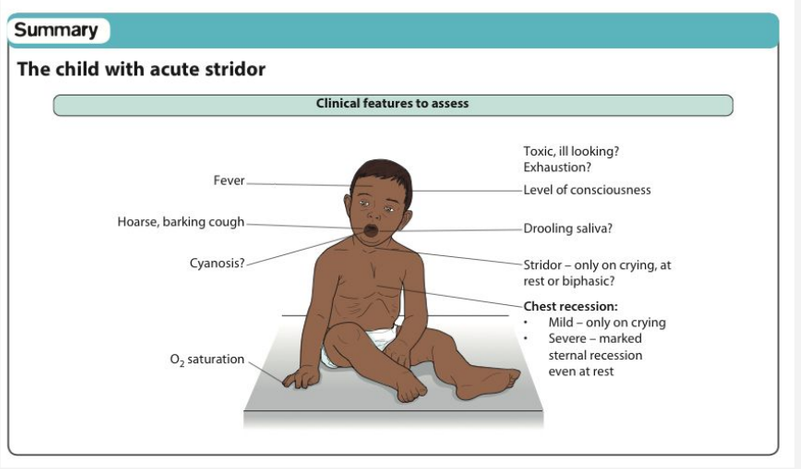
-Chronic stridor is usually due to a structural problem: intrinsic narrowing or collapse of the laryngotracheal airway, subglottic stenosis or external compression

-Laryngomalacia is common and is due to the soft immature cartilage of the upper larynx collapsing on inspiration causing airway obstruction. Usually it presents at about 4 weeks of age when imspiratory flow rates are sufficient to generate stridor, worse when infant is agitated, feeding or lying on their back. No treatment or investigations if the child is thriving. Resolve by 2 years

- Severity of upper airway obstruction is assessed clinically by: characteristics of the stridor (none, only on crying, at rest, or biphasic), the degree of accompanying chest retraction (none, only on crying, at rest)
- Central cyanosis, drooling of saliva from inability to swallow it or reduced level of consciousness suggest impending complete airway obstruction and the need for intubation
- Hypoxia is a late feature in upper airway obstruction unlike parenchymal lung disease
- Steroids in croup are used when there is a chest recession at rest.
- **Croup:** If the upper airway obstruction is severe, nebulized epinephrine with oxygen by face mask provides rapid but transient improvement (it is useful whilst waiting for corticosteroids to take effect)
- **Croup:** recurrent croup may be related to atopy
- Bacterial tracheitis can cause copious thick airway secretions and is typically caused by staph. aureus

Table 17.1 Clinical features of croup (viral laryngotracheitis) and bacterial tracheitis/epiglottitis

	Croup	Bacterial tracheitis and epiglottitis
Onset	Over days	Over hours
Preceding coryza	Yes	No
Cough	Severe, barking	Absent or slight
Able to drink	Yes	No
Drooling saliva	No	Yes
Appearance	Unwell	Toxic, very ill
Fever	<38.5°C	>38.5°C
Stridor	Harsh, rasping	Soft, whispering
Voice, cry	Hoarse	Muffled, reluctant to speak



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Lower respiratory tract infections

- Pulse oximetry should be performed on all children with suspected broncholitis. No other investigations are routinely recommended

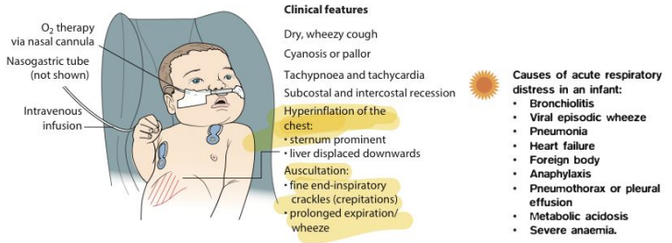

Figure 17.5 Clinical features of bronchiolitis in an infant requiring hospital care.

- RSV is highly infectious, and infection control measures, particularly good hand hygiene, cohort nursing, and gowns and gloves, have been shown to prevent cross- infection to other infants in hospital
- Prevention of broncholitis: a monoclonal antibody to RSV (palivizumab) given monthly by IM injection reduces the number of hospital admissions in high risk preterm infants
- At all ages Mycobacterium tuberculosis should be considered as cause of bacterial pneumonia
- The most sensitive clinical sign of pneumonia is raised respiratory rate so this MUST be measured in a febrile child
- The classic signs of consolidation are often absent in children
- Antibiotic choice depends on age and severy: newborn (broad spectrum IV antibiotics) older infants (oral amoxicillin with broader spectrum antibiotics such as conamoxicla reseved for compicated or unresponsive pneumonia) , children > 5 years either amoxicillin or an oral macrolide such as clarithromycin. If child has mild / moderate pneumonia we give oral unless he is vomiting
- Small sterile parapneumonic effusions occur in up to one-third of children with pneumonia and usually resolve once the pneumonia is treated
- Pneumonia: Those with a lobar collapse or persistent symptoms should have a repeat chest X-ray after 4–6 weeks to confirm resolution

Whooping cough (pertussis)

1# Catarrhal phase	Coryza for a week
2# Paroxysmal phase	Then they develop spasmodic cough followed by characteristic inspiratory whoop. Those spams are worse at night and may culminate in vomiting (tussive vomiting) . During paroxysm, the child goes red or blue in the face and mucus flow from the nose and mouth. The whoop may be absent in infant and apnea is common. Epistaxis and subconjunctival hemorrhage can occur due to vigorous coughing. This phase lasts for 3 months. **Infants and young children suffering severe spasms of cough or cyanotic attacks should be admitted to hospital and isolated from other children**
3# Convalescent phase	Decrease of symptoms but may persist for many months

Summary

Pertussis

- Caused by *Bordetella pertussis*.
- Paroxysmal cough followed by inspiratory whoop and vomiting; in infants, apnoea rather than whoop, which is potentially dangerous.
- Diagnosis is usually clinical. It is suggested by marked lymphocytosis on a blood film and confirmed by culture / PCR from a pernasal swab.

- Although macrolide antibiotics eradicate the organism, they decrease symptoms only if started during the catarrhal phase. Siblings, parents and school contacts are at risk and close contacts should receive macrolide prophylaxis. Unimmunized infant contacts should be vaccinated
- Reimmunization of mothers during pregnancy is recommended in the UK and a number of other countries as it reduces the risk of pertussis in the first few months of the infant's life, when it is most dangerous.