Review Article

Pediatric Education and Research
Volume 4 Number 2, May - August 2016
DOI: https://dx.doi.org/10.21088/per.2321.1644.4216.8

Approach to a Child with Recurrent Pneumonia

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Abstract

Pneumonia is commonest cause of under five mortality. Recurrent pneumonia occurs in approximately 10% cases of all pneumonias. Most common causes of recurrent pneumonia are: pulmonary tuberculosis, foreign body aspiration, misdiagnosed or inappropriately treated asthma, HIV, bronchiectasis, congenital heart diseases. Speed of radiographic resolutions depends on etiological organism causing difficulty in arriving at one particular cut off for defining persistent pneumonia. Early and accurate diagnosis is essential to ensure the optimal treatment and to minimise the risk of progressive or irreversible lung damage.

Keywords: Recurrent Pneumonia; Persistent Infiltrates; Children.

Introduction

Respiratory diseases belong to the most frequent and common disorders in clinical practice of every paediatrician. Recurrent viral infections are part of the growing up process of any child. It is a fact that children should suffer 7 to 8 upper respiratory infections per year until they are 5 years of age when their immune status reaches adult level[1]. Pneumonia is a major problem in children, especially those younger than 5 years, accounting for up to 5 million deaths each year in developing countries. Worldwide, 20% mortality among children aged less than 5 years is attributed to respiratory tract infections (predominantly pneumonia associated)[2]. While acute lower respiratory tract infections remain the most important cause of mortality and morbidity in under fives in the developing countries, recurrent and persistent pneumonias are not uncommon [3].

Recurrent respiratory infections in children pose a great challenge to the pediatrician where he has to exercise his clinical acumen and methodical approach for correct diagnosis and treatment. Recurrent pneumonia occurs in fewer than one tenth of all children hospitalized with pneumonia and constitute 7-9% of all cases of pneumonia with existing underlying illness in 84-90 % cases [4-6]. Firstly, one has to be sure that the recurrent infections are lower respiratory tract infections before the child is investigated for recurrent pneumonia. Secondly, the patient referred for recurrent or persistent pneumonia has clinical and radiographic features documented for these episodes [7].

Definitions

- *Recurrent pneumonia* is defined as two episodes of pneumonia in 1 year or three episodes over any time frame[8]. Conditions that are not included are: uncomplicated asthma with intermittent chest findings, presence of a persistent infiltrate, in the same location and without proven clearing of the radiograph in the interval between pneumonias.
- *Non resolving pneumonia/Persistent Pneumonia*

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is characterized by the persistence of symptoms and roentgenographic abnormalities for more than 1 month [8,9]. There are no clear cut guidelines for defining non-resolving or persistent pneumonia in children. Most acute pneumonias improve clinically and radiologically in 2-4 weeks.

Points of Interest before Making a Diagnosis

1. Make sure that these recurrences are lower respiratory infections and not acute upper respiratory tract infections.
2. Take history of previous events as many time "pneumonia" is the diagnosis conveyed to the parents for underlying bronchiolitis, bronchitis, asthma or persistent cough.
3. Bacterial pneumonias may appear to be recurrent if therapy given for underlying pathogen is inadequate / duration of treatment is inadequate or in presence of non-compliance of medication.
4. Symptoms of bronchial asthma and use of bronchodilators for relief of the same should be asked in detail. Bronchial asthma can initially be misdiagnosed as recurrent/persistent pneumonia, especially when it is not associated with wheezing [10].
5. The speed of radiographic resolution depends on the etiological agent as well [11-13].

- RSV/ parainfluenza ~ 2-3 weeks
- Adenovirus ~ 12 months
- Pneumococcal ~ 6-8 weeks
- Chlamydial ~ 1-3 months
- Mycoplasma ~ 2wks-2months
- Staphylococcal/ Legionella/ GNB ~ 3-6 months

ETIOLOGY

Patho-physiologically, recurrent and persistent pneumonia can be caused by singly or in combination by one of these three conditions Deficiencies in local pulmonary defenses

This includes defects and deficiencies at various levels [14].

- Bypassed nasal defenses in case of a child with tracheostomy
- Habitual mouth breathers
- Bypassed nasopharyngeal defences in cases of neurologic disorders with abnormal cough reflex
- Anatomical defects including vascular rings, polyps, tracheal web, tracheomalacia
- Aspirations (tracheoesophageal fistula, GERD, abnormal gag reflex)
- Mucocilliary clearance defects (immotile cilia syndrome, abnormal purulent mucus), abnormal airway secretions (cystic fibrosis, secrettory IgA deficiency)
- Obstruction to clearance (pulmonary secretions, cysts, fistulas, retained foreign body, bronchiectasis, extrinsic airway compression)

Deficiencies in Systemic Host Defenses

HIV and various primary immunodeficiencies. An underlying immunodeficiency is more likely when some of the following "warning" symptoms or signs occur [15,16]:

- Eight or more new ear infections (otitis media) within 12 months
- Two or more serious sinus infections within 12 months
- Two or more episodes of pneumonia within 12 months
- Two or more invasive infections in the history (meningitis, cellulitis, osteomyelitis, septicaemia)
- Failure of an infant to gain weight or grow normally ± chronic diarrhoea
- Recurrent deep skin or organ abscesses
- Persistent superficial candidiasis after age of 1 year
- Two or more months on antibiotics with little or no effect
- Need for intravenous antibiotics to clear infections
- Family history of primary immunodeficiency

Disorders that Modify Lung Defenses

Causes of Recurrent and Persistent Pneumonia [6,17- 23]

A. Congenital Malformations

Airways

- Cleft Palate
- Pierre Robin syndrome
- Tracheoesophageal fistulae
- Tracheomalacia

Lungs

- Pulmonary hypoplasia

- Pulmonary sequestration
- Congenital adenomatoid malformation of the lung
- Bronchogenic cyst

Cardiovascular

- Congenital heart disease, especially
- Left to Right shunts
- Vascular ring

B. Aspirations

- Gastro-esophageal reflux
- Swallowing abnormalities
- Foreign body
- Anomalies of the upper airways

C. Defects in the Clearance of Airways Secretions

- Cystic fibrosis
- Abnormalities of the ciliary structure of function
- Abnormal clearance secondary to infections, repair of congenital defects
- Airway compression (intrinsic/extrinsic) e.g., mediastinal tubercular lymphnodes

D. Disorders of Local/Systemic Immunity

Primary immune-deficiencies

- Brutons agammaglobulinemia
- Selective IgG subclass deficiencies
- CVID
- SCID
- Chronic granulomatous disease
- Hyper IgE syndrome (Job syndrome)
- Leukocyte adhesion defect

Acquired immune-deficiencies

- HIV Infection
- Immunosuppressive therapy
- Malnutrition

Non Infectious Causes of Persistent Lung Infiltrates (these conditions should be considered in a child with recurrent or persistent lung infiltrate, if infection seems unlikely).

- Asthma,
- Congenital anomalies like lung cysts & sequestration
- Pulmonary hemosiderosis
- Hyper-sensitivity pneumonitis
- Sarcoidosis
- Interstitial pneumonitis
- Alveolar proteinosis,
- Collagen vascular diseases
- Eosinophilic pneumonias

Causes of Recurrent or Persistent Cough

Asthma	Very common
Recurrent 'normal' infections	Very common
Prolonged infection (e.g. pertussis, mycoplasma, RSV)	Common
Cigarette smoking (passive/active)	Common
Habit or psychogenic cough	Common
Idiopathic Common Aspiration	Uncommon
Gastro-oesophageal reflux	Uncommon
Inco-ordinate swallowing	Uncommon
Intra-bronchial foreign body	Uncommon
Mediastinal or pulmonary tumours	Very rare
Suppurative lung disease	Very rare
Cystic fibrosis Post-infective (e.g. adenovirus, pertussis)	
Tuberculosis Ciliary abnormalities	
Congenital abnormalities of the respiratory tract	
Retained foreign body	
Immunodeficiency	

Approach to A Child with Recurrent /Persistent Pneumonia

3 steps approach

Step 1: careful history and clinical evaluation

Step 2: Localize the disease, establish the diagnosis of lower respiratory tract infection and Exclude common causes including TB, Foreign body, HIV and asthma

Step 3: Cause specific treatment In case of failure of diagnosis, refer to higher center for specialized investigations

History

Age of Onset

Onset soon after birth occurs in congenital malformations or hereditary disorders. Humoral immunity disorders manifest later in infancy.

Risk Factors for Lower Respiratory Infections in Children

Prematurity, parental smoking large family size, overcrowding, congenital abnormalities, immuno-deficiency should be inquired into.

Details of Episodes

Each episode merits detailed description with emphasis on onset, nature, duration of symptoms and documentation of signs of lower respiratory tract infections .All previous chest x-rays should be evaluated sequentially . Type and duration of antimicrobials used, response to treatment , need for hospitalization should be asked for.Any h/o wheeze, relation to feeds needs to be noted.

Past/Associated Complaints

Repeated infections at other sites give a clue towards probable immunodeficiency. Any history of choking episodes or paroxysmal cough while eating something point towards possible foreign body aspiration. If there is a tuberculosis contact, tuberculosis work up needs to be done before preceding onto any further investigations. Malabsorption symptoms ,salt craving and salty taste on kissing, fat soluble vit deficiencies and malnutrition favors diagnosis cystic fibrosis .

Environmental History

Exposure to sources of infection ,aero-allergens and passive smoking should be asked.

Perinatal History

History of prematurity with stormy neonatal course ,bronchopulmonary dysplasia or prolonged O2 exposure needs to be asked as these children are more susceptible to have recurrent chest infections.Any maternal infections or blood transfusions should be noted. Meconium ileus or delayed passage of meconium points toward cystic fibrosis.

Family History

Any history of allergic disorders, parental asthma, cystic fibrosis manifestations, recurrent infections in members should be asked for. High risk behavior in parents and history blood products use points towards possibility of acquired immunodeficiency

Physical Examination

Look for

- Significant weight loss, failure to thrive
- Digital clubbing, lymphadenopathy, absence of tonsils.
- Upper airway disease: enlarged tonsils and adenoids, prominent rhinitis, nasal polyps
- Unusually severe chest deformity (Harrison's sulcus, barrel chest)
- Fixed monophonic/ asymmetric wheeze
- Stridor
- Signs of cardiac or systemic disease/ dextrocardia

Investigations

- ⊙ X RAY Chest –PA as well as lateral view, as many areas of infection are often missed on PA view. Sequential x-rays of past events if available are helpful in reaching to diagnosis of recurrent pneumonia [24].
- ⊙ CT chest
- Suspected complications of bacterial pneumonia (eg. abscess)
- Exclude an underlying structural abnormality in recurrent or persistent pneumonia
- Investigate the immune-compromised child with a normal or equivocal x-ray
- Mediastinal compressive masses including suspected vascular rings
- ⊙ High Resolution Computed Tomography (HRCT) is used for evaluating all forms of bronchiectasis (including cystic fibrosis) and interstitial lung disease in children
- ⊙ Pulmonary function testing is done commonly

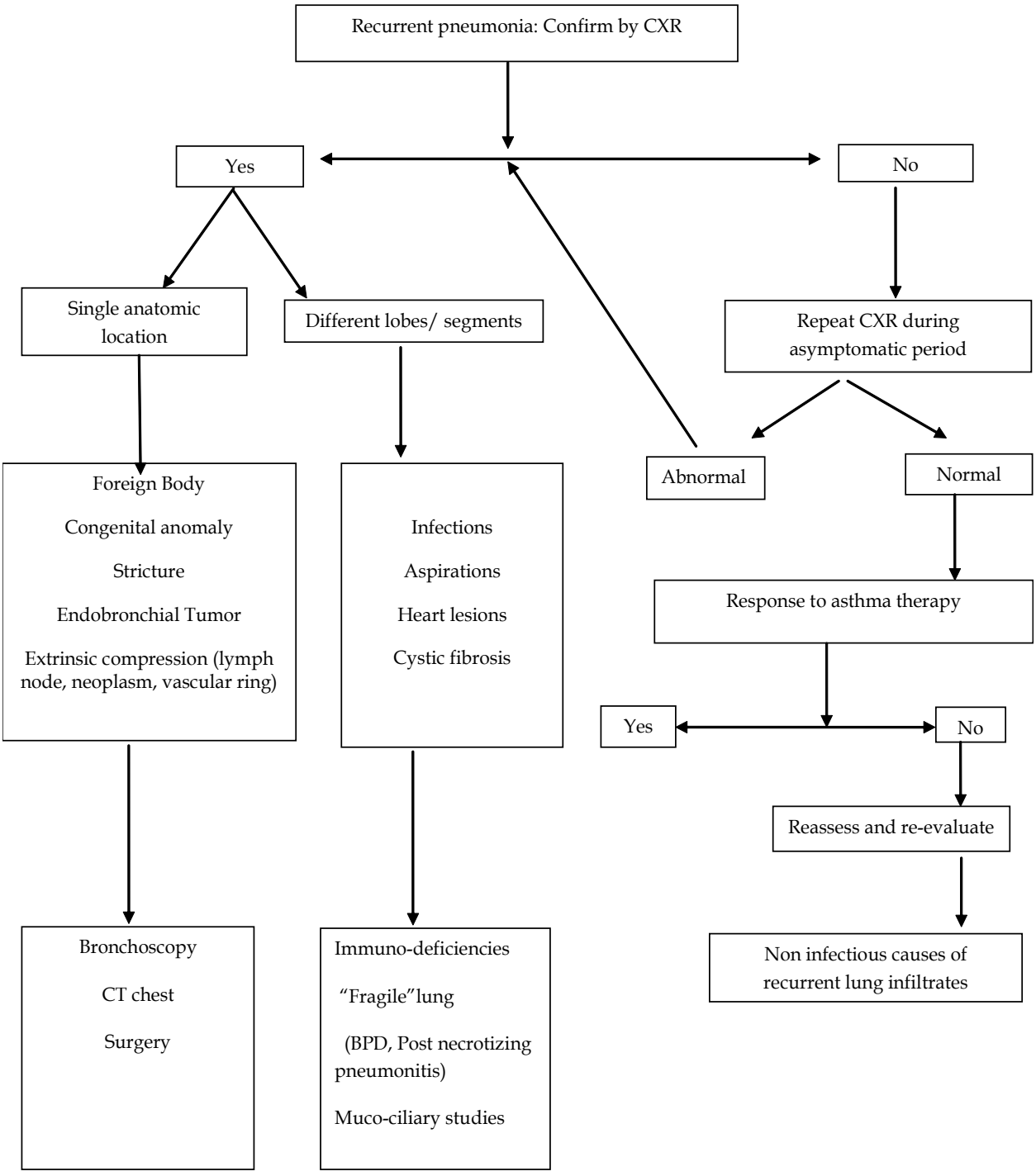

Fig. 1: Approach to a child with recurrent/persistent pneumonia

by spirometry (in more than 5 years of age) to evaluate airway hyper-reactivity

⊙ Bronchoscopy helps in finding

- Abnormal bronchial anatomy
- Suspected FB
- Broncho-alveolar lavage for etiological agent

⊙ GER scan with delayed films and esophageal pH

⊙ Milk technitium scan

⊙ For suspected Cystic fibrosis

- Sweat chloride
- Stool for fat globules
- Mutational analysis

⊙ Nasal mucosal scrapings for EM morphological studies

⊙ X-ray PNS for chronic sinusitis

Treatment

Treatment is directed towards the underlying cause once the diagnosis is made along with the supportive treatment.

Key Points of Clinical Interest

- There are many different causes of recurrent chest infections in children. The clinician has to distinguish between children with self-limiting or easily managed conditions, such as recurrent acute viral infections or asthma and those with more severe, often progressive, diseases
- It is important to understand the epidemiology of acute respiratory infections in children and the factors that influence the pattern of these common infections
- A chronic or recurrent cough productive of purulent sputum, or repeated episodes of pneumonia, suggest chronic suppurative lung disease and the possibility of bronchiectasis. These children require detailed and specialist assessment.
- The commonest causes of suppurative lung disease are cystic fibrosis, immune deficiencies, congenital lung and ciliary abnormalities, and lung damage caused by acute pneumonia. Other causes include an unsuspected foreign body or recurrent aspiration

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