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In the Name of God

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Signs and symptoms of pneumonia in children aged 1 month to five years, Booali Hospital, 2007-2008

Background: This survey was conducted to study the signs and symptoms of pneumonia in children aged 1 month to five years in Booali Hospital from 2007 to 2008.

Methods: In this descriptive-analytical cross-sectional study, 100 children with pneumonia aged 1 month to five years in Booali Hospital from 2007 to 2008, were evaluated.

Results: Among the children 91% had cough, 51% fever, 51% tachypnea, 36% dyspnea, 52% fatigue, 2% chest pain, 3% cyanosis, 55% wheezing, 18% chest retraction, 39% nasal retraction, 39% abnormal chest radiogram, and 48% had leukocytosis.

Conclusions: This study conclusively points out that the cough, fever, tachypnea, and wheezing are the most common signs and symptoms in children with pneumonia.

Introduction

Pneumonia and other lower respiratory tract infections are the leading cause of death worldwide. Other respiratory tract diseases such as croup (laryngotracheobronchitis), bronchiolitis, and bronchitis are beyond the scope of this article and are not discussed further. Approximately 150 million new cases of pneumonia occur annually among children younger than 5 years worldwide, accounting for approximately 10-20 million hospitalizations.[1] Although the diagnosis is usually made on the basis of radiographic findings in developed countries, the World Health Organization (WHO) has defined pneumonia solely on the basis of clinical findings obtained by visual inspection and timing of the respiratory rate.[2,3,4,5]

It is important for the physician to understand that the typical causes and presentations of pneumonia in infants and children are variable, depending upon the child's age and underlying medical condition. Accordingly, this study was conducted to study the signs and symptoms of pneumonia in children aged one month to five years in Booali Hospital from 2007 to 2008.

Review of Literatures

Pathophysiology

Pneumonia results from inflammation of the alveolar space and may compromise air exchange. While often complicating other lower respiratory infections such as bronchiolitis or laryngotracheobronchitis, pneumonia may also occur via hematogenous spread or aspiration. Most commonly, this inflammation is the result of invasion by bacteria, viruses, or fungi, but it can occur as a result of chemical injury or may follow direct lung injury (eg, near drowning).

Four stages of lobar pneumonia have been described. In the first stage, occurring within 24 hours of infection, the lung is characterized microscopically by vascular congestion and alveolar edema. Many bacteria and few neutrophils are present. The stage of red hepatization (2-3 d), so called because of its similarity to the consistency of liver, is characterized by the presence of many erythrocytes, neutrophils, desquamated epithelial cells, and fibrin within the alveoli. In the stage of gray hepatization (2-3 d), the lung is gray-brown to yellow because of fibrinopurulent exudate, disintegration of red cells, and hemosiderin. The final stage of resolution is characterized by resorption and restoration of the pulmonary architecture. Fibrinous inflammation may extend into the pleural space, causing a rub heard by auscultation, and it may lead to resolution or to organization and pleural adhesions.

Bronchopneumonia, a patchy consolidation involving one or more lobes, usually involves the dependent lung zones, a pattern attributable to aspiration of oropharyngeal contents. The neutrophilic exudate is centered in bronchi and bronchioles, with centrifugal spread to the adjacent alveoli.

In interstitial pneumonia, patchy or diffuse inflammation involving the interstitium is characterized by infiltration of lymphocytes and macrophages. The alveoli do not contain a significant exudate, but protein-rich hyaline membranes similar to those found in adult respiratory distress syndrome (ARDS) may line the alveolar spaces. Bacterial superinfection of viral pneumonia can also produce a mixed pattern of interstitial and alveolar airspace inflammation.

Miliary pneumonia is a term applied to multiple, discrete lesions resulting from the spread of the pathogen to the lungs via the bloodstream. The varying degrees of immunocompromise in miliary tuberculosis, histoplasmosis, and coccidioidomycosis may manifest as granulomas with caseous necrosis to foci of necrosis. Miliary herpesvirus, cytomegalovirus, or varicella-zoster virus infection in severely immunocompromised patients results in numerous acute necrotizing hemorrhagic lesions.

Factors that bypass or inactivate local defenses (eg, tracheostomy tubes, immotile cilia syndrome) predispose the child to pneumonia. The result is loss of surfactant activity with local collapse and consolidation. Pneumonia may

be classified by the causative organism, the anatomic location, or the tissue response.

Frequency

United States

A WHO Child Health Epidemiology Reference Group publication cited the incidence of community-acquired pneumonia among children younger than 5 years in developed countries as approximately 0.026 episodes per child-year.[1]

In a prospective multicenter study of 154 hospitalized children with acute community-acquired pneumonia in whom a comprehensive search for etiology was sought, a pathogen was identified in 79% of children. Bacteria accounted for 60%, of which 73% were due to Streptococcus pneumoniae; Mycoplasma pneumoniae and Chlamydia pneumoniae were detected in 14% and 9%, respectively. Viruses were documented in 45% of children. Notably, 23% of the children had concurrent acute viral and bacterial disease.[6] In the study, preschool-aged children had as many episodes of atypical bacterial lower respiratory infections as older children. Multivariable analyses revealed that high temperature (38.4°C) within 72 hours after admission and the presence of pleural effusion were significantly associated with bacterial pneumonia.

Thompson et al reported annual influenza-associated hospitalizations in the United States by hospital discharge category, discharge type, and age group.[7]

After elderly persons, the second highest rates of influenza-associated hospitalizations were in children younger than 5 years.

In a randomized double-blind trial, the heptavalent pneumococcal vaccine reduced the incidence of clinically diagnosed and radiographically diagnosed pneumonia among children younger than 5 years by 4% and 20%, respectively.[8] Although the overall rate of pneumonia has decreased in the United States with the use of the 7-valent vaccine, the rate of empyema and complicated pneumonia has increased.[9]

International

The WHO Child Health Epidemiology Reference Group estimated the median global incidence of clinical pneumonia to be 0.28 episodes per child-year.[1] This equates to an annual incidence of 150.7 million new cases, of which 11-20 million (7-13%) are severe enough to require hospital admission. Ninety-five percent of all episodes of clinical pneumonia in young children worldwide occur in developing countries.

Over half of Kenyan children hospitalized for severe pneumonia (based upon WHO clinical criteria) had a respiratory virus detected. Respiratory syncytial virus was identified in 34% of these children.[10]

Mortality/Morbidity

According to the WHOs Global Burden of Disease 2000 Project, lower respiratory infections were the second leading cause of death in children younger than 5 years (about 2.1 million [19.6%]).

- Most children are treated as outpatients and fully recover. However, in young infants and immunocompromised individuals, mortality is much higher.
- In studies of adults with pneumonia, a higher mortality rate is associated with abnormal vital signs, immunodeficiency, and certain pathogens.

Race

Pneumonia affects children of all races; however, certain conditions that may predispose to pneumonia have racial predilections. For example, cystic fibrosis is far more common in white children. Children with sickle cell anemia are at increased risk for pneumonia as a result of sickling within the pulmonary vasculature and functional asplenia.

Age

Pneumonia in the pediatric population is most common in infants and toddlers and least common in adolescents and young adults.

Clinical

History

In children, etiologic agent, age of the patient, and underlying illnesses all affect the historical features of the illness.

- Neonates
    - The infant may present with tachypnea; signs of respiratory distress, such as grunting, flaring, and retractions; lethargy; poor

feeding; or irritability. Fever may not be present in newborns; however, hypothermia and temperature instability may be observed.

- Cyanosis may be present in severe cases.
- Nonspecific complaints, such as irritability or poor feeding, may be the presenting symptoms.
- Cough may be absent in the newborn period.
- Early-onset group B streptococci infection usually presents via ascending perinatal infection as sepsis or pneumonia within the first 24 hours of life. Chlamydia trachomatis pneumonia should be considered in infants aged 2-4 weeks and is often associated with conjunctivitis.

- Infants
  - After the first month of life, cough is the most common presenting symptom.
  - Infants may have a history of antecedent upper respiratory symptoms.
  - Depending upon the degree of illness, tachypnea, grunting, and retractions may be noted. Vomiting, poor feeding, and irritability are also common.
  - Infants with bacterial pneumonia often are febrile, but those with viral pneumonia or pneumonia caused by atypical organisms may

have a low-grade fever or may be afebrile. The child's caretakers may complain that the child is wheezing or has noisy breathing.

- Toddlers and preschool children
    - A history of antecedent upper respiratory illness is common.
    - Cough is the most common presenting symptom.
    - Vomiting, particularly post-tussive emesis, may be present. Chest pain may be observed with inflammation of or near the pleura. Abdominal pain or tenderness is often seen in children with lower lobe pneumonia.
    - The presence and degree of fever is dependent upon the organism involved.
- Older children and adolescents
    - Atypical organisms, such as Mycoplasma, are more common in this age group.
    - In addition to the symptoms observed in younger children, adolescents may have other constitutional symptoms, such as headache, pleuritic chest pain, and vague abdominal pain. Vomiting, diarrhea, pharyngitis, and otalgia/otitis are other common symptoms.

Physical

- Early in the physical examination, identifying and treating respiratory distress, hypoxemia, and hypercarbia is important. Signs such as

grunting, flaring, severe tachypnea, and retractions should prompt the clinician to provide immediate respiratory support. An assessment of oxygen saturation by pulse oximetry should be performed early in the evaluation of all children with respiratory symptoms. When appropriate and available, capnography may be useful in the evaluation of children with potential respiratory compromise.

- Visual inspection of the degree of respiratory effort and accessory muscle use should be performed to assess for the presence and severity of respiratory distress. The examiner should simply observe the patient's respiratory effort and count the respirations for a full minute. In infants, observation should include an attempt at feeding, unless the baby has extreme tachypnea.
- An ED-based study conducted in the United States found that respiratory rate alone and subjective clinical impression of tachypnea did not discriminate children with and without radiographic pneumonia.[11] However, children with tachypnea as defined by WHO respiratory rate thresholds were more likely to have pneumonia than children without tachypnea.
- Auscultation is perhaps the most important portion of the examination of the child with respiratory symptoms. The examination often is very difficult in infants and young children for several reasons.

- Babies and young children often cry during the physical examination making auscultation difficult. The best chance of success lies in prewarming hands and instruments and in using a pacifier to quiet the infant. The opportunity to listen to a sleeping infant should never be lost.
- Older infants and toddlers may cry because they are ill or uncomfortable, but, most often, they have stranger anxiety. For these children, it is best to spend a few minutes with the parents in the child's presence. If the child sees that the parent trusts the examining physician then he or she may be more willing to let the examiner approach. A small toy may help to gain the child's trust. Any part of the examination using instruments should be deferred as long as possible, because the child may find the medical equipment frightening. Occasionally, if the child is allowed to hold the stethoscope for a few minutes, it becomes less frightening. Even under the best of circumstances, examining a toddler is difficult. If the child is asleep when the physician begins the evaluation, auscultation should be performed early.
- It is not unusual for children with respiratory symptoms to have a concomitant upper respiratory infection with copious upper airway secretions. This creates another potential problem, transmission of upper airway sounds. In many cases, the sounds

created by upper airway secretions can almost obscure true breath sounds and lead to erroneous diagnoses. If doubt exists as to the etiology of sounds heard through the stethoscope, the examiner should listen to the lung fields and then hold the stethoscope near the child's nose. If the sounds from both locations are approximately the same, the likely source of the abnormal breath sounds is the upper airway.

- Even when the infant or young child is quiet and has a clear upper airway, the child's normal physiology may make the examination difficult. The minute ventilation is the product of the respiratory rate and tidal volume. In young children, respiratory rate makes a very large contribution to the overall minute ventilation. In other words, babies take many shallow breaths as opposed to a few deep ones. Therefore, a subtle finding, particularly one at the pulmonary bases, can be missed.
- The sine qua non for this disease has always been the presence of crackles or rales. Although often present, focal crackles as a stand-alone physical examination finding is neither sensitive nor specific for the diagnosis of pneumonia.[12,13,14] Additionally, not all children with pneumonia have crackles.
- Other examination findings suggestive of pneumonia include focal wheezing or decreased breath sounds in one lung field.

- Similarly, certain more diffuse lung infections may result in generalized crackles or wheezing.
- Although the presence of wheezing may be associated with pneumonia, the overall presence of radiographic pneumonia among children with wheezing is uncommon.[15] Historical and clinical factors such as fever and hypoxia may be used to determine the need for chest radiography for wheezing children. The authors recommend that routine use of chest radiography for children with wheezing but without fever should be discouraged.

- Percussion may reveal important information. Occasionally, a child presents with a high fever and cough but without ausculatory findings suggestive of pneumonia. In such cases, percussion may help to identify an area of consolidation.
- Pneumonia may occur as a part of another generalized process. Therefore, signs and symptoms suggestive of other disease processes, such as rashes and pharyngitis, should be sought during the examination.

Causes

Pathogens implicated in pneumonia vary with the age of the child, the underlying patient-specific risk factors, immunization status, and seasonality.

- Newborns and infants

- In the neonate, pathogens that may infect the infant via the maternal genital tract include group B streptococci, Escherichia coli and other fecal coliforms, and C trachomatis. Group B streptococci most often is transmitted to the fetus in utero, usually as a result of colonization of the mother's vagina and cervix by the organism.
    - Affected infants commonly present within the first few hours after birth, but if infection is acquired during the delivery, the presentation may be delayed.
    - The usual presenting symptoms include tachypnea, hypoxemia, and signs of respiratory distress.
    - Physical examination may reveal diffuse fine crackles, and the chest radiograph may demonstrate a ground-glass appearance and air bronchograms.
- Newborns may be affected by the bacteria and viruses that cause infections in older infants and children. Risk factors for infection include older siblings, group daycare, and lack of immunization, particularly against pertussis.
- In the young infant, aged 1-3 months, continued concern about perinatally acquired pathogens mentioned above as well as the unusual Listeria monocytogenes remains. However, most pneumonia in this age group is community acquired and involves

Streptococcus pneumoniae, Staphylococcus aureus, and non-typeable Haemophilus influenzae.

- Although the young unimmunized or incompletely immunized infant remains at theoretical risk for H influenzae and pneumococcal disease, herd immunity gained from widespread immunization of the population has been generally protective.
- Most lower respiratory disease in the young infant occurs during the respiratory virus season and is viral in origin, particularly in the patient with clinical bronchiolitis. The most common agents include parainfluenza viruses, influenza virus, adenovirus, metapneumovirus, and respiratory syncytial virus (RSV). Morbidity and mortality from RSV and other viral infections is higher among premature infants and infants with underlying lung disease.

- Atypical organisms may also cause infection in infants. Of these, C trachomatis, Ureaplasma urealyticum, cytomegalovirus, and Pneumocystis carinii (PCP) are the most common. Pneumocystis pneumonia is generally limited to immunocompromised infants.
- Bordetella pertussis may affect infants. Only 80% of fully immunized children are protected against pertussis and immunity