Introduction

Lower respiratory tract infection is a leading cause of morbidity and mortality in children worldwide ***(Samransamruajkit et al., 2008).***

More than one third of the estimated global mortality of 12-14 millions age less than five years has been ascribed to acute respiratory infections. Acute lower respiratory tract infection, especially severe pneumonia was responsible for >75% of these deaths, with two thirds occurring in infants ***(Abdul-Wahab et al., 2008).***

Community acquired pneumonia (CAP) is defined as pneumonia acquired outside the hospital setting, it is still today the most common cause of mortality in children specially among those under the age of 5 years. This is most significant in developing countries, where incidence rates are up to 10 times greater than in developed countries. Almost 2 million children died yearly from acute respiratory infection most from pneumonia ***(Renato et al., 2007).***

Community acquired pneumonia (CAP)is associated with significant costs, including loss of school days, several health care visits, hospital admissions and sometimes unnecessary antibiotics prescription ***(Samransamruajkit et al., 2008).***

The aetiological agents are varied, including a number of viruses e.g respiratory syncytial virus and influenza virus, bacterial and Chlamydophila ***(Keiko et al., 2008).***

Viral pathogens are increasingly recognized as playing a major role in the etiology of lower respiratory tract infections and are considered the predominant pathogens in community-acquired pneumonia in preschool children ***(Gustavo et al., 2008).***

Respiratory syncitial virus (RSV) is a highly prevalent agent affecting the lower airways and may progress with pulmonary infiltrates.

RSV, influenza, and rhinoviruses are the most common viruses associated with CAP in childhood ***(Renato et al., 2007).***

Rapid and accurate diagnostic techniques may reduce the need for empirical antibiotics which may contribute directly and indirectly to increased antimicrobial resistance and costs of hospitalization ***(Wen et al., 2007).***

Aim of the Work

The aim of this work is to:

Determine the frequency of viral pneumonia (RSV, Influenza A & B) among patients with CAP admitted to the Ain Shams university Hospitals.

Chapter (1): Community acquired pneumonia in pediatric

- Definition
- Classification of pneumonia
- Respiratory viruses
- Epidemiology and incidence
- Risk factors
- Pathogenesis
- Clinical manifestations
- Indication for admission to hospital
- Laboratory diagnosis
- Treatment
- Prevention

Definition

Pneumonia still remains a condition that is challenging to accurately diagnose. Therefore, no single definition that accurately describes childhood pneumonia currently exists. Pneumonia is defined as a lower respiratory tract infection (LRTI) typically associated with fever, respiratory symptoms, and evidence of parenchymal involvement by either physical examination or the presence of infiltrates on chest radiography. Pathologically, it represents an inflammatory process of the lungs, including airways, alveoli, connective tissue, visceral pleura, and vascular structures. Radiologically, pneumonia is defined as an infiltrate on chest radiograph in a child with symptoms of an acute respiratory illness ***(Rani et al., 2013).***

American Lung Association has defined Pneumonia as a type of respiratory disease in which the lungs are infected by bacteria, viruses or fungi. It makes our lungs not to be able to function properly and thus can cause many unwanted, severe problems such as respiratory difficulties. Besides that, pneumonia may lead to other diseases such as meningitis, etc. ***(American Lung Association, 2011).***

Classification of Pneumonia

Pneumonia classification is either based on:

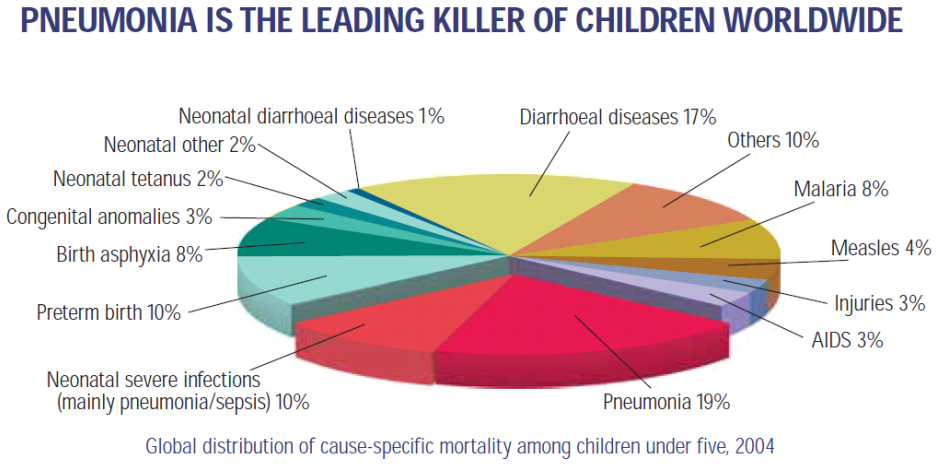
- **Etiological agent:** into bacterial, viral or atypical.
- **Anatomical:** into lobar, lobular, bronchopneumonia or interstitial.
- **Clinical presentation:** into classical or atypical.
- **Mode of infection**: into pneumonias acquired by healthy persons are known as community-acquired pneumonias. While those encountered in hospitalized patients are known as hospital-acquired or nosocomial pneumonias. The etiologic pathogens associated with community - acquired and hospital - acquired pneumonias are somewhat different. However, many organisms can cause both types of infection ***(Alcon et al., 2005).***

Community-acquired pneumonia (CAP) can be defined clinically as the presence of signs and symptoms of pneumonia in a previously healthy child due to an acute infection (of less than 14 days' duration) of the lower respiratory tract (usually occurs below terminal bronchioles) leading to cough or difficult breathing, tachypnoea, or lower chest-wall indrawing, which has been acquired in the community outside hospital ***(BTS, 2002).*** In developed countries this can be verified by the radiological finding of consolidation ***(BTS, 2002).*** In resource poor setting of the developing world, a more practical term - acute lower respiratory infection (ALRI) - is preferred, reflecting the difficulties in obtaining a chest radiograph, especially in rural areas ***(BTS, 2002).***

Epidemiology and incidence

Community-acquired pneumonia (CAP) remains a frequent cause of Morbidity and mortality worldwide, even in industrialised countries, and its incidence is highest among children aged<5 years ***(Esposito et al., 2012).***

It is estimated that CAP is responsible for one-fifth of the deaths of young children, with two million deaths per year in the developing and developed world: the incidence of CAP among children aged<5 years in developing countries is 0.29 per child-year, with a mortality rate of 1.3-2.6% and, in North America and Europe, its incidence in preschool children is still approximately 36 per 1,000 child - years ***(Principi et al., 2011).***



Source: Pneumonia the forgotten killer of children ***(WHO, 2006)***

Risk factors

Risk factor for pneumonia in children:

- Sex: M:F [1.25:1–2:1
- Socioeconomic/environmental factors:

Lower socioeconomic status (family size, crowding), Low maternal educational level, Poor access to care, Indoor air pollution, Malnutrition Lack of breastfeeding, Cigarette smoke (active and passive smoke exposure) Alcohol, drugs, and cigarettes use (increased risk of aspiration) in teens.

- Underlying cardiopulmonary disorders and medical conditions: tracheoesophageal fistula, and cystic adenomatoid malformations, Congenital heart disease, Bronchopulmonary dysplasia and chronic lung disease, Diabetes mellitus Cystic fibrosis, Asthma, Sickle cell disease, Neuromuscular disorders (especially those associated with altered mental status). Some Gastrointestinal disorders (eg, gastroesophageal reflux, Tracheo esophageal fistula), Congenital and acquired immunodeficiency disorders Respiratory virus ***(Wonodi CB et al., 2012; Chang AB et al., 2009).***

Risk factors related to the host and the environment that affects incidence of childhood clinical pneumonia in the community

1-Definite	Malnutrition Low-birth-weight Non-exclusive breastfeeding (during the first 4 months of life) Lack of measles immunization (within the first 12 months of life) Indoor air pollution Crowding
2-Likely	Parental smoking Zinc deficiency Mother's experience as a caregiver Concomitant diseases (e.g. diarrhoea, heart disease, asthma)
3-Possible	Mother's education Day-care attendance Rainfall (humidity) High altitude (cold air) Vitamin A deficiency Birth order Outdoor air pollution

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Aetiology

Viruses cause a significant percentage of CAP infections, especially in children younger than two years; the prevalence of viral pneumonia decreases with age ***(Kimberly et al., 2012).***

Respiratory syncytial virus, influenza A, and para-influenza types 1 through 3 are the most common viral agents. Other viral pathogens include adenovirus, rhinovirus, influenza B, and enteroviruses ***(Michelow, 2004).***

Human metapneumovirus has been identified as a common cause of CAP in cases previously classified as virus-negative. The spectrum of illness caused by metapneumovirus is similar to that of respiratory syncytial virus ***(Williams et al., 2004).***

Mixed viral and bacterial infection accounts for 30 to 50 percent of CAP infections in children ***(Cincinnati Children's Hospital Medical Center 212)***.

Streptococcus pneumoniae is the most common bacterial cause of CAP. The widespread use of pneumococcal immunization has reduced the incidence of invasive disease ***(Black S et al., 2004).***

Children with underlying conditions and those who attend child care are at higher risk of invasive pneumococcal disease. Breast-feeding seems to be protective. Penicillin-resistant S. pneumoniae infections can occur in children with recent antibiotic use.

Mycoplasma pneumoniae, Chlamydophila pneumoniae, and S. pneumonia are the predominant etiologies of CAP in school-aged children ***(Kimberly et al., 2012).***

Haemophilus influenzae and group A streptococcus are less common causes. Staphylococcus aureus, especially methicillin-resistant S. aureus (MRSA), is increasingly common and causes significant morbidity and mortality ***(Kallen et al., 2010)*.**

Identification of S. pneumoniae and S. aureusas pathogens can be problematic because they can be carried asymptomatically ***(Kumar et al., 2008).***

Table (1): Age-Based Etiologies of Childhood Community-Acquired Pneumonia.

Age	Common etiologies	Less common etiologies
2 to 24 months	Respiratory syncytial virus Human metapneumovirus Parainfluenza viruses Influenza A and B Rhinovirus Adenovirus Enterovirus Streptococcus pneumoniae Chlamydia trachomatis	Mycoplasma pneumoniae Haemophilus influenzae (type B and nontypable) Chlamydophila pneumoniae
2 to 5 years	Respiratory syncytial virus Human metapneumovirus Parainfluenza viruses Influenza A and B Rhinovirus Adenovirus Enterovirus S. pneumoniae M. pneumoniae H. influenza (B and nontypable) C. pneumoniae	Staphylococcus aureus (including methicillin-resistant S. aureus) Group A streptococcus
Older than 5 years	M. pneumoniae C. pneumoniae S. pneumoniae Rhinovirus Adenovirus Influenza A and B	H. influenza (B and nontypable) S. aureus (including methicillin-resistant S. aureus) Group A streptococcus Respiratory syncytial virus Parainfluenza viruses Human metapneumovirus Enterovirus

(Michelow et al., 2004).

Pathogenesis

Pneumonia typically follows an upper respiratory tract infection. Microrganisms that cause LRTI usually are transmitted by droplet spread directly from close personal contact. Following initial colonization of the nasopharynx, organisms may be inhaled, leading to a pulmonary focus of infection; less commonly, bacteremia results from the initial upper airway colonization, with subsequent seeding of the lung parenchyma. Normal pulmonary host defence system consists of multiple mechanical barriers, including saliva, nasal hairs, the mucociliary escalator, the epiglottis and the cough reflex. Humoral immunity, including secretory immunoglobulin A (IgA) and serum IgG, defends against pneumonia, and other airways constituents such as surfactant, fibronectin and complement play roles in microbial killing. Phagocytic cells, including polymorpho-nuclear cells and alveolar macrophages, play an important defensive role, and cell-mediated immunity is important in the defence against certain pathogens, such as viral agents and other intracellular organisms ***(Durbin and Stille 2008).***

Although the inflammatory response based on such cells is necessary to reinforce innate immunity and to rid the lungs of microbes, it contributes directly to lung injury and abnormal pulmonary function (Fig. 1) ***(Mizgerd, 2008).***

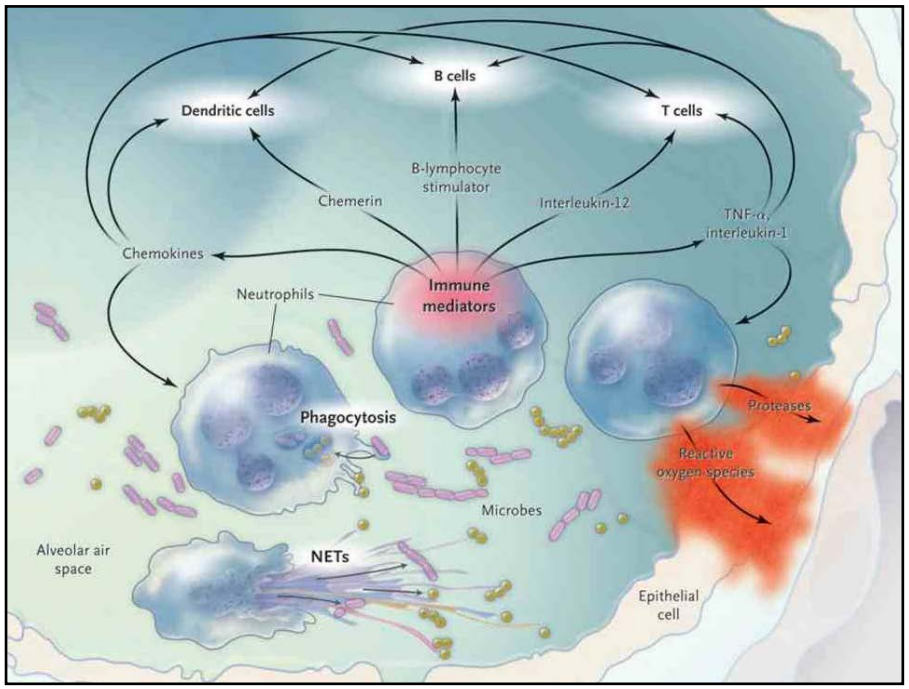

Fig. (1): Neutrophils and lung infection. Neutorphils are effectors cells of innate immunity, killing microbes using phagocytosis and neutrophil extracellular traps (NETs). Neutrophils also generate a variety of immune mediators to direct immune responses, influencing other cells of innate and adaptive immunity. Finally, neutrophils damage tissues, products such as proteases and reactive oxygen species injuring cells and digesting matrix. TNF denotes tumor necrosis factor ***(Nathan, 2006)***

Clinical Manifestations

Symptoms:

Productive cough, fever accompanied by chills, shortness of breath, sharp or stabbing chest pain during deep breaths, confusion, and an increased respiratory rate in the elderly ***(Hoare and Lim, 2006).*** The typical symptoms in children under five years are fever, cough, and rapid or difficult breathing. Fever, however, is not very specific, as it occurs in many other common illnesses, and may be absent in those with severe disease or malnutrition. In addition, a cough is frequently absent in children less than 2 months old ***(Singh and Aneja, 2011).*** More severe symptoms may include: central cyanosis convulsions, persistent vomiting, or a decreased level of consciousness ***(Singh and Aneja, 2011).*** Some causes of pneumonia are associated with classic, but non-specific, clinical characteristics. Pneumonia caused by legionella may occur with abdominal pain, diarrhea, or confusion ***(Darby and Buising, 2008).*** While pneumonia caused by streptococcus pneumoniae is associated with rusty colored sputum ***(Ortqvist et al., 2005),*** pneumonia caused by klebsiella may have bloody sputum often described as "currant jelly" ***(Tintinalli and Judith, 2010).*** Symptoms of pneumonia indicating a medical emergency include the following: Blood in sputum bluish-tinged (cyanotic) skin, high fever, heavy breathing and mental confusion ***(Hoare and Lim 2006).***

Signs of pneumonia

Physical examination may sometimes reveal low blood pressure, tachycardia or a low oxygen saturation. Examination of the chest may be normal, but may show decreased chest expansion on the affected side. Harsh breath sounds. Rales (or crackles) may be heard over the affected area during inspiration. Percussion may be dulled over the affected lung, and increased, rather than decreased, vocal resonance distinguishes pneumonia from a pleural effusion. Struggling to breathe, confusion, and blue-tinged skin are signs of a medical emergency ***(Hoare and Lim, 2006).***

World Health Organisation, 2009 Classified pneumonia signs as the following:

Pneumonia: 1-Age-specific tachypnoea (>60⁄min if <2 months; >50⁄min if 2-11 months; >40 if 12- 24 months) and 2-absence of wheeze (with or without fever).

Severe pneumonia: above mentioned criteria of neumonia plus chest indrawing.

Very severe pneumonia: Criteria of pneumonia plus at least one of the danger signs (central cyanosis, severe respiratory distress [head nodding, nasal flaring, grunting], inability to drink, convulsions, vomiting) ***(World Health Organization, 2009).***

The WHO algorithm stresses the importance of tachypnea as an indicator of pneumonia. It was found that tachypnea had 74% sensitivity and 67% specificity for radiologically defined pneumonia. However, in children