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# BACTERIAL PATHOGENS ASSOCIATED WITH COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN AGED BELOW TWELVE YEARS IN TERTIARY CARE HOSPITAL, SALEM, INDIA

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**Abstract**

To decide the bacterial pathogens causing community-acquired pneumonia in children under 12 years in a teritiary care hospital, Salem.

Children under the age of 12 who met the WHO criteria for pneumonia, serious pneumonia, or extreme pneumonia, as well as those who had lung infiltrates on a chest X-ray, were eligible to participate in the study. Each child provided two respiratory samples, one for culture and the other for PCR investigation, as well as a blood sample for culture, which were all collected.

The bacterial pathogens *Streptococcus pneumoniae* and *Hemophilus influenzae* were found in the majority of the 100 samples tested. Typical bacterial pathogens had identical performance in culture as did the non-pathogenic bacteria.

*S. pneumoniae* and *H. influenzae* were the most frequently identified organisms in respiratory discharges from children who had contracted community-acquired pneumonia in the study period and the site.

Key words: Epidemiology, Etiology, *Streptococcus pneumonia.*

## Introduction

Pneumonia is an extreme type of acute lower respiratory infection that explicitly influences the lungs furthermore, represents a huge extent of acute lower respiratory infections (ALRI) disease trouble. The lungs are made out of a large number of tubes (bronchi) that partition into more modest air routes (bronchioles), which end in small sacs (alveoli). In the case of pneumonia, discharge and liquid fill the alveoli in one or both lungs, and this interferes with oxygen absorption, making breathing difficult. According to the United National Children Fund (UNICEF), paediatric pneumonia is responsible for the death of more than 800,000 young children worldwide[1]. *Streptococcus pneumoniae* (pneumococcus) is the most common bacterial pathogen among children in developing countries, whereas *Haemophilus influenzae*, *S. queues*, *Mycoplasma pneumoniae*, and *Chlamydophila pneumoniae* are the most frequently encountered bacterial pathogens among children aged 5 years and older in the community-acquired pneumonia [2].

When grown on solid media, *Streptococcus pneumoniae* forms unpigmented, umbilicated provinces surrounded by a zone of incomplete (α) haemolysis. *Streptococcus pneumoniae* is a gram-positive, lancet-molded, polysaccharide-embodied diplococcus that can be found as individual cocci or in chains. In addition to being optochin sensitive, *S. pneumoniae* is bile soluble (i.e., 10 % deoxycholate). This strain of *Streptococcus pneumoniae* is closely related to the viridian groups of the bacterium *Streptococcus mitis*. Explicit antibodies to capsular polysaccharides confer protection on the host, allowing for the advancement of phagocytosis. CD4+ T cells also play an important role in the development of antibody-independent immunity against pneumococcal nasopharyngeal colonisation[3]. The bacteria and viruses that cause community-acquired pneumonia (CAP) in children under the age of five are the most common. The purpose of this study is to identify the bacterial pathogens that cause CAP in children under the age of 12 years old.

## Methods

The study population consisted of 100 cases of CAP in children under the age of 12 who were admitted to the department of paediatrics at a tertiary care hospital in Salem, Tamilnadu, between October 2019 and March 2020. Inclusion criteria for pneumonia were severe pneumonia or very severe pneumonia as defined by the World Health Organization (WHO)[4], as well as the presence of lung infiltrates on chest X-ray. All cases of hospital-acquired pneumonia were excluded from the study. The study was approved by the organization's Institutional Ethical Committee. For the study population, informed consent was obtained from the parents or legal guardians of the participants in the study. Pulse oximetry, complete blood cell count (CBC count), sputum and blood culture, serology, chest radiography, and ultrasonography are the most common diagnostic tests for pneumonia that are performed. An erythrocyte sedimentation rate and an acute-phase reactants (ESR, CRP, or both) also performed in addition to a complete blood cell count with differential and the evaluation of acute-phase reactants[5].

Blood cultures are simple to get and moderately non-invasive and nondramatic, the outcomes are infrequently certain within the sight of pneumonia and surprisingly less so in instances of pre-treated pneumonia[6]. Inflammatory markers were identified based on the time elapsed between infection and abnormal values. As a result, serial measurements are frequently required, and they do have a high negative predictive value[7,8]. PCR is non-invasive, an advantage over lung aspirate or bronchoalveolar lavage (BAL) cultures[9]. Chest radiography is demonstrated in complicated cases in which treatment neglects to get a reaction, in patients with respiratory trouble, or in the individuals who require hospitalization[10]. Various radiographic examples are steady with pneumonia and a large number of other pathologic processes[11]. A synthesis of all accessible data and cautious thought of the differential analysis is essential to establishing the diagnosis. Ultrasonography is most commonly used to detect complications in children, such as pleural emanations, and in children in whom antibiotic treatment has failed to produce a response. It is possible to distinguish between a low-grade (non-fibroin purulent) effusion and a high-grade

(fibrinopurulent and organising) effusion using ultrasonography[12].

## Results

A total of 100 paediatric patients (aged up to 12 years, both male and female) with pathogen reports diagnosed were selected. The cases were chosen based on the inclusion and exclusion criteria. The occurrence of pneumonia was more prominent in males than females however the death due to pneumonia has been higher among females. This study also focuses on the presenting symptoms. The collected data was entered in a proforma and then analysed. After analysing the data, the results were represented in a tabular and graphical form. The results and discussions of the present study are given further.

Among 100 paediatric patients selected for this study 42 (42%) were female and 58 (58%) were male patients. The ages of the patients were classified into five groups[13]. 5 patients were from 0-30 days, 30 patients were from 1-12 months, 34 patients were from 1-2 years, 23 patients were from 2-5 years and 8 patients were from 6-12 years age groups shown in Table No. 1. The average number of days of hospitalization was found to be 4.35±1.70 days. Most of the patients were admitted for 3-4 daysThe majority of the patients were from the age group of 1-2 years which was also observed in a study conducted by Korppi *et al*[14]. It was found that the most commonly presenting symptoms were cough (97%), followed by fever (85%), cold (60%), and breathing difficulty (44%). The same type of results was observed in a study conducted by Grossman and Caplan[15]. In the study population, bacterial culture tests for all the patients were done using sputum samples and the culture reports were tabulated. Among 42 female patients, 15 patients showed no growth, and 27 showed positive culture for various pathogens. Similarly, among 58 male patients, 10 had no bacterial growth and 48 had positive culture reports. Totally, among 100 samples 25 showed no bacterial growth and 75 had positive culture reports. Similar reports were reported by a study conducted by Das et al[16]. In our study, the most common organism that caused pneumonia was *S. pneumonia* (17%), followed by *H. influenza* (19%), *K. pneumonia* (11%), *S. aureus (8%)*, *P. aeruginosa* (6%), *M. pneumonia* (5%), *B. pertussis* (4%), *C. pneumonia* (3%), and *Acinetobacter species* (2%), which was also reported by a study conducted by Woodhead *et al* [17] (Table No. 1). The patient's $SpO_2$ levels were analyzed and found to be in the range of 84 % to 100 %. The majority of patients (42) had a $SpO_2$ of 98%. The study shows most of the children were admitted to the hospital during October (37%), followed by December (19%). In our study, most of the patients were prescribed Augmentin followed by Azithromycin, Ceftriaxone, Piptaz, and Vancomycin. Augmentin was prescribed to 53 patients. The detailed numbers are shown in Table No. 1.

## Discussion

Community-acquired pneumonia (CAP) is a significant reason for dreariness and hospitalization in young children worldwide. It causes great morbidity and mortality as well as an enormous economic burden[18,19]. Childhood pneumonia has been recognized as the major "forgotten killer of children" by UNICEF and the WHO[20]. Infants and young children, adults over the age of 65, and people with other health problems are the groups most at risk of contracting the disease. As a leading cause of hospitalisation in both children and adults, pneumonia is a serious concern. The majority of cases can be successfully treated, though it may take several weeks for the patient to fully recover. CT scan can differentiate the bacterial and nonbacterial, but based on the CT study the treatment is the gold standard as like in the present scenario covid pneumonia. Very fast breathing is one of the most common symptoms of pneumonia in newborns. Breathing with wheezing sounds, fever, cough, working hard to breathe are other features. If the child has pneumonia then the following are some of the symptoms including persistent vomiting, not able to drink, convulsion lethargic or unconscious, and severe malnutrition. In this study, it was found that males (58%) were mostly affected with pneumonia than females (42%). In the study population, children were grouped based on their age, and 1-2 years age group were more commonly affected with pneumonia. Various studies were supported this and almost 8,00,000 children under the age of 5 were lost their lives due to pneumonia (ie. Almost every 39 seconds, one

child lost due to pneumonia)[21,22]. A retrospective study of 100 patients was done to evaluate bacterial pathogens causing pneumonia in a tertiary care hospital at Salem. The hospital had a high rate of antibiotic use, despite the fact that it did not follow the WHO standard treatment guidelines. All of the affected children received a wide range of extended-spectrum antibiotics to treat their illness. Sputum culture was done for all the patients in the study population and the reports were collected and analyzed to check for the presence of bacterial growth. Among 100 samples collected for culture studies, 75 children showed the presence of at least one microorganism and 25 showed no bacterial growth. The culture reports suggested that *S. pneumonia, H. influenza, K.pneumonia, S.aureus, P.aeruginosa, M.pneumonia, B.pe rtussis, C.pneumonia,* and Acinetobacter species were the micro-organisms that caused pneumonia in children in the study population. Of the reported micro-organisms *S. pneumonia* was found in more paediatric patients followed by *H. influenza* and *K.pneumonia.* In 100 cases, we found that the most commonly presenting symptoms were cough (97%), followed by symptoms of fever (85%), cold (60%), breathing difficulty (44%). In this study population majority of patients (42) had a $SpO_2$ of 98%. In the present study, most children were admitted to the hospital during October also due to the climatic change, ie the rainy season in the study area.

From this study, it can be concluded that children from age group 1-2 years are more commonly affected with pneumonia and the most commonly identified pathogens were *S. pneumonia, H. influenza,* and *K. pneumonia.* The most common symptoms found in pneumonia patients were cough, fever, and cold. Parents of the children showing such symptoms for more time should consult paediatricians for an evaluation. This will help in the early identification and management of the illness. Since the prevalence of pneumonia in children is more during October which is also the rainy season in southern India, proper preventive care such as drinking hot water and using winterwear must be followed. Paediatricians treating such common symptoms of pneumonia must be thorough in examining lungs to identify or cross out pneumonia for better and optimal patient care. Culture tests are an important part of managing pneumonia because identifying the right organism will lead to choosing the appropriate sensitive antibiotic. This will improve therapeutic outcomes and minimize the risk of developing antimicrobial resistance and treatment failure.

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| Variables | Sub groups | Male | Female | Total No. of Patients |
|---|---|---|---|---|
| **Age** | 0-30 Days | 2 | 3 | 5 |
| | 1-12 Months | 10 | 20 | 30 |
| | 1-2 Years | 16 | 18 | 34 |
| | 2-5 Years | 11 | 12 | 23 |
| | 6-12 Years | 3 | 5 | 8 |
| **Organism** | *S. pneumonia* | 4 | 15 | 19 |
| | *H. influenza* | 6 | 11 | 17 |
| | *K.pneumonia* | 4 | 9 | 13 |
| | *S.aureus* | 4 | 4 | 8 |
| | *P.aeruginosa* | 0 | 5 | 5 |
| | *M.pneumonia* | 5 | 0 | 5 |
| | *B.pertussis* | 2 | 1 | 3 |
| | *C.pneumonia* | 1 | 2 | 3 |
| **Antibiotics Prescribed** | Augmentin | 29 | 24 | 53 |
| | Azithromycin | 8 | 10 | 18 |
| | Ceftriaxone | 12 | 13 | 25 |
| | Piptaz | 5 | 12 | 17 |
| | Vancomycin | 2 | 3 | 5 |
| | Meropenem | 2 | 2 | 4 |
| | Amikacin | 1 | 0 | 1 |
| | Neomycin | 1 | 2 | 3 |
| | Doxycycline | 0 | 2 | 2 |

Total study population n=100

**Table 1:** Distribution of children affected with pneumonia