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PATTERNS AND PREDICTORS OF SEVERE PNEUMONIA AMONG INFANTS IN IRAQ: A COMPREHENSIVE ANALYSIS

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ABSTRACT

Background: For children less than five years old, pneumonia ranks among the top causes of illness and death worldwide. Developing nations account for 95% of all cases of clinical pneumonia in children under the age of five on the planet. When it comes to forecasting which kids may experience unfavorable outcomes like clinical worsening, serious illness, or the emergence of complications, there is a lack of data. **Aim of study:** To throw light on the occurrence of pneumonia in infants and its severity in Baghdad and to evaluate the possible factors that may be associated with its severity. **Methods:** A cross-sectional study with analytic components that was conducted at Pediatric ward in four hospitals in Baghdad during a period of one year from October 2024 to October 2025. It included 283 patients aged up to 12 months, admitted to the pediatric ward, and diagnosed with pneumonia. Severity of pneumonia is defined as pneumonia plus inability to drink, persistent vomiting, convulsions, lethargy, stridor. Childhood pneumonia cases were classified into two groups: non-severe and severe pneumonia. **Results:** In this study, 27.6% of infants were diagnosed with severe pneumonia while the remaining 72.4% were with non-severe pneumonia. Four factors were found to be important independent risk factors for severe pneumonia among infants. These factors were low birthweight, prematurity, lack of immunization, and congenital heart disease. **Conclusion:** The prevalence of severe pneumonia among infants is relatively high. The possible risk factors that increase the incidence of severe pneumonia were low birth weight, prematurity, lack of immunization, and congenital heart diseases.

KEYWORDS: Pneumonia, infants, severe, prevalence, Iraq.

INTRODUCTION

Inflammation of the lung tissue caused by an infectious pathogen is known as pneumonia. It is still the leading cause of death for children younger than five years old on a global scale.[1] Furthermore, it continues to be the leading cause of pediatric death and the leading reason for pediatric clinical visits, placing a heavy strain on healthcare systems across the globe.[2] The World Health Organization estimates that 808,694 children died from pneumonia in 2017, making it the leading cause of death for children younger than five years old. More than 20 million new cases of pediatric community-acquired pneumonia (CAP) are reported each year in developing nations like China, making the situation even worse.[3] Pneumonia in children can have two main causes: organisms particular to the age group in question and those specific to the infection itself. Group-B streptococci, Klebsiella, and Escherichia coli are among the bacterial pathogens that can infect neonates through the birth canal.[4] Viruses are the main cause of pneumonia in older infants and toddlers between 30 days and two-years old.[5] The presence of two or more of the following symptoms, in addition to a persistent cough, is diagnostic of severe pneumonia: Central cyanosis or an oxygen saturation level below 90% as measured by pulse oximetry, severe difficulty breathing (such as grunting or extremely heavy chest pain), or any general warning symptom (such as inability to feed or drink, drowsiness

or unconsciousness, convulsions) warrant medical attention. It is considered no pneumonia in children if they do not show symptoms of mild or severe pneumonia: a respiratory infection.[6] Pneumonia can range from mild to severe, depending on the individual. Some mild cases may improve without any therapy at all, while others, even with extensive care, may have a very bad ending.[7] Cough, fever, tachypnea, and dyspnea are some of the more generic symptoms that can accompany pneumonia. Babies and toddlers may have tummy aches. Time since symptoms first appeared, places visited, people infected, the child's general health, any preexisting conditions, symptoms that come back, history of immunizations, mother's health, and any problems with the baby's delivery are all important pieces of information to gather.[8] Diagnosis is often based on symptoms and physical examination. Chest X-rays, blood tests, and culture of the sputum may help confirm the diagnosis.[9] In industrialized nations, pneumonia has a better prognosis and fewer fatalities each year, but it still causes a tremendous amount of suffering with about 2.5 million cases each year. Hospitalizations occur in around one-third to one-half of these instances.[10] The aim of this study is to throw light on the occurrence of pneumonia in infants and its severity in Baghdad and to evaluate the possible factors that may be associated with its severity.

PATIENTS AND METHODS

Study design and setting

This was a cross-sectional study with analytic components conducted at Pediatric ward in four hospitals selected using convenience sampling techniques, including Al-Elwaiya Children Teaching Hospital, Ibn Al-Balady Children & Maternity Hospital, Al-Numan Teaching Hospital, and Central Teaching Children's Hospital / Baghdad during a period of one year from October 2024 to October 2025.

Study patients

The study included patients aged up to 12 months, admitted to the pediatric ward, and diagnosed with pneumonia. The patients' relatives were informed about the nature of the study and verbal consent was obtained from them. Diagnosis of pneumonia was based on.

- History: Cough is the most common presenting symptom of pneumonia and may be accompanied by congestion, fever, irritability, and decreased feeding.
- Examination: Signs of respiratory distress including tachypnea, nasal flaring, lower chest in-drawing, or hypoxia on room air. Auscultation for rales or rhonchi in all lung fields with the appropriately sized stethoscope can also aid in diagnosis.
- Chest X ray.

Severe pneumonia is defined as pneumonia plus inability to drink, persistent vomiting, convulsions, lethargy, stridor, or severe malnutrition.[11] Childhood CAP cases were classified into two groups: non-severe and severe pneumonia.

Sample size calculation

The sample size was calculated using the following equation: $n= (z^2pq)/d^2$ in which n= sample size, z= 1-α/2 percentile of a standard normal distribution = 1.96, p= expected proportion (prevalence of severe pneumonia is 19%)[12], q= 1-p, and d= absolute precision = 0.05.

The estimated sample was 185, but to account for a 20% non-response rate and to increase the power of this study, the final sample size was adjusted to 283 patients.

Data collection tool

A questionnaire was applied to all enrolled patients to collect the needed information which was filled in by the researcher. It included questions to gather the following information: Age and gender, residence, gestational age (Preterm is < 37 weeks of gestation), birthweight, mode of delivery, type of feeding: Breast, bottle, or mixed, vaccination status (Received or not), presence of congenital heart disease (CHD), previous hospitalization, and mode of presentation: Cough, irritability, shortness of breath, poor feeding, respiratory rate, temperature, cyanosis, subcostal or intercostal retractions, and percentage of lung involvement by x-ray.

Ethical Considerations

The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Names were removed and replaced by identification codes. All information kept confidential in a password secured laptop and data used exclusively for the research purposes.

Statistical analysis

The data analyzed using Statistical Package for Social Sciences (SPSS) version 26. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Chi square test was used to assess the association between provisional diagnosis and certain information, while fisher exact test was used instead when the expected frequency was less than 5. A level of P – value less than 0.05 was considered significant.

RESULTS

In this study, the age of infants was ranging from 18 days to 12 months with a mean of 6.22 ± 3.1 months; 61.1% of them were males; 73.1% were living in urban area; and 33.2% were preterm; 29.3% of them were delivered weighing < 2500 grams; 66.4% were delivered by NVD; 48.7% were fed by mixed feeding type; 40.6% were unvaccinated; 7.8% had congenital heart disease; 25.4% had a history of previous hospitalization; and 27.6% of them were diagnosed with severe pneumonia.

Table 1: Distribution of study participants by general characteristics.

Variable	No. (n= 283)	Percentage (%)
Age (Months)		
< 2	102	36.0
2 – 6	134	47.3
> 6	47	16.7
Gender		
Male	173	61.1
Female	110	38.9
Residence		
Urban	207	73.1
Rural	76	26.9
Gestational age at birth		
< 37	94	33.2
≥ 37	189	66.8
Birthweight (gm)		
< 2500	83	29.3
≥ 2500	200	70.7
Mode of delivery		
NVD	188	66.4
C/S	95	33.6
Type of feeding		
Exclusively Breast	65	23.0
Bottle	80	28.3
Mixed	138	48.7
Vaccination status		
Vaccinated	168	59.4
Not	115	40.6
CHD		
Yes	22	7.8
No	261	92.2
History of hospitalization		
Yes	72	25.4
No	211	74.6
Severity of pneumonia		
Severe	78	27.6
Non-severe	205	72.4

Logistic regression analysis was applied (table 2) using results of severe pneumonia as the dependent variable. Four factors were found to be important independent risk factors for severe pneumonia among infants. These factors were congenital heart disease is 6.77 more likely increase severe pneumonia rate (OR= 6.77 with 95% Confidence Interval (CI): 2.71 to 14.33), lack of immunization is 9.22 more likely increase severe pneumonia rate (OR= 9.22 with 95% CI: 4.12 to 34.2), prematurity is 4.11 more likely increase severe pneumonia rate (OR= 4.11 with 95% CI: 1.92 – 13.44), and low birthweight is 6.12 more likely increase severe pneumonia rate (OR= 6.12 with 95% CI: 2.71 to 22.1).

Table 2: Logistic regression analysis of possible risk factors for severe pneumonia among infants.

Variables	Odd's ratio	95% CI for odd's ratio
Congenital heart disease	6.77	2.71 – 14.33
Lack of immunization	9.22	4.12 – 34.2
Prematurity	4.11	1.92 – 13.44
Low birthweight (< 2500 gms)	6.12	2.71 – 22.1

DISCUSSION

Pneumonia is still the most common cause for pediatric clinical visits and the major cause of pediatric mortality, having a significant burden to the health system worldwide but can be easily prevented if identified early, and appropriate action is taken timely.[13] Regarding severity classification of pneumonia in the present work, 27.6% of cases had severe pneumonia while the remaining 72.4% were with non-severe pneumonia.

Higher results were found in studies conducted by Srivastava AD et al in 2024 (62.1% of pneumonia cases were severe)[14], Kasundriya SK et al in 2020 (63.7% of pneumonia cases were severe)[15]; while lower findings were noticed in a study conducted by Chekole DM et al in 2022 (10.4% of pneumonia cases were severe).[16] Different rates in regard of pneumonia severity might be affected by the level of access to care and referral, different diagnostic criteria used for severe pneumonia in different studies, also differences in medical infrastructure and practice patterns can influence reported rates as availability and use of laboratory tests, training of personnel in recognizing severe pneumonia, and reporting systems (some countries have mandatory reporting, others don't).

In this study, four factors were found to be important independent risk factors for severe pneumonia among infants. These factors were low birthweight, prematurity, lack of immunization, and congenital heart disease. A study conducted by Leroux et al in 2021 observed that severe pneumonia was strongly associated with younger age, preterm birth, and hypoxia.[17] Sutriana et al study in 2021 reported that severe pneumonia more likely increased with nonexclusive breastfeeding, and lacking vaccination.[18] Variations in sample size and research strategy may account for the discrepancies found in the aforementioned studies. Furthermore, it is worth noting that premature birth is associated with various risks for childhood morbidity, such as reduced trans-placental antibody transfer, anemia, inadequate breastfeeding, delayed or missed vaccinations, and slower growth. This may be the underlying cause of the correlation between pneumonia severity and premature infant.[19] When gestational age is known with precision, preterm birth serves as a risk stratification signal. This allows frontline health care providers to swiftly retrieve at-risk children's birth records from the patients themselves, and then prioritize their evaluation and pulse oximetry testing.[20] The severity of pneumonia might differ greatly from one individual to another. Patients with mild cases may make

a full recovery without specialized therapy, whereas those with severe cases may have a grim prognosis even after receiving specialized care. Pediatric pneumonia management and treatment outcomes have not improved much despite medical advancements. This is mostly due to the difficulty in predicting how severe the disease will be and in providing high-risk patients with early intensive treatment or preventative therapies.[21]

Study limitations

This study had number of limitations: First, it used a convenience sampling technique (non-random method), meaning the results might not accurately represent all infants with pneumonia across Baghdad or the entirety of Iraq, Second, information was collected through a questionnaire administered to the patients' relatives. This can introduce a few potential biases such as recall and social desirability biases.

CONCLUSION

The prevalence of severe pneumonia among infants is relatively high. The possible risk factors that increase the incidence of severe pneumonia were low birth weight, prematurity, lack of immunization, and congenital heart diseases. In order to minimize the magnitude of this problem, we recommended that the Ministry of Health utilize all of its resources, including educational campaigns, mass media, social media, stickers, and brochures, to spread the word about the importance of vaccinations and encourage pregnant women to go to their prenatal appointments regularly so doctors can check on the baby's health and reduce the likelihood of premature labor. In addition, to reduce pneumonia-related morbidity and mortality, it is imperative that all facilities, including central hospitals and respiratory care unit centers, be equipped with the appropriate devices, medications, and equipment.

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Declaration of Competing Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

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