

Pneumonia Clinical Features in Under-Five Children Treated in Atma Jaya Hospital in 2017–2020

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Abstract

Pneumonia is the leading cause of infection-related death among children and still remains a global health problem, especially for children under five. This study aimed to identify the clinical features of pneumonia in under-five children treated at Atma Jaya Hospital during the period of 2017–2020. This was a cross-sectional retrospective descriptive study on all under-five patients diagnosed with pneumonia treated in Atma Jaya Hospital. Data were collected from November 2021–January 2022 from the medical records of these children (n=148) and analyzed using the univariate analysis. Results showed that most subjects of this study were boys (60.8%), in the age group of 1–4 years old (62.2%), with fever as the most common pneumonia clinical symptom (93.9%). Physical examinations revealed that the average pulse of the subjects were 131.2 beats/minute and the average temperature was 37.1°C. Other signs and symptoms identified during physical examinations were tachypnea (20.3%), retractions (56.1%), crackles (82.4%), and wheezing (22.3%). The laboratory findings presented a mean hemoglobin of 11.0 g/dL, a mean hematocrit of 32.5%, and a mean CRP of 13.2 mg/dL, while most subjects had normal leukocyte (58.1%) and platelet counts (52.0%). The most common chest X-ray finding of pneumonia in these children was infiltrate (92.6%) and the average length of stay was 4 days. Most under-five children experiencing pneumonia recovered after treatment (97.3%).

Keywords: Clinical features, pneumonia, under five

Introduction

Pneumonia is the leading cause of death due to infection in children and is still a world health problem, especially in children under five. The World Health Organization (WHO) stated that 15% of all deaths in children under five years were caused by pneumonia, with the death rate reaching 808,964 children in 2017.¹ More than 1,400 cases of pneumonia per 100,000 children or 1 case per 71 children each year occur globally, with the highest incidence occurring in South Asia (2,500 cases per 100,000 children) and West and Central Africa (1,620 cases per 100,000 children).² The prevalence of pneumonia in children under five in Indonesia, according to the Basic Health Research (RISKESDAS) in 2018, was 4.8% based on the diagnosis of medical personnel or symptoms experienced by the

patient.³ The 2019 Indonesian Health Profile stated that pneumonia is one of the causes of death in children under five, with a death toll of 277 cases or 9.5% of the total under-five deaths in Indonesia. The prevalence of pneumonia in children under five in Indonesia and Jakarta is 3.55% and 4.24%.⁴

The alveoli of pneumonia patients are filled with pus and fluid, increasing breathing effort and using accessory respiratory muscles to fulfill the body's oxygen demands. Pneumonia risk factors among children under five can be classified into child and environmental factors. Child factors that play a role include malnutrition, not exclusively breastfed, and pre-existing illnesses such as HIV infections and measles, which weaken the child's immune system. Environmental factors, including indoor air pollution, overcrowding homes, and parental smoking, also increase the susceptibility of pneumonia in children.¹

Atma Jaya Hospital was chosen as the research location in this study because it is located close to the Faculty of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia,

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North Jakarta. Research on the clinical features of pneumonia in children under five has never been conducted in Jakarta, especially in North Jakarta and Atma Jaya Hospital in 2017–2020. The high pneumonia mortality rate in children under five requires further research attention and treatment. Therefore, this study aimed to identify the characteristics of pneumonia, clinical symptoms, laboratory examination findings, and chest X-ray imaging in children under five at Atma Jaya Hospital in 2017–2020.

Methods

This cross-sectional retrospective descriptive study was conducted at Atma Jaya Hospital, Penjaringan, North Jakarta, from November 2021 to January 2022, using the medical records of under-five patients from January 2017 to December 2020.

The inclusion criteria in this study were as the following: (1) a pneumonia patient aged under five years by the time the case was reported, (2) a case reported between January 2017 to December 2020 and was treated at Atma Jaya Hospital. The exclusion criteria in this study were pneumonia patients under five years who were treated at Atma Jaya Hospital between January 2017 to December 2020 and did not have chest X-ray expertise.

A total sampling method was applied to all children under five with pneumonia in Atma Jaya Hospital that met the inclusion criteria in that period will be used for this study. Data collected then were analyzed using the IBM SPSS for Windows version 25. A univariate analysis was performed to understand the characteristics of children under five with pneumonia, clinical symptoms, physical examination findings, laboratory examination findings, and chest X-ray images. The Health Research Ethical Committee of Atma Jaya Catholic University of Indonesia approved this study for Ethical clearance with the number 08/10/KEP-FKIKUAJ/2021.

Table 1 Characteristics of Patients

Characteristics	n=148	%
Sex		
Boys	90	60.8
Girls	58	39.2
Age		
<1 year	56	37.8
1–4 years	92	62.2

Results

One hundred forty-eight medical records fulfilled the inclusion criteria. Table 1 shows that more patients with pneumonia were boys (60.8%) than girls (39.2%). Characteristics of patients based on age were higher in the age group of 1-4 years (62.2%) compared to <1 year (37.8%).

Table 2 shows that fever (93.9%) was the most common clinical symptom in pneumonia patients under five, followed by cough (91.2%)

Table 2 Characteristics of Clinical Features of Pneumonia in Children Under Five

Characteristics	n=148	%
Symptoms		
Fever	139	93.9
Cough	135	91.2
Runny nose	84	56.7
Dyspnea	52	35.1
Liquid defecation	51	34.4
Vomiting	70	47.2
Seizure	17	11.4
Decreased intake	40	27.0
Weight loss	3	2.0
Cyanosis	4	2.7
Nasal flaring	2	1.3
Respiratory rate		
Tachypnea	30	20.3
No tachypnea	118	79.7
Retractions		
Retractions	83	56.1
No retractions	65	43.9
Crackles		
Crackles	122	82.4
No crackles	26	17.6
Wheezing		
Wheezing	33	22.3
No wheezing	115	77.7
Leukocytes level		
Normal	86	58.1
Leukocytosis	50	33.8
Leukocytopenia	12	8.1
Thrombocytes level		
Normal	77	52.0
Thrombocytosis	65	43.9
Thrombocytopenia	6	4.1
Chest x-ray		
Infiltrates	137	92.6
Consolidation	1	0.6
Opacification	6	4.1
No infiltrates	4	2.7
Outcome		
Recovered	144	97.3
Had not recovered	4	2.7

Table 3 Characteristics of Clinical Features' Mean Value of Pneumonia in Children Under Five

Characteristics	(n=148)
Vital Signs	
Pulse, mean (SD) beats/minute	131.2 (19.2)
Temperature, mean (SD) °C	37.1 (0.7)
Blood Results	
Hemoglobin, mean (SD) g/dL	11.0 (1.3)
Hematocrit, mean (SD) %	32.5 (3.7)
CRP, mean (SD) mg/dL	13.2 (16.6)
Length of Stay	
Length of stay, mean (SD) days	4.7 (3.0)

and runny nose (56.7%). The respiratory rate in pneumonia under five was tachypnea (20.3%) and no tachypnea (79.7%). The physical examination of retractions shows there were retractions (56,1%) and no retractions (43,9%). The physical examination of crackles shows there were crackles (82.4%) and no crackles (17.6%). The physical examination of wheezing shows that there was wheezing (22,3%) and no wheezing (77,7%). The laboratory examination of leukocytes was normal (58.1%), followed by leukocytosis (33.8%) and leukocytopenia (8.1%). The laboratory examination of thrombocytes was normal (52.0%), followed by thrombocytosis (43.9%) and thrombocytopenia (4.1%). Chest X-ray images in pneumonia patients under five were infiltrates (92.6%), followed by opacification (4.1%), no infiltrates (2.7%), and consolidation (0.6%). The outcome of pneumonia patients under five was recovered (97.9%) and had not recovered (2.1%).

Table 3 shows an average pulse of 131.2 beats/minute and an average temperature of 37.1 °C from physical examination results of pneumonia patients under five. The laboratory examination results of pneumonia in children under five show a mean hemoglobin of 11.0 g/dL, a mean hematocrit of 32.5%, and a mean CRP of 13.2%. The average length of stay for pneumonia patients under five was four days.

Discussion

The 2018 Riskesdas National Report results showed a higher incidence of pneumonia in boys.³ The 2019 Indonesian Health Profile stated that boys had more pneumonia cases than girls.⁴

The same result was also found by Omaridegun et al.,⁶ who found that pneumonia was generally reported more frequently in boys than girls. Boys are thought to be more vulnerable to pneumonia because they are given more attention in the community than girls.⁵

The number of pneumonia cases was higher in the age group of 1–4 years than in the age group of <1 year, according to the 2019 Indonesian Health Profile.⁴ The 2018 Riskesdas National Report results found that the prevalence in the age group of 1–4 years was higher compared to the age group of <1 year.³ Research conducted by Kasundriya et al.⁷ stated that the global prevalence of pneumonia in children under five was highest in the age group of 1–4 years.

A study conducted by Monita⁸ found that fever was the most common clinical symptom in pediatric pneumonia patients (92.7%). Research by Kaunang⁹ obtained different results, with dyspnea (93.7%) as the most common clinical symptom among pediatric pneumonia patients. The difference in the results of these studies was influenced by the alloanamnesis of the mother, who was more sensitive to fever than other symptoms.

The study by Kaunang⁹ found that the average pulse rate was 194.7 beats/minute, the average respiratory rate was 60.4 breaths/minute, and the average temperature was 37.8°C. This may be because the study was conducted in the pediatric intensive care unit, showing a more severe condition; some respondents were older than five years old. Another study by Nurjannah¹⁰ found that the average pulse rate was 147 beats/minute, the average respiratory rate was 60 breaths/minute, and the average temperature was 38°C. These results showed quite a significant difference in the average pulse rate, which could be caused by some of the respondents' age of more than five years. WHO clinical criteria for pneumonia have been reported to have poor sensitivity in diagnosing pneumonia in children. However, according to the WHO respiratory rate threshold definition, children with tachypnea were less likely to develop pneumonia than children without tachypnea. The WHO respiratory rate thresholds are as follows: 60 breaths/minute for children under two months, 50 breaths/minute for children 2–12 months, and 40 breaths/minute for children 1–5 years.¹¹

SomestudiesbyMonita⁸andNurjannah¹⁰found that most patients had retractions. Retraction is an abnormal inward movement of the subcostal tissue during inspiration. Pulmonary compliance

decreases as inflammation of the airways and alveoli continues during pneumonia. Greater inspiratory force is generated to maintain adequate tidal respiratory volume by increasing the negative intrapleural pressure. Increased negative intrapleural pressure during inspiration can pull the subcostal tissue inward. The need to produce a more negative intrapleural pressure due to worsening lung compliance necessitates the use of accessory muscles of respiration, such as the intercostal, sternocleidomastoid, and scalenus muscles that lie between the ribs and the lateral neck.¹²

Monita,⁸ Kaunang,⁹ and Nurjannah¹⁰ found crackles in almost all the respondents of the studies. Crackles are associated with a sudden opening of the airways or movement of air through obstructed airways. This condition can impair ventilation/perfusion, a significant cause of hypoxemia.¹³

The study by Monita⁸ found that there were only 26 cases of wheezing (14.6%). Wheezing is a musical sound of high frequency caused by air movement through narrowed small airways. These sounds occur predominantly during expiration. They may occur during inspiration and expiration or, in particular cases, depending on the individual physical state and its correlation with the pathology.¹⁴ Wheezing is more common in pneumonia caused by viruses, *M. pneumoniae*, and *C. pneumoniae*.¹⁵

The case fatality rate of pneumonia was higher in children with anemia than in children without. Anemia remained an independent risk factor for death in children hospitalized from pneumonia or severe pneumonia after adjusting for confounding factors. The trend of anemia prevalence was inversely proportional to increasing age among children under five years hospitalized due to pneumonia or severe pneumonia. This may be due to the higher prevalence of severe diseases associated with anemia, such as severe acute malnutrition and severe sepsis, in infants compared to older children.¹⁶

The hematocrit range varies by sex and age. Decreased hematocrit can be found in anemia, leukemias, lymphomas, Hodgkin disease, myeloproliferative disorders, adrenal insufficiency, chronic disease, acute and chronic blood loss, hemolytic transfusion reactions, and pregnancy. Increased hematocrit can be found in erythrocytosis, polycythemia vera, and hemoconcentration from hypovolemia.¹⁷

Tarhani¹⁸ in Iran stated that 53.7% of patients had leukocyte levels higher than normal. Other

laboratory tests, including stool examination, urinalysis, urine culture, ESR, CRP, and blood glucose, were normal in most patients.

Some studies by Kiyawat¹⁹ and Chandrakala²⁰ found that thrombocytosis was frequently associated with pneumonia in children. Children with thrombocytosis could develop chronic disease and complications that result in an extended hospital stay. The degree of thrombocytosis was directly correlated with the severity of the disease. The degree of thrombocytosis was directly correlated with the severity of the disease.

Studies conducted by Monita⁸ and Kaunang⁹ stated that the most frequently found chest X-ray images were the presence of infiltrates. An alveolar infiltrate is a dense or smooth opacity that occupies a portion or whole lobe, or of the entire lung, that may or may not contain air bronchograms. An interstitial infiltrate is a lacy pattern involving both lungs, featuring peribronchial thickening and multiple areas of atelectasis. It also includes minor patchy infiltrates that are not sufficient to be defined as consolidation and small areas of atelectasis that in children may be difficult to distinguish from consolidation. A radiograph is identified as having to infiltrate if there is either an alveolar infiltrate, interstitial infiltrate, or both.²¹

Nurjannah¹⁰ found that the average length of stay was eight days. Monita⁸ found the highest frequency of length of stay at 5–10 days. The median time to recover was four days, according to Tirore et al.²² Recovery time from severe pneumonia was significantly affected by weight, age, first antibiotic administration, and antibiotic change. This was done to provide nutritious food for children, underweight children.

The most outcome showed recovery or improvement (56,7%) in the study conducted by Monita.⁸ Le observed low mortality from pneumonia in a study conducted in South Africa. Clinical factors associated with death or ICU admission included age under two months, premature birth, or hypoxia. Doctors should consider these risk factors to identify children who may need additional monitoring or early treatment.

This study was able to see the characteristics distribution of pneumonia in children under five at Atma Jaya Hospital in 2017–2020. This study had not observed the factors influencing pneumonia in children under five, including low birth weight, prematurity, nutritional status, exclusive breastfeeding, history of respiratory infections, primary immunization status,

socioeconomic status, parental education, residential density, and exposure to cigarette smoke. This study had yet to observe blood gas analysis and oxygen saturation examination.

The first limitations of this study were the incomplete coding of the medical records; therefore, not all data were taken. Second, medical records were not recorded entirely. Third, Jakarta's implementation of restrictions on community activities in response to the COVID-19 pandemic.

In conclusion, the characteristics of children under five who experience pneumonia are mostly boys (60.8%) and the age group of 1-4 years (62.2%). The most common clinical symptom of pneumonia in children under five is fever (93.9%). The physical examination results for pneumonia in children under five showed an average pulse rate of 131.2 beats/minute and an average temperature of 37.1°C. Other physical examinations are tachypnea (20.3%), retractions (56.1%), crackles (82.4%), and wheezing (22.3%). The laboratory examination results of pneumonia in children under five show a mean hemoglobin of 11.0 g/dL, a mean hematocrit of 32.5%, and a mean CRP of 13.2 mg/dL. Other laboratory examinations are average leukocyte count (58.1%) and normal platelet count (52.0%). The most common chest X-ray finding of pneumonia in children under five is infiltrated (92.6%). The average length of stay for pneumonia in children under five is four days. The most common outcome of pneumonia in children under five is a recovery (97.3%).

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