

Risk factors of complicated pneumonia in children

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Risk Factors Of Complicated Pneumonia In Children

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Abstract

Introduction: *Pneumonia* causes morbidity and mortality in children worldwide. Pediatric patients with complicated pneumonia have a poor prognosis and are more at risk of death. Objective To identify risk factors for complications in pediatric patients with pneumonia.

Method: This research was a case-control study, involving children with pneumonia aged 1-59 months in Dr. Soetomo in 2016-2020. The sample was divided into two groups. Patients who had complications at first admission were classified as a case group. Whereas patients without complications at first admission were classified as a control group. Samples for the case group were obtained by using total sampling method, while the control group employed random sampling technique. Data were collected from medical records and analyzed by chi-square test.

Result: A total of 44 case group samples and 53 control group samples were involved during this study. Among investigated variables, male gender (OR=2,842; 95% CI, 1,24-6,49) and anemia (OR=3,283; 95% CI, 1,26-8,49) might increase the risk of complicated pneumonia. Meanwhile other variables, namely age, comorbidities, birth weight, malnutrition, and immunization status did not have a significant relationship with the incidence of complications in pneumonia patients.

Conclusion: Male gender and anemia are risk of complicated pneumonia.

Keywords: Complicated Pneumonia, Pediatrics, Risk Factor

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Faktor Risiko Pneumonia Komplikata Pada Anak

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Abstrak

Pendahuluan: Pneumonia menyebabkan morbiditas dan mortalitas pada anak-anak di seluruh dunia. Pasien anak dengan pneumonia komplikata memiliki prognosis yang buruk dan memiliki risiko kematian lebih tinggi. Tujuan Untuk mengidentifikasi faktor risiko komplikasi pada pasien anak dengan pneumonia.

Metode: Penelitian ini merupakan studi kasus kontrol dengan melibatkan anak penderita pneumonia usia 1-59 bulan di RSUD Dr. Soetomo antara tahun 2016-2020. Sampel dibagi menjadi dua kelompok. Pasien yang mengalami komplikasi pada saat masuk pertama diklasifikasikan sebagai kelompok kasus. Sedangkan pasien tanpa komplikasi saat masuk pertama diklasifikasikan sebagai kelompok kontrol. Sampel untuk kelompok kasus diperoleh dengan menggunakan metode total sampling, sedangkan kelompok kontrol menggunakan teknik random sampling. Data dikumpulkan dari rekam medis dan dianalisis dengan uji chi-square.

Hasil: Sebanyak 44 sampel kelompok kasus dan 53 sampel kelompok kontrol dilibatkan selama penelitian ini. Di antara variabel yang diteliti, jenis kelamin laki-laki (OR=2,842; 95% CI, 1,24-6,49) dan anemia (OR=3,283; 95% CI, 1,26-8,49) dapat meningkatkan risiko pneumonia komplikata. Sedangkan variabel lain yaitu umur, penyakit penyerta, berat badan lahir, gizi buruk, dan status imunisasi tidak memiliki hubungan yang bermakna dengan kejadian komplikasi pada pasien pneumonia.

Kesimpulan: Jenis kelamin laki-laki dan anemia merupakan risiko terjadinya pneumonia komplikata.

Kata Kunci: Pneumonia Komplikata; Anak-Anak; Faktor Risiko

Introduction

Pneumonia is a disease that causes the largest number of children mortality in 2017.¹ Complicated pneumonia in pediatric patients increase mortality by 23 times more.² In addition, patients with complications could increase the duration of antibiotic therapy during hospitalization.³

As an effort to deal with pneumonia problems, World Health Organization (WHO) has made pneumonia classifications and recommendations for treating children with pneumonia in health facilities. In the other hand, the Indonesian Ministry of Health has written a Manajemen Terpadu Balita Sakit, which provide guidelines for management

of pneumonia in children. The Ministry of Health set a target coverage of finding five-year-old pneumonia patients by health facilities to improve pneumonia management. Although there are guidelines for handling pneumonia in children, there is little information about risk factors for complications in children. High mortality and morbidity caused by complicated pneumonia can be prevented by early massive treatment in patient who had risk factor of complicated pneumonia. But risk factor of complicated pneumonia are not clearly known yet. Risk factor of complicated pneumonia had different result in each study. So, more study about risk factor of complicated pneumonia are needed. The aim of this study was to identify risk factors for compli-

cations in pediatric pneumonia patients.

Method

Research Population

This research is an observational analytical study with a case-control approach. This research was conducted at Dr. Soetomo Hospital. Medical records during January 1, 2016 - January 31, 2020 were analyzed to identify hospitalized patients with pneumonia. Patients were furtherly classified into two groups: patients with complications and patients without complications. In the current study, only patients 1-59 months of age were included. Patients hospitalized ≥ 2 days before being referred were excluded. This research was conducted after obtaining ethical approval from the Health Research Ethics Committee of Dr. Soetomo Hospital with certificate number 1410 / KEPK / VIII / 2019. The sampling technique in the case group was total sampling, while the control group was simple random sampling and minimum sample requirement were 53.

Research variable

Variable collected as independent variable include: gender, age, anemia, nutritional status, comorbid diseases, birth weight, and immunization status according to age. Patients with anemia are patients with laboratory Hb < 11 g/dL, while the definition of malnutrition is Weight-for-age score ≤ -2 SD. Low birth weight infants were babies weighing less than 2500 gram at birth. Subject that did not get immunization as schedules in Rekomendasi Ikatan Dokter Anak Indonesia classified as incomplete immunization. Dependent variable consisted of pleural effusion, empyema, lung abscess, pneumatocele, atelectasis, respiratory failure, or sepsis. Patients who had complications at first admission were classified as cases group, while patients without complications at first admission were classified as a control group.

Statistic analysis

The chi-square test was used to analyze the relationship between independent variables and the presence of complication. The finding was deemed significantly at $p < 0.05$.

Results

The study sample consisted of 44 samples of complicated pneumonia and 697 samples of uncomplicated pneumonia. Furthermore, 53 samples of uncomplicated pneumonia were selected by simple random sampling. Since our investigated variables were not available, the number of samples analyzed for each variable was different. Out of 97 sample, 69% patients were children aged ≤ 1 year; 47% were boys; and 91% of children had comorbidities. A positive correlation was noted between anemia and the incidence of complications in pediatric pneumonia patients (OR=3,283; 95% CI 1,26-8,49; P= 0,023). In addition, significant correlation between male gender and the incidence of complications were observed (OR=2,842; 95% CI 1,24-6,49; P= 0,021). Nevertheless, other variables, namely age, presence of comorbids, birth weight, malnutrition, and completeness of immunization status showed insignificant relationship with incidence of complications. Risk factors of complicated Pneumonia in children can be seen in table 1.

Discussion

In this study, children age was not have a significant relationship with the incidence of complications. In agreement with our result, five other studies considered insignificant correlation.³⁻⁷ In contrast, younger age are more likely to be complicated pneumonia because they have narrower airways, and defense mechanisms in the respiratory tract are immature.^{8,9} Another different results suggest that older children are significantly more associated with the incidence of complications.¹⁰⁻¹² According to Byington et al,¹¹ the reason that

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Table 1. Risk Factors of Complicated Pneumonia in Children

Variable	With complication	Without complication	Sample of uncomplicated	P value	OR	CI 95%
Ages						
≤1 years	31 (46,3)	36 (53,7)	44	0,962	0,888	0,373-2,114
>1 years	13 (43,3)	17 (56,7)				
Anemia						
Yes	25 (53,2)	22 (46,8)	34	0,023	3,283	1,269-8,490
No	9 (25,7)	26 (74,3)				
Comorbid						
Present	40 (44,9)	49 (55,1)	44	0,534	1,225	0,288-5,209
Absent	4 (50)	4 (50)				
Gender						
Male	27 (58,7)	19 (41,3)	44	0,021	2,842	1,243-6,496
Female	17 (33,3)	34 (66,7)				
Birh weight						
Normal	34 (47,2)	38 (52,8)	41	0,303	0,522	0,190-1,431
LBW	7 (31,8)	15 (68,2)				
Nutritional Status						
Normal	22 (45,8)	26 (54,2)	44	0,544	0,963	0,433-2,142
Malnutrition	22 (44,9)	27 (55,1)				
Immunization status						
Complete	20 (45,5)	24 (54,5)	38	0,949	1,137	0,473-2,730
Incomplete	18 (48,6)	19 (51,4)				

could explain the increased incidence of complications in older patients is the emergence of new serotypes in the community. Moreover, Tan et al¹² suggest that this increase occurred because the antibiotics received by patients before diagnosis could partially suppress infection but were not sufficient to prevent the progression of complications. Since this study did not examine the serotype of pathogens that infected each patient or the antibiotics received by the patient before hospitalization, cause of the insignificant correlation between age and the incidence of complications in pediatric pneumonia patients is not yet known.

Anemia appeared to correlate with the incidence of complications in children with pneumonia. The same way, studies conducted by Aftab et al⁹ and Wexler et al⁷ stated that anemia was more often found in complicated

pneumonia patients. Our study did not investigate the type of anemia, so the specific effect of anemia to complications could not be explained. But low hemoglobin in the blood, however, would reduce the amount of oxygen circulated to the tissues. Oxygen is needed in cell metabolism, as well as by the lung parenchymal cells which are experiencing inflammation.

In this study, the presence of comorbid was not considered as risk factor of complicated pneumonia. As national referral hospital in Indonesia, the most patients hospitalized at Dr Soetomo Hospital came with comorbid diseases. Only 8 out of 97 patients presented without comorbid diseases. As in our study, Wexler et al⁷ stated that comorbid was not considered as risk factor of complicated pneumonia. In opposite result, Tan et al¹² stat-

ed that the underlying disease was more common in patients without complications than in patients with complications. Another result obtained from study by Onyago et al¹³ showed that the presence of comorbid diseases exacerbated pneumonia because comorbidities could reduce immunity.

Our study shows a correlation between gender and the incidence of complicated pneumonia. Women seem to have better immunity as the immune response of T helper type 1 is better than man.¹⁴ Different results were obtained from several studies that showed no significant relationship between complications and gender.^{3-6,9,10} Another different result, a study by Atwa et al,¹⁵ stated that male gender as a protective effect against the development of complications (OR = -1.058).

Normal birth weight and low birth weight did not have a significant relationship with complications in pneumonia patients. The fact that most of the patients had normal birth weight (76%). Our finding was consistent with the study conducted by Amorim et al³ which showed an insignificant relationship between birth weight and complicated pneumonia because most of the sample had normal birth weight indicating easy access and wide coverage of health services. However, different results in the study of Ooi et al⁵ showed that pneumonia patients with complications had a higher birth weight.

Malnutrition was not considered as a risk factor for complicated pneumonia. Insignificance results of association between the complications incidence in pediatric pneumonia patients with malnutrition in the our study is not yet understood. In other studies, malnutrition is an important risk factor for complications of pneumonia.^{7,9} The systematic review by Jackson et al¹⁶ showed no relationship between HAZ and WHZ with the severity of pneumonia, while WAZ found a significant relationship.

In this study, incomplete immunization status did not have a significant relationship with the incidence of complications in pediatric pneumonia patients. Current study did not include PCV (Pneumococcal conju-

gate vaccine) as one of the criteria for completing immunization status. PCV is a vaccine that can prevent diseases caused by *Streptococcus pneumoniae*. However, this vaccine is still classified as a non-mandatory vaccine in Indonesia. In fact, *Streptococcus pneumoniae* is the most common pneumonia-causing bacteria in both adults and children.¹² In agreement with our result, a study by Onyago et al¹³ was not considered incomplete immunization as risk factor of complicated pneumonia.

This study has some limitations. First, minimum sample of cases group from the sample count (53 samples) was not fulfilled. This is because the number of complicated patients at the first admission is small and as retrospective study, our data collection was restricted to hospital medical record. Second, some medical records with the same number was borrowed by other researchers. Third, some of them was Graha Amerta's medical records, so they were not available in the central medical record and some medical record more than 3 years ago. In addition, some medical record possess incomplete required data.

Conclusion

In conclusion, gender and anemia were considered as risk factor for complications in pediatric pneumonia patients. Meanwhile, age, comorbidities, birth weight, malnutrition, and immunization status were not considered as risk factor of complicated pneumonia. Further research is suggested to increase the number of risk factor variables and the number of samples studies.

Conflict of Interest

None of the authors have any proprietary interests of conflicts related to this submission.

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