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### Overview of Risk Factors for Toddlers with Congenital Heart Disease Suffering from Pneumonia at Dr. M. Djamil General Hospital, Padang, Indonesia

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#### A B S T R A C T

**Background:** Congenital heart disease (CHD) includes structural and non-structural abnormalities that arise from birth. Disorders of the circulatory system can also affect the respiratory system, causing symptoms and disturbances that similar to primary respiratory disease. This study aimed to describe the risk factors for toddlers with congenital heart disease who suffer from pneumonia at Dr. M. Djamil General Hospital, Padang, Indonesia. **Methods:** Descriptive observational study using secondary data. A total of 58 research subjects participated in the study. The research subjects met the inclusion criteria in the form of patients who had been diagnosed with congenital heart disease, aged 29 days – 60 months, and were treated at Dr. M. Djamil General Hospital, Padang, Indonesia. Data analysis was performed using SPSS software univariately. **Results:** The majority of patients with various age levels have a cured outcome. The majority of subjects with medium and high parental education had a greater recovery percentage than subjects with low parental education. Subjects with medium and high socioeconomic status had a greater percentage of recovery outcomes than subjects with low socioeconomic status. The majority of subjects with normal nutritional status and normal birth weight had a higher percentage of recovered outcomes than those who died. The history of DPT immunization and the type of congenital heart disease did not show a large percentage difference between patients who recovered and died. History of measles immunization and leukocytosis showed a greater percentage of patients with cured outcomes than death outcomes. **Conclusion:** CHD patients with pneumonia are under 1 year old, male, come from families with low-medium socioeconomic status, low-medium educational level, and malnutrition status have worse patient outcomes.

#### 1. Introduction

Congenital heart disease (CHD) includes structural and non-structural abnormalities that arise from birth. Structural abnormalities of the heart or congenital heart defects are the most common birth defects in newborns. The incidence of CHD in the general population is around 1% and varies from 4/1000 to 50/1000 live births. Continental variation in incidence has been reported from 6.9 per 1000 births in Europe to 9.3 per 1000 in Asia. In Indonesia, the percentage of CHD is around 0.8% to 1% of the number of births per year. An estimated 40,000 to 50,000 babies are born with CHD per year. There is a

close relationship between cardiovascular function and the respiratory system. The body's metabolic requirements rapidly adjust to changes in cardiac output and minute ventilation. In this condition, there is a limitation of the systemic ability of the heart or pulmonary blood flow, PO<sub>2</sub> Arteries can become congested as a result of shunt lesions in the heart, and oxygen delivery does not meet tissue demands. Disorders of the circulatory system can also affect the respiratory system, causing symptoms and disturbances that mimic those of primary respiratory disease.<sup>1-5</sup>

A study shows that of as many as 72 children with lower respiratory tract infections, 75% of them suffer from CHD at the age  $\leq$  5 years. Acyanotic congenital heart diseases such as ventricular septal defect (VSD), atrial septal defect (ASD), patent ductus arteriosus (PDA), and atrioventricular septal defect (AVSD) predispose to pneumonia in children. Pneumonia ranks first as a comorbid disease that brings children to seek treatment, and congenital heart disease is a risk factor for recurrent pneumonia in children.<sup>6-8</sup> This study aims to describe the risk factors for toddlers with congenital heart disease who suffer from pneumonia in Dr. M. Djamil General Hospital, Padang, Indonesia.

## 2. Methods

This study was a descriptive observational study and used secondary data sourced from medical record data at Dr. M. Djamil General Hospital, Padang, Indonesia. A total of 58 research subjects participated in this study. The research subjects met the inclusion criteria in the form of patients who had been diagnosed with congenital heart disease, aged 29 days – 60 months, and were treated at Dr. M. Djamil General Hospital, Padang, Indonesia. Subjects with incomplete medical record data were excluded from this study.

This study was approved by the medical and health research ethics committee of the Faculty of Medicine, Universitas Andalas, Padang, Indonesia.

This study presents data including the frequency of acyanotic and cyanotic congenital heart disease, patient characteristics (age, birth weight, DPT immunization, measles immunization, nutritional status, exclusive breastfeeding), and pneumonia. Tracing the age when receiving treatment and echocardiography results became the inclusion criteria. Data analysis was performed with the help of SPSS software version 25. Univariate analysis was performed to present the data frequency distribution for each variable.

## 3. Results

Table 1 presents the sociodemographic characteristics of the study subjects related to patient outcomes. The majority of patients with various age levels have a cured outcome. The majority of subjects with moderate and high parental education had a greater recovery percentage than subjects with low parental education. Subjects with medium and high socioeconomic status had a greater percentage of recovery outcomes than subjects with low socioeconomic status.

Table 1. Sociodemographic characteristics of research subjects related to patient outcomes.

Patient characteristics	Outcomes				Total	
	Died		Recovered		f	%
	f	%	f	%		
<b>Age</b>						
2 months – 12 months	6	14,0%	37	86,0%	43	100,0%
12 months – 24 months	0	0,0%	10	100,0%	10	100,0%
$\geq$ 2 years	0	0,0%	5	100,0%	5	100,0%
<b>Father's education</b>						
Low	4	20,0%	16	80,0%	20	100,0%
Medium	2	7,4%	25	92,6%	27	100,0%
High	0	0,0%	11	100,0%	11	100,0%
<b>Mother's education</b>						
Low	4	19,0%	17	81,0%	21	100,0%
Medium	1	3,7%	26	96,3%	27	100,0%
High	1	10,0%	9	90,0%	10	100,0%
<b>Socioeconomics</b>						
Low	3	25,0%	9	75,0%	12	100,0%
Medium	1	4,5%	21	95,5%	22	100,0%
High	2	8,3%	22	91,7%	24	100,0%

Table 2 shows the clinical characteristics of research subjects related to patient outcomes. The majority of subjects with normal nutritional status and normal birth weight had a higher percentage of recovered outcomes than those who died. The history of DPT immunization and the type of congenital heart

disease did not show a large percentage difference between patients who healed and died. History of measles immunization and leukocytosis showed a greater percentage of patients with cured outcomes than death outcomes.

Table 2. Clinical characteristics of research subjects related to patient outcomes.

Patient characteristics	Outcomes				Total	
	Died		Recovered		f	%
	f	%	f	%		
<b>Nutritional status</b>						
Malnutrition	5	12,2%	36	87,8%	41	100,0%
Normal	1	5,9%	16	94,1%	17	100,0%
<b>Birth weight</b>						
LBW	4	28,6%	10	71,4%	14	100,0%
Normal	2	4,5%	42	95,5%	44	100,0%
<b>History of DPT immunization</b>						
Incomplete	1	8,3%	11	91,7%	12	100,0%
Complete	5	10,9%	41	89,1%	46	100,0%
<b>History of measles immunization</b>						
Incomplete	6	13,3%	39	86,7%	45	100,0%
Complete	0	0,0%	13	100,0%	13	100,0%
<b>Leukocytes</b>						
Normal	4	13,8%	25	86,2%	29	100,0%
Leukocytosis	2	6,9%	27	93,1%	29	100,0%
<b>Congenital heart disease</b>						
Cyanotic CHD	2	9,5%	19	90,5%	21	100,0%
Acyanotic CHD	4	10,8%	33	89,2%	37	100,0%

#### 4. Discussion

Other studies have shown that risk factors that influence the incidence of pneumonia in children include age, asthma co-morbidities, and a history of previous infections. Studies show that younger people have a higher risk of developing community-acquired pneumonia. The number of patients under the age of 1 year has a higher mortality rate than the group aged 12-24 months and over 2 years. Other studies have shown that younger people have a higher risk of developing severe pneumonia with a high risk of mortality. Another study showed that children under 1 year of age have a 3 times higher risk of mortality than children over 1 year of age. In this study, all subjects who died had an outcome under 1 year of age,

which is consistent with studies that state that higher mortality can be caused by narrowed airways which cause more severe respiratory obstruction in children and a higher risk of hypoxia.<sup>9-12</sup>

Other studies have shown a relationship between parents' educational level and socioeconomic status on the morbidity of pneumonia in children. The role of educational level and socioeconomic status in the incidence of pneumonia and mortality of pneumonia can be caused by delays in parents' decisions to bring their children to health services to get help due to ignorance. Another factor is the habit of smoking around children caused by a low level of knowledge among parents, which increases the incidence of lung infections in children. The results of this study

indicate that the number of cases in the population of children with CHD who experience pneumonia with educational levels and low-medium socioeconomic status has greater number than parents with high levels of education and high socioeconomic status.<sup>13-15</sup>

The relationship between low birth weight and child mortality with pneumonia has been shown by other studies, which show a 3-fold risk of mortality. In this study, it was also found that children with low birth weights had a higher incidence of death than those with normal birth weights. This can be caused by the impaired formation of immune cells in children with low birth weight making it easier to get more severe infections. Children with low birth weight also have a higher risk of experiencing impaired lung formation and development, which can lead to suboptimal lung function. Other studies have also shown that respiratory tract infections commonly occur in patients with CHD, which can result in respiratory failure, long hospital stays, and the use of ventilation.<sup>16-18</sup>

In this study, it was found that acyanotic congenital heart disease has a higher incidence of undergoing treatment due to pneumonia compared to cyanotic CHD. Until now, there have been no studies showing a difference in the risk of pneumonia between cyanotic CHD and acyanotic CHD. Other studies state that unstable hemodynamic conditions and the presence of pulmonary congestion in children with CHD can increase the risk of pulmonary infection. In cyanotic CHD, it occurs right to left shunt, which causes a cyanotic condition in sufferers. This could lead to the significant hemodynamic compromise mentioned in the study. In addition, the condition of growth and development disorders in children with cyanotic CHD can affect the condition of immunity and resistance, which can increase the risk of developing pneumonia in children. In this study, both types of CHD experienced pneumonia, with a higher number of deaths in children with acyanotic CHD. This is consistent with other studies which show that

acyanotic CHD has a 9-fold higher risk of death than children without CHD.<sup>19,20</sup>

## 5. Conclusion

CHD patients with pneumonia are under 1 year old, male, come from families with low-medium socioeconomic status, low-medium educational level, and malnutrition status have worse patient outcomes.

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