

Early-Onset Neonatal Sepsis in Low-Birth-Weight and Birth-Asphyxia Infants at Haji Hospital Surabaya, Indonesia

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Abstract

Introduction: The incidence of early-onset neonatal sepsis is still high, therefore special attention is needed early detection of risk factors for early management. Many risk factors could affect early-onset neonatal sepsis such as birth-weight and birth-asphyxia.

Aim: This study explored the risk factors for early-onset neonatal sepsis among neonates at Haji Hospital, Surabaya City, Indonesia.

Method: This study was observational analytic with a cross-sectional design. The data used retrospective document review was conducted in NICUs of Haji Hospital, Surabaya City, Indonesia. 1.461 infants were born from January 2018 to December 2018. The data analysis of this study was the Chi-Square Test and Multiple Logistic Regression Test using SPSS for windows v.17.

Result: This study involved 1.461 infants with one hundred seventy-eight suffered of sepsis. The study found out that low-birth-weight and birth-asphyxia were significantly associated with neonatal sepsis ($p < 0.001$). Last, the result of multiple regression analysis showed that early-onset sepsis was influenced by low-birth-weight ($p < 0,001$; RR: 10.405; CI: 6.346 to 17.061) and birth-asphyxia ($p < 0.001$; RR: 17.038; CI: 10.644 to 27.271).

Conclusion: The neonatal sepsis was influenced by low-birth-weight and birth-asphyxia. Based on these results we recommend to focus on the intensive treatment for infants who suffered asphyxia and had low-birth-weight.

Keywords: Neonatal sepsis; low-birth-weight; birth-asphyxia.

Introduction

Infant Mortality Rate (IMR) is an indicator that reflects the state of health in society including Indonesia and is a sensitive benchmark of all management efforts undertaken by the government, especially in the health sector¹. IMR in Indonesia in 2015 was still high at

22.23 per 1,000 live births while in East Java the IMR in 2014 reached 26.66 per 1000 live births². IMR in East Java decreased compared to the previous year but it was not significant, namely in 2013 several 27.5 per 1000 live births. IMR in the city of Surabaya in 2015 amounted to 6.48 per 1000 live births. This figure has increased compared to 2014 which was 5.62 per 100 live births. The United Nations set this indicator on the 2030 Sustainable Development Goals (SDG's) at point 3, namely in 2015-2030, which is to reduce the infant mortality rate to at least 12 per 1,000 live births.³.

According to WHO in 2016 neonatal deaths account for 45% of child deaths under 5 years. The majority of all

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neonatal deaths (75%) occur in the first week of life, and between 25% to 45% of neonatal deaths occur within the first 24 hours. Almost all (98%) of five million neonatal deaths occur in developing countries. Neonatal sepsis accounts for nearly 80% of neonatal deaths⁴.

Sepsis was initially defined as a suspicion or proven infection accompanied by clinical conditions of SIRS (Systemic Inflammatory Response Syndrome) but the definition is now abandoned. As per the consensus regarding the latest sepsis, sepsis is defined as a state of life-threatening organ dysfunction/failure, caused by an unregulated host response to infection. The cause of early onset neonatal sepsis is different from the cause of slow onset neonatorum sepsis. The cause of SNAD is microorganisms that are transmitted vertically from mother to baby, both before and during labor⁵.

As per the consensus regarding the latest sepsis, sepsis is defined as a state of life-threatening organ dysfunction, caused by an unregulated host response to infection. Neonatal sepsis is divided into two namely early-onset neonatal sepsis (age <72 hours) and advanced (age > 72 hours)⁶. Early-onset neonatal sepsis causes high morbidity and mortality in newborns. The incidence of early-onset neonatal sepsis is higher in developing countries (1.8 to 18 per 1000 live births) than in developed countries (1 to 5 per 1000 live births). The case fatality in EONS ranges from 16.7% to 19.4%⁷. The incidence rates of neonatal infection in several referral hospitals in Indonesia is approximately 8.76%–30.29% with the mortality rate is 11.56%–49.9%. The incidence rates of neonatal sepsis in several referrals hospital in Indonesia is 1.5%–3.72% with the mortality rate is 37.09%–80%⁵.

In Haji Hospital Surabaya there was an increase in cases of newborn infections in 2015-2017 to 21.50%. Several factors of mother, babies, and environment are contributed to the infection exposed and non-optimal of NM immunologic response so as the newborn become susceptible to be infection⁸. The objective of this study is to explore the risk factors for early -onset sepsis among neonates at Haji Hospital, Surabaya City, Indonesia.

Material and Method

This study was observational analytic with a cross-sectional design. The data used retrospective document review was conducted in NICUs of Haji Hospital, Surabaya City, Indonesia. 1.461 infants were born from January 2018 to December 2018. The independent variables of this study were birth-weight and birth-asphyxia. The dependent variable of this study was early-onset sepsis.

This study used SPSS Statistics 17.0 for data analysis. Bivariate analysis was correlated using cross-tabulations and Chi-Square Test with $\alpha=0.05$. A multivariable logistic regression model was created to examine the causal association between independent variables and breast milk production using Multiple Logistic Regression with $\alpha=0.05$. This study was received ethical approval from the Health Research Ethics Committee, Faculty of Medical, Universitas Airlangga.

Findings: Most of the 928 infants (63.51%) were female while almost half were 533 infants (36.48%) were male. Almost entirely, 1353 babies (92.61%) were born with clear membranes while only a small portion, namely 108 babies (7.39%) were born with turbid green membranes.

Furthermore, almost 1350 babies (92.40%) were born full term and a small part, namely 107 babies (7.30%) were born with a premature period as well as babies born over time (postdate) only a small portion, 4 babies (0.30%). Other data show that almost all 1340 infants (91.72%) had no low birth weight (LBW) while only a small portion, 121 babies (8.28%) were born with LBW.

The data of asphyxia in infants shows that almost all of 1333 infants (92.61%) were born not asphyxia while only a small proportion of 128 infants (8.76%) experienced asphyxia. And it shows that almost all 1420 babies (97.19%) were single born and only a small portion, 41 babies (2.81%) were born twin (multiple)

Based on data which fulfill our inclusion criteria. These are the result.

Table 1: Bivariate analysis between independent variables and early-onset sepsis

Variables	Early-Onset Neonatal Sepsis				Total		p
	EONS		Non-Sepsis		n	%	
	n	%	n	%			
Birth-weight							
Low (< 2500 gram)	76	42.7	45	3.5	121	8.3	< 0.001*
Normal (> 2500 gram)	102	57.3	1238	96.5	1340	91.7	
Asphyxia							
Yes	87	48.9	41	3.2	128	8.8	< 0.001*
No	91	51.1	1242	96.8	1333	91.2	

*Significantly correlate using Chi-Square Test (p < 0.05)

Table 2: Summary of multiple logistic regression

Variables	B	SE	P	RR
Birth-weight				
Low	2.342	0.252	< 0.001*	10.405
Normal (Reference group)				
Asphyxia				
Yes	2.835	0.240	< 0.001*	17.038
No (Reference group)				

*Significantly associate using Multiple Logistic Regression Test (p < 0.05)

This study involved 1.461 infants with one hundred seventy-eight suffered of sepsis. As shown in **Table 1**, there was a correlation between LWB and neonatal sepsis (p<0.001). Most of infants who had normal weight (96.5%) did not suffer sepsis than infants who had LBW. In contrast, almost half of participants (42.7%) who had LBW were suffer early onset sepsis highly than infants who had normal weight. It could be concluded that the early onset sepsis was more suffered by infants who had low-birth-weight (less than 2500 gram).

Table 1 also shows that there was a correlation between asphyxia and neonatal sepsis (p<0.001). Only 3.2% (n=41) infants who are getting sepsis were infants who had asphyxia. In contrast, almost half of participants (48.9%) who had asphyxia were suffered early onset sepsis highly than normal infants. It could be concluded that the sepsis was more suffered by infants who had asphyxia.

Table 2 shows that the results of multivariate analysis with Multiple Logistic Regression Test ($\alpha = 0.05$). The result showed that neonatal sepsis was influenced by low-birth-weight (p<0,001; RR: 10.405; CI: 6.346 to 17.061) and birth-asphyxia (p<0.001; RR: 17.038; CI: 10.644 to 27.271).

The infants who had LBW were at risk for getting early onset sepsis 10.405 times greater than infants who had normal weight. Then, infants who suffered asphyxia were at risk for getting early onset sepsis 17.308 times greater than infants who not suffered asphyxia. So that, asphyxia most likely has an influence.

Discussion

Following approval from the institutional ethical committee, almost half of participants (42.7%) who had LBW were suffering early onset sepsis highly than infants who had normal weight. It could be concluded that the early onset sepsis was more suffered by infants who had low-birth-weight (less than 2500 grams).

The results of this study are in line with the results of a research namely LBW has three times the risk of developing sepsis than non LBW^{9,10}. This is in line that infants with sepsis had more low birth weight (85.7%)¹¹. The central regulation of breathing is not perfect, the respiratory muscles and ribs are still weak in LBW infants resulting in less oxygen entering the brain, if oxygen is lacking, anaerobic germs easily develop which causes easy infection. In contrast to research conducted by Rahmawati in Dr. M. Djamil Padang Hospital, the

results showed that there was no statistically significant relationship between birth weight in the form of low and normal categories with the incidence of neonatal sepsis. A significant relationship appears in LBW infants with prematurity where the maturation of their organs (liver, lungs, enzymes, digestion, brain, immune system against infection) is not perfect, so LBW babies often experience complications that end in death^{12,13}.

Then, infants who lived asphyxia were at risk for getting early onset sepsis 17,308 times greater than infants who didn't live asphyxia. So that, asphyxia most likely has an influence to. Neonatal asphyxia facilitates systemic infections. This is due to inhibited leukocyte activity because it requires energy (ATP) for cytoskeletal microfilament contractions. The state of hypoxia will also inhibit the microbicidal activity of *polymorphonuclear* cells¹⁴. Neonatal asphyxia increased the risk of EONS with a positive blood culture result 4-fold (RO = 4.102; 95% CI 1.04-16.14)^{15,16}.

Neonatal asphyxia was assessed by examining APGAR scores. A low APGAR score increases the risk of EONS. Research conducted by Muhammad et al in 2015 found that Apgar scores <7 in the first minute had a risk of 14.05 times (95% CI 5.487-35.987) for EONS events¹⁷. APGAR scores <7 in the first minute were also reported by Shah et al., which were significant with each OR being 5.7 for EONS events. In general, the first minute APGAR score is associated with *Potential Hydrogen* (pH) umbilical cord blood and intrapartum depression and is not related to the results, whereas the APGAR score then reflects changes in the baby's condition during resuscitation^{10,18}.

Asphyxia neonatorum is very closely related to health problems of pregnant women, including infections. Babies with asphyxia neonatorum appear unfit and have a history of fetal distress before birth. Neonatal asphyxia facilitates systemic infections. Neonatal asphyxia increases the risk of early onset neonatal sepsis with positive blood cultures. In addition, low birth weight babies, including this risk group. Most problems occur in infants who weigh less than 1500 grams with high mortality and require special medical care and treatment for infants at 2.75 times higher risk of neonatal sepsis^{10,13,16}.

The diagnosis of early onset neonatal sepsis is very important in the management and prognosis of the patient. Delay in diagnosis can potentially threaten the

survival of the baby and worsen the patient's prognosis. The prognosis of neonatal sepsis depends on diagnosis and therapy. The prognosis of neonatal sepsis is good if the diagnosis is made early and the therapy is given appropriately. Mortality rates can increase if clinical manifestations and risk factors for neonatal sepsis are not well identified. Midwives and doctors play an important role in efforts to improve the health of mothers and children, especially in clinical cases^{19,20}.

Conclusion

The neonatal sepsis was influenced by low-birth-weight and birth-asphyxia. Based on its conclusion, it is suggested to Health Service Centre to focus on the intensive treatment for infants who had low-birth-weight and suffered asphyxia. It is also suggested to society, especially for husband, to keep supporting the pregnant-mothers for check their pregnancies regularly.

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