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The Impact of Low Birth Weight on the Risk of Early Onset Neonatal Sepsis at Soe Regional Hospital, South Central Timor Regency, East Nusa Tenggara Province

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Abstract

Background: Low Birth Weight (LBW) is one of the risk factors for Early Onset Neonatal Sepsis (EPN). Neonatal mortality is still a challenge both globally and in Indonesia. Based on data from the World Health Organization, neonatal mortality in 2021 reached 47% of the total deaths of 5.0 million toddlers. LBW is one of the highest causes of death in Indonesia for several consecutive years, in 2023 LBW was ranked second at 0.7%. Risk factors for LBW consist of maternal risk factors and fetal risk factors. This study aims to determine the impact of LBW on the risk of early onset neonatal sepsis.

Methods: This study is a quantitative study with an analytical observational method and a case-control design. The number of samples was 192 respondents of Newborn Babies at Soe Hospital in 2024. Sampling used a simple random sampling technique according to the inclusion and exclusion criteria that had been set. This research instrument used secondary data in the form of medical records and data collection sheets. Data were analyzed using the chi square method.

Results: The results of the study showed that there was a relationship between LBW and Early Onset Neonatal Sepsis with a p value = 0.006 ($p < 0.05$) and OR 2.434. Conclusion: There is a relationship between LBW and Early Onset Neonatal Sepsis. nSuggestions for further researchers to examine other risk factors causing LBW using different research designs and sampling techniques.

Keywords: LBW; Early Onset Neonatal Sepsis; Neonatal; Infant Mortality Rate

1. Introduction

In the Third Goal of the Sustainable Development Goals (SDGs), the target for preventable neonatal mortality in 2030 is to reach 12 per 1,000 live births, and the under-five mortality rate is 25 per 1,000 live births[1]. One of the causes of neonatal death in Indonesia is neonatal sepsis [2] NTT Province in 2021 The cause of death due to sepsis was 27 cases and LBW was 178 cases out of a total of 995 deaths [3]. South Central Timor Regency in 2023 The cause of death due to sepsis was 6 cases and LBW was 17 cases from a total of 62 deaths (4). In Soe Regional Hospital in 2024, there were 299 cases of early onset neonatal sepsis and 290 cases of LBW. Early onset neonatal sepsis is a dangerous condition that can cause morbidity and mortality in newborns [5]. The causative agents of infection are microorganisms that colonize the maternal genitourinary tract, Group B Streptococcus (GBS) remains the most common cause of early neonatal sepsis seen in term infants, while Escherichia coli is the most common cause of early sepsis in preterm infants[6]. Low Birth Weight (LBW) is defined as a birth weight of less than 2500 grams and is a significant global health problem [7]. LBW is often associated with an immature immune system, maternal antibody deficiency, and increased risk of exposure to pathogens during delivery, thereby increasing susceptibility to infection[8].

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Several studies have shown that there are various risk factors that cause Early Onset Neonatal Sepsis, including research at Dr. Hasan Sadikin General Hospital, Bandung, which showed that delivery by cesarean section (CS) is at greater risk of neonatal sepsis than normal delivery[9]. Ervina's (2023) research at Dr. H. Abdul Moeloek Hospital, Lampung, during the period from January to June 2023 found that mothers with premature rupture of membranes (PROM) had a 4 times greater risk of experiencing neonatal sepsis compared to mothers without PROM. Atmaja et al.'s (2023) study at Dr. H. Abdul Moeloek Hospital, Bandar Lampung, revealed that early-onset neonatal sepsis had a 5 times higher risk than late-onset neonatal sepsis. In addition, infants with low birth weight (LBW) <2500 grams had a 3 times greater risk of developing sepsis compared to infants with birth weight ≥ 2500 grams. These studies emphasize the importance of identifying and treating risk factors, both sociodemographic, maternal and neonatal factors, early on to prevent neonatal sepsis, which is one of the main causes of morbidity and mortality in neonates [10].

RSUD Soe is a Type C Hospital and also the only referral center hospital in South Central Timor Regency, East Nusa Tenggara Province. Based on the researcher's preliminary study, the incidence of early-onset Neonatal Sepsis in 2024 was 299 cases and LBW was 290 cases.

2. Material and methods

2.1. Type of Study

This research is a quantitative research using an analytical observational research design. The approach in this research uses case control.

2.2. Population

The population in this study was all newborns aged <72 hours at Soe Regional Hospital from January to December 2024, totaling 1454.

2.3. Sample

The sample selection in this study was carried out using the Simple random sampling method. The sample in this study was a sample that met the criteria, namely the inclusion criteria were complete medical record data and the exclusion criteria were Newborns with congenital abnormalities. The sampling technique used in this study used the probability sampling method, namely by means of simple random sampling for the case group and the control group, sampling each individual had an equal opportunity to be taken as a sample from patients and non-patients who met the inclusion criteria and exclusion criteria.

2.4. Data Collection

Data collection in this study used secondary data, namely medical records at Soe Regional Hospital in 2024.

2.5. Data Analysis

The scale used in this study is a nominal scale, with the chi square analysis method.

3. Results and Discussion

From the results of data processing to determine the relationship between LBW and the incidence of Early Onset Neonatal Sepsis, the following results were obtained.

Table 1 Cross Tabulation Between LBW and Early Onset Neonatal Sepsis Incidence at Soe Regional Hospital

Variable	Early Onset Neonatal Sepsis				Total		*P-Value*	OR 95 % CI
	Yes		No					
	n	%	n	%	n	%		
LBW								
Yes	43	64.2	24	35.8	67	100	*0.006*	2.434 (1.319-4.491)
No	53	42.4	72	57.6	125	100		

Based on the table above, from a total of 192 respondents of the LBW variable, the results showed that early-onset neonatal sepsis occurred in most infants with LBW compared to the group without early-onset neonatal sepsis, the chi-square test results obtained a p-value of 0.006. Statistically, it shows a significant relationship between LBW and the incidence of early-onset neonatal sepsis. The OR calculation shows that LBW is 2,434 times more at risk of experiencing early-onset neonatal sepsis than non-LBW infants.

The results of this study are in line with research conducted by Suwarna (2024) which showed that babies with LBW have a 1.42 times greater risk of experiencing early-onset neonatal sepsis compared to normal birth weight (OR 1.42; 95% CI 1.2–1.7). The main relationship between these two conditions is the prematurity factor, where around 80% of LBW cases occur before 37 weeks of pregnancy. This shows that as determinants of SNAD risk, prematurity and LBW are closely related. Babies with LBW have immunological maternal antibody deficiencies, mainly due to impaired IgG transfer through the placenta, which causes IgG levels in LBW babies to be lower, around 300–400 mg/dL, compared to babies with normal weight which reaches 600–1000 mg/dL [8] Meanwhile, other studies have shown that the immune cell function of LBW infants is not yet mature in the production of pro-inflammatory cytokines, such as IL-6 and TNF-α, decreasing by 50% and neutrophils cannot kill bacteria. LBW infants have imperfect growth and development of organs and body systems, especially the development of the immune system, which is responsible for fighting infections. This increases the likelihood of infection in low birth weight infants. [10] Exposure to Intrapartum Infection including Chorioamnionitis in Mothers with premature rupture of membranes (PROM) or intrauterine infection is at risk of transmitting bacteria to the fetus. In LBW, preterm birth is often associated with asymptomatic maternal infection(12). Maternal Bacterial Colonization Group B streptococcus and E. coli bacteria can migrate from the vagina into the amniotic fluid, causing invasive infection in infants with immature epithelial barriers (13).

The results of the meta-analysis by Guo (2022) also support the results of the study at Soe Hospital, namely that lower gestational age and very low birth weight are important perinatal risk factors for SNAD. Low birth weight babies usually have an immature immune system and an incapable immune response, which makes them susceptible to infection. In addition, physical problems such as problems absorbing breast milk reduce immunity due to insufficient intake of antibodies and antimicrobial substances. Heat loss, low glucose reserves, and hypoglycemia are disorders of BBRL, which indirectly increase the risk of infection (14).

In LBW babies, the respiratory control center is also not perfect, lung surfactant is still lacking, so that its development is not perfect, respiratory muscles and ribs are still weak which results in less oxygen entering the brain, if oxygen is lacking then anaerobic germs can easily develop causing easy infection, neonates with LBW are more susceptible to sepsis. In addition, medical complications such as asphyxia and respiratory disorders that often occur with LBW can make it more difficult for the neonate's body to maintain homeostasis and respond well to infection [11]. In addition to biological and clinical factors, socioeconomic factors also affect the risk of sepsis in LBW infants. Limited access to health services, lack of maternal knowledge about newborn care, and poor sanitation conditions are all factors that increase the risk of infection in newborns [12]. Therefore, the prevention and management strategies for early-onset neonatal sepsis must be multidimensional, not only focusing on medical aspects, but also paying attention to the social and environmental conditions in which the neonate grows.[13]

4. Conclusion

Based on the research that has been conducted, it can be concluded that there is a relationship between LBW and the incidence of early-onset neonatal sepsis.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflict of interest that could influence this article.

Statement of ethical approval

The research and ethics committee of the Faculty of Medicine, Airlangga University, Surabaya, Indonesia, has approved this research with letter number 29/EC/KEPK/FKUA/2025, which is valid from January 20, 2025 to January 20, 2026.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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