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Analysis of factors associated with the incidence of neonatal asphyxia in the neonatal intensive care unit (NICU) and perinatology unit in Wangaya Regional General Hospital

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ABSTRACT

Background: Neonatal asphyxia is the second leading cause of neonatal death in Indonesia. According to the World Health Organization (WHO), neonatal asphyxia is the failure of neonates to begin and maintain normal breathing. Neonatal asphyxia can be caused by several factors, namely neonatal, maternal, placental, and delivery factors. This study is aimed to describe the factors associated with the incidence of neonatal asphyxia in Wangaya General Hospital.

Methods: This study used an analytical method with a cross-sectional design. Data for the study were obtained from medical records. Study samples were selected using a simple random sampling technique, and the number of samples included was 170 neonates. The dependent variable was neonatal asphyxia, while the independent variables were preterm gestation, low birth weight baby, premature rupture of membrane, and delivery requiring the procedure. Data were analyzed with bivariate and multivariate analysis on SPSS.

Results: The risk factors that showed association with neonatal asphyxia were preterm gestation (p=0.000; PR= 6.87; 95% CI: 3.19-14.79), low birth weight (p=0.000; PR=9.55; 95% CI 4.14-22.01), and premature rupture of membrane (p=0.002; PR=3.06; 95% CI: 1.48-6.3). while delivery requiring procedure was found to have no significant association with neonatal asphyxia (p=0.219, PR=0.64; 95% CI: 0.31-1.31). On multivariate analysis, it was found that preterm gestation, low birth weight, and premature rupture of membrane all showed significant association with neonatal asphyxia.

Conclusion: There was a significant association between preterm gestation, low birth weight, and premature rupture of the membrane with neonatal asphyxia in Wangaya Regional General Hospital.

Keywords: risk factor, neonatal asphyxia, NICU

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BACKGROUND

According to data from the World Health Organization (WHO), in 2019, 2.4 million infants died in the first month of life worldwide. The neonatal mortality rate in Indonesia in 2019 reached 60,000 deaths. Therefore, Indonesia was in seventh place of 10 countries with the highest neonatal mortality rate.[1] Neonatal death can be affected by several factors, including neonatal asphyxia. According to the WHO in 2005, neonatal asphyxia was the cause of death of neonates in the first week of life. The incidence of neonatal asphyxia is between 1 to 6 per 1000 livebirth in developing countries.[2] According to the Indonesian Health Profile in 2019, neonatal asphyxia was reported to be the second leading cause of death in neonates (27.0%), following low birth weight (35.3%).[3] Neonatal asphyxia is defined by the WHO as a failure to begin and maintain normal breathing at birth.[4] Neonatal asphyxia refers to an emergency condition in which a baby could not spontaneously and regularly breathe, causing decreased blood oxygen level (hypoxemia) and increased blood carbon dioxide level.[5-7] Asphyxia occurs due to impairment in oxygen supply through the umbilical vein, which occurs during the antepartum, intrapartum, or postpartum period. The factors affecting asphyxia in neonates may originate from maternal, neonatal, placental, and delivery factors.[6,7] Based on the previous description, the authors were interested in conducting a study on the factors associated with the incidence of neonatal asphyxia in the neonatal intensive care unit (NICU) and perinatology unit in Wangaya General Hospital.

METHODS

The study method used in this study was the analytical method with a cross-sectional design. The study was conducted in the NICU and perinatology unit in Wangaya Regional General Hospital,

Denpasar. The inclusion criteria to select the samples were neonates who were admitted to the NICU and perinatology unit of Wangaya Regional General Hospital from May 2020 to May 2021. In contrast, the exclusion criteria in this study were neonates with congenital abnormalities, neonates who were referred to and were born out of Wangaya Regional General Hospital Denpasar, and neonates with incomplete medical records. The sample size was calculated using formulations, and the number of samples required for this study was 170 neonates. Samples were selected using a simple random sampling technique. The dependent variable in this study was neonatal asphyxia. In comparison, the independent variables in this study were premature rupture of membrane (PRM), low birth weight (LBW), preterm gestation, and delivery requiring the procedure. Neonatal asphyxia is defined as an APGAR score of less than 7 upon examination at the first and fifth minute after birth. Premature rupture of membrane (PRM) is a condition in which the amniotic membrane ruptured preceding any signs of delivery. Low birth weight (LBW) is babies born with a birth weight under 2500 grams. Gestational age is determined by calculating the total Ballad or Finnstrom score, which is presented in weeks. Preterm gestation is defined as gestational age of fewer than 37 weeks. At the same time, delivery requiring procedures with a different approach to expel the fetus from the uterus, by cesarean section or vacuum or forceps extraction. This study obtained data from patients' medical records, then processed and analyzed with univariate and bivariate analysis using the Chi-square test with a 95% confidence interval (p-value <0.05). We also calculated the prevalence risk of each variable using data processing software SPSS version 26.0. Independent variables with a p-value of <0.20 were then analyzed with multivariate analysis using the logistic regression method.

RESULTS

In this study, it was found that the number of neonates with neonatal asphyxia was 41 neonates (24.1%). Neonates with male gender were 99 babies (58.2%). More than half of these neonates were born at term, 118 neonates (69.1%). Neonates with low birth weight (LBW) were 60 neonates (35.3%). Premature rupture of membrane (PRM) was found in 61 neonates (35.9%) before birth. There were 109 neonates (64.1%) who required procedures for delivery, including the cesarean section (C-section) and vacuum or forceps, as seen in Table 1.

The result of bivariate analysis using Chi-square test, from the result, it was found that preterm gestation was significantly associated with neonatal asphyxia with a p-value = 0.000 (PR=6.87; 95% CI: 3.19-14.79). The association between LBW and neonatal asphyxia was also statistically significant (p=0.000; PR 9.55; 95% CI: 4.14-22.01). The incidence of PRM before delivery was also significantly associated with the incidence of neonatal asphyxia with a p-value = 0.002 (PR=3.06; 95% CI: 1.48-6.31). At the same time, the association between delivery requiring procedures including C-section, vacuum, or forceps with neonatal asphyxia was found to be not significant (p=0.219), as presented in Table 2.

Variables with a p-value of <0.20 were analyzed with multivariate analysis using the logistic regression method, and the results are presented in Table 3. According to multivariate analysis, it was found that preterm gestation, LBW, and the presence of PRM all showed statistically significant association with neonatal asphyxia (p-value = 0.048, p= 0.001, and p= 0.020, respectively).

DISCUSSION

This study found that neonates born prematurely were at a 6.87-fold risk to suffer from neonatal asphyxia. This is in accordance with a study by Santos et al., in 2019 which found that mothers who gave birth at under 37 weeks of gestation had six fold higher risk to deliver babies with an APGAR score of less than 7.7 In a study by Dasah et al., it was found that neonates who were born with preterm gestational age were at 2.62 fold higher risk at the first minute and 2.71 fold higher risk at the fifth minute to have a meager APGAR score (0-3).[8] A study by Abdo et al. found that neonates born at under 37 weeks of gestational age had a 4.7 fold higher risk for neonatal asphyxia (95% CI: 1.5-14.11).[9] Purwaningsih et al., in their study, stated that preterm gestation increases the risk of neonatal asphyxia with a p-value <0.001

Table 1. Characteristics of samples

Characteristic	Frequency (n)	Percentage (%)
Gender		
Male	99	58.2
Female	71	41.8
Neonatal asphyxia		
Yes	41	24.1
No	129	75.9
Gestational age		
Preterm	52	30.6
Term	118	69.4
Birth weight		
<2500 gram	60	35.3
≥2500 gram	110	64.7
Premature rupture of membrane		
Yes	61	35.9
No	109	64.1
Delivery requires procedure		
Yes	109	64.1
No	61	35.9

(OR=4.84; 95% CI: 2.42-9.68).[10] Increased risk in neonates born at under 37 weeks of gestational age is due to the condition of the immature lung. In preterm neonates, there is surfactant deficiency which can cause a spontaneous apneic period at birth, which results from a stiff alveolar surface causing neonatal asphyxia.[11] The respiratory muscles in preterm neonates are also still weak, which causes the baby not to have a strong cry and increases the risk of asphyxia.[12]

According to multivariate analysis in this study, it was found that low birth weight (LBW) was significantly associated with the incidence of neonatal asphyxia (PR=6.09; 95% CI: 2.14-17.40). This result was supported by findings from a case-control study by Razak, which stated that the risk of LBW neonates was 3.32 fold higher to suffer from neonatal asphyxia than neonates with normal birth weight.[13] A study by Aslam et al. stated that the risk of neonatal asphyxia was more increased in neonates with a birth weight of 1-2 kg than those with a birth weight of 2.5 - >3.5 kg (p≤0.01).[14] A similar finding was also reported by Gudayu with their study finding that LBW (1500-2499 grams) to be a risk factor for neonatal asphyxia (AOR 4.46; 95% CI: 1.55-12.83).[15] Coinciding result was found in a study by Meshesha et al., which demonstrated that neonates with LBW were at 8.94 fold higher risk of developing neonatal asphyxia than neonates with normal birth weight (95% CI: 4.08-19.56).[16] In neonates with LBW, the respiratory organ (lungs) is not completely developed yet. Therefore, they could not function normally, causing the baby prone to respiratory failure due to hypoxia. Complications of respiratory impairment in neonates with LBW include a high risk of brain hemorrhage, necrosis, and even death.[6] Low birth weight can be due to intrauterine growth restriction, maternal health problems, underage pregnancy, and twin pregnancy.[16]

In this study, the incidence of premature rupture of membrane (PRM) was significantly associated with the incidence of neonatal asphyxia (PR=2.66; 95% CI: 1.17-6.04). Another study also found similar results in which PRM for over 18 hours was the most common risk factor in asphyxia (OR=10.61; 95% CI: 1.81-62.08).[2] A study by Xia et al. demonstrated that the incidence of asphyxia was significantly higher in the group of neonates with PRM compared to the control group (p<0.05).[17] This finding was also supported by a study by Bayih et al., which stated that babies born from mothers with PRM were at a 6.3 fold higher risk to develop asphyxia at birth.[18] The occurrence of PRM can increase stress for the baby. Premature rupture of the membrane increases the risk of feto-maternal infection. The most common complications are amnionitis and endometritis, which increase the risk of bloodstream infection (sepsis).[2]

Delivery and delivery requiring procedures including C-section, vacuum, or forceps in this study were not found to be significantly associated with neonatal asphyxia (p=0.219). A coinciding result was found in a study by Sadeghnia, which stated that delivery methods do not affect the incidence of neonatal asphyxia.[19] A study by Salmarini et al. found a contradicting result: C-section delivery was significantly associated with the incidence of asphyxia in neonates (p<0.05).[6] A different result was also found in another study which found that delivery using instruments (vacuum and forceps) increases the risk of asphyxia by 3.03 fold higher in neonates.[16] Another author stated that babies born with vacuum delivery were at a 6.2 fold higher risk of suffering from neonatal asphyxia than babies born with spontaneous vaginal birth.[18] The different result found in this study was likely due to other delivery indications that delivery requires an additional procedure. Even though the fetus's condition was still good, those indications may include high myopia of the mother, narrow pelvic floor, short stature, etc.

The limitations of our study were that our study was conducted in one general hospital in Denpasar, and the results of the study could not predict the overall situation in the community. Also, the diagnosis of neonatal asphyxia in this study was determined by Apgar score, which can give subjective results to the examination. Furthermore, this study didn't consider other potential risk factors leading to neonatal asphyxia, such as placental factors, multiple pregnancies, meconium-stained amniotic fluid, and prolonged labor.

Table 2. Bivariate analysis using chi-square test

Independent variable	Neonatal asphyxia		p-value	PR (95% IC)
	Yes n (%)	No n (%)		
Gestational age				
Preterm	26 (50.0)	26 (50.0)	0.000	6.87 (3.19-14.79)
Term	15 (12.7)	103 (87.3)		
Birth weight				
<2500 gram	32 (47.8)	35 (52.2)	0.000	9.55 (4.14-22.01)
≥2500 gram	9 (8.7)	94 (91.3)		
Premature rupture of membrane				
Yes	23 (37.7)	38 (62.3)	0.002	3.06 (1.48-6.31)
No	18 (16.5)	91 (83.5)		
Delivery requires procedure				
Yes	23 (21.1)	86 (78.9)	0.219	0.64 (0.31-1.31)
No	18 (29.5)	43 (70.5)		

Table 3. Multivariate analysis using the logistic regression method

Independent variable	p-value	PR (95% IC)
Preterm gestation	0.048	2.57 (1.01-6.59)
Low birth weight	0.001	6.09 (2.14-17.40)
Premature rupture of membrane	0.020	2.66 (1.17-6.04)

CONCLUSION

According to the study results, it can be concluded that preterm gestation, LBW, and premature rupture of the membrane were all significantly associated with the incidence of neonatal asphyxia in the NICU and perinatology unit in Wangaya Regional General Hospital. However, delivery requiring procedure was not found to be significantly associated with neonatal asphyxia.

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ETHICAL CLEARANCE

This study has received ethical approval from the Medical Research Ethical Committee of Wangaya Regional General Hospital with registration number 059/VIII.9/KEP/RSW/2021.

CONFLICT OF INTEREST

We declare that there were no conflicts of interest in this study.

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AUTHOR CONTRIBUTION

All of the authors are equally contributed to the study.

REFERENCES

1. World Health Organization. Global health observatory (GHO) data: neonatal mortality [Internet]. World Health Organization. 2016 [cited Aug 15, 2021]. Available from: https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/neonatal-mortality-and-causes-of-death
2. Kardana IM. Risk factors of perinatal asphyxia in the term newborn at Sanglah General Hospital, Bali-Indonesia. Bali Medical Journal. 2016;5(1):175-8.
3. Kemenkes RI. Profil kesehatan Indonesia tahun 2019 [Internet]. Kementerian Kesehatan Republik Indonesia. 2020 [cited 15th of August, 2021]. Available from: https://pusdatin.kemkes.go.id/resources/download/pusdatin/profil-kesehatan-indonesia/Profil-Kesehatan-indonesia-2019.pdf
4. Abdo RA, Halil HM, Kebede BA, et al. Prevalence and contributing factors of birth asphyxia among the neonates delivered at Nigist Eleni Mohammed memorial teaching hospital, Southern Ethiopia: a cross-sectional study. BMC Pregnancy and Childbirth. 2019;19(1):1-7.
5. Lestary DI, Sulaeman ES, Suryani N. Path analysis on the determinants of neonatal asphyxia at Dr. Saiful Anwar Hospital, Malang. Journal of Epidemiology and Public Health. 2016;1(2):140-7.
6. Salmarini DD, Dona S, Azhari FN. Analysis of the incidence asphyxia neonatorum at Ansari Saleh General Hospital Banjarmasin. Dinamika Kesehatan: Jurnal Kebidanan dan Keperawatan. 2017;8(2):454-62.
7. Santos NCP, Vogt SE, Duarte ED, et al. Factors associated with low Apgar in newborns in birth center. Rev Bras Enferm. 2019;72(3):297-304.
8. Dassah ET, Odoi AT, Opoku BK. Stillbirths and very low Apgar scores among vaginal births in a tertiary hospital in Ghana: a retrospective cross-sectional analysis. BMC Pregnancy and Childbirth. 2014;14:289.
9. Woday A, Muluneh A, St Denis C. Birth asphyxia and its associated factors among newborns in public hospital, northeast Amhara, Ethiopia. PLoS ONE. 2019;14(12): e0226891.
10. Purwaningsih Y, Dewi YLR, Indarto D, et al. Factors associated with newborn asphyxia at Dr. Harjono Hospital, Ponorogo, East Java. Journal of Maternal and Child Health. 2018 Aug 8;3(4):287-93.
11. Opitasari C, Andayasari L. Maternal education, prematurity and the risk of birth asphyxia in selected hospitals in Jakarta. Health Science Journal of Indonesia. 2015;6(2):111-5.
12. Dassios T, Vervenioti A, Dimitriou G. Respiratory muscle function in the newborn: a narrative review. Pediatr Res. 2021;1-8.
13. Razak R, Adisasmita A. Low birth weight and asphyxia neonatorum risk: a case-control study. Advances in Health Sciences Research. 2020;25:384-7.
14. Aslam HM, Saleem S, Afzal R, et al. Risk factors of birth asphyxia. Italian Journal of Pediatrics. 2014 Dec;40(1):1-9.
15. Gudayu TW. Proportion and factors associated with low fifth minute Apgar score among singleton newborn babies in Gondar University referral hospital; North West Ethiopia. African Health Sciences. 2017 May 23;17(1):1-6.
16. Meshesha AD, Azage M, Worku E, et al. Determinants of birth asphyxia among newborns in referral hospitals of Amhara National Regional State, Ethiopia. Pediatric Health, Medicine and Therapeutics. 2020;11:1-9.
17. Xia H, Li X, Li X, et al. The clinical management and outcome of term premature rupture of membrane in East China: results from a retrospective multicentre study. International Journal of Clinical and Experimental Medicine. 2015;8(4):6212.
18. Bayih WA, Yitbarek GY, Aynalem YA, et al. Prevalence and associated factors of birth asphyxia among live births at Debre Tabor General Hospital, North Central Ethiopia. BMC pregnancy and childbirth. 2020;20(1):1-2.
19. Sadeghnia A, Mohammadpoor S. The investigation of rate of birth asphyxia and its relationship with delivery mode at Shahid Beheshti Hospital of Isfahan during 2013, 2014, and 2015. International Journal of Preventive Medicine. 2019;10:23-32.