

Correlation Between Method of Labor and Incidence of Neonatal Asphyxia at Wangaya General Hospital, Denpasar

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Abstract: Indonesia is one of ten countries with the highest newborn mortality rate. Asphyxia is the second most common cause of neonatal death (27%) under low birth weight (35,3%) and is still a major health worldwide problem. The risk factor for neonatal asphyxia are grouped into four, maternal factors, infant factors, umbilical cord factors and labor factors. We aimed to determine the correlation between method of labor and incidence of neonatal asphyxia. This is a case control study which performed 37 neonates with asphyxia as the case and 37 neonates without asphyxia as the control at Wangaya Hospital from March to May 2022. Neonates who had major congenital abnormalities and born through vacuum and forceps were excluded. Assessment of neonatal asphyxia using Appearance, Pulse, Grimace, Activity, Respiration (APGAR) score. Analysis was performed using chi-square test, confident interval (CI) 95%, significant if $p < 0.05$. The study showed cesarean delivery method was the main risk factor for neonatal asphyxia (OR = 8,48; CI 95% = 2,83-25,44; $p = 0,00$). Other risk factors such as gestational age < 37 weeks, low birth weight, premature rupture of membranes, hypertension in pregnancy, and ante partum bleeding as confounding factors after being analyzed with the delivery of labor in neonates with asphyxia did not have a significant relationship ($P > 0.05$).

Keywords: Method of Labor, Neonatal Asphyxia, APGAR Score

1. Introduction

Indonesia is one of ten countries with the highest newborn mortality rate. According to the results of the Indonesian demographic and health survey in 2017, the neonatal mortality rate was 15/1000 live births, this figure has decreased when it compared to 2012, where the neonatal mortality rate was 19 per 1000 live births. Based on data from the Bali Provincial Health Office in 2017, the highest neonatal mortality rate was in Jembrana Regency at 6.96/1000 live births, while the lowest was in Denpasar City at 0.58/1000 live births. Asphyxia is the second leading cause of neonatal death (27%) under low birth weight (35.3%) and is still a major health worldwide problem that contributes the increasing of mortality and morbidity in neonates [1, 2]. The incidence of neonatal asphyxia at Sanglah

General Hospital in 2010 to 2014 was relatively stagnant, namely 2010 (8.6%), 2011 (9.3%), 2012 (11.6%), 2013 (8.3%), and 2014 (11,3%) [3].

The American Academy of Pediatrics classified asphyxia based on the APGAR score, it is referred as severe asphyxia if the APGAR score was zero to three in the first minute, moderate asphyxia if the APGAR score was four to six in the first minute and the score \geq seven was classified as not asphyxia. [4, 5]. The incidence of neonatal asphyxia at Sanglah Hospital in 2010 to 2014 was relatively stagnant, namely 2010 (8.6%), 2011 (9.3%), 2012 (11.6%), 2013 (8.3%), and 2014 (11,3%) [3].

Asphyxia caused by a failure of blood gas exchange which causes a lack of oxygen levels and excessive accumulation of carbon dioxide. The risk factors of neonatal asphyxia are

grouped into four, which is maternal factors, infant factors, umbilical cord factors and labor factors. Maternal factors such as antepartum bleeding, hypertension in pregnancy and anemia in pregnancy. Infant factors such as prematurity, low birth weight, fluid aspiration and congenital abnormalities. Umbilical cord factors such as umbilical cord entanglement, short umbilical cord, and umbilical cord prolapse. Labor factors such as method of delivery, prolonged labor, and premature rupture of membranes [3, 5].

The surgical method of delivery, especially if there are no signs of labor, does not have benefit from expulsion of lung fluid and compression of the thorax, resulting in more persistent respiratory distress. Compression of the fetal thorax in the second stage of labor pushes fluid out of the respiratory tract. Therefore, in babies born with the procedure, the lungs contain more fluid than air in the first six hours after birth [6]. Hence, we want to discover the correlation between method of labor and incidence of neonatal asphyxia.

2. Methods

This is a retrospective case control study. The data was collected from March to May 2022. There were 37 cases and 37 controls. The case comprised of neonates diagnosed with asphyxia, while the control comprised of neonates without asphyxia.

The inclusion criteria are neonates born at Wangaya General Hospital and have a complete medical record. Major

congenital abnormalities and born through vacuum and forceps are excluded from the study.

The diagnosis of asphyxia can be made by determining the APGAR score. There are five components on the APGAR that are assessed including skin color, heart rate, baby's response and reflexes, muscle activity, and breathing. Each component is scored equally and given a score of zero, one or two. All of these components are assessed and added together to give the total APGAR score. Assessments are made in the first and fifth minutes. If at the fifth minute the APGAR score is less than seven then a follow-up assessment is carried out every five minutes [4].

The data collected from medical records will be extracted to a data collection form. Furthermore, the hardcopy data is inputted into microsoft excel form and after that the data is analyzed. The data will be analyzed using SPSS 26 and displayed in tabular form. All categorical variables are presented as frequencies and percentages.

Data analysis in this study was carried out bivariate with the chi-square test. Confounding variables are controlled by design and by analysis. The study was approved by the Ethics Committee of Wangaya General Hospital.

3. Results

During March to May 2022, there were 448 births. The sample size in this study was 74 samples which were selected by consecutive sampling technique and fulfil the inclusion and exclusion criteria.

Table 1. Characteristics of Research Subjects.

Characteristics	Case (n=37) f(%) Asphyxia	Control (n=37) f(%) Without Asphyxia
Gestational age		
Aterm (≥ 37 weeks)	22 (59,5)	22 (59,5)
Preterm (<37 weeks)	15 (40,5)	15 (40,5)
Method of labor		
Spontaneous	6 (16,2)	23 (62,2)
Sectio caesarea	31 (83,8)	14 (37,8)
Gender		
Male	21 (56,8)	25 (67,6)
Female	16 (43,2)	12 (32,4)
Birth weight		
Normal birth weight (2500)	17 (45,9)	28 (75,7)
Low birth weight (<2500)	20 (54,1)	9 (24,3)

n = number; f = frequency.

There were 37 neonates with asphyxia and 37 without asphyxia which is matched on gestational age. Based on gender, there was not much differences between cases and controls, where male was more dominant than female. In the case group, there were 21 (56.8%) males and 16 (43.2%)

females, while in the control group there were 25 (67.6%) males and 12 (32.4%) females. Based on birth weight, neonatal asphyxia was more likely to have low birth weight, as many as 20 (54.1%) while those who did not experience neonatal asphyxia were only 9 (24.3%).

Table 2. Correlation Between Method of Labor and Incidence of Neonatal Asphyxia.

Method of labor	Case (n=37) f (%) Asphyxia	Control (n=37) f (%) Without asphyxia	OR	95%CI	p
Sectio caesarea	31 (83,8)	14 (37,8)	8,48	2,83-25,44	0,00
Spontaneous	6 (16,2)	23 (62,2)			

OR = odd ratio; CI 95% = confidence interval 95%; p = probability.

Delivery of labor was a risk factor of neonatal asphyxia. Neonates born by cesarean delivery method 8.48 times greater risk of experiencing asphyxia compared to neonates born by spontaneous delivery method (OR=8.48; 95% CI=2.83-25.44; $p=0.00$).

Table 3. Risk Factor of Neonatal Asphyxia.

Risk Factor	Asphyxia		P
	Section caesarea	Spontaneous	
Preterm (n=15) f(%)	12 (80)	3 (20)	0,60
Low birth weight (n=20) f(%)	17 (85)	3 (15)	0,82
Premature rupture of membranes (n=16) f(%)	14 (87,5)	2 (12,5)	0,59
Hypertension in pregnancy (n=8) f(%)	8 (100)	0 (0)	0,15
Ante partum bleeding (n=4) f(%)	4 (100)	0 (0)	0,34

Preterm, low birth weight, premature rupture of membranes, hypertension in pregnancy, and ante partum bleeding did not have a significant relationship with the delivery of labor in neonates with asphyxia ($p > 0.05$).

4. Discussion

Indonesia is one of ten countries with the highest newborn mortality rate. Indonesia is in seventh position with a newborn mortality rate of 56,000 people behind India, Nigeria, Pakistan, Ethiopia, Congo and China [7].

One of the Sustainable Development Goals (SDGs) programs which began in 2015 to 2030 has a priority target for children, namely by 2030 ending the death of newborns and children under the age of five from preventable causes [8].

The method of labor is one of the risk factors for neonatal asphyxia. This study shows that the method of labor is a risk factor for neonatal asphyxia and is statistically significant. Neonates born by cesarean delivery method have an 8.48 times greater risk of experiencing asphyxia compared to neonates born by spontaneous delivery method (OR=8.48; 95% CI=2.83-25.44; $p=0.00$). Other hospital based studies also had similar result, in a study of 70 newborns, the method of delivery was found to be a risk factor for neonatal asphyxia based on bivariate analysis (OR=6.77; 95% CI=2.31-19.84; $p=0.00$) and multivariate analysis (OR= 5.51; 95% CI=1.24-24.48; $p=0.02$) [5]. A study in Negara General Hospital from January 2019 to January 2020 showed that babies born from assisted delivery had a prevalence of asphyxia 2.54 times higher than spontaneous delivery (PR=2.54; 95% CI=1.04-6.18; $p=0.03$) [9].

A case control study conducted at Amhara Hospital, Ethiopia from March 1 to April 20, 2018 also found that babies born with the help of a device had a 3.03 times greater risk of experiencing asphyxia when compared to babies born spontaneously (aOR = 3.03; 95% CI = 1.41-6.49; $p < 0.01$) [10]. Similar results were also obtained in Nepal, where it was found that delivery with a device had a 4.4 times greater risk of experiencing neonatal asphyxia when compared to spontaneous delivery (aOR=4.4; 95% CI=3.1-6.1) [11].

Similar research was also obtained at Shoa Zone Hospital, Ethiopia. It was found that delivery by cesarean section had a risk of 3.68 times greater (AOR=3.68; 95% CI=1.31-10.28) and delivery with assisted equipment had a risk of 5.69 times greater (AOR= 5.69; 95% CI = 2.17-14.91). This is because

most mothers come late with labor complications or the decision to take action is delayed, increasing the risk of asphyxia [6].

Different results were obtained in research conducted in the perinatology room and the neonatal intensive care unit (NICU) Wangaya Hospital, Denpasar City. It was found that the type of delivery did not have a significant relationship with the incidence of neonatal asphyxia (OR=1.429; 95% CI=0.36-5.54; $p=0.48$). This can be caused by other factors that can cause asphyxia such as premature rupture of membrane, delivery of twins, prolonged labor, and others [12]. Other hospital based studies also had similar result, a case control study at Shahid Beheshti Hospital of Isfahan found that delivery mode did not have any significant effect on the rate of neonatal asphyxia ($p=0.99$) [13].

Surgical delivery, especially if there are no signs of labor, does not have benefit from expulsion of lung fluid and compression of the thorax, resulting in more persistent respiratory distress. Compression of the fetal thorax in the second stage of labor pushes fluid out of the respiratory tract. Therefore, babies born with this procedure will not experience this physiological process so that their lungs contain more fluid than air in the first six hours after birth. In lung conditions that contain more fluid, it will increase airway resistance and decrease lung compliance which will cause impaired air exchange, retraction, hypoxia and even apnea [14-16]. Long uterine incision time for cesarean delivery and anesthesia also have an impact on decreasing maternal blood pressure, resulting in decreased uterine perfusion [17].

The limitation of this study is that it uses secondary data, namely patient medical records, much of the required information is not available. In addition, this study was only conducted in one hospital in Denpasar City, therefore the results of the study cannot be generalized to a wider population.

5. Conclusion

The risk factors of neonatal asphyxia are grouped into four, which is maternal factors, infant factors, umbilical cord factors and labor factors. Labor factors such as method of delivery, prolonged labor, and premature rupture of membranes.

Delivery of labor is a risk factor for neonatal asphyxia. Neonates born by cesarean delivery method have an 8.48 times greater risk of experiencing asphyxia compared to

neonates born by spontaneous delivery method. Neonates born by cesarean delivery will not experience physiological process so that their lungs contain more fluid than air.

This research is a retrospective study based on medical record data so that there can be much missed in the data collection process. Prospective research is recommended to obtain better data.

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