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Risk factors that influance incidence of neonatal asphyxia

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ABSTRACT

The incidence of asphyxia can have an impact on infant mortality due to factors such as mother, fetus, and childbirth. There was an increase in cases of Sleman Regional Hospital from 12.2% (2017) to 24.2% (2018). The objective of this study was to determine the risk factors that influence the incidence of asphyxia. The research used a control case design. The population of all newborns in Sleman Regional Hospital and the sample was 70 asphyxia and 70 non-asphyxic babies. Research time was August 2019-May 2020. Sampling used consecutive sampling. The variables studied were maternal age, parity, amniotic fluid, premature rupture of membrane (PROM), birth weight, and prematurity. Data were analyzed univariate, chi-square test, and logistic regression. The proportion of asphyxia babies, most of the subjects, were at the age of the mother who was not at risk (74.3%), parity at risk (61.4%), clear amniotic fluid (68.6%), not PROM (74.3%), not LBW (67.1%) and not premature (67.1%). Meanwhile, infants who were not asphyxia, almost all subjects were at the age of the mother who was not at risk (78.63%), parity at no risk (58.6%), clear amniotic fluid (90.0%), not PROM (80%), not LBW (84.3%), and not premature(91.4%). The variables associated with the incidence of asphyxia were parity(p-value 0.028; OR 2.252; 95% CI 1.145-4.429)); meconium in the amniotic (p-value 0.004; OR 4.125; 95% CI 1.628-10.452); birth weight (p-value 0.03; OR 2.625; 95% CI 1.163-5.926) and prematurity (p-value 0.001; OR 5.220 95%;CI 1,971-13,827). Maternal age (p-value 0.690; OR 1.269 95%; CI 0.580-2.777) and PROM (p-value 0.546; OR 1.385 95%; CI 0.626-3.063) were not related. The most dominant factor was prematurity (p-value 0,000; OR: 8.549; 95% CI 2.947-24.800). The incidence of asphyxia was influenced by parity, meconium in the amniotic fluid, birth weight, and prematurity. Meanwhile, maternal age and PROM did not affect the incidence of asphyxia.

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INTRODUCTION

Maternal and infant mortality rates are indicators of a country's health status. Indonesian health profile data in 2018, reported the death rate in 2012, the infant mortality

rate was 34/1000 KH and in 2017 it fell to 24/1000 KH.[1]However, infant mortality in DIY has increased, from 278 cases in 2016 to 313 cases in 2017 and 2018 to 318 cases. Common causes of infant and neonatal mortality in DIY are low birth weight and sepsis. In addition, other causes of infant mortality that are often encountered in DIY include asphyxia at birth.[2,3]Infant mortality in DIY due to asphyxia was 16.9%. Sleman is one of the districts with the highest infant mortality rate with the highest cause of asphyxia, namely 14 cases.[4] According to the preliminary study of the Sleman Regional Hospital, the incidence of asphyxia has increased from 2017 as many as 161 cases (12.2%) to 231 cases (24.2%) in 2018.

Three risk factors can cause asphyxia, namely fetal factors, maternal factors, and childbirth factors. Research from Farhana, et al (2014) stated that maternal age has a relationship with the incidence of asphyxia with a p-value of 0.03.[5] Research conducted by Aslam, et al (2014) stated that parity increases the risk of asphyxia by 2.64 times.[6] Research conducted by Solayman, et al (2017) states that meconium in the amniotic fluid has a relationship with the incidence of neonatal asphyxia with a p-value of 0.004.[7] Research by Fikadu, et al (2020) states that low birth weight can increase the risk of asphyxia incidence by 6.52 times.[8] Research by Chayasak et al. (2011) explains that premature rupture of membranes for more than 18 hours does not have a significant relationship with the incidence of neonatal asphyxia.[9] The results of research from Hagos, et al (2018) stated that premature babies are at risk of increasing the incidence of asphyxia by 2.2 times.[10] The results of past research can be said to be still inconsistent because the results shown from several studies are still different. This study uses a different type of research, population, sample, sampling technique, and analysis technique from previous studies. From the inconsistent results, researchers are interested in reexamining what risk factors can cause the incidence of neonatal asphyxia. This study was conducted to determine the risk factors that influence the incidence of neonatal asphyxia in Sleman Hospital. This research is useful as a basis for vigilance for midwives to provide maximum service in preventing the incidence of neonatal asphyxia caused by various factors.

METHOD

This research uses observational analytic research using a case-control research design. The population in this study were all newborns living in RSUD Sleman. This study was conducted from August 2019 to May 2020. Based on the sample size formula according to Lemesshow, the total sample size was 49 subjects, which the researcher then rounded up to 70 subjects. The sampling method used consecutive sampling based on inclusion criteria (complete medical record and malpresentation) and exclusion (infants who had complete medical records, mothers who had a history of pregnancy hypertension, and mothers who experienced antepartum hemorrhage). The data obtained in this study are secondary data based on the patient's medical record. Data analysis used the chi-square test for bivariate analysis and logistic regression for multivariate analysis. This research has been declared worthy of ethics by the ethics committee of RSUD Sleman with number 180/0940.

RESULTS

1. Subject Frequency Distribution Based on Characteristics

Table 1.Frequency distribution of research subjects based on characteristics in Sleman Hospital in 2019

Characteristics	Asphyxia		Not asphyxia		Total		p-value
	f	%	F	%	n	%	
Mother's age							
a. Age at risk (<20 or> 35 years)	18	25.7	15	21.4	33	23.6	0.236
b. Age is not at risk (20-35 years)	52	74.3	55	78.6	107	76.4	
total	70	100.0	70	100.0	140	100.0	
Parity	43	61.4	29	41.4	72	51.4	
a. Parity is risky (parity 0 or> 3)							0.498
b. Parity is not risky (parity 1-3)	27	38.6	41	58.6	68	48.6	
total	70	100.0	70	100.0	140	100.0	
Meconium in the amniotic							
a. Meconium amniotic fluid	22	31.4	7	10.0	29	20.7	0,000
b. The amniotic water is clear	48	68.6	63	90.0	111	79.3	
total	70	100.0	70	100.0	140	100.0	
PROM							
a. PROM	18	25.7	14	20.0	32	22.9	0.110
b. Not PROM	52	74.3	56	80.0	108	77.1	
total	70	100.0	70	100.0	140	100.0	
Birth weight							
a. LBW (<2500 grams)	23	32.9	11	15.7	34	24.3	0,000
b. Not LBW (≥2500 gram)	47	67.1	59	84.3	106	75.7	
total	70	100.0	70	100.0	140	100.0	
Prematurity							
a. Premature (UK <37 weeks)	23	32.9	6	8.6	29	20.7	0,000
b. Not premature (UK 37-42 weeks)	47	67.1	64	91.4	111	79.3	
total	70	100.0	70	100.0	140	100.0	

Source: secondary data

Based on the table, the frequency distribution of the subjects consisted of 140 subjects consisting of 70 asphyxic babies and 70 non-asphyxic babies. The proportion for the group of asphyxia babies showed that most of the subjects were at the age of the mother who was not at risk (74.3%), parity at risk (61.4%), clear amniotic fluid (68.6%), without PROM (74.3%)) are not LBW (67.1%) and not premature (67.1%). Whereas for the group of infants who did not experience asphyxia, it showed that almost all subjects were at no risk age (78.6%), clear amniotic fluid (90%), no PROM (80%), not LBW (84.3%), not premature. (91.4%) and most of the subjects were at no risk parity (58.6%).

2. Analysis of the Relationship of Factors for the Incidence of Asphyxia Neonatorum

Table 2. Table of Differences in Risk Factors for the Incidence of Asphyxia Neonatorum

Characteristics	**Asphyxia**		**Not asphyxia**		**p-value**	**OR**	**CI**	
	f	**%**	**f**	**%**			**Lower**	**Upper**
Mother's age	18	25.7	15	21.4				
a. Age at risk (<20 or> 35 years)	52	74.3	55	78.6	0.690	1,269	0.580	2,777

Characteristics	Asphyxia		Not asphyxia		p-value	OR	CI	
	f	%	f	%			Lower	Upper
b. Age is not at risk (20-35 years)								
Parity								
a. Parity is risky (parity 0 or> 3)	43	61.4	29	41.4	0.028	2,252	1,145	4,429
b. Parity is not risky (parity 1- 3)	27	38.6	41	58.6				
Meconium in the amniotic								
a. Meconium amniotic fluid	22	31.4	7	10.0	0.004	4,125	1,628	10,452
b. The amniotic water is clear	48	68.6	63	90.0				
PROM								
a. PROM	18	25.7	14	20.0	0.546	1,385	0.626	3,063
b. Not PROM	52	74.3	56	80.0				
Birth weight								
a. LBW (<2500 grams)	23	32.9	11	15.7	0.030	2,625	1,163	5,926
b. Not LBW (≥2500 gram)	47	67.1	59	84.3				
Prematurity								
a. Premature (UK <37 weeks)	23	32.9	6	8.6	0.001	5,220	1,971	13,827
b. Not premature (UK 37-42 weeks)	47	67.1	64	91.4				

Source: Secondary Data

Based on table 2, the proportion of asphyxia babies was mostly born to mothers with no risk age (74.3%). Meanwhile, the proportion of infants without asphyxia, almost all subjects were also born to mothers with no risk age (78.6%). The p-value is 0.690 or> 0.05. It can be concluded that there is no significant relationship between maternal age and the incidence of neonatal asphyxia (OR 1.269 95% CI 0.580-2.777).

The proportion of asphyxia babies was mostly born to mothers with parity at risk (61.4%). Meanwhile, most of the babies without asphyxia were born to mothers with no risk parity (58.6%). The p-value is 0.028 or <0.05. It can be concluded that maternal parity has a significant relationship with the incidence of neonatal asphyxia (OR 2.252 95% CI 1.145-4.429).

The proportion of babies with asphyxia was mostly born with clear membranes (68.6%). Meanwhile, the proportion of babies with asphyxia was mostly born with clear amniotic fluid (90%). The result p-value is 0.004 or <0.05. It can be concluded that meconium in the amniotic fluid has a significant relationship with the incidence of neonatal asphyxia (OR 4.125 95% CI 1.628-10.452).

The proportion of babies with asphyxia was mostly born to mothers without PROM (74.3%). The proportion of infants without asphyxia, almost all subjects were also born to mothers without PROM (80%). The p-value is 0.546 or> 0.05. It can be concluded that PROM has no significant relationship with the incidence of neonatal asphyxia (OR 1.385 95% CI 0.626-3.063).

The proportion of babies with asphyxia was mostly born with normal weight (67.1%). The proportion of infants who were not asphyxia, almost all subjects were also born with normal weight (84.3%). The p-value is 0.030 or <0.05. It can be concluded that birth weight has a significant relationship with the incidence of neonatal asphyxia. (OR 2,625 95% CI 1,163-5,926).

The proportion of babies with asphyxia was mostly not born prematurely (67.1%). Almost all the infants who were not asphyxia were also not born prematurely (91.4%). The result of the p-value is 0.001 or <0.05. It can be concluded that prematurity has a significant relationship with the incidence of neonatal asphyxia. (OR 5,220 95% CI 1,971-13,827).

Logistic regression analysis

Table 3. Multivariate Analysis of Risk Factors for the Incidence of Asphyxia Neonatorum

	Variable	Coef-β	P-Value	OR	95% CI
Step 1	Parity	1,107	0.006	3,026	1,376-6,657
	Meconium in the amniotic	1,795	0.001	6,019	2,175-16,656
	Birth weight	0.595	0.268	1,813	0.632-5.201
	Prematurity	1,842	0.002	6,311	1,932-20,610
	Constant	-9,268	0.000	0.000	
Step 2	Parity	1,094	0.006	2,987	1,365-6,534
	Meconium in the amniotic	1,701	0.001	5,480	2,016-14,893
	Prematurity	2,146	0.000	8,549	2,947-24,800
	Constant	-8,573	0.000	0.000	

Source: Secondary data

Step 1 of the table above shows the results of the logistic regression analysis for the variables of parity, meconium in the amniotic fluid, birth weight, and prematurity. The results showed that the p-value for birth weight was the greatest. Therefore, the birth weight must be removed in the second step.

Step 2 of the table above is the result of logistic regression analysis and shows the risk factors for neonatal asphyxia, namely parity, meconium in the amniotic fluid, and prematurity. The results of the analysis also showed that the greatest OR or relationship strength was prematurity (OR: 8,549), and the smallest was parity (OR: 2.987). Thus, the most dominant risk factor for the incidence of neonatal asphyxia in Sleman Regional Hospital in 2019 is prematurity.

DISCUSSION

1. Subject frequency distribution based on characteristics

   Based on the results in table 1, it states that of the 140 study subjects, almost all subjects were mothers aged 20-35 years of age without risk, clear amniotic fluid color, mothers did not experience PROM, babies did not experience LBW, and were not premature. Meanwhile, most of the subjects were born to mothers who had risk parity.
2. Relationship between maternal age and incidence of neonatal asphyxia

   Based on the results of the analysis in Table 2, it shows that maternal age does not have a significant relationship with the incidence of neonatal asphyxia with a p-value of 0.690> 0.05, but maternal age> 20 or> 35 years have a risk of 1.269 times increasing the incidence of asphyxia. This study shows that the variable maternal age is not a risk factor for the occurrence of neonatal asphyxia in Sleman Hospital.

   Age is an important part of reproductive status. Age is related to the increase or decrease in body function so that it affects health status. Based on the theory, the reproductive system is mature and ready to use at the age of 20-35 years, while the age <20 years or> 35 years can have bad consequences for the health of the mother and the baby born.

The results of this study are not appropriate when compared to research conducted by Ritbano Ahmed, et al (2019) which states that the age of mothers who give birth more than 35 years can cause neonatal asphyxia.[11] However, when compared with the results of research by Wahyuni and Fauzia (2017), this research has suitability. Wahyuni and Fauzia's research said that maternal age had no relationship with the incidence of neonatal asphyxia with a p-value of 0.893> 0.05.[12]

3. Relationship between parity and incidence of neonatal asphyxia

Based on the results in table 2, shows that there is a significant relationship between parity and the incidence of asphyxia where the p-value is 0.028. Mothers who have a parity of 0 or> 3 will be at risk of giving birth to asphyxia babies by 2.252 times compared to mothers with parity 1-3. This study shows that the parity variable is one of the risk factors that can cause asphyxia neonatal in RSUD Sleman.

Parity is a risk factor that can cause neonatal asphyxia, especially in women who have a parity of 0 or> 3. The occurrence of asphyxia neonatal is caused by maternal parity because mothers who have never given birth allow a lack of physical and mental preparation, while for mothers who have given birth more than 3 times there will be a decrease in their reproductive organs to undergo pregnancy and childbirth again. This can affect the labor process that will be undergoing and can experience an inability to deal with labor complications. Complications that occur during pregnancy and childbirth can cause the baby to experience stress and fetal distress so that which can cause asphyxia due to impaired oxygen flow.[13]

This study is compatible with research conducted by Ana Sapitri (2019) which states that risky parity has a significant relationship with the incidence of neonatal asphyxia with a p-value of 0,000.[14] The results of the study are also appropriate when compared to the research of Abay et al. (2019) showing that babies born to primiparity mothers have a 4 times risk of experiencing asphyxia compared to multiparity.[15]

4. Relationship between meconium in the amniotic fluid and the incidence of neonatal asphyxia

Based on the results in table 2, shows that meconium mixed amniotic fluid has a significant relationship with the incidence of neonatal asphyxia with a p-value of 0.004. Babies born with meconium mixed amniotic fluid have a 4.125 times risk of experiencing asphyxia when compared to babies with clear amniotic fluid. This study shows that the meconium variable in the amniotic fluid is a risk factor for the occurrence of neonatal asphyxia in RSUD Sleman.

The state of the amniotic fluid can help determine the state of the fetus at birth. Amniotic fluid mixed with meconium is one of the causes of asphyxia neonatal. If the fetus does not get enough oxygen during pregnancy and delivery, the fetus will release meconium due to an increase in intestinal peristaltic and the relaxation of the anal sphincter so that the contents of the rectum are excreted. When the condition of the amniotic fluid mixed with meconium is inhaled by the baby and into the lungs, it will cause the baby to have difficulty breathing at the beginning of birth and asphyxia occurs.[16]

Research conducted by Jenie Palupi (2019) states that meconium in the amniotic fluid has a relationship with the incidence of neonatal asphyxia with a risk of 6.389 times when compared to babies whose water is clear.[17] Research conducted by Herawati et al. (2020) also stated that meconium mixed amniotic fluid had a significant relationship with a p-value of 0.002 or p <0.05.[18]

5. Relationship between PROM and the incidence of neonatal asphyxia

Based on the results in table 2, shows that premature rupture of membranes shows no significant relationship with the incidence of neonatal asphyxia with a p-value of 0.546> 0.05. However, PROM has a risk of 1.385 times the incidence of

neonatal asphyxia. This study shows that the variable premature rupture of membranes is not a risk factor that causes asphyxia neonatal in RSUD Sleman.

Premature rupture of membranes is a determining factor for the health and safety of the fetus after birth. Babies born to mothers with a history of PROM, are at risk for respiratory failure or asphyxia at birth. The rupture of the amniotic fluid before delivery can cause the amniotic fluid to decrease so that oligohydramnios can occur so that the baby will experience interference with the exchange of O2 and CO2.

Research conducted by Nova (2018) shows different results from this study. Nova's study said that premature rupture of membranes was statistically associated with asphyxia where the p-value was 0.000 or p <0.05.[19] This study is in line with research conducted by Fatemeh Nayeri, et al. (2012) which states that premature rupture of membranes is not one of the causes of neonatal asphyxia where the p-value obtained is 0.61 or> 0.05 which means there is no relationship.[20]

6. Relationship between birth weight and incidence of neonatal asphyxia

Based on the results in table 2, shows that birth weight has a relationship with the incidence of neonatal asphyxia with a p-value of 0.030> 0.05. Babies born weighing less than 2500 grams will be at risk of asphyxia by 2.625 times when compared to babies who are not LBW. This study shows that the variable birth weight is one of the risk factors that can cause asphyxia neonatal in RSUD Sleman.

LBW or Low Birth Weight is a condition where the weight of the baby at birth is less than 2500 grams. Babies who are born with less weight can cause various complications and one of them is asphyxia neonatal. This can be caused by a lack of surfactant, lung growth, and development that are still not perfect so that the baby can experience respiratory problems because they do not get enough oxygen.[21]

Research conducted by Alemwork, et al (2020) shows that infants with low birth weight have a risk of association with neonatal asphyxia with a p-value of 0.000.[22] However, it is not in line with the research of Eka Riana, et al. (2016) where the study showed insignificant results or there was no relationship between birth weight and the incidence of neonatal asphyxia.[23]

7. Relationship of prematurity with neonatal asphyxia

Based on the results in table 2, shows that the analysis of the results is p-value 0.001. This shows that there is a significant relationship between prematurity and the incidence of neonatal asphyxia. Babies who were born prematurely had a 5,220 times chance of experiencing asphyxia compared to babies who were not premature. This study shows that the variable prematurity is one of the factors causing neonatal asphyxia in Sleman Hospital.

Gestational age is one of the determinants of the condition of the fetus at birth. A fetus that is born prematurely is likely to have a worse condition than a baby who is not premature. Premature babies often have breathing problems due to lack of surfactant, and lung growth and development are not yet complete. The lungs are not fully mature until 34 weeks of gestation. Surfactants help the lungs to readily expand and take a breath when newborn and the baby can breathe on their own without the help of the placenta.[24]

Research conducted by Chayasak, et al (2011) states that babies born prematurely have a risk of 2.08 times experiencing asphyxia.[9] However, it is not in line with Warjidin and Yeyen (2015) where the results showed that there was no relationship between prematurity and the incidence of neonatal asphyxia with a p-value of 0.123 or p> 0.05.[25]

8. Logistic regression analysis

Based on the results of the logistic regression analysis in Table 3, shows that the variables associated with neonatal asphyxia in Sleman Regional Hospital include parity, meconium in the amniotic fluid, and prematurity. The three factors that have a significant relationship to the incidence of neonatal asphyxia, prematurity is the most

dominant factor in the incidence of neonatal asphyxia, premature babies have an 8,549 times risk of experiencing neonatal asphyxia compared to non-premature babies.

This study is in line with Rosminah's (2016) study which shows that prematurity has a risk of 2.06 times the incidence of neonatal asphyxia compared to babies who were not born prematurely.[26]

CONCLUSION AND SUGGESTIONS

Based on the results of the research above, several conclusions were obtained. Maternal age does not have a significant effect on the incidence of neonatal asphyxia. However, mothers aged <20 or> 35 years have an increased risk of neonatal asphyxia. A parity of 0 or> 3 has a significant effect on the incidence of neonatal asphyxia. A parity of 0 or> 3 has the risk of increasing the incidence of neonatal asphyxia. Amniotic meconium affects the incidence of neonatal asphyxia and babies born with meconium mixed amniotic fluid have an increased risk of neonatal asphyxia. Premature rupture of membranes has no significant effect on the incidence of neonatal asphyxia. However, mothers with PROM have an increased risk of neonatal asphyxia. Birth weight has a rule against the incidence of neonatal asphyxia and babies born with low birth weight have an increased risk of neonatal asphyxia. Prematurity has a significant effect on the incidence of neonatal asphyxia and babies born prematurely have an increased risk of neonatal asphyxia.

Suggestions for the Sleman Regional Hospital are expected to be a reference for making decisions in handling cases of neonatal asphyxia, and suggestions for midwives at the Sleman Regional Hospital are expected to be used as a basis for vigilance for midwives to provide maximum service in preventing the incidence of neonatal asphyxia caused by various factors, as well as for future researchers it is suggested that further researchers investigate risk factors for neonatal asphyxia by adding variables or other risk factors that can cause asphyxia and by using a better research design.

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