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Original Research Article

Analysis of the relationship between premature rupture of membranes with delivery method and newborn asphyxia

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ABSTRACT

Background: As many as 20% of maternal deaths are caused by premature rupture of membranes (PROM). The high rate of PROM is believed to affect newborn asphyxia. In addition, the high rate of cesarean section is one of the reasons or most frequent indications of PROM. Therefore, researchers were interested in knowing how the relationship between PROM and delivery method and newborn asphyxia was.

Methods: This study was an analytical study conducted with a cross-sectional approach by taking secondary data from patients through medical records of pregnant women who experienced PROM in January 2020 to July 2021.

Results: This study found that the incidence of PROM was more dominant in multiparous women 55.4%, in term pregnancy 79.2%, duration of PROM ≥ 12 hours 55.4%, have normal leukocyte levels 76.2%, the incidence of asphyxia (mild asphyxia) 90.1% and the rate of cesarean section as much as 24%. The bivariate analysis found a significant relationship between the length of PROM and the method of delivery (p value 0.049) and the duration of PROM with newborn asphyxia (p value 0.040) and there was no significant relationship between maternal leukocyte count and newborn asphyxia (p value 0.444).

Conclusions: The longer the duration of PROM with delivery, the greater the chance of infection for the mother and fetus. The length or duration of PROM will have an impact on the method of delivery and increase the likelihood of asphyxia in newborns.

Keywords: Premature rupture of membranes, Labor, Asphyxia, Leukocytes, Caesarean section

INTRODUCTION

The maternal mortality rate (MMR) is the proportion of maternal deaths caused by pregnancy, childbirth or postpartum care but not by other causes such as accidents or falls.¹ Maternal death according to the WHO is maternal death during pregnancy or 42 days after delivery due to causes or aggravated by pregnancy and not due to trauma or injury and it is estimated that in 2017 around 810 women died every day due to complications and childbirth.²

Some of the common causes of maternal deaths include bleeding 28%, infection of PROM 20%, eclampsia 12%, abortion 13%, prolonged labor 18% and other causes 2%.¹ One of the infections that most often causes death is endometritis and postpartum subinvolution due to premature rupture of membranes during intrapartum. The incidence of PROM is considered quite high when compared to other pregnancy problems. The percentage of PROM both at term and preterm is about 10% of all pregnancies and is more common in primigravida, while PROM at term has an incidence of about 8% of all term in

the world.³ Spontaneous labor after premature rupture of membranes usually occurred within 24 hours, with 79% of women delivering spontaneously within 12 hours and 95% within 24 hours.⁴

The majority of patients with PROM experienced a 24 hour latent phase as much as 26.7%, while the highest perinatal morbidity cases were caused by PROM for 12-24 hours as much as 30% and mortality among perinatal cases was 5% within 12-24 hours and >24 hours. In preterm PROM, infant survival rates at discharge were only 14.1%, 39.5%, 66.8% and 75.8% at 22, 23, 24 and 25 weeks respectively.⁵

The high incidence of intrapartum infection caused by PROM allows increased maternal mortality.⁷ In addition, the delivery method taken at the time of infection must really pay attention to aspects of the safety of the baby and mother. Although caesarean section is not a completely safe procedure, considering aspects of the safety of the mother and baby as well as the advantages and disadvantages of the procedure, the procedure for choosing a method of delivery can be considered in order to improve maternal and infant outcomes.

The high rate of premature rupture of membranes is believed to affect newborn asphyxia.⁸ Babies with a lower Apgar score are believed to be one of the outcomes of childbirth that experience infection, one of which is PROM. In addition, the high rate of cesarean section is one of the reasons or the most frequent indication of premature rupture of membranes.⁹

However, not all premature rupture of membranes must end with abdominal delivery, considering the condition of the mother and baby. Therefore, researchers are interested in knowing how the relationship between premature rupture of membranes and the method of delivery was and newborn asphyxia.

METHODS

The research plan

This study was an analytical study conducted with a cross-sectional approach by taking secondary data from patients through the medical records of pregnant women who experienced PROM in January 2020 to July 2021.

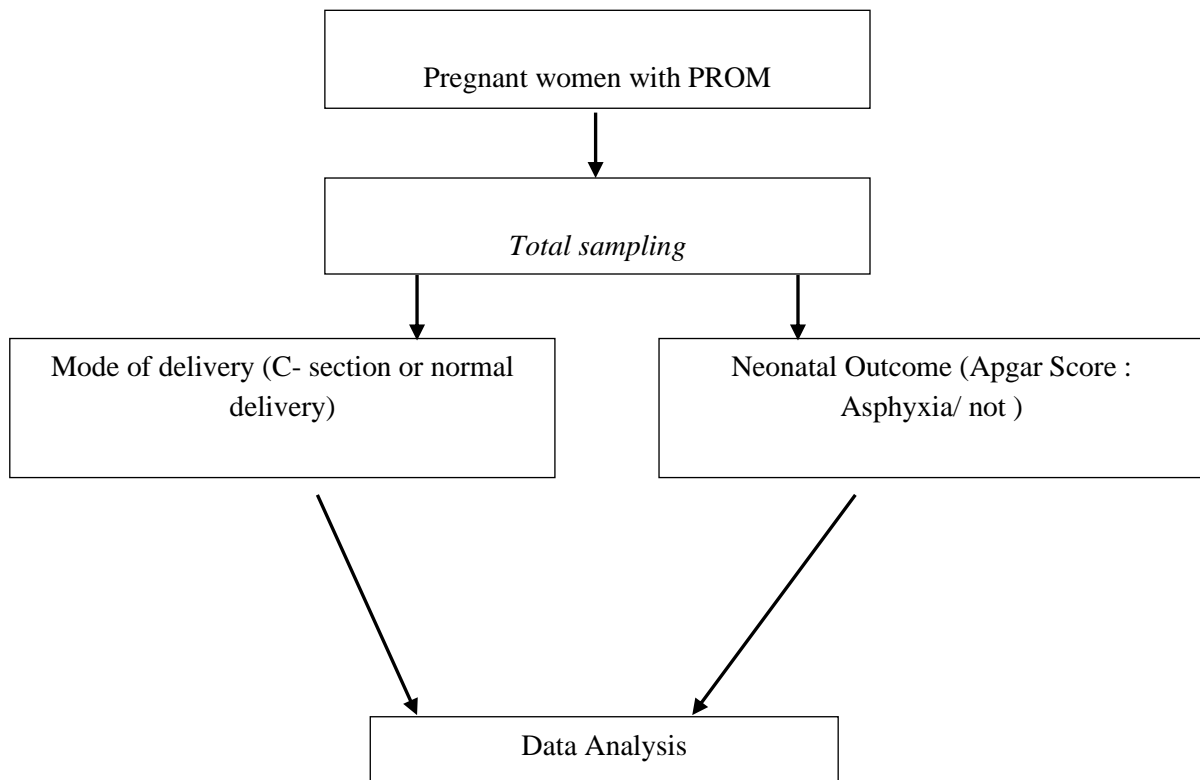


Figure 1: Research flow.

Samples and the population

The data on pregnant women with PROM used in this study came from secondary data in the PKU Muhammadiyah Mamajang hospital's medical records. The data was taken by total sampling starting of complete medical records from January 2020 to July 2021.

Variable or instrument

The variables assessed in this study were pregnant women who experienced PROM as evidenced by history taking and confirmed by examination of the patient's nitrazine test at the time of vaginal examination upon admission to the

hospital at the maternal ER at PKU Muhammadiyah hospital Mamajang. The nitrazine test was a conventional test for testing the pH of the amniotic fluid to assess the presence of PROM and had been used since 1938.¹⁰

Other variables were the method of delivery of the baby and the Apgar score, which was calculated at the time of birth and recorded in the medical record status. Newborns with an Apgar score <7 in the first and fifth minutes after delivery were defined as having birth asphyxia, while newborns with an APGAR score of 7 in the first and fifth minutes were considered not to have birth asphyxia (Chart 1).¹¹

Data analysis

Data analysis in this study used the Chi square test to see the relationship between PROM with delivery method and newborn asphyxia.

Ethical approval

Researchers made administrative preparations before researching, namely submitting a letter of ethics and a statement of passing the ethical test. A statement letter on research ethics was issued by the health research ethics

commission of the faculty of medicine and health sciences of UIN Alauddin Makassar with a recommendation of ethical approval number B.145/KEPK/FKIK/IX/2021.

RESULTS

Characteristics of pregnant women

In this study, a sample of 101 pregnant women who gave birth with a diagnosis of PROM were found. From a total of 101 data on pregnant women, the majority were aged 20-35 years with a percentage of 68.3% and the dominant parity status of multigravida was 56 people (55.4%).

The majority of gestational age at term were 80 people (79.2%), the dominant education level was in the high category as many as 81 people (80.2%), the majority of PROM duration was ≥ 12 hours as many as 56 people (55.4%) and the majority of leukocytes were normal (5,000-14,000 mm³), 77 people (76.2%). The majority of term PROM ≥ 12 hours were 44 people (55.0%), the majority of preterm PROM ≥ 12 hours were 12 people (57.1%), 80 people (79.2%) had dominant PROM status at term, mild asphyxia status (Apgar score 7-10) as many as 91 people (90.1%) and the majority method of delivery was normal, as many as 77 people (76.2%) (Table 1).

Table 1: Characteristics of pregnant women who underwent labor with a diagnosis of PROM.

Characteristics	Jumlah	
	Total	%
Age (in years)		
<20	13	12.9
20-35	69	68.3
>35	19	18.8
Parity		
Primigravida	45	44.6
Multigravida	56	55.4
Gestational age		
Preterm	21	20.8
Term	80	79.2
Education		
Low	20	19.8
High	81	80.2
Working status		
Working	24	23.8
Not working	77	76.2
PROM duration (in hours)		
<12	45	44.6
≥ 12	56	55.4
Leukocytes		
Normal	77	76.2
Leukocytosis	24	23.8
PROM in term (in hours)		
<12	36	45.0
≥ 12	44	55.0
PROM in preterm (in hours)		

Continued.

Characteristics	Jumlah	
	Total	%
< 12	9	42.9
≥12	12	57.1
PROM		
Term	80	79.2
Preterm	21	20.8
Asphyxia		
Mild	91	90.1
Moderate	10	9.9
Delivery method		
Normal	77	76.2
C-Section	24	23.8
Total	101	100.0

Table 2: The relationship between the length of the PROM and the method of delivery for pregnant women.

PROM duration		Mode of delivery		Total	P value
		Normal	C section		
<12	N	39	6	45	0.049
	%	86.7	13.3	100.0	
≥12	N	38	18	56	
	%	67.9	32.1	100.0	
Total	N	77	24	101	
	%	76.2	23.8	100.0	

Table 3: The relationship between PROM and newborn asphyxia.

PROM duration		New born outcome		Total	P value
		No asphyxia	Asphyxia		
<12	N	44	1	45	0.040
	%	97.8	2.2	100.0	
≥12	N	47	9	56	
	%	83.9	16.1	100.0	
Total	N	91	10	101	
	%	90.1	9.9	100.0	

Table 4: Relationship of maternal leukocytes with asphyxia of newborns.

Leucocytes		New born outcome		Total	P value
		No asphyxia	No asphyxia		
Normal	N	68	9	77	0.444
	%	88.3	11.7	100.0	
Leukocytosis	N	23	1	24	
	%	95.8	4.2	100.0	
Total	N	91	10	101	
	%	90.1	9.9	100.0	

The long-term relationship of PROM with the method of delivery

In this study, it was shown that there was a significant relationship between the duration of PROM and the method of delivery in pregnant women with a p value of 0.049<0.05 (Table 2).

The long-term relationship of PROM with newborn asphyxia

In this study, it was shown that there was a significant relationship between duration of PROM and asphyxia of newborns with a p value of 0.040<0.05 (Table 3).

The relationship of maternal leukocytes with newborn asphyxia

In this study, it was shown that there was no significant relationship between maternal leukocyte count and newborn asphyxia with a p value of $0.444 > 0.05$ (Table 4).

DISCUSSION

In this study, it was found that the incidence of PROM was more dominant in multiparous women with 56 patients (55.4%). This study was in accordance with research conducted by Habte et al 2021 and Ramseyer et al 2020 which showed that the incidence of PROM was more dominant in multiparas.^{12,13} This was different from the research conducted by Ibishi et al 2015 and Chandra et al 2020 which found that the incidence of PROM tended to be suffered by primiparous women.^{14,15}

In this study, PROM dominantly occurred in term pregnancy with a total of 80 patients (79.2%) compared to preterm PROM as many as 21 patients (20.8%). This study was in line with research conducted by Begum et al 2018 in Dhaka which found that PROM dominantly occurred in term pregnancies as much as 55% and preterm pregnancies in 45%.¹⁶ A similar study was also presented by Habte et al 2021 which stated that PROM was dominant in term pregnancies with a percentage of 60.9%.¹² In addition, in this study, the majority of PROM durations were ≥ 12 hours in as many as 56 patients (55.4%). This was different from Chandra et al 2020, which stated that the majority of PROM durations were < 12 hours with a percentage of 76.5% and ≥ 12 hours with a percentage of 23.50%.¹⁵ This study also found that the majority of patients with PROM had normal leukocyte levels, as many as 77 people (76.2%). This was in line with the study of Pramono et al 2020, which stated that 60% of patients with PROM did not experience leukocytosis.¹⁷ Maternal leukocyte counts cannot identify the presence of microbial invasion into the amniotic cavity or intra-amniotic inflammation in women with PROM before delivery.¹⁸ In addition, this study also found the incidence of asphyxia in mothers with PROM, namely mild asphyxia in as many as 91 babies (90.1%). This was in line with the research of Babih et al 2020, which stated that as many as 44% of PROM cases cause asphyxia in infants.¹⁹ Another supporting study, namely Chandra et al 2020, stated that as many as 55.4% of PROMs caused infant asphyxia.¹⁵

In this study, the percentage of caesarean section rates in the incidence of PROM was 24%. Several other studies from various references also found the incidence of caesarean section in PROM cases to be up to 28%, 30% and 26%.^{14,15,20} Bivariate analysis in this study, related to the duration of PROM with the method of delivery, showed a significant relationship with a p value of 0.049. Although there was no statistically significant difference in neonatal/perinatal mortality, according to a study by Kayiga et al (2018) in terms of different modes of delivery, in low-resource settings, vaginal delivery was a safer mode

of delivery. Vaginal birth causes less maternal and perinatal morbidity than cesarean section. These data supported the practice that has been adopted in high-income countries regarding planned vaginal delivery for PROM and should be adopted as standard practice in low- and middle-income countries.²¹ The longer the duration of PROM with delivery, the greater the possibility of infection for the mother and fetus.

In this study, it was also found that there was a significant relationship between the duration of premature rupture of membranes and asphyxia in newborns with a p value of 0.040, namely in premature rupture of membranes more than 12 hours, 16.1% more infants suffered from moderate asphyxia compared to PROM. Sample with experience PROM < 12 hours suffering from moderate asphyxia only 2.2% of the total sample. In line with this study, a study in Batam with 91 samples also found that there was a relationship between the incidence of premature rupture of membranes and neonatal asphyxia.²² However, Begum's research 2018 in Dhaka also showed an increase in infant mortality by 7% due to premature rupture of membranes, where one of the causes of infant mortality was severe asphyxia, respiratory distress and sepsis.¹⁶ However, a study conducted by Al Fattah with 175 samples found that the duration of premature rupture of membranes was not associated with the presence of asphyxia of the newborn but related with gestational age and the number of leukocytes. The sample found that the duration of premature rupture of membranes was not associated with the presence of asphyxia of the newborn but related with gestational age and the number of leukocytes.²³ This study showed that there was no significant difference between the leukocyte count of mothers with PROM and asphyxia in infants with a p value of 0.444. This study was in line with Pramono et al 2020, which stated that there was no significant difference between the number of maternal leukocytes and the incidence of PROM, with a percentage of 62.5% of infants not having asphyxia.¹⁷ Maternal leukocyte levels at the time of hospital admission cannot be used as a standard-criteria as a non-invasive screening tool to identify complications in mothers with PROM.¹⁸

Limitations

Our research has several limitations, one of which was due to the retrospective method which allowed data not to be obtained at the same time, but we tried to minimize this by taking complete data in medical records and using the most recent data started from January 2020 to July 2021.

CONCLUSION

This study confirmed that there was a significant relationship between the length of PROM and the method of delivery and also the duration of PROM with newborn asphyxia. The longer the duration of PROM with delivery, the greater the chance of infection for the mother and fetus. The length or duration of PROM will have an impact on

the method of delivery and increase the likelihood of asphyxia in newborns.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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