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Duration of Premature Rupture of Membranes with Infant APGAR Score in PROM Patients at Banten Hospital in 2023

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ABSTRACT

Premature rupture of membranes (PROM) is a labor disorder in the form of rupture of the amniotic membrane before labor occurs. According to the World Health Organization (WHO) 2014, the incidence of PROM in the world is 5-10% of total deliveries, while the proportion of PROM in Indonesia based on Riskesdas 2018 is 5.6% and Banten ranks second with a proportion of 7% PROM which exceeds the national PROM average. This study aims to determine whether there is a relationship between the duration of premature rupture of membranes and the APGAR score of infants in patients with COPD at Banten Hospital using a cross-sectional design through a retrospective approach with inclusion criteria in this study, namely mothers giving birth at Banten Hospital in the period January 1-December 31, 2023 who were diagnosed with COPD and exclusion criteria including, the presence of congenital malformations, giving birth to twins, fetal death during labor, and intrauterine growth restriction (IUGR). Sampling was done through proportional random sampling approach. Data processing was carried out using the chi-square or fisher statistical test using the p value limit of meaningfulness. 106 samples were obtained in this study. The proportion of PROM duration ≥12 hours was 53.8% and APGAR score <7 was 17%. Based on the results of statistical tests using chi-square there is a significant relationship between the length of PROM ≥12 hours with the 5th minute APGAR score in mothers with PROM at Banten Hospital in 2023 (p=0.025) with PR (IK 95%) 3.00 (1.06-8.54)]).

Keywords : Premature rupture of membranes (KPD), APGAR score, 5th minute APGAR score, laboring mother

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INTRODUCTION

The APGAR score is defined as a systematic method for evaluating newborns. Changes in APGAR scores at sequential time points can describe how well the baby responds to resuscitation.[1] There are 5 components assessed, namely color, heart rate, reflex activity response to stimulation, muscle tone, and respirations as seen on the APGAR score assessment form (Figure 2.1). The maximum total score from the APGAR assessment is 10 with each component being given a score of 0, 1, or 2. The objective assessment uses the APGAR score measured at the 1st and 5th minutes, and at every 5 to 20 minute interval thereafter if obtained. 5th minute score <7.[2]

Based on data from the World Health Organization (WHO), asphyxia is the second most common cause of death after premature birth in neonates, namely 23.9% and 11% of asphyxia cases are the cause of mortality in toddlers throughout the world. asphyxia is the third highest cause of death in Southeast Asia, with a prevalence of 23%, after prematurity/low birth weight babies (27%), and neonatal infections (36%). In Indonesia, based on 2021 Maternal Perinatal Death Notification (MPDN) data, it is known that there are three main causes of infant death, namely infection (5.4%), asphyxia (27.44%), and LBW (29.21%).[3,4]

There are several factors that can influence the APGAR score, such as maternal factors, placental factors, fetal factors, and birth factors.[5] Maternal factors consist of sociodemographic factors, parity, preeclampsia, anemia during pregnancy, nutritional status, multiple pregnancies, environmental stress, smoking, amniotic fluid containing meconium, and premature rupture of membranes. Placental factors include placental abruption, placenta previa, as well as birth factors consisting of fetal presentation, prematurity, LBW, and congenital abnormalities. prolonged labor, types of labor.[6–12]

Premature rupture of membranes (PROM) is one of the disorders of labor caused by rupture of the amniotic membrane before labor occurs. PROM can occur in aterm pregnancy (>37 weeks) and preterm PROM (<37 weeks).[13] According to data from the World Health Organization (WHO) 2014 in Rizki Nikmathul Ali, the incidence of premature rupture of membranes is 5-10% of total births and about 30% of PROM cases cause premature birth.[14] The proportion of premature rupture of membranes in Indonesia based on Riskesdas 2018[15] is 5.6% and is the most common delivery disorder when compared to other delivery disorders, such as convulsions (0.2%), placenta previa (0.7%), retained placenta (0.8%), bleeding (2.4%), hypertension (2.7%), cord entanglement (2.9%), transverse / breech fetal position (3.1%), prolonged partus (4.3%), and others (4.6%). According to Riskesdas 2018[15], there are 3 provinces with the highest proportion of CPD, namely DI Yogyakarta (10.1%), Banten (7%), and

Jakarta (7%). Banten ranks second with the highest proportion of CPD in Indonesia, even exceeding the national average CPD rate. In addition, research by Muayah et al[16] at Banten Regional Hospital in 2020 found that out of 114 laboring mothers, 62 people or 54.4% experienced premature rupture of membranes.

Research conducted by Rina Octavia et al[17], showed that 15.9% of all births at Budi Asih Serang Hospital in 2017 experienced PROM. Rupture of membranes affects fetal outcomes and disrupts the delivery process because it can cause umbilical cord prolapse, placental abruption, pulmonary hypoplasia, limb contractures, and correlates with premature birth rates, periventricular leukomalacia, respiratory distress syndrome, chronic lung disease, necrotizing enterocolitis, patent ductus arteriosus , retinopathy of prematurity, and cerebral palsy.[18,19]

Poor fetal outcomes can be identified through the APGAR score. The APGAR score is an objective tool to assess the condition of the neonate and to assess the need for resuscitation, which is calculated using 5 components, namely respiratory effort, grimace response, heart rate, muscle tone and skin color.[19] Low baby APGAR scores can be found in mothers giving birth with PROM. A decrease in APGAR scores at 5 and 10 minutes correlates with the incidence of neonatal infections, neonatal hypoglycemia, respiratory disorders, neonatal deaths, air leak syndrome, retinopathy of prematurity, and oligohydramnios. Low birth weight is known to correlate with lower APGAR scores at the 1st and 5th minutes compared to those who do not experience preterm PROM. 8 Babies with low APGAR scores who experience preterm birth and have a weight <2,500 g have a higher survival rate low life.[20,21]

Sudha Priyanka's[22] research showed complications of premature rupture of membranes, namely respiratory distress syndrome, hyperbilirubinemia, sepsis and necrotizing enterocolitis (6%). In addition, in this study it was discovered that there were differences in the latency period in preterm PROM, namely 63% of early preterm PROM (28-33 weeks 6 days) and 24% of late preterm PROM (34-36 weeks 6 days) had a latent period of >24 hours.[22] Research by Tigist Endale et al[23] shows that premature rupture of membranes influences several factors on maternal and fetal outcomes. The duration of PROM with a duration of >12 hours has a worse impact on fetal outcomes when compared to women giving birth with a duration of PROM <12 hours. Fetal outcomes due to PROM discussed in this study include LBW <2,500 g, low 5th minute APGAR score, requiring ICU care, and cerebrospinal fluid color containing meconium.[23]

The duration of premature rupture of membranes is correlated with the APGAR score, this is in accordance with research conducted by Novia Anggraeni et al at Syekh Yusuf Gowa Hospital13, in this study it showed that mothers with a duration of PROM <12 hours were 10.71% with an APGAR score

of 4-6, whereas for PROM duration >12 hours it was 1.79% with an APGAR score <3 and 32.14% with an APGAR score of 4-6.[24] However, Shalzanisa Dwianing's research at RSU Karsa Husada showed different results from the studies mentioned previously. Researchers did not find a significant relationship between the length of PROM and the APGAR score.[25]

Based on the above, it is known that there is still limited research covering the incidence, proportion and relationship between duration of PROM and APGAR scores and there are different results from several previous studies, so researchers are interested in finding out the relationship between the duration of premature rupture of membranes and the baby's APGAR score in patients with PROM at Banten District Hospital in 2023. This research is expected to provide an overview of the proportion of duration of premature rupture of membranes, APGAR scores, and the relationship between duration of premature rupture of membranes and the baby's APGAR score.

METHODS

This study used a cross-sectional design using a retrospective approach to determine the relationship between the duration of premature rupture of membranes (PROM) and the baby's APGAR score in PROM patients at Banten District Hospital for the period 1 January to 31 December 2023. The sample in this study was 106 mothers who gave birth at the Banten District Hospital and were diagnosed with PROM. The instruments used were secondary data from maternal medical records and case-report forms. Sampling uses a probability sampling technique, namely proportional random sampling, so that the sample size between group 1 (length of PROM >12) and group 2 (length of PROM <12 hours) can be represented. The samples taken met the inclusion criteria, namely women giving birth who were diagnosed with premature rupture of membranes as proven by the results of anamnesis, physical examination and support, namely using a litmus test leading to PROM in the medical record as well as the exclusion criteria of congenital malformations in the baby being born, giving birth to children. twins (gemelli), fetal death during delivery, and intrauterine growth restriction (IUGR)

Data processing is carried out by coding the variables contained in the research, editing the data, transferring the data to a computer-based application via the Microsoft Excel and SPSS version 26 applications. Presentation of descriptive data in univariate analysis was carried out in tabular form to determine the proportion of each variable examined in this study, including APGAR scores as the dependent variable and length of PROM as the independent variable. Apart from that, univariate analysis was carried out by looking at confounding variables, namely age, nutritional status of pregnant women, LBW, gestational age, anemia, gravidity, parity, abortion and type of delivery. This research uses categorical data for univariate analysis, so the data is presented in the form of numbers (n) and

percentages (%).

Data processing and input in bivariate analysis was carried out using chi-square with a 2x2 table or using the Fisher exact test to test the relationship between the independent variable (length of premature rupture of membranes) and confounding variables on the dependent variable (APGAR score) with the confidence level used being 95 %. If the p-value is <0.05 which is statistically significant then h0 is rejected, so it is known that there is a relationship between the dependent and independent variables. If the p-value probability value is >0.05 which is not statistically significant then h0 is accepted, so there is no significant relationship between the dependent and independent variables.

This research has passed the ethical review of the Health Ethics and Research Committee (KEPK) of the Medical Study Program, Faculty of Medicine and Health Sciences (FKIK) Sultan Ageng Tirtayasa University with Letter Number 18/UN43.20/KEPK/2024 and received permission from the House Ethics and Research Committee. Banten Regional General Hospital with Letter Number 028/KEHRS/II/2024

RESULTS

This study (Table 4.1) consisted of 106 samples of mothers with PROM aged <20 years, 13 samples (12.3%), 20-35 years, 75 samples (70.8%), and >35 years, 18 samples (17%). The majority of the sample, 90.6% in this study, were housewives or did not work. The health status of mothers with chronic energy deficiency (KEK) was 12 samples (11.3%) and those who had anemia with Hb <11 g/dL were 29 samples (27.4%).

The obstetric characteristics of the sample in this study consisted of 64 samples (60.4%) multigravidity, 31 samples (29.2%) primipara, 31 samples (29.2%) multipara, 12 samples (11.3%) had experienced abortion, and gestational age <37 weeks at delivery for 23 samples (21.7%). In addition, the proportion of duration of PROM in this study was 57 (53.8%) with duration of PROM > 12 hours and 49 (46.2%) with duration of PROM < 12 hours.

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Table 1. Characteristics of mothers with PROM at Banten District Hospital in 2024.

Characteristics	Total (n=106)	
	Frequency (n)	Percentage (%)
Mother's age		
<20 years	13	12,3
20-35 years	75	70,8
>35 years	18	17,0
Maternal nutritional status		
CED	12	11,3
Normal	94	88,7
Job status		
Work	10	9,4
Doesn't work	96	90,6
Hb level		
<11 g/dL	29	27,4
>11 g/dL	77	72,6

Source: Selma Christalia Hestining Prasetya,2024

Table 2. Obstetric characteristics of PROM patients at Banten District Hospital in 2023

Characteristics	Total (n=106)	
	Frequency (n)	Percentage (%)
Gestational age		
<37 weeks	23	21,7
≥37 weeks	83	78,3
Gravidity		
Primigravida	42	39,6
Multigravida	64	60,4
Parity		
Nulliparous	44	41,5
Primipara	31	29,2
Multiparous	31	29,2
Abortion		
Had an abortion	12	11,3
Never had an abortion	94	88,7
PROM duration		
≥12 hours	57	53,8
<12 hours	49	46,2

Source: Selma Christalia Hestining Prasetya,2024

Table 4.3 shows the characteristics of the babies from this study which shows that 29 samples (27.4%) had low birth weight (<2,500 grams). Of the total 106 samples, the majority of samples, namely 71 samples (67%) underwent spontaneous vaginal delivery, 30 samples had caesarean section (28.3%), and 5 samples (4.7%) had vacuum extraction. In addition, the proportion of 5th minute APGAR scores <7 in babies born at Banten District Hospital in 2023 was 18 samples (17%) and the proportion of APGAR scores >7

was 88 samples (83%). As additional data in this study, it is known that the proportion of low APGAR scores at the 1st minute was greater than at the 5th minute, namely 34.9%. There is a difference in proportion of 17.9% between low APGAR scores at the 1st minute and the 2nd minute, which shows an increase in APGAR scores in 19 babies born at the Banten Regional Hospital from the period 1 January to 31 December 2023.

Table 3. Characteristics of babies born at Banten Regional Hospital to mothers with PROM in 2023

Characteristics	Total (n=106)	
	Frequency (n)	Percentage (%)
Baby weight		
<2.500 gram	29	27,4
≥2.500 gram	77	72,6
Types of childbirth		
Spontaneous labor	71	67
Caesarean section	30	28,3
Forceps extraction	0	0
Vacuum extraction	5	4,7
1st minute APGAR score		
<7	37	34,9
≥7	69	65,1
5th minute APGAR score		
<7	18	17
≥7	88	83

Source: Selma Christalia Hestining Prasetya,2024

Based on Table 4.4, of the 106 samples of mothers who gave birth with PROM, the proportion of duration of PROM > 12 hours and giving birth to a baby with a low APGAR score was 14 samples (24.6%), while the proportion of duration of PROM < 12 hours and giving birth to a baby with a high APGAR score was as many as 45 samples (91.8%) had a long duration of PROM <12 hours with an APGAR score >7. From the calculation results in the table above using the chi-square test, it shows that the duration of PROM is significantly related to the 5th minute APGAR score with a value of p=0.025 (significant p<0.05). In addition, mothers who gave birth with a PROM duration of >12 hours had a tendency to have a low APGAR score at the 5th minute of 3.00 times compared to those with a PROM duration of <12 hours.

Table 4. Correlation between duration of PROM and 5th minute APGAR score

		APGAR score		**Total**	**PR (IK 95%)**	***p-value***
		Low (%)	High n (%)			
PROM duration	≥12 jam	14 (24,6%)	43 (75,4%)	57 (100%)	3,00 (1,06-8,54)	0,025[cs]
	<12 jam	4 (8,2%)	45 (91,8%)	49 (100%)		
	Total	18 (17%)	88 (83%)	106		

Source: Selma Christalia Hestining Prasetya,2024

DISCUSSION

Low APGAR scores in babies at birth can be influenced by several risk factors, such as PROM. The results of this study found that there were 14 samples (24.6%) of babies with low APGAR scores born to mothers with PROM duration >12 hours and 43 samples (75.4%) with high APGAR scores. However, this study had a total sample with a low APGAR score of only 18 samples (17%) out of a total of 106 samples taken. This study showed that the proportion with low APGAR scores was greater in mothers with a PROM duration of >12 hours, amounting to 14 samples (77.7%) of the total 18 samples who had low APGAR. Even though it has a large proportion, the number of samples with low APGAR scores in this study is relatively small, namely only 18% of the total 106 samples taken. Apart from that, the results of this study through statistical analysis showed that the duration of premature rupture of membranes and the 5th minute APGAR score had a significant relationship (p-value 0.025). It is known that mothers with PROM duration >12 hours have a 3.00 times tendency to give birth to babies with low APGAR scores compared to mothers with PROM duration <12 hours [PR 95% 3.00 (1.06-8.54)].

The results of this study are similar to previous research by Sekarayu Khairunisa[26] showing that mothers with a PROM duration of >12 hours were 4.77 times more likely to give birth to a baby with a low APGAR score at the 5th minute than mothers with a PROM duration of <12 hours (p-value < 0.05). The longer the duration of PROM, the greater the possibility of experiencing complications during the birth process, thereby increasing the risk of asphyxia, morbidity and infant death. Asphyxia that is not resolved in newborns will affect the function of body cells, causing apnea with a decrease in respiratory frequency. In addition, asphyxia can affect heart function and result in metabolic acidosis, causing muscle weakness in the heart. This weakness of the heart muscle ultimately causes inadequate air to fill the alveoli, thus causing higher pulmonary vascular resistance.[26]

This research has similarities with Sekarayu Khairunisa's research[26], namely using a cross-sectional research design using a retrospective approach by observing medical record data and discussing the relationship between duration of PROM and APGAR scores. Demographic characteristics in Sekarayu Khairunisa's research consisted of maternal age and gestational age. However, in Sekarayu Khairunisa's research no further analysis was carried out regarding the relationship between these demographic factors. In contrast to Sekarayu Khairunisa's research with a sample size of 204 using a consecutive non-probability sampling technique, this study has a sample size of 106 using a proportional random sampling approach.

The results of this research are also supported by previous research by Novi Anggraeni[24] and Rico Alexander[27] showing that there is a significant relationship between the length of PROM and the APGAR score with a p-value <0.001. In contrast to this study which used both preterm and term pregnancies, Rico Alexander's research15 only used subjects in term pregnancies and did not mention at what minute the APGAR measurements were analyzed in the study.15 The difference between this study and Novi Anggraeni was using the APGAR score at the second minute 1 with a non-probability sampling technique using purposive sampling, the sample size was 112 samples, and dividing the APGAR score into 3 outcomes, namely severe with an APGAR score of 1-3, moderate 4-6, and normal 7-10.[24,27]

PROM can occur due to lack of cleanliness in the genital area which allows ascending infections to occur, especially if PROM over a longer period of time increases complications for the mother and fetus, such as endometritis or chorioamnionitis which can cause sepsis, thereby affecting the amnion lining of the inferior part of the uterus to become fragile or rupture. . PROM can affect the release of amniotic fluid, resulting in a decrease in the volume of amniotic fluid which functions to protect the baby (oligohydramnios). Oligohydramnios causes pressure on the umbilical cord resulting in sudden neonatal asphyxia and mothers with PROM are at risk of experiencing maternal infection which causes the production of endotoxin by gram-negative cells, thus causing strong vasospasm in the veins. Vasospasm causes the volume of circulating blood to decrease due to fluid moving from the vascular to the extravascular space, thereby reducing maternal placental blood flow and reducing the oxygen received by the fetus which ultimately causes hypoxia. Prolonged hypoxia causes a bluish color to the peripheral parts of the body. In addition, if oligohydramnios occurs, the fluid that protects the umbilical cord from external pressure will decrease, causing a slowdown in the fetal heart rate and when the baby is born it will affect the APGAR score.[12,24,26–28]

A low APGAR score is a sign that a baby is experiencing asphyxia which causes an emergency in the baby after birth due to failure to breathe spontaneously and regularly. A low APGAR score indicates that the baby is experiencing hypoxia, acidemia, and hypercarbia which increases energy

needs and consumption and disrupts the baby's circulation.[27] In addition, if a mother with PROM undergoes labor for a long duration, this can result in a decrease in uteroplacental perfusion by 60% and exceed the ability to tolerate hypoxia. that the fetus has, causing asphyxia and acidosis.[12]

In contrast to this research, Shalzanisa Dwianing's research did not find a significant relationship between the length of PROM and the APGAR score at RSU Karsa Husada (p value 0.638). This research is a cross-sectional study using a non-probability sampling method using consecutive sampling. Apart from that, a study with different results by Alex Yeshaneh with a cut-off for duration of PROM >8 hours and <8 hours had no relationship with the APGAR score with a p-value of 0.5.18 This could be caused by the use of different cut-offs for duration of PROM and APGAR score assessment can show false positives, namely a condition when a baby does not actually experience acidosis or hypoxia, but shows a low APGAR score <7. False positive APGAR scores can occur in several cases, such as very rapid labor, maternal analgesia, premature birth, lung anomalies, and spinal cord trauma. In addition, babies with high catecholamine levels can show false negative results on the APGAR score.[25]

CONCLUSION

There is a significant relationship between the length of PROM > 12 hours and the 5th minute APGAR score in mothers with PROM at the Banten District Hospital in 2023. Mothers with PROM > 12 hours have a 3.00 chance of giving birth to babies with low 5th minute APGAR scores. when compared with mothers with PROM <12 hours

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