

The Relationship between Maternal Characteristics and Neonatal Outcomes of Premature Rupture of Membranes

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Abstract

Introduction: Premature rupture of the membranes occurs when the amniotic membrane bursts before 37 weeks of gestation. Preterm labour is the primary cause of perinatal and neonatal death, with premature membrane rupture accounting for 40% of cases. This study aimed to investigate the relationship between the incidence of premature rupture of membranes (PROM) with maternal characteristics and neonatal outcomes.

Methods: This study was carried out through medical record analysis in premature rupture of membrane patients at the Regional General Hospital Prof. Dr. Margono Soekarjo for the period July 2022 to March 2023 using descriptive and analytical methods with a cross-sectional study design.

Results: Among 139 patients with PROM, the majority of patients are less than 35 years old, multipara, term birth, and education level below junior high school. For neonatal outcomes, both infants with PROM and without PROM, the majority were born with normal weight, first and fifth-minute APGAR without asphyxia, and male. The results found a significant relationship between gestational age, maternal education level, birth weight, and neonatal APGAR scores on the incidence of PROM.

Conclusions: premature rupture of membrane significantly impact neonatal outcome including birth weight, first-minute APGAR, and fifth-minute APGAR.

Keywords: Analytical Studies, Maternal Characteristics, Neonates Outcomes, Premature Rupture Of Membranes,

Hubungan Karakteristik Maternal dan Luaran Neonatus Kasus Ketuban Pecah Dini

Abstrak

Pendahuluan: Ketuban pecah dini terjadi ketika selaput ketuban pecah sebelum usia kehamilan 37 minggu. Persalinan prematur adalah penyebab utama kematian perinatal dan neonatal dengan ketuban pecah dini mencapai 40% kasus. Penelitian ini bertujuan untuk mengetahui hubungan antara kejadian ketuban pecah dini dan karakteristik ibu dan luaran neonatal.

Metode: Penelitian ini dilakukan melalui analisis rekam medis pada pasien ketuban pecah dini di Rumah Sakit Umum Daerah Prof. Margono Soekarjo periode Juli 2022 hingga Maret 2023. Metode yang digunakan untuk penelitian ini adalah metode deskriptif dan analitik dengan desain studi cross-sectional.

Hasil: Dari 139 pasien ketuban pecah dini, mayoritas pasien berusia kurang dari 35 tahun, multipara, lahir cukup bulan, dan tingkat pendidikan di bawah SMP. Untuk luaran neonatal, baik bayi dengan ketuban pecah dini, maupun tanpa ketuban pecah dini, mayoritas lahir dengan berat badan normal, APGAR menit pertama dan kelima tanpa asfiksia, dan berjenis kelamin laki-laki. Hasil penelitian menemukan adanya hubungan yang signifikan antara usia kehamilan, tingkat pendidikan ibu, berat badan lahir, dan skor APGAR neonatus terhadap kejadian ketuban pecah dini.

Kesimpulan: ketuban pecah dini berdampak signifikan terhadap luaran neonatal termasuk berat badan lahir, APGAR menit pertama, dan APGAR menit kelima.

Kata Kunci: Study Analitik, Karakteristik Maternal, Luaran Neonatus, Ketuban Pecah Dini

Introduction

Premature rupture of the amniotic membranes (PROM) occurs when the baby is delivered before 37 weeks of gestation. About 3% of pregnancies result in premature rupture of the membranes, which raises risks for both the mother and the newborn.^{1,2} Premature rupture of the membranes happens in 8% of pregnancies, according to data from the American College of Obstetricians and Gynaecologists from 2016. This is followed by spontaneous onset and labour. According to the 2012 Standar Kompetensi Dokter Indonesia (SKDI), there are still 359 maternal deaths for every 100,000 live births in Indonesia, which is a high rate. Premature rupture of the membranes might result in infection in 23 percent of pregnancies.^{1,3}

Around 18% to 20% of perinatal fatalities are linked to premature rupture of the membranes, which also accounts for 2% to 20% of labour difficulties. Additionally, PROM has been linked to a number of newborn problems, including fetal mortality, neonatal infection, and respiratory distress syndrome. PROM complicates 3% of pregnancies, and causes for nearly one-third of all premature deliveries.^{4,5} During the PROM latency phase, which is the interval between the beginning of PROM and delivery, there is a risk of intrauterine mortality, abruptio placentae, fetal infection, and umbilical cord prolapses. It's still difficult to handle pregnancies complicated by PROM optimally. Pregnancy treatment with prompt delivery is still debatable, particularly when PROM occurs at fewer than 30 weeks of gestation. In order to improve outcomes for both mothers and infants, the most recent Cochrane study on this topic suggests a treatment strategy with close monitoring between 25 and 37 weeks of gestation.^{1,3}

Due to its complex etiology, PROM cannot be effectively prevented. Therefore, early detection of PROM risk factors can

enhance maternal and neonatal health and lessen the likelihood of poor mother and infant outcomes.⁶ Because of the importance of knowledge about the relationship between the incidence of PROM and maternal characteristics and neonatal outcomes, the author is interested in knowing the relationship between the incidence of premature rupture of membranes (PROM) with maternal characteristics and neonatal outcomes at Prof. Doctor Margono Soekarjo General Hospital Purwokerto.

Methods

This study was conducted at the Prof. Dr. Margono Soekarjo Hospital using a cross-sectional design and a case-control analytical approach evaluates the association between maternal characteristic (age, parity, education, gestational age) and the outcomes of newborns in situations of preterm rupture of membranes. Purposive sampling was used in research sampling. The subjects in this study were patients with cases of premature rupture of membranes which had been proven by physical examination at the Obstetrics outpatient unit and emergency room at Prof. Dr. Margono Soekarjo Hospital.

The sample size calculation for categorical data with a minimum of 33 individuals was used to establish the minimum sample size in this investigation. The study employed secondary data obtained from medical records of patients with preterm rupture of the membranes in mothers and infants who were treated at the obstetrics outpatient unit and emergency department of Prof. Dr. Margono Soekarjo Hospital.

The subjects in this study were patients with cases of premature rupture of membranes. This has been proven by physical examination at the Obstetrics outpatient unit and emergency room at Prof. Dr. Margono Soekarjo Hospital. The inclusion criteria for patients in this study were of mothers and

babies with premature rupture of membranes in the obstetrics outpatient unit and emergency room at Prof. Dr. Margono Soekarjo Hospital with complete medical records. Exclusion criteria in this study is patients with premature rupture of membranes and has other obstetrical complications, patient with multiple pregnancy, stillbirth during labor, fetal with congenital abnormalities, and patients with incomplete medical record data. Group of cases in this study are premature rupture of membranes patients defined as spontaneous rupture of membranes that occurred before the onset of signs of labor and group controls consisted of patient who gave birth without premature rupture of membranes.

Data collection was carried out using a total sampling method using medical records of maternal and infant patients with premature rupture of membranes in the obstetrics outpatient unit and emergency room. The data that has been collected is processed computerized to convert the data into information. Patient data collection is carried out by searching medical record data. After obtaining the medical record data, the patient's medical record was reviewed and the data was re-collected for patient inclusion and exclusion criteria data. The data that has been collected will be analyzed using descriptive statistics. The data will then be processed using statistical software (Microsoft® Excel 2010) which will then be explained in a descriptive explanation.

Numerical data in the form of maternal age and gestational age are described in the form of a measure of centrality of numerical data with mean and median and a measure of distribution of numerical data with standard deviation and range (min-max). Then data analysis was carried out using the t-test to see whether there was a relationship between the incidence of PROM and maternal characteristics and neonatal outcomes at Prof. Dr. Margono Soekarjo Hospital. Analysis is

carried out through analysis descriptive and hypothesis testing. Statistical analysis for categorical data was tested using the chi-square test. Then Exact test Fisher used for 2x2 tables and Kolmogorov-Smirnov for tables more than 2x2.

The ethical aspect of this study was that identity confidentiality is maintained, and data from medical records is only known to the researcher and will not be published without the permission of the study subject. Medical record data be treated with full responsibility from the collection process until the study was completed and will be returned to the medical record unit.

Results

The sample for this study were patients diagnosed with KPD who met the research inclusion criteria who were treated at the Professor Margono Soekarjo General Hospital, Purwokerto in the period from July 2022 to March 2023, totaling 139 patients whose characteristics were then compared with 139 patients in the same period but without a history of KPD as described in table 1.

The majority of patients with PROM had a history of education below junior high school, 121 patients (87.05%), and 18 of them had a history of education above or equivalent to junior high school (12.95%). Of patients without PROM, 81 of them had a history of education below junior high school in 26 (18.71%) with the remaining 113 having a history of education above or equivalent to junior high school (81.29%) with the odds ratio of educational history to the incidence of PROM being 29.22 and the results of chi-square analysis. found a p-value of 0.0001, which means there is a significant relationship between the mother's educational history and the incidence of PROM.

Based on table 2, it was found that, from July 2022 to March 2023, data was analyzed

Table 1 Relationship between Maternal Characteristics and the Incidence of PROM

Variables	PROM				OR	P value
	Yes		No			
	n=139	%	n=139	%		
Maternal Age (years)						
≥ 35	36	25.90	30	21.58	1.27	0.2161
<35	103	74.10	109	78.42		
Parity						
Primiparity	50	35.97	43	30.71	1.25	0.1990
Multipara	89	64.03	96	69.06		
Gestational Age						
Preterm	70	50.36	20	14.39	6.04	0.0001
Full term	69	49.64	119	85.61		
Mother Education						
Under junior high school	121	87.05	26	18.71	29.22	0.0001
Above junior high school	18	12.95	113	81.29		

Using the chi-square test

Table 2 The relationship of KPD to neonatal outcomes

Variable	PROM				OR	P value
	Yes		No			
	n=139	%	n=139	%		
Birth Weight						
Low	80	57.55	21	15.11	4.14	0.0001
Normal	59	42.45	118	84.89		
APGAR (minute 1)						
Asphyxia	100	71.94	23	16.55	1.97	0.0003
Normal	39	28.06	116	83.45		
APGAR (minute 5)						
Asphyxia	120	86.33	7	5.04	2.99	0.0001
Normal	19	13.67	132	94.96		
Baby's sex						
Male	77	55.40	75	53.96	1.06	0.7336
Female	62	44.60	64	46.04		

Using the chi-square test

from 139 babies born with PROM and 139 patients born without PROM. Of the babies born with PROM, there were 80 patients with low birth weight (57.55%) and 59 patients with normal weight (42.45%). In babies born without PROM, there were 118 patients with normal weight (84.89%) and 21 patients with low birth weight (15.11%) with the odd ratio value of low birth weight with the incidence of PROM being 4.14 and p-value 0.001 which

means there is a relationship significant relationship between neonate weight and the incidence of PROM.

The odds ratio of the first minute APGAR score on the incidence of PROM was 1.97, and the results of chi-square analysis revealed a p-value of 0.0003. The odd ratio of the APGAR score at the fifth minute for the incidence of PROM was 2.99, and the results of the chi-square analysis revealed

a p-value of 0.0001, which means there is a significant relationship between the fifth minute APGAR value of neonates and the incidence of PROM.

The majority of babies born with PROM were male, 77 patients (55.40%), and 62 of them were female (44.60%). For babies born without PROM, the majority were male, 75 patients (53.96%), and 64 of them were female (46.04%) with the odds ratio value of the APGAR value for gender regarding the incidence of PROM was 1.06 and the results of the chi-square analysis found a p-value of 0.7336, which means there is no significant relationship between neonate gender and the incidence of PROM.

Discussion

Premature rupture of the membranes (PROM) is a moderately frequent pregnancy issue that is defined as spontaneous rupture of the membranes before 37 weeks of gestation.^{8,9} It accounts for one-third of premature deliveries and occurs in around 5–7% of pregnancies. About four out of every 1000 pregnancies are affected by the less common incidence of previable gestational age pregnancy loss (PROM).⁷

A shorter PROM latency period was shown to be linked with the following factors: advanced maternal age, cervical dilatation more than or equivalent to 3 centimetres, gestational age at rupture, absence or low amniotic fluid volume, and the presence of painful contractions upon admission. Due to the statistically considerable increased likelihood of early delivery among nulliparous women, a parity of two or more also preserved the latency period of PROM. There was no correlation seen between shorter PROM delay and vaginal bleeding at admission. Although it was present in 28.8% of patients, a prior history of spontaneous preterm delivery was not linked to a shorter PROM latency.^{8,9}

The results of this study are in line with research conducted where it was found that 70 patients with PROM experienced preterm birth (50.36%) and 69 of them were term (49.64%) with an odd ratio value of gestational age to the incidence of PROM was 6.04 and the results of chi-square analysis found a value The p-value is 0.0001, which means there is a significant relationship between gestational age and the incidence of PROM. Apart from that, this study also found that the majority of patients with PROM were multiparous, 89 patients (64.03%), and 50 of them were primiparity (35.97%) with the odd ratio value of parity for the incidence of PROM was 1.25 and the results of the chi-square analysis found a p-value. amounting to 0.199, which means there is a significant relationship between maternal parity and the incidence of PROM.

Gestational age at rupture, oligohydramnios, cervical dilatation more than 1 centimetre, and vaginal haemorrhage at rupture are factors linked to PROM delay. Previous results that shorter PROM latency times are connected with oligohydramnios and increasing gestational age are supported by research data. In contrast to previously published cut-off predictors of cervical dilation, researchers discovered that cervical dilation of 3 centimetres was predictive of a shorter PROM latency period. This finding was statistically significant.^{10,11,12,13} Contrary to earlier reports, researchers did not discover that vaginal haemorrhage was a statistically significant predictor of PROM delay. Researchers discovered that nulliparity was linked to shorter pregnancy PROM latencies, which is consistent with results initially published by Melamed et al. The study's results contribute to the modernization of the hazards related to a shorter PROM latency period following PROM. The researchers found that the survival rate in neonates born from prolonged complex PROM pregnancies at gestational age <24 was 79.2%.^{13,14}

About one-third of all preterm deliveries, 3% of pregnancies are complicated by PROM, and it plays a significant role in the perinatal morbidity and death that affects about 150,000 pregnancies yearly in the US. Mid-trimester premature loss of pregnancy, also known as PROM prior to 28 weeks of gestation, affects 0.4% to 0.7% of pregnancies and is linked to elevated rates of both short- and long-term infant morbidity.^{15,16}

Infection, abruptio placentae, prolapses of the umbilical cord, and intrauterine mortality are among the risks that PROM imposes on the foetus during its latency stage. Preterm delivery, an inflammatory response, and a degree of pulmonary hypoplasia, which results from a decrease in amniotic fluid at a very early gestational age, are the main causes of poor neonatal outcomes.⁷ It's still difficult to handle pregnancies complicated by PROM optimally. It is debatable whether to deliver a baby right away or keep expectant, particularly when PROM occurs before 30 weeks of gestation. The last Cochrane on this issue recommended a policy of pregnancy management between 25 and 37 weeks of gestation with careful monitoring to achieve better outcomes for mother and baby.^{17,18,19}

The results of this research regarding the relationship between PROM and poor outcomes are in line with previous research, where in babies born with PROM there were 80 patients with low weight (57.55%) and 59 patients with normal weight (42.45%). In babies born without PROM, there were 118 patients with normal weight (84.89%) and 21 patients with low birth weight (15.11%) with the odd ratio value of low birth weight with the incidence of PROM being 4.14 and p-value 0.001 which means there is a relationship significant relationship between neonate weight and the incidence of PROM.²⁰

Of the ninety-four mothers in research with PROM labour (lasting more than seven days), none had previously had amniocentesis. All of them were admitted at the beginning of

PROM, and they were observed in the high-risk pregnancy unit for mothers until their birth. In summary, the average gestational age at birth was 30.8 ± 3.1 weeks (range 23–34), and the average mother age was 28.4 ± 5.4 . The mean duration of the PROM latency period in days was 16 ± 21.8 (7–105), and the median gestational age at the onset of PROM was 27.1 ± 4.2 weeks (range 17–33). Most moms (96.7–98.9%) received antibiotics, magnesium, and corticosteroids.¹⁴

Neonatal survival rates have increased as a result of improvements in prenatal and neonatal care; nonetheless, there is still considerable variation in these rates between studies. The findings of the researchers are not consistent with those of previous studies, which show that survival rates in previable PROM might range from 24% to 70%.^{21,22}

According to Sim et al., the overall neonatal survival rate to discharge was 33.8%. Patients were stratified into two groups based on when they became pregnant: early (12 to 19 + 6 weeks gestation) and late pre-viable (20 to 23 + 6 weeks gestation). The latter group had survival rates that were 3.6 times higher (12.2% versus 43.8%, $p < 0.001$).²⁶ Furthermore, in a retrospective research by Linehan et al., KPD diagnosed between 14 and 23 + 6 weeks of gestation had a reported newborn survival rate until discharge of 20%. According to Esteves et al., the infant survival rate for passing PROMs was 18.7% between 18 and 20 gestations and 42.8% between 22 and 24 gestations.^{23,24} The findings of this study are consistent with a study that found that 70 patients with PROM had preterm births (50.36%), and 69 of them had term births (49.64%). The study also found that the odd ratio between the incidence of PROM and gestational age was 6.04, and the chi square analysis results showed a p-value of 0.0001, indicating a significant relationship between the two variables.

The results of newborns with PROM were also examined in this study using their APGAR

scores; most babies were born with asphyxia PROM (71.94%) based on the APGAR score in the first minute of 100 patients, and 39 of them were fit (28.06%) based on the APGAR score in the first minute. There is a substantial correlation between the incidence of PROM and neonates' first minute APGAR score, as evidenced by the 1.97 first minute APGAR value for the incidence of PROM and the p-value of 0.0003 discovered using chi-square analysis. Meanwhile, the fifth minute APGAR also showed the same results where the majority of babies were born with PROM asphyxia based on the APGAR score at the fifth minute, as many as 120 patients (86.33%) and 19 of them were fit based on the fifth minute APGAR score (13.67%) with the odds ratio value of the APGAR value the fifth minute of the incidence of KPD was 2.99 and the results of the chi-square analysis found a p-value of 0.0001, which means there was a significant relationship between the fifth minute APGAR value of neonates and the incidence of PROM.

The researchers hypothesize that there are a number of reasons why the high survival rates in their study are different from those seen in the literature. In order to remove fetal distress or newly developing medical indications, the researchers initially selected enrolled prolonged PROM complicated pregnancies (PROM latency length of at least 7 days). This might have led to higher probabilities of neonatal survival for a subgroup of PROM patients. Second, the prolonged latency phase of PROM allows for therapeutic medical therapy, which includes two rounds of corticosteroids, antibiotics, and magnesium, with the ultimate goal of obtaining advanced gestational age at birth.¹⁴ In fact, group 1's 50% of mothers experienced a PROM latency period of at least seven weeks. Additionally, coupled with increased gestational age at rupture, prolonging the length of the PROM latency phase enhances the probability of newborn survival.²⁵

The result of this study is different from the results of previous study conducted by Rachmayanti et al where maternal characteristics obtained were higher in the primiparity group. Meanwhile, based on neonatal outcomes result on 5 minute APGAR score more fit babies were found. The study result obtained is in accordance with the aim of the initial study that there is a relationship between maternal characteristics (parity, gestational age and education level) on the incidence of premature rupture of membranes and there is a relationship with neonatal outcomes (low birthweight dan 1-minute and 5-minute APGAR score. Based on the result of this study, it is hoped that readers will be able to estimate maternal characteristic that are risk factors for premature rupture of membranes, where this is also related to neonatal outcomes as well as perinatal morbidity and mortality.

The limitation of this study was that other neonatal outcomes such as anthropometrics, infection and jaundice not assessed. This study also haven't assessed maternal outcomes. Therefore future studies could examine these outcomes. We hope that the risk of premature rupture of membranes can be reduced with good maternal education remember the negative impact of premature rupture of membranes on both mother and baby.

Conclusion

Parity, gestational age and education can be used as maternal clinical parameters to predict the occurrence of premature rupture of membranes so that it is hoped that the incidence of prematurity, which mostly preceded by premature rupture of membranes can be detected and treated earlier. The health system can screen for maternal characteristics so that perinatal morbidity and mortality can be reduced.

Conflict of Interest

The authors declared there was no conflict of interest

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