Research Article

The Impact of Premature Rupture of Membranes (PROM) and Low Birth Weight (LBW) Infant Outcomes to the Survival Rate

Hubungan Ketuban Pecah Dini (KPD) dengan Luaran Bayi Berat Badan Lahir Rendah (BBLR) terhadap Survival rate setelah Satu Minggu Dilahirkan

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Abstract

Objective: To determine the impact of premature rupture of membranes and the outcome of low birth weight on the survival rate one week after birth in RSUDZA Banda Aceh.

Method: This study used an observational analytic study with a prospective cohort study design. The research samples were 84 samples that met the inclusion and exclusion criteria. The data source used was primary data obtained by direct examination by weighing the newborn at birth and during visits.

Results: There was an impact of premature rupture of membranes and the outcome of low birth weight on the survival rate of infants after one week. The results showed that the p-value <0.000. The lowest neonatal survival rate was in the group weighing less than 1000 grams, namely 0%. Weight group 1000 grams to 1500 grams with a survival rate of 55% and group weight 1500 grams to 2500 grams with a survival rate of 95%.

Discussion: There was an impact of premature rupture of membranes and the outcome of low birth weight on the survival rate one week after birth in RSUDZA Banda Aceh.

Keywords: low birth weight (LBW), preterm premature rupture of membranes, survival rate.

Abstrak

Tujuan: *Untuk mengetahui dampak ketuban pecah dini dengan luaran berat badan lahir rendah terhadap survival rate satu minggu setelah dilahirkan di RSUDZA Banda Aceh.*

Metode: *Penelitian ini menggunakan studi analitik observasional dengan desain penelitian kohort prospektif. Sampel penelitian sebanyak 84 sampel yang memenuhi kriteria inklusi dan eksklusi. Sumber data yang digunakan adalah data primer yang diperoleh dengan cara pemeriksaan langsung dengan penimbangan bayi saat baru lahir dan ketika kunjungan.*

Hasil: *Ada dampak ketuban pecah dini dengan luaran berat badan lahir rendah terhadap survival rate bayi setelah satu minggu didapatkan hasil bahwa p-value <0,000. Survival rate neonatal terendah pada kelompok berat badan di bawah 1000 gram yakni 0%. Kelompok berat badan 1000 gram sampai di bawah 1.499 gram memiliki survival rate 55% dan kelompok berat badan 1.500 gram sampai 2.499 gram memiliki angka survival rate 95%.*

Diskusi: *Ada dampak ketuban pecah dini dengan luaran berat badan lahir rendah terhadap survival rate satu minggu setelah bayi dilahirkan di RSUDZA Banda Aceh.*

Kata kunci: *berat badan lahir rendah (BBLR), ketuban pecah dini, survival rate.*

INTRODUCTION

Premature rupture of membranes (PROM) is a condition in which the membranes break before childbirth. Premature rupture of membranes that occurs before 37 weeks of gestation was called a preterm premature rupture of membranes (PPROM).[1] The prevalence is different in each country.[2] According to the World Health Organization (WHO), data on spontaneous early PROM were more prevalent in developing countries.[3] Based on data from the Ministry of Health of the Republic of Indonesia (KEMENKES RI) in 2013, the incidence of premature rupture of membranes in Indonesia is reported to vary, ranging from 6% to 10%.[4,5]

PROM complications can occur in both mother and fetus. In the mother, PROM can cause intrauterine infection, whereas, in the fetus, PROM will cause preterm labor and low birth weight (LBW)[2]. Low birth weight is a baby born weighing less than 2500 grams.[6] The prevalence of LBW according to WHO is estimated to be 17% of the 25 million births in the world annually, where 95% of them occur in developing countries and 11.6% of all cases of LBW worldwide are in Southeast Asia. The incidence of LBW in Indonesia was 11.1%. LBW incident at the dr. Zainoel Abidin Regional General Hospital (RSUDZA) Banda Aceh is still quite high, it was found that out of 1441 births, 248 (17.2%) were LBW babies while out of 1763 births there were 267 (15.1%) cases of LBW babies[6].

Low birth weight is one of the main causes of neonatal mortality. Until now, the infant mortality rate (IMR) in Indonesia is high compared to other countries in the Association of Southeast Asia Nations (ASEAN). There are multiple risk factors for neonatal mortality including LBW. LBW is not only a direct cause of death but also a major factor that threatens the chance of the newborn's survive.[7] LBW babies are babies who are susceptible to disease and have low survival. Some studies suggest that this survival rate is related to the management of infants in health services.[8] This study was conducted to assess the impact of PROM and LBW infant outcomes to the survival rate one week after birth at RSUDZA Banda Aceh.

METHODS

This study was an observational analytic study of primary data with a prospective cohort study design. This research was conducted from January 1, 2020, to September 30, 2020, at the dr. Zainoel Abidin Banda Aceh after receiving ethical approval from the Health Research Ethics Committee (HREC), Faculty of Medicine, Syiah Kuala University. The design was chosen because the researchers wanted to see the role of time (one week) in health services as exposure to LBW with PROM and assess the survival rate. This research was conducted at RSUDZA Banda Aceh from January to September 2020 with 97 research samples, but 13 samples did not follow the follow-up examination (lost to follow-up) so that the total sample that met the inclusion and exclusion criteria was 84 research samples. Infants with intrauterine growth restriction (IUGR), newborns with congenital abnormalities, mothers with other diseases such as severe preeclampsia, hyperthyroidism, heart disease, and patients who did not undergo further examination (loss to follow up) were excluded in this study.

The data was processed by univariate and bivariate methods, using survival analysis. Survival analysis aims to estimated the probability of survival, recurrence, death, and other events over a certain period. The statistical method used to see the probability of survival rate was the Kaplan Meier method. Also, the association between the independent and dependent variables will be assessed using bivariate analysis with the cox proportional hazard model method to identify the effect of birth weight on neonatal survival. Cox Proportional Hazards regression or better known as the Cox regression model were used to determine the relationship between the dependent variable and the independent variable, where the data used in the Cox Proportional Hazards regression was in the form of survival time data from an individual.

RESULTS

This research was conducted at RSUDZA Banda Aceh from January to September 2020 with 97 research samples, but 13 samples did not follow the follow-up examination (lost to follow-up) so that the total sample that met the inclusion and exclusion criteria were 84 research samples. The general characteristics of research subjects in this study were grouped based on maternal age, parity, gestational age, method of delivery, birth weight, and complete newborn outcome were listed in table 1.

Table 1. General characteristics of the research subject

Respondent characteristics	Total (n=84)	(%)
Maternal age (y o)		
15-20	4	4.7
21-25	19	22.6
26-30	23	27.4
31-35	22	26.2
36-40	12	14.2
41-45	4	4.7
Parity		
Primipara	27	32.1
Multipara	57	67.9
Gestational Age (weeks)		
Preterm (<37)	67	79.8
Early Term (37^{+0}-38^{+6})	17	20.2
Method of Delivery		
Pervaginam	33	39.2
Perabdominal	51	60.8
Birth Weight (grams)		
<1.000	4	4.8
1.000-1.500	9	10.7
1.500-2.500	71	84.5
Newborn Outcome		
Alive	68	81
Dead	16	10

Based on Table 1, the most maternal age group was 26-30 years old, namely, 27.4%, while for the lowest age group were 15-20 years and 41-45 years, 4.7% respectively. Of the 84 samples, it was dominated by multiparous as many as 57 samples. A total of 67 patients (79.8%) experienced premature rupture of membranes during preterm gestation. Cesarean section was a separate choice where as many as 51 samples (60.8%) underwent the procedure. Most low birth weight newborns were in the range 1,500-2,500 grams. A total of 68 samples of this study were declared alive.

The characteristics of the research variables in this study were grouped based on the APGAR score and birth weight were listed in table 2.

Table 2. Characteristics of the research variables

Characteristics	Total (n=84)	(%)
APGAR Score		
Severely depressed (0-3)	3	3,6
Moderate depressed (4-6)	13	15,4
Excellent condition (7-10)	68	81,0
Birth Weight (grams)		
Extremely low birth weight (<1000)	4	4,8
Very low birth weight (1000 - <1500)	9	10,7
Low birth weight (1500 - <2500)	71	84,5

Table 2 showed that the highest APGAR score was in excellent condition (7-10) with a percentage of 81%. For the characteristics of birth weight in the sample of this study, there were 84.5% with birth weight in the low birth weight group (LBW) or 1500-2500 grams and there were 4.8% with extremely low birth weight (ELBW) or below 1000 grams.

The complete distribution between the variables of gestational age and birth weight can be seen in table 3.

Table 3. Distribution of Gestation Age Against Birth Weight

Gestational Age	Birth Weight						Total	
	ELBW		VLBW		LBW			
	n	%	n	%	n	%	n	%
Preterm	4	4.8	5	6	58	69	67	79.8
Early Term	0	0	0	0	17	20.2	17	20.2
Total	4	4.8	5	6	75	89.2	84	100

The distribution of subjects based on the variable gestational age to birth weight is categorized as extremely low birth weight (ELBW) where the birth weight is less than 1000 grams, the birth weight is very low (VLBW), namely birth weight ranges above 1000 grams but below 1500 grams, and low birth weight (LBW), namely birth weight above 1500 to less than 2500 grams, the results show that babies with low birth weight were born with a gestational age below 37 weeks or preterm as much as 69%, in which there were 4.8% of the sample. The total sample who had low birth weight in the category of LBW with 89.2% followed by 6% VLBW, and 4.8% ELBW. In the early term sample, 17 samples (20.2%) had low birth weight (LBW).

The data was processed using the Cox Proportional Hazards Regression method to determine the impact of the dependent variable and the independent variable. After processing the cox regression data to assess the impact of newborn weight and preterm premature rupture of membranes on the survival rate of infants after one week, the results show that the p-value is less than 0.05 indicating that the dependent variable and the independent variable have an impact.

In this study, observations were made on all samples, namely 84 samples, it was found that 16 samples died under the age of 7 days. From a total of 16 samples who died, it was found that the lowest birth weight was 530 grams. From the results of the research that has been done, the sample who died was dominated by the female gender as much as 56.2% and the average body weight ranged from 1500 grams to 2500 grams.

Table 4. Characteristics of Study Variables who Died with in the First 7 Days

Characteristics	Total (n=84)	(%)
Gender		
Boys	7	43.8
Girls	9	56.2
Birth Weight (grams)		
ELBW (<1000)	4	25
VLBW (1000 - <1500)	5	31.25
LBW (1500 - <2500)	7	43.75

DISCUSSIONS

In this study were grouped characteristics based on maternal age, parity, gestational age, method of delivery, birth weight, and newborn outcome. The largest group of maternal age was the 26-30 year age group, namely 27.4%, while the least age group was the 15-20 years and 41-45 years age group, namely 4.7% respectively (Table 1). Meanwhile, Radha Y. Aras showed that pregnancies at extreme reproductive ages - young adolescents and older women (after 40 years) - were at high risk of giving birth to low birth weight babies so community-based awareness were needed for the prevention of teenage pregnancy and prevention of pregnancy after 40 years of maternal age and will carry important public health significance in reducing low birth weight infants, thereby avoiding further consequences for low birth weight infants.[9]

Of the 84 samples, it was dominated by multiparous as many as 57 samples. The highest percentage of parity status was multigravida with a rate of 67.9%, primigravida was 32.1%. Atiya and Sutjhata showed the risk of maternal parity on the fetal outcome with 365 samples, the results were 52.81% multigravida. Cesarean section was a separate choice where as many as 51 samples (60.8%) underwent the procedure. Most low birth weight newborns were in the range 1,500-2,500 grams.

A total of 67 patients (79.8%) experienced premature rupture of membranes during preterm gestation. On the characteristics based on gestational age, the highest results were obtained, namely the Preterm group (<37 weeks) as much as 79.8%. This was consistent with the theory that premature rupture of membranes were leading cause of preterm birth in the United States, based on gestational age, babies born prematurely can be small or large during gestation but most cases of preterm or premature babies will be born with low birth

weight. Many studies have been conducted regarding the association of prematurity with neonatal morbidity and mortality. Mosammat et al, investigated 100 samples to assess maternal factors in preterm and low birth weight infants found a mean gestational age of 27 weeks.[10] Also, Tanushree et al's study on 213 samples with very, very low birth weight found a mean gestational age of 27 weeks with an average birth weight of 783 grams.[11]

Based on table 4.2, showed that the highest APGAR scores were in excellent condition (7-10) with a percentage of 81%. This was not in line with a retrospective study conducted by Bernard et al with a sample of 1237 newborns with very low birth weight who were found to have the highest APGAR scores, namely 0-3 or severely depressed. Samples with severely depressed APGAR scores who were unable to survive were 68.1%.[12] However, this is in line with this study where preterm birth was associated with low birth weight (LBW).

For the characteristics of birth weight in the sample of this study, there were 84.5% with birth weight in the 1500–2500 grams group and there were 4.8% birth weight below 1000 grams. This is in line with research conducted by Andhikary et al where their study was a cross-sectional study of 50 pregnant women with gestational age more than 28 weeks who had PROM, where the results showed that perinatal mortality increased if PROM appeared when the fetus was not yet viable for extrauterine conditions. Also, the study observed that 45.8% neonates weight less than 2500 grams, and 2.08% have a bodyweight below 1500 grams.[12] In theory, neonates weighing less than 1000 grams have a 95% risk of death and according to the ACOG, the risk of death was increased in infants with birth weight less than 750 grams.[13]

Based on table 4.3, the results showed that babies with low birth weight were born with a gestational age of fewer than 37 weeks or preterm as much as 76.1%, in which 4.7% of the samples were born with ELBW. Meanwhile, of the total sample with low birth weight, the largest percentage was in the LBW category, namely 65.5% followed by VLBW 5.9%, and ELBW 4.7%. This was in line with the theory, namely, birth weight was categorized into extremely low birth weight (ELBW) where the birth weight was less than 1000 grams, very low birth weight (VLBW), i.e. birth weight was around 1000 grams but below 1500 grams, and low birth weight (LBW),

namely birth weight over 1500 grams to less than 2500 grams.

Table 4 showed that of the 84 samples, 16 samples died under the age of 7 days. From a total of 16 samples who died, it was found that the lowest birth weight was 530 grams. From the results of the research that has been done, the sample who died was dominated by the female gender as much as 56.2%. There was no significant difference in mortality and morbidity between male and female newborns, even after considering other risk factors such as gestational age, birth weight, and the delivery process using logistic regression methods and linear.[14] Besides, there was no sex association with neonatal mortality.[15] The same results, namely, there was no gender relationship with neonatal mortality.[16] The male gender, mothers whose age at pregnancy were too young or too old, multiparity, and deprivation contribute to the increased mortality rate in infants with VLBW and LBW.[17] Similar to the study conducted by D'Sa et al, namely gender was not a contributing factor to the incidence of neonatal mortality.[18]

Table 4.4 showed the average newborn body weight ranging from 1500 grams to 2500 grams. This was in line with research conducted by Vilanova et al. where low birth weight was closely related to infant mortality, especially in infants born to young mothers and born in public hospitals.[19] Besides, according to research by Mosammat et al. that low birth weight carries a relatively large risk in the perinatal period and increases neonatal morbidity and mortality. The study was also aimed at assessing maternal risk factors resulting in low birth weight where 33% of the causes of low birth weight were PROM. From a total sample of 100 infants with low birth weight, 52 boys and 48 girls, the survival rate was 87%, with the main cause of death being septicemia (30%).[10] In line with Abebaw's study on determinants of neonatal mortality in the intensive care unit, the neonatal mortality rate was around 38%.[20] Idrisa et al also assessed neonatal outcome in PROM cases and found that PROM had a significant effect on the perinatal, peripartum, and neonatal periods. Morbidity and mortality associated with PROM were ARDS, LBW, IUGR, and sepsis.[21] Heny et al. In a cohort study to assess the survival rate of low birth weight infants without major morbidity with a total sample of 49,333 had a 62.2% survival rate.[22]

Survival was correlated with gestational age for infants according to gestational age. In 2010, the infant mortality rate was 24 times higher for infants with low birth weight (<2500 grams) and 100 times higher in infants with very low birth weight (<1500 grams) than for infants with birth weight 2500 grams or more. First-year survival was 15.5% for infants weighing less than 500 grams. Infants with extremely low birth weight (ELBW) are more susceptible to all complications of preterm birth, both in the immediate neonatal period and after discharge from intensive care.[23,24] A meta-analysis by Laswell et al showed that VLBW infants and very preterm infants had an increased likelihood of death if they were not born in a grade III hospital. Also, significant rates of intraventricular bleeding (IVH) and periventricular leukomalacia (PVL), were associated with less than optimal neurodevelopmental outcomes, increase.[22]

The survival function was obtained from the Kaplan Meier described the probability of survival of the individual being the object of the study. Figure 4.1 showed the Kaplan Meier curve to assess the survival rate of infants with low birth weight in the first 1 week, the results were obtained where the survival rate was 81.0%.

In this study, after performing a statistical test with the Kaplan Meier method, the lowest neonatal survival rate was obtained in the group with body weight below 1000 grams where the survival rate for this group was 0%. This indicates that 4 samples with a birth weight below 1000 grams experienced death within the first 7 days / early neonatal death. Meanwhile, the group weighing 1000 grams to below 1500 grams had a survival rate of 55%, and the group weighing 1500 grams to below 2500 grams had a survival rate of 95%. The results of this study were in line with the theory and supported by other studies in which WHO estimates that out of about 130 million babies born worldwide, 4 million die at neonatal age, most (98%) occur in developing countries.[25] There were multiple risk factors for neonatal mortality including low birth weight (LBW). It was not only a direct cause of death but also a major factor that threatens the newborn's chance of survival.[26] WHO also says that 60–80% of the infant mortality rate (IMR) was caused by low birth weight.[25]
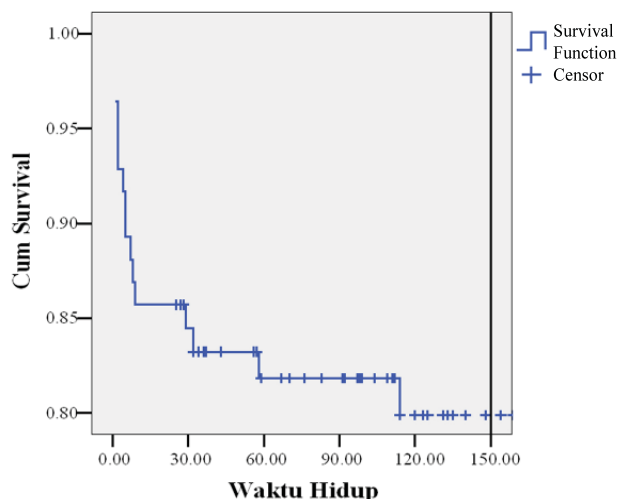
Figure 1. Survival Function

The lower the birth weight, the lower the probability of neonatal survival. The probability of survival increases with higher birth weight. This was supported by Alhassan et al. In a retrospective study to assess risk factors and neonatal outcomes in NICU care, the overall survival rate was 60.73%. The lowest survival rates were in the very low birth weight (14.3%) and very premature (20%) groups. A significant association was observed between birth weight, gestational age, and survival.[27]

Zhang et al in their study said that the increased survival rate of neonates with a low birth weight with or without major morbidity has increased. This point was associated with perinatal care and neonates that have changed in the last 2 decades. However, late-onset sepsis was still a major concern.[16] Also, in a longitudinal observational study that included 2,390 extremely preterm infants (gestational age <27 weeks), Pappas et al. Reported that antenatal exposure to chorioamnionitis appears to increase the likelihood of cognitive impairment as well as death/neurodevelopmental disorders.[25]

Although the mortality rate was greatly reduced with surfactant use, the proportion of surviving infants with severe sequelae, such as chronic lung disease, cognitive delay, cerebral palsy, and neurosensory deficits, did not increase significantly. Although there have been reports of improved neurodevelopmental outcomes in a few small studies, these improvements have not been seen on a global scale.[24]

CONCLUSIONS

This study concludes that there was an impact of newborns weight and premature rupture of membranes on the survival rate of infants after one week after being born in RSUDZA Banda Aceh and the survival rate for low-birth-weight babies with premature rupture of membranes one week after birth has a survival rate of 81%.

SUGGESTIONS

Suggestions that could be given from this study are the need for further research by adding variable characteristics, namely the cause of death of the sample and further research on the care of neonates with low birth weight at the Dr. Zainoel Abidin Regional General Hospital Banda Aceh.

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