

## Risk factors for the incident of respiratory distress syndrome in neonates at the Regional General Hospital of Buleleng District, 2020

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### ABSTRACT

**Background :** *The main causes of death in neonates are complications of pregnancy and childbirth, such as asphyxia, sepsis and low birth weight complications. Respiratory Distress Syndrome (RDS) is a condition related to the respiratory system of neonates. The large number of RDS cases is one of the highest causes of death in neonates.*

**Objectives:** *The aim of this study is to determine the risk factors for the incidence of RDS at Buleleng District Hospital, especially in premature neonates in 2020.*

**Methods:** *This research method uses a retrospective cohort study. Where the data was taken using secondary data in the NICCU room at Buleleng Regional Hospital. The independent variables included are the characteristics of the neonate including gestational age, history of hypertension experienced by the mother during pregnancy, birth weight, history of premature rupture of membranes, history of asphyxia experienced during the birth process. The dependent variable in this study was the incidence of RDS in neonates. The sample included in this research was 64 mothers who gave birth at the Buleleng District Hospital in 2020. This research used univariate analysis to assess the frequency distribution of each variable, then continued using bivariate analysis to determine the variables that were included in the multi-variate analysis. Multivariate analysis was carried out computerized using logistic regression.*

**Results:** *The results of this study found that there were 2 risk factors that directly increased the incidence of RDS in neonates including premature gestational age with a value of  $p < 0.01$  (19.8, 95% CI 1.8-133.7, low birth weight ( 2.9, 95% CI 1.9-8.4).*

**Conclusions:** *The conclusion is that there are 2 risk factors that are associated and increase the incidence of RDS in neonates, namely premature gestational age and low birth weight.*

**KEYWORD:** *respiratory distress syndrome; risk\_factors; neonates*

Article Info :

Article submitted on November 28, 2023

Article revised on December 29, 2023

Article received on January 20, 2024

## INTRODUCTION

Indonesia's health status is measured using several indicators, one of which is the health status of mothers and children. These health levels include the Maternal Mortality Rate (MMR), Neonatal Mortality Rate (NMR), Infant Mortality Rate (IMR), and Under-five Mortality Rate. The NMR indicator needs attention because it contributes to 59% of infant deaths (1). Infant mortality is defined as dead babies under 1 year old per 1000 births within 1 year (2). In general, if you look at the comparison, the infant mortality rate from 2017 to 2020 has decreased, according to the 2017 Indonesian Health Basic Survey (SDKI), which was 24 infant deaths per 1,000 live births and in 2020 there were 18.6% deaths. The desired target in 2024 is 16 deaths per 1000 live births (2).

Respiratory Distress Syndrome (RDS) is a condition consisting of one or more of the following symptoms: tachypnea or respiratory rate of more than 60x/minute, chest wall retractions (subcostal, intercostal, sternal, suprasternal), and the presence of breathing sounds in the form of moans, stridor or wheezing (3). This condition often occurs in premature newborns, causing quite serious impacts on the baby. Disorders of the respiratory system result in a lack of oxygen (hypoxia) in the body. The baby will adapt to hypoxic conditions by activating anaerobic metabolism. If hypoxic conditions become more severe and prolonged, anaerobic metabolism will increase lactic acid levels. If damage to the

brain and other organs occurs due to hypoxia and ischemia, this will cause death in the neonate. RDS also attacks neonates more often with a history of premature birth (4).

Based on the research results, it was found that multiple pregnancies, gestational age, parity, and maternal hypertension were significant risk factors for neonatal RDS. RDS mainly occurs in premature babies; The incidence rate is inversely proportional to gestational age and body weight. Although most commonly seen after premature birth, other disorders such as maternal diabetes or meconium aspiration syndrome can also inhibit surfactant production (5). Maternal age and a history of newborn asphyxia also support the high rate of RDS in neonates (6). Gestational age and multiple pregnancies are also risk factors for increased incidence of RDS (7).

RDS is a neonatal emergency which is a critical and serious problem because it is directly related to increased incidence of mortality and morbidity. Research related to the incidence of RDS in Bali is very minimal so there is a need for scientific efforts to reduce or even prevent it in terms of the characteristics of pregnancy or processes related to pregnancy. Based on a preliminary study conducted at Buleleng Regency Regional Hospital by looking at registers for the last three years, it is known that the number of babies experiencing RDS in 2017 was 67 cases, in 2018 there were 47 cases, and in 2019 there were 67 cases. 61 cases. So, there is a need for

preventive efforts by knowing the risk factors that can increase the incidence of RDS, starting from ensuring pregnancy, preventing premature birth, surfactant therapy and even preparing for respiratory assistance (8).

Based on the high prevalence of RDS and the lack of data regarding RDS in Bali in general and in Buleleng Regency Regional Hospital in particular, the author wants to conduct research on the risk factors for RDS in premature neonates in Buleleng Regency. General Hospital in 2020.

## MATERIALS AND METHODS

This research method uses quantitative research with a retrospective approach. The data taken is secondary data by collecting data using patient medical records at Buleleng Regional Hospital. This medical record is the starting point for data extraction to assess the independent and dependent variables. The independent variables that we want to look at are related to the characteristics of the respondent, including gestational age (gestation), history of hypertension, history of asphyxia, birth weight of the baby. The dependent variable is the incidence of RDS in neonates. The data collection time was from the beginning of 2020 to the end of 2020.

The inclusion criteria for this study were complete medical records for data input and a maximum dropout rate of 10% of the total respondents included. This research uses a data extract table when

collecting data. Extract the data entered based on the variables taken. Medical records were assessed starting at the beginning of 2020. The sample included in this study was 64 respondents. This study uses bivariate chisquare analysis to determine variables that can be included in multivariate analysis by looking at the p value <0.05. Next, all variables that met the requirements for entering the multivariate analysis were analyzed using the enter method logistic regression.

## RESULTS AND DISCUSSION

### RESULTS

The results of this study report a univariate analysis related to the frequency distribution found in the table below:

**Table 1. Frequency distribution of independent variables**

Variable	f(%)
Gestation	
Preterm	51 (79.7)
Aterm	13 (20.3)
History of hypertension	
Hypertension	18 (28.1)
No	46 (71.9)
Birth weight	
Low birth weight	57 (89.1)
Normal dan	7 (10.9)
Makrosomia	
Premature rupture membrane	
>6 hours	18 (28.1)
<6 hours	46 (71.9)
Asphyxia	
Severe Asphyxia	10 (15.6)
Moderate asphyxia	36 (56.2)
Vigerous baby	18 (28.1)
RDS	
RDS	44 (68.8)
No	20 (31.2)

The results of the univariate analysis above show that the majority of preterm

pregnancies were 79.7%, with a history of hypertension 28.1%. The majority of babies' birth weights were LBW with a value reaching 89.1% who gave birth at the Buleleng District Hospital. As many as 71.9% experienced rupture of membranes <6 hours and 56.2% experienced moderate asphyxia. The majority of neonates born in 2022 experi-

enced RDS at 68.8%. The results of the bivariate analysis related to the bivariate risk factor analysis data are shown in **Table 2** below. The results of bivariate analysis using *chiquare* found that variables that are bivariate risk factors for RDS that can be included in the multivariate analysis can be seen in the table below.

**Table 2. Bivariate analysis of respiratory distress syndrome risk factors**

Variable	RDS		OR	P value
	RDS	No		
Gestation			25.6	<0.0001*
Preterm	42 (82.4)	9 (17.6)		
Aterm	2 (15.4)	11 (84.6)		
History of hypertension			1.2	0.7
Hypertension	13 (72.2)	5 (27.8)		
No	31 (67.4)	15 (32.6)		
Birth weight			18.4	0.001*
Low birth weight	43 (75.4)	14 (24.6)		
Normal dan Makrosomia	1 (14.3)	6 (85.7)		
Premature rupture membrane			2,1	0.04*
>6 hours	9 (50)	9 (50)		
<6 hours	35 (76.1)	11 (23.9)		
Asphyxia			-	0,3
Severe Asphyxia	10 (100)	0 (0)		
Moderate asphyxia	33 (91.7)	3 (8.3)		
Vigerous baby	1 (5.6)	17 (94.4)		

\*variables that can be included in multivariate analysis

**Table 3. Multivariat analyze risk factors of respiratory distress syndrome**

Variable	AOR	P value	95% CI	
			Lower	Upper
Gestation	19.8	0.01	1.8	133.7
Low Birth Weight	2.9	0.03	1.9	8.4
Premature rupture membrane >6 hours	2.2	0.08	0.5	9.4

Multivariately, the variable that is included as a risk factor for RDS is caused by premature gestational age. A total of 19.8 times premature births have a risk of increasing the incidence of RDS. This result is statistically significant with a p value of 0.01 95% CI 1.8-133.7.

Furthermore, low birth weight is also a risk factor for increasing RDS with statistically significant results (2.9, 95% CI 1.9-8.4). Premature rupture of membranes is not a risk factor for RDS if seen statistically. Premature rupture of membranes >6 hours can increase the incidence of RDS by 2.2

times (2.2, 95% CI 0.5-9.4). However, this result is not statistically significant because the p value is  $>0.05$  and the 95% CI exceeds zero.

## **DISCUSSION**

### **Premature Birth**

Premature birth is a risk factor for increasing the incidence of RDS. Respiratory problems in neonates are closely related to the immaturity of the baby's body organs or immaturity of the body's organs. Respiratory problems in babies are caused by delayed lung maturation and lead to surfactant deficiency (9). Babies who experience RDS are more often found in premature births compared to mature/term births. The highest levels of surfactant in homogenized fetal lungs occur at 20 weeks of gestation, but do not reach the lung surface until the baby is full term.

The results of this study found that premature birth can increase the risk of neonates developing RDS by 19 times. These results are in line with previous research that gestational age before term or before 27 weeks increases the incidence of RDS in neonates (7). In accordance with the results of previous research which reported that 60% of babies with prematurity and LBW were at risk of RDS (10). The younger the baby is at birth, the more the incidence of respiratory problems increases, this occurs due to a lack of surfactant in the lungs, causing the alveoli to collapse (11). There are four factors that cause surfactant deficiency, such as premature birth,

asphyxia, gestational diabetes, and caesarean section.

The results of other studies in Egypt also reported the same thing that the increase in the incidence of RDS was caused by several things including premature rupture of membranes, prematurity and a history of diabetes in the mother (12). Lung growth and maturation begins in pregnancy at the age of 16-24 weeks, which is a determinant for the future respiratory system and is related to lung development (13). Most neonates who have problems related to breathing are caused by sectional deliveries. Babies who are delivered by surgery or section procedures have a larger volume of lung fluid than those born vaginally. As a result, it releases a little surfactant into the alveoli (14).

Babies born prematurely have become a procedure that requires health workers who assist with childbirth to prepare equipment to assist with asphyxia and even problems related to breathing. The need for positive ventilation is very high in babies born prematurely (12).

Research in Bali also found that on average, babies born prematurely predominantly showed signs of RDS (15). Returning again to the problem of surfactant, where babies born prematurely or preterm easily experience a lack of surfactant in their lungs so that the alveoli collapse and lead to respiratory problems and even RDS. The diameter of the bronchioles of premature babies is smaller

than that of term babies and attempts to expand them are difficult (16). Premature birth is the cause of immaturity of body organs which causes babies to be susceptible to RDS due to surfactant deficiency (17).

This indicates that at a premature gestational age, adequate equipment must be prepared from the start to assist the birth process, because with premature birth the risk of asphyxia also increases. Equipment for the resuscitation process and a safe place so that the baby can receive immediate treatment for respiratory failure must be considered from the start.

### **Low Birth Weight (LBW)**

Low birth weight is a high risk factor for RDS. Be it heavy or light RDS. LBW combined with prematurity will further aggravate and further increase the risk of neonates experiencing RDS. Previous research results also found the same thing that the risk of RDS in babies with low birth weight was higher when compared to those with normal weight (17). Babies with low birth weight are at risk of experiencing apnea attacks. With immature body organs and weak respiratory muscles, LBW will very easily experience respiratory problems, one of which is RDS (18). LBW also increases the occurrence of respiratory problems in the form of breathing through the nostrils, chest retraction, groaning sounds during expiration. This is a sign of RDS interference. The risk of hypoxia due to RDS in LBW babies is also very high (19).

RDS often attacks babies with low birth weight, this is due to the immaturity of the baby's body organs and the immaturity of lung function and structure which is a factor in RDS vulnerability due to surfactant deficiency. Small alveoli cause the alveoli to be underdeveloped, the chest wall is still weak so that surfactant production is also weak (20).

Previous research results reported that low birth weight even in babies born at term is a risk that can increase the incidence of RDS (21). Low birth weight infants show clinical manifestations of RDS including rapid breathing, chest retraction, presence of nostril breathing and cyanosis (7). So there are research results that apply positions to babies with low birth weight so that respiratory problems or disorders do not occur. The position given is a quarter prone position which stabilizes respiratory frequency and can increase oxygen saturation in LBW babies (22).

### **CONCLUIONS AND RECOMMENDATION**

The risk factors for RDS at Buleleng Regional Hospital are caused by two major factors, namely premature birth with a gestational age of less than 37 weeks. Then another factor is babies with low birth weight. Meanwhile, premature rupture of membranes more than 6 hours is not a statistical risk factor for RDS. The suggestion is that by knowing the causal factors that can increase the incidence of RDS, prevention can automatically be carried out immediately by avoiding

premature births and LBW through comprehensive and integrated pregnancy examinations. Early detection during pregnancy and safe delivery and appropriate treatment are also needed.

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