

# Factors Affecting Neonatal Sepsis in Neonatal Intensive Care Unit (NICU) and Perinatology of Wangaya General Regional Denpasar Hospital

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**Abstract:** Background: Neonatal sepsis is an important cause of mortality and morbidity both in developed and developing countries. Delays in the identification and treatment of neonatal sepsis are among the main contributors to the high mortality. Objective: To determine the risk factors of neonatal sepsis in NICU and perinatology in Wangaya General Regional Denpasar Hospital. Methods: An analytic study with a case control was obtained in Wangaya General Regional Hospital. The subjects were inpatient babies in the Perinatology ward and Neonatal Intensive Care Unit (NICU) and was born in Wangaya Regional Public Hospital, Denpasar city from 01 September 2017 to 30 May 2019. There were 58 samples that match to the inclusion and exclusion criteria in each group. Consecutive sampling and gender matching were performed for the subjects selection. The data of risk factors and neonatal sepsis were collected from the medical record. Statistical analyses included McNemar and logistic regression using SPSS v21 software with  $p < 0,05$ . Results: Bivariate statistical analyses results from neonatal sepsis risk factors were  $p$  value = 0,000 for gestational age,  $p$  value = 0,000 for low birth weight,  $p$  value = 0,000 for intra partum fever,  $p$  value = 0,302 for premature ruptures of membranes more than 24 hours, and  $p$  value = 0,000 for APGAR score. Meanwhile, from multivariate analyses there were significant results for gestational age factor with  $p$  value = 0,000 (OR = 11,4; CI95% = 2,61 – 49,76), low birth weight ( $p$  = 0,000, OR = 1,8; CI95% = 0,52 – 6,78), intra partum fever factor with  $p$  value = 0,000 (OR = 25,7; CI95% = 5,30 – 124,85), and APGAR score factor with  $p$  value = 0,000, (OR = 6,9; CI95% = 2,05 – 23,41). Conclusion: Prematurity, low birth weight, history of intra partum fever, and APGAR score lower than 7 at first minute after delivery have significant association with neonatal sepsis in Wangaya General Regional Hospital.

**Keywords:** APGAR score, intra partum fever, low birth weight, neonatal sepsis, prematurity

## 1. Introduction

Neonatal sepsis is a condition defines as a clinical syndrome characterized by signs and symptoms of infection in an infant 28 days of life or younger.[1] It is observed that birth asphyxia, prematurity, low birth weight, and other factors such as delivery setting, type of delivery, antenatal care received, newborn mixed feeding, and some cultural practices for cord care are believed to contribute to the incidence of neonatal sepsis across the world causing morbidity and mortality among neonates.[2-4]

The incidence of neonatal sepsis varies from 1-4 per 1000 live births in developed countries to 10-50/1000 live births in developing countries.<sup>4</sup> The third Sustainable Development Goal for child health aims to end preventable deaths of newborns and children under five years of age by 2030, this goal may not be attained without significant reduction of neonatal mortalities directly related to infection in developing countries.[5]

In 2015, The World Health Organization (WHO) reported that the neonatal mortality in Asia is 24,3 per 1000 live births. The report shows that Asia is the third highest neonatal mortality region after Africa and the Mediterranean. In Asia Pacific, Indonesia took place as the 5<sup>th</sup> highest mortality of neonatal sepsis with 13,5 per 1000 live births. Neonatal mortality rates in Brunei Darussalam are 4,3 per 1000 live births, Malaysia 3,9 per 1000 live births, and Singapore 1 per 1000 live births.[6,7]

The aim of the study was to determine the risk factors of neonatal sepsis in NICU and perinatology in Wangaya

General Regional Denpasar Hospital. Early identification of these risk factors of neonatal sepsis and early interventions can reduce neonatal mortality and morbidity rates in the country and the world.

## 2. Methods

In this study, a retrospective case control study was performed, the subjects were inpatient babies in the Perinatology ward and Neonatal Intensive Care Unit (NICU) and was born in Wangaya Regional Public Hospital, Denpasar city from 01 September 2017 to 30 May 2019. There were 58 samples that match to the inclusion and exclusion criteria in each group, neonates with sepsis categorized as the case group and neonates without sepsis will be categorized as the control group.

Consecutive sampling and gender matching were performed for the subjects selection. The data of risk factors and neonatal sepsis were collected from the medical record. All neonates who were born and admitted in NICU and Perinatology of Wangaya Public Hospital during the period of 1 January 2017 until 30 May 2019 were included in this study, whereas neonates who were self-discharge against medical advice, incomplete patient chart information, neonates with congenital abnormality, and born outside Wangaya hospital were excluded from this study.

Possible risk factors for neonatal sepsis were: gestational age determined based on the first day of last period or New Ballard Score (NBS), grouped as premature or term; birth weight measured within 1 hour after birth, grouped into  $< 2500$  grams and  $\geq 2500$  grams, history of intra partum fever,

grouped into temperature < 38°C or ≥ 38°C; premature rupture of membrane > 24 hours before delivery; Apgar score at 1 minute after delivery, score < 7 if the baby did not immediately cry or vigorous if the baby immediately cried with score ≥ 7 at 1 minute observation.

Descriptive and analytical statistical analyses included McNemar and logistic regression using Statistical Package for Social Sciences SPSS for Macbook 22.0 software. The direction and strength of statistical association were measured by the Odds Ratio with 95% CI. Adjusted OR along with 95% CI was estimated to identify the associated factors for neonatal sepsis. In this study, P value < 0.05 was considered to declare a result as a statistically significant association. This study was approved by the Ethics committee of Wangaya Regional Public Hospital, Denpasar, Bali.

### 3. Results

In the current study, a total of 58 neonates who had sepsis (cases) and 58 neonates who had no sepsis (controls) were enrolled. From the characteristics table, it shows matching gender on both group, 31 (53,4%) are boys and 27 (46,6%) are girls.

Forty eight (82,8%) of cases and 20 (34,5%) of controls were delivered prematurely. The majority of the cases 39 (67,2%) were delivered with low birth weight and 47 (81%) of the controls with normal birth weight. Majority of both groups had section cesarean delivery. The proportion of neonates who had an APGAR score < 7 at the first minute were higher in the cases, 36 (62,1%) than controls, 11 (19%). While 47 (81%) in the control group and 22 (37,9%) neonates in the case group had an APGAR score ≥ 7.

History of the mothers, forty-six (79,3%) mothers from the case group had received antenatal care (ANC) services less than 3 times, while 47 (81%) of the mothers from the control group had received more than 3 times ANC during pregnancy. The study revealed that 50% of the cases had intra partum fever and 50% of the cases had no fever during pregnancy, while 54 (93,1%) had normal temperature during pregnancy in the control group.

The percentage of mothers who had history of premature rupture of membrane (PROM) more than 24 hours was 12 (20,7) in the case group and 7 (12,1%) in the control group, respectively. The study revealed that the percentage of mothers who had urinary tract infections during pregnancy were 12 (20,7%) in the case group and 5 (8,6%) in the control group.

Bivariate statistical analyses results from neonatal sepsis risk factors were p value= 0,000 for gestational age, p value= 0,000 for low birth weight, p value= 0,000 for intra partum fever, p value= 0,302 for premature ruptures of membranes more than 24 hours, and p value= 0,000 for APGAR score.

Further analysis by multivariate logistic regression test showed significant results for gestational age factor with p value= 0,000 (OR = 11,4; CI95% = 2,61 – 49,76), low birth weight (p = 0,000, OR = 1,8; CI95% = 0,52 – 6,78), intra

partum fever factor with p value = 0,000 (OR = 25,7; CI95% = 5,30 – 124,85), and APGAR score factor with p value = 0,000 (OR = 6,9; CI95% = 2,05 - 23,41).

Figure 1: Sample characteristics

Variable	Case (n=58)	Control (n=58)
<b>Sex, %</b>		
Boys	31 (53,4)	31 (53,4)
Girls	27 (46,6)	27 (46,6)
<b>Gestational age, %</b>		
Preterm	48 (82,8)	20 (34,5)
Aterm	10 (17,2)	38 (65,5)
<b>Birth weight, %</b>		
Low	39 (67,2)	11 (19)
Normal	19 (32,8)	47 (81)
<b>Type of delivery, %</b>		
Spontaneous	26 (44,8)	14 (24,1)
Sectio cesarea	32 (55,2)	44 (75,9)
<b>APGAR Score, %</b>		
< 7	36 (62,1)	11 (19)
≥ 7	22 (37,9)	47 (81)
<b>Antenatal Care, %</b>		
< 3 times	46 (79,3)	11 (19)
≥ 3 times	12 (20,7)	47 (81)
<b>Intra partum fever, %</b>		
Fever	29 (50)	4 (6,9)
Normal	29 (50)	54 (93,1)
<b>PROM &gt; 24 hours, %</b>		
Yes	12 (20,7)	7 (12,1)
No	46(79,3)	51 (87,9)
<b>UTI, %</b>		
Yes	12 (20,7)	5 (8,6)
No	46 (79,3)	53 (91,4)
<b>Gravida, %</b>		
1	20 (34,5)	22 (37,9)
2	21 (36,2)	16 (27,6)
≥ 3	17 (29,3)	20 (34,5)

Figure 2: Bivariate analysis

Variable	OR	p value
Prematurity	15	0,000
Low Birth Weight	10,3	0,000
Intra partum fever	26	0,000
PROM > 24 hours	2	0,302
APGAR score < 7	9,3	0,000

Figure 3: Multivariate analysis

Variable	OR	p value	CI 95%
Prematurity	11,4	0,000	2,61 – 49,76
Low birth weight	1,8	0,000	0,52 – 6,78
Intra partum fever	25,7	0,000	5,30 – 124,85
APGAR lower than 7	6,9	0,000	2,05 – 23,41

### 4. Discussion

Strategies aimed to decrease mortality in neonates with sepsis must include measures that will decrease the incidence of intra partum fever during pregnancy, prematurity, low APGAR score and low birth weight infants.

The study identified that prematurity to be associated with mortality in neonates with bacterial sepsis, similar to previous studies in various developed and developing countries. This finding is consistent with a logistic

regression study by Martono in Indonesia which revealed that premature delivery had risk of 4 times higher to be at risk of neonatal sepsis than full term babies ( $p=0,000$ ). The association of prematurity with mortality of neonatal sepsis may be due to deficiencies in humoral and cellular immunity. Transplacental maternal antibodies primarily mediate humoral immunity, hence premature infants are less likely to receive as many maternal immunoglobulins (Ig) as term infants. During the last trimester of pregnancy, Ig is passively transferred across the placenta, premature infants have extremely low Ig levels (except for IgG) to specific maternal antigens.[8-14]

Further logistic regression analysis in this study revealed that neonates who had birth weight less than 1.5 kg were 1,8 times more likely to be at risk of neonatal sepsis than those neonates who had normal birth weight. Similarly, a study by Martono concluded that babies with low birth weight had 2,75 times higher odds of having neonates with sepsis as compared to normal birth weight babies ( $p=0,001$ ). In addition, a study by Peter et al. revealed that low birth weight infants are almost four times more likely to have neonatal sepsis as compared to neonates with normal birth weight ( $p=0,022$ ). Furthermore, premature and low birth weight infants need prolonged hospitalization, which increases the risk of nosocomial infections. [8,15]

Intra partum fever has shown a significant effect on the development of neonatal sepsis in the present study. Neonates who were born to mothers who had fever during pregnancy had 25 times higher odds of developing sepsis compared to neonates born to mothers who did not have fever during pregnancy. This is consistent with the study conducted previously in Indonesia in 2013, Pakistan in 2014, and North Ethiopia in 2015 which revealed intra partum fever was a predictor of neonatal sepsis with risk of 7 times, 36 times, and 6 times higher to develop neonatal sepsis, respectively. Intra partum fever is indicative of maternal infections that are frequently transmitted to the baby in utero or during passage through the canal which usually causes early onset sepsis.[16-19]

The current study finding revealed that APGAR scores at first minutes were significantly associated with the risk of neonatal sepsis. The current finding is consistent with the results of a previous study conducted by Siakwa et al. and Peter et al. in Ghana where they found the APGAR score at the first minute less than 7 were 5 times ( $p=0,000$ ) and 2,6 times ( $p<0,001$ ) more likely to be associated with the occurrence of neonatal sepsis, respectively. [15,20]

## 5. Conclusion

The study found that prematurity, low birth weight, history of intra partum fever, and APGAR lower than 7 have significant association with neonatal sepsis in Wangaya General Regional Hospital. Therefore, encouraging mothers to utilize antenatal services might help identify the risk factors and possible interventions to minimize the risk factors of adverse birth outcomes including neonatal sepsis.

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## Author Profile



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