



Risk Factors Associated with Hypothermia in The Newborn Babies Referred to Dr. Moewardi Hospital

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ABSTRACT

Background: Hypothermia is a condition when temperature's body drops drastically, if it occurs in neonates can increase the risk of neonatal mortality. Data on the prevalence of hypothermia in the world reaches 11% - 92% occurring in the community and still being a problem in Dr Moewardi hospital up to 29.9% in 2011. This research interested in finding out more about the risk factors associated with the incidence of hypothermia in referred babies at Dr. Moewardi General Hospital.

Method: This research is an observational study using a retrospective cross-sectional design to determine the factors associated with the incidence of hypothermia in referred neonates at the emergency room at Dr. Moewardi General Hospital using total sampling technique. This research analysis uses univariate and bivariate analysis using Statistical Product and Service Solution (SPSS).

Results: From the results of chi-square test on the birth weight were found to be significantly related to the incidence of hypothermia in asymptomatic referred neonates, with (p-value) 0.016 ($p < 0.05$).

Conclusion: The risk factor associated with the incidence of hypothermia in referred neonates is the birth weight factor.

Keywords: Hypothermia; referred neonates; gestational age; birth weight; mortality

INTRODUCTION

Hypothermia is a condition when body temperature drops drastically, which can be a dangerous situation¹². WHO defines the range as 36.5°C to 37.5°C as normal axillary temperature for neonates and as hypothermia if below 36.5°C. Data on the prevalence of hypothermia in the world reaches 11% - 92% occurring in the community and 8% - 85% occurring in hospitals. Hypothermia that occurs in neonates increases the risk of neonatal mortality. The mortality rate due to hypothermia in neonates with birth weight less than 2000 grams is 98% if the temperature 32°C; 90% if the temperature between 32°C – 35°C; and drops to 23% if the temperature can be maintained above 35°C¹³. Hypothermia occurs during transportation to the NICU can increase mortality, significant brain injury, severe retinopathy, bronchopulmonary dysplasia, necrotizing enterocolitis and sepsis².

Several studies have identified the high prevalence of hypothermia in neonates showing various risk factors, ranging from premature neonates, birth weight, small of gestational age, prolonged resuscitation, sepsis, neurological problems, surgical problems, less active or hypotonous, and environmental factors. According to WHO, in 2018 Indonesia was ranked fifth in the number of premature births with 765,700 neonates. Where premature neonates are vulnerable to hypothermia after birth due to their large body surface area and immaturity of thermoregulatory physiological functions. Apart from the factors above, there are many other factors that can cause hypothermia in neonates. At Dr. Moewardi Hospital, hypothermia is still a problem, 29.9% of referred neonates experienced

hypothermia in 2011. Based on previous research, researchers were able to find out more about what risk factors are associated with the incidence of hypothermia in referred neonates at Dr. Moewardi Hospital. Tujuan penelitian ini adalah untuk mengetahui lebih dalam mengenai apa saja faktor risiko yang berhubungan dengan kejadian hipotermia pada neonatus rujukan di RSUD Dr. Moewardi.

METHOD

This research was conducted retrospective cross sectional study design. The population used in the study were all referred neonates in the emergency room at Dr. Moewardi Hospital in April - June 2024. The subjects of this study with inclusion criteria were neonates who were referred to the emergency room at Dr. Moewardi Hospital and the exclusion criteria are neonates with major congenital abnormalities, neonates with comorbidities (sepsis, respiratory disease, hypoglycemia, intraventricular hemorrhage). The sampling technique used was purposive sampling with 36 total samples. The variables in this study were divided into two, the independent variable were gestational age, birth weight, gender, transport method and the dependent variable were hypothermia in the referred neonates. This research analysis uses univariate and bivariate analysis to analyze the correlation between two variables using chi square test. Then the data obtained was analyzed using Statistical Product and Service Solution (SPSS) 29.0.2.0. This research has passed the ethical requirements of the Dr. RSUD Health Research Ethics Commission of Dr. Moewardi Hospital on April, 8th 2024 with Number: 960/IV/HREC/2024.

RESULT

Primary data taken 40 samples. After data collection, research results were obtained as presented in table 4.1 as the characteristics of referred neonates to the ER of Dr. Moewardi Hospital. In the gender category, it was found that referred neonates were predominantly male, 22 (55%) while the female neonates were 18 (45%). Distribution depend on gestational age, the largest percentage was gestational age > 37 weeks with 26 (65%), followed by gestational age < 37 weeks with 14 (35%) with an average gestational age of 35.72 weeks. Based on birth weight, it was found that there were no referred neonates who came with macrosomic birth weight (≥ 4100 g). The largest percentage was low birth weight at 22 (55%) and normal birth weight at 18 (45%) with an average birth weight of 2381.75 grams. Most neonates were referred using incubators 36 (90%) and without incubators or other equipment 4 (10%). Results for referred neonates in the emergency room at Dr. Moewardi hospital who experienced hypothermia were 6 (15%) and neonates who did not experience hypothermia were 34 (85%).

Table 1. Characteristics of Research Variables

Variable	n (%)	Max	Min	Average
Gender				
Male ^a	22 (55%)	-	-	-
Female ^a	18 (45%)	-	-	-
Transport Method				
With Incubator ^a	36 (90%)	-	-	-
Without Incubator ^a	4 (10%)	-	-	-
Gestational age ^b (weeks)	-	40	26	35.72
Birth weight (grams) ^b	-	3800	230	2381.75

^a Analysis using Frequency Test, ^b Analysis using Test *Descriptive*

Table 2. Relationship between Gender and the Incident of Hypothermia in Referred Neonates

Variable	Hypothermia	No Hypothermia	Total	OR (95% CI)	<i>p-value</i>
Man	4 (18,2%)	18 (81,8%)	22 (100%)		
Woman	2 (11,1%)	16 (88,9%)	18 (100%)	1.778	0.545
Total	6 (15%)	34 (85%)	40 (100%)	(0.286-11.039)	

Note: chi square test *significant at $p < 0.05$

Based on table 2, the results show that the percentage of hypothermic male neonates is greater than female, 18.2%. Meanwhile, the percentage of hypothermic neonates who were female was 11.1%. From the results of statistical analysis, the value of $p = 0.545$ ($p > 0.05$) was obtained, which shows that the relationship is not significant. The odds ratio value = 1.778, which means that male neonates are 1.8 times more likely to be at risk of experiencing hypothermia compared to female neonates.

Table 3. Relationship between Gestational Age and the Incident of Hypothermia in Referred Neonates

Variable	Hypothermia	No Hypothermia	Total	OR (95% CI)	<i>p-value</i>
< 37 weeks	4 (28,6%)	10 (71,4%)	14 (100%)		
> 37 weeks	2 (7,7%)	24 (92,3%)	26 (100%)	4.8	
Total	6 (15%)	34 (85%)	40 (100%)	(0.754-30.55)	0.078

Note: chi square test *significant at $p < 0.05$

Based on table 3, the results show that gestational age < 37 weeks has a hypothermia percentage of 28.6% and gestational age > 37 weeks has a hypothermia percentage of 7.7%. From the results of statistical analysis, the value of $p = 0.078$ ($p > 0.05$) was obtained, which shows that the relationship is not significant. Odds ratio value = 4.8, which means that neonates with a gestational age of <37 weeks are 4.8 times more likely to be at risk of experiencing hypothermia compared to babies with a gestational age of >37 weeks.

Table 4. Relationship between Birth Weight and the Incidence of Hypothermia in Referred Neonates

Variable	Hypothermia	No Hypothermia	Total	OR (95% CI)	<i>p-value</i>
LBW	6 (27,3%)	16 (72,7%)	22 (100%)		
NBW	0 (0%)	18 (100%)	18 (100%)	n/s	0.016
Total	6 (15%)	34 (85%)	40 (100%)	(not specified)	

Note: chi square test *significant at $p < 0.05$

Based on table 4, the results show that LBW have a greater percentage of experiencing hypothermia, 27.3%, while normal birth weight is 0%. From the results of statistical analysis, the value of $p = 0.016$ ($p < 0.05$) was obtained, which shows a significant relationship. The Odds ratio not specified (n/s) value is because there is a value of 0 in the crosstab data processing calculation for the BBL variable who experienced hypothermia.

Table 5. Relationship between Transport Methods and the Incident of Hypothermia in Referred Neonates

Variable	Hypothermia	No Hypothermia	Total	OR (95% CI)	<i>p-value</i>
With Incubator	5 (13,9%)	31 (86,1%)	36 (100%)		
No Incubator	1 (25%)	3 (75%)	4 (100%)	0.484	0.555
Total	6 (15%)	34 (85%)	40 (100%)	(0.042-5.621)	

Note: chi square test *significant at $p < 0.05$

Based on table 5, the results showed that referred neonates without an incubator had a greater percentage experiencing hypothermia, 25%, while referred neonates with an incubator were 13.9%. From the results of statistical analysis, the value of $p=0.555$ ($p>0.05$) was obtained, which shows that the relationship is not significant. Odds ratio value = 0.484, which means that referred neonates without an incubator are 0.5 times less likely to experience hypothermia compared to neonates referred with an incubator.

DISCUSSION

Risk Factors Associated with Hypothermia Events

This study aims to determine what risk factors are associated with the incidence of hypothermia in referred babies at Dr. RSUD. Moewardi. Based on the results of data analysis, a significant relationship was found between birth weight and the incidence of hypothermia with a value of $p=0.016$ ($p<0.05$), while for the Odds Ratio the results were not specified (n/s). This is because there is a value of 0 in the crosstab calculation for the BBLC variable with hypothermia and 27.3% of LBW referral neonates experienced hypothermia. The total sample in this study was 40 reference neonate samples with 15% experiencing hypothermia, while previous research by Dwi Hidayah in 2023 at RSUD Dr. Moewardi, there were 56 reference neonate samples with 60.7% experiencing ⁶. This shows that there is a decrease in the incidence of hypothermia in referred neonates at RSUD Dr. Moewardi.

After all variables were analyzed, only birth weight had a significant effect on hypothermia according to the explanation above. The percentage of birth weight in this study was lower than previous research conducted on 254 neonates in the NICU at Korle-Bu Teaching Hospital with LBW, it was found that 44.5% experienced hypothermia ¹¹. Similar results were also revealed in another study which analyzed 23,549 neonates who were treated, of which 4.3% were LBW babies with a total of 11,322 (43.4%) neonates experiencing hypothermia ³.

The Relationship between Gender and the Incident of Hypothermia in Infants

The findings from the analysis in this study showed that there was no significant relationship between the gender factor and the incidence of neonatal hypothermia. This is in line with previous research which stated that there was no relationship between gender and the incidence of hypothermia. Sex differences are often assumed to be due to anthropometric factors, women's thermoregulatory responses are insufficient to maintain core body temperature within safe limits, but there is no evidence that women are at greater risk than men ⁹.

The Relationship between Gestational Age and the Incident of Hypothermia in Babies

The results of data analysis in this study showed that there was no significant relationship between gestational age and hypothermia. In line with the results of research conducted in 2015 at Sleman Regional Hospital that hypothermia does not have a significant relationship between gestational age and neonate body temperature based on the results of data processing, this could be due to several other factors such as IMD because when the research measurements were carried out before the baby had IMD so half of them experienced hypothermia. However, this is different from previous research which stated that gestational age and the occurrence of hypothermia at birth is an independent risk factor for the occurrence of moderate and severe hypothermia and is significantly correlated with the duration of hypothermia ¹⁰. Possible reasons for this finding are that premature infants (<37 weeks) have a large surface area to body mass ratio, minimal subcutaneous fat stores, poor clinical status, low tone, and limited capacity to produce fat ¹⁴.

The Relationship between Birth Weight and the Incidence of Hypothermia in Babies

Based on the results of data analysis, this research shows that there is a significant relationship between birth weight and hypothermia, especially LBW. This is in line with other research which suggests that LBW can cause hypothermia in neonates. Neonatal hypothermia is considered a cause of death and morbidity in LBW and LBW neonates⁴. This is due to the body's inability to retain heat and its ability to increase heat production is very limited due to inadequate muscle growth. However, it is also said that there are factors other than the weight of the baby, such as caring for the baby during delivery⁷.

The Relationship between Transport Methods and the Incident of Hypothermia in Infants

According to the results of the analysis in this study, it shows that there is no significant relationship between the transport method factor (incubator) and the incidence of neonatal hypothermia. In contrast to the results of other studies, where differences in baby temperature were obtained when using an incubator, before using the incubator all neonates experienced hypothermia¹. The incubator creates a microclimate where temperature and humidity can be regulated individually. The incubator draws room air through a filter and warms it with a heating element. High humidity benefits premature neonates who experience less noticeable water loss because their skin is immature. Heating devices other than incubators cannot provide controlled humidity⁸. The limitation of this research is that the sampling in this research was carried out within a short period of time. Apart from that, the independent variables used in the research were only 3 factors. Suggestions for the limitations of this research are that the research could be carried out for a longer duration and add the number of independent variables to obtain other factors related to the incidence of hypothermia, such as the method of delivery.

CONCLUSION

It was concluded that birth weight was related to the incidence of hypothermia in referred neonates at RSUD Dr. Moewardi. Gender and gestational age are risk factors but are not significant, whereas the use of an incubator is a preventive factor in the incidence of hypothermia in referred neonates at Dr. Moewardi.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest

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