

Risk factors for neonatal mortality at Moewardi Hospital, Surakarta

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Abstract

Background Neonatal mortality remains a major concern in developing countries. Identifying potential risk factors is important in order to decrease the neonatal mortality rate. In Moewardi Hospital, Surakarta, the risk factors for neonatal mortality have not been assessed.

Objective To evaluate potential risk factors of neonatal mortality.

Methods We reviewed medical records of all neonates hospitalized in the neonatal intensive care unit (NICU) at Dr. Moewardi Hospital from January to December 2011. Analyzed variables were sex, birth weight, gestational age, maternal age, place of delivery, mode of delivery, and sepsis. Data were analyzed by Chi square and binary logistic regression with 95% confidence intervals (CI).

Results Out of 841 neonates, the mortality rate was 212 (25.2%). Univariate logistic regression revealed that the significant risk factors for neonatal mortality were preterm (OR 4.41; 95%CI 4.24 to 4.57; P=0.0001), low birth weight (OR 4.30; 95%CI 4.13 to 4.47; P=0.0001), sepsis (OR 2.99; 95%CI 2.81 to 3.17; P=0.0001), maternal age \geq 35 years (OR 1.53; 95%CI 1.37 to 1.70), and non-spontaneous delivery (OR 1.67; 95%CI 1.50 to 1.84). Further multivariate regression analysis revealed that the significant risk factors were preterm (OR 2.27; 95%CI 2.05 to 2.48; P=0.0001), low birth weight (OR 2.49; 95%CI 2.27 to 2.71; P=0.0001), and sepsis (OR 2.50; 95%CI 2.30 to 2.69; P=0.0001).

Conclusion The risk factors for neonatal mortality in the NICU are preterm, low birth weight, and sepsis. [Paediatr Indones. 2014;54:219-22.].

Keywords: neonatal mortality, sepsis, low birth weight, preterm, risk factor

Neonatal mortality remains a major problem in developing countries. It has been estimated that 4 million infants die in the first 28 days of life each year, and approximately 30 per 1,000 livebirths.¹⁻³ Three-quarters of neonatal deaths occur in the first week, mostly in the first 24 hours.^{1,2} Infections such as sepsis, pneumonia, and tetanus, as well as diarrhea (35%), preterm birth (28%) and asphyxia (23%) were the main direct causes of neonatal deaths worldwide.¹⁻³ The fourth *Millennium Development Goal* is to reduce under-five child mortality. One of the efforts is to reduce the neonatal mortality rate.^{2,3} Identifying the causes of neonatal mortality is an important step in order to plan appropriate and effective action to achieve this goal. The objective of this study was to identify risk factors associated with neonatal mortality in NICU at Moewardi Hospital, Surakarta.

Methods

Data was taken from the medical records of neonates

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who were hospitalized in the Neonatal intensive care unit (NICU) at Moewardi Hospital from January to December 2011. Patients with incomplete medical records were excluded. The dependent variable was neonatal mortality, while independent variables were sex, birth weight, maternal and gestational ages, place and mode of delivery, and sepsis.

Low birth weight was defined as birth weight <2500 grams; normal birth weight was considered to be \geq 2500 grams. Maternal age was categorized as <35 years or \geq 35 years. Gestational age was categorized as preterm for <37 weeks or full term for \geq 37 weeks. Place of delivery was defined as inborn for infants delivered at Moewardi Hospital or outborn for those delivered elsewhere. Mode of delivery was defined as spontaneous vaginal or non-spontaneous (Caesarian section, vacuum extraction, or forceps). Sepsis diagnoses were taken from the final diagnosis shown in the medical records.

Data was entered, coded and analyzed using SPSS version 17.0 software. Chi square and binary logistic regression analyses were performed. P values < 0.05 were considered to be statistically significant with 95% confidence intervals (CI).

Results

During the one-year study period, a total of 841 neonates were hospitalized in NICU at Dr. Moewardi Hospital. Of these 841 neonates, 212 died (25.2%). Subjects' baseline characteristics are shown in **Table 1**. The predominant clinical features were female gender, full term, birth weight \geq 2500 grams, sepsis, maternal age \geq 35 years, non-spontaneous mode of delivery and born at Dr. Moewardi Hospital.

Univariate logistic regression analysis revealed

Table 1. Baseline characteristics

Characteristics	n (%)
Mortality	
Survived	629 (74.8)
Died	212 (25.2)
Gender	
Female	461 (54.8)
Male	380 (45.2)
Gestational age	
Aterm	548 (65.2)
Preterm	293 (34.8)
Birth weight	
\geq 2500 grams	473 (56.2)
<2500 grams	368 (43.8)
Sepsis	
Non-sepsis	352 (41.8)
Sepsis	489 (58.2)
Maternal age	
<35 years	328 (39.0)
\geq 35 years	513 (61.0)
Mode of delivery	
Spontaneous	345 (41.0)
Non-spontaneous	496 (59.0)
Place of delivery	
Inborn	557 (66.2)
Outborn	284 (33.8)

that sex and place of delivery were not significantly associated with the neonatal mortality. However, preterm (OR 4.41; 95%CI 4.24 to 4.57), low birth weight (OR 4.29; 95%CI 4.13 to 4.47), sepsis (OR 2.99; 95%CI 2.81 to 3.17), maternal age \geq 35 years (OR 1.53; 95%CI 1.37 to 1.70), and non-spontaneous delivery (OR 1.67; 95%CI 1.50 to 1.84) were significantly associated with neonatal mortality (**Table 2**). Multivariate analysis revealed significant associations between neonatal mortality and preterm (OR 2.27; 95%CI 2.05 to 2.49), low birth weight (OR 2.49; 95%CI 2.27 to 2.71), sepsis (OR 2.50; 95%CI 2.30 to 2.69), and non-spontaneous delivery (OR 1.44; 95%CI 1.25 to 1.62), but sex and place of delivery were not (**Table 3**).

Table 2. Univariate analysis of risk factors for neonatal mortality

Variables	OR	95% CI	P value
Male	1.14	0.98-1.30	0.4000
Preterm	4.41	4.24-4.57	0.0001
Low birth weight	4.30	4.13-4.47	0.0001
Sepsis	2.99	2.81-3.17	0.0001
Maternal age \geq 35 years	1.54	1.37-1.70	0.0110
Non-spontaneous delivery	1.67	1.50-1.83	0.0030
Outborn	1.33	1.16-1.49	0.0930

Table 3. Multivariate analysis of risk factors for neonatal mortality

Variables	OR	95%CI	P value
Preterm	2.27	2.05-2.49	0.0001
Low birth weight	2.49	2.28-2.71	0.0001
Sepsis	2.50	2.30-2.69	0.0001
Maternal age \geq 35 year	1.30	1.11-1.49	0.1640
Non-spontaneous delivery	1.44	1.25-1.62	0.0510

Discussion

Over the one-year period of this study, we estimated the neonatal mortality rate to be 25.2%. This rate was higher than the worldwide neonatal mortality rate (30/1,000).^{1,4} Based on characteristic data, two of the predominant clinical features of our subjects were sepsis (58.2%), and maternal age \geq 35 years (61%). The prevalence of sepsis in developing countries is generally higher than in developed countries. Although the incidence of neonatal sepsis varies among the geographic areas, the highest are in Africa and Asia (23-38/1,000 live births) while the lowest are in the US and Australia (1.5-3.5/1,000 live births).⁵

The risk factors found to be significantly correlated with neonatal mortality in the univariate analysis included preterm, low birth weight, sepsis, maternal age $>$ 35, and non-spontaneous delivery. Neither sex nor place of delivery were significantly associated with neonatal mortality. A Pakistani study showed that neither delivery in health facility nor by health professionals were associated with neonatal mortality.⁶ In contrast, a study in the Netherlands reported that infants of pregnant women whose labor started in primary care under the supervision of a midwife had a higher risk of delivery-related perinatal death and the same risk of admission to the NICU compared to infants of high risk, pregnant women whose labor started in secondary care under the supervision of an obstetrician.⁷

When these factors were evaluated using regression analysis (excluding sex and place of delivery), only preterm, low birth weight, and sepsis were significantly associated with neonatal mortality. Similarly, studies from other developing areas such as Pakistan, Ethiopia, Sao Paulo, East Africa found that preterm and low birth weight were important risk factors associated with neonatal mortality.^{6,8-11}

Neonatal sepsis is a major cause of neonatal morbidity and mortality. Similar to previous studies,

we found that sepsis was strongly associated with neonatal mortality.^{6,11}

Maternal age \geq 35 years and non-spontaneous delivery were not significantly correlated to neonatal mortality. A previous cohort study of 864 newborns in Banfora (Burkina Faso) found no association between older maternal age and increased neonatal deaths.¹² However, an urban Pakistan study found that Caesarean section was associated with neonatal mortality.⁶

A limitation of this study was that the data was taken from medical records. Also, we did not include asphyxia as a possible risk factor because APGAR score data were sometimes not written in medical records of the infants who were referred to Dr Moewardi Hospital. In conclusion, we find that sepsis, low birth weight, and preterm are significant risk factors for neonatal mortality in the NICU. However, non-spontaneous delivery, maternal age \geq 35 years, outborn delivery and sex are not significantly associated with neonatal mortality.

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