

## Early neonatal mortality rate and the risk factors in Wangaya hospital

Made Indah Nastiti Utami Budha, Wayan Retayasa, Made Kardana

### Abstract

**Background** The first week of life of a neonate is a critical period. In Asia, early neonatal mortality rate remains high.

**Objective** To investigate early neonatal mortality rate and the risk factors in Wangaya Hospital.

**Methods** A cross sectional study was carried out retrospectively on neonates registered at Perinatology Unit, Wangaya Hospital Denpasar, Bali since January 2006. The study was done from October to November 2007. Data was obtained from medical record, analyzed as univariate using chi-square test or Fisher's exact test and multivariate logistic regression analysis model.

**Results** Early neonatal mortality rate in Wangaya Hospital was 38.7 per 1000 livebirths. Univariate analyses showed that there were five significant risk factors of early neonatal death, i.e., respiratory distress, asphyxia, birth weight less than 2500 grams, sepsis, and gestational age less than 37 weeks. Multivariate analysis showed that those five variables were significant as risk factors of early neonatal death i.e., OR (95% confidence interval) for respiratory distress: 16.8 (3.7 to 76.6)], asphyxia: 13.5 (6.1 to 29.9)], birth weight <2500 grams: 8.1 (3.3 to 19.9)], sepsis: 7.3 (3.1 to 17.1), and gestational age <37 weeks: 3.5 (1.6 to 7.8)].

**Conclusions** Early neonatal mortality rate in Wangaya Hospital remains high. Respiratory distress, asphyxia, birth weight <2500 gram, sepsis, and gestational age <37 weeks were independent risk factors of early neonatal death. [Paediatr Indones 2008;48:306-11].

**Keywords:** early neonate, mortality rate, risk factors

**H**ealth status of a nation or community, among others, includes mortalities, morbidities, and nutritional status. In 2000, neonatal mortality rate and early neonatal mortality rate in the entire world were 80 per 1000 live births and 23 per 1000 live births, respectively. In developed countries, they were only 5 per 1000 live births and 4 in 1000 life births. In Asia, neonatal mortality rate and early neonatal mortality rate were 32 per 1000 live births and 24 per 1000 live births, respectively.<sup>3</sup> Early neonatal mortality rate in Wangaya Hospital in 2004 was 23.6 per 1000 live births.<sup>4</sup>

This study aimed to investigate early neonatal mortality rate and its risk factors in Wangaya Hospital in order to be able to conduct more intensive and optimal treatment to reduce early neonatal death rate.

### Methods

This retrospective study was conducted in Wangaya Hospital between October–November 2007. Data of

---

From the Department of Child Health, Medical School, Udayana University, Sanglah Hospital, Denpasar, Indonesia.

**Request reprint to:** Made Indah Nastiti Utami Budha, MD, Department of Child Health, Medical School, Udayana University, Sanglah Hospital, Jl. P Nias Denpasar Bali, Indonesia.  
Telp. 62-361-244038. Fax. (0361)244038.

subjects were obtained from the medical records of the neonates registered at Perinatology Unit, since January 2006. The inclusion criterion was all live births registered at Perinatology Unit in Wangaya Hospital, since January 2006. We excluded neonates who had incomplete data. This study was approved by the Ethical Clearance from the Ethics Committee of Medical School, Udayana University/Sanglah Hospital-Denpasar.

Samples size was calculated by using the sample size estimation equation for single proportion;<sup>5</sup> one thousand five hundred live births were included.

We collected data on medical record number, gender, gestational age, birth weight, asphyxia, congenital anomaly, respiratory distress, sepsis, maternal age, parity, early neonatal deaths, and early neonatal age at death.

## Definitions

Early neonatal death was defined as neonatal death in the first seven days of life.<sup>1</sup> Early neonatal mortality rate was the number of early neonatal death divided by the number of live births, multiplied by 1000.<sup>6</sup> Live birth was defined as birth of infant regardless the length of intrauterine period, in which the baby showed any signs of life as breathing, positive heartbeat or umbilical cord pulse or any muscle movements.<sup>6</sup> Gestational age was defined as a period from the first day of the last normal menstrual period until the day of birth (calculated in weeks), grouped as gestational age less than 37 weeks and  $\geq 37$  weeks.<sup>6</sup> Birth weight was the body weight recorded at birth by baby scales at Perinatology Unit Wangaya Hospital, categorized as low birth weight if less than 2500 gram and not low birth weight if  $\geq 2500$  gram. Asphyxia was defined as a condition where the baby had not adequate, spontaneous and regular breathing at birth.<sup>7,8</sup> Congenital anomaly was anomaly that exist since birth.<sup>6</sup>

Respiratory distress was defined as a syndrome consisted of minimal 2 of 5 cardinal signs of respiratory distress: dyspnea with breathing frequency more than 60 times per minutes, nasal flaring, grunting, intercostal, subcostal, or suprasternal retraction, and cyanosis in room temperature.<sup>9</sup> Sepsis was defined as a clinical syndrome characterized by systemic infections (minimal 3 organs involved) and / or followed by bacteremia (positive blood culture).<sup>10-12</sup> Clinical signs of sepsis

are irregularity of body temperature (hyperthermia, hypothermia), change of behavior/ consciousness (lethargy, irritable), change of tone, change of normal skin (poor of peripheral perfusion, cyanosis, mottling, pale, petechie, rash, jaundice, sclerema), feeding disorder (feeding intolerance), gastrointestinal problems (vomiting, diarrhea, abdominal distension, cardiopulmonary problems (tachypnea, tachycardia, hypotension, respiratory distress), and metabolic disorder (hypoglycemia, hyperglycemia, metabolic acidosis).<sup>11,12</sup> Maternal age was calculated from mother's birthday, categorized as less than 20 years, 20-35 years, and more than 36 years. Parity was defined as a number of pregnancies until the present pregnancy, categorized as parity 1 or parity  $\geq 5$  and parity 2-4.

## Data analysis

Data were analyzed using SPSS version 13.0 for Windows. Univariate analysis was performed using chi-square test or Fisher's exact test. For multivariate analysis, we performed multiple logistic regression model, to determine risk factors that significantly associated with early neonatal death. The strength of the association was indicated by odds ratio (OR); confidence intervals were supplied. Level of significance was set at  $P < 0.05$ .

## Results

From 1500 live birth infants enrolled in this study, there were 58 infants died during the early neonatal period, thus giving the early neonatal mortality rate of 38.7 per 1000 live births. Among the 58 succumbed infants, 34 (59%) occurred in the first 24 hours after birth. The characteristics of study samples are described in **Table 1**. The results of early neonatal death are shown in **Table 2**.

Multivariate analysis (logistic regression model) showed that five variables were significant as risk factors of early neonatal death in Wangaya Hospital (**Table 3**). Those five variables (figures indicate OR, with 95% confidence intervals) were respiratory distress (16.8, 3.7 to 76.6), asphyxia (13.5, 6.1 to 29.9), birth weight  $< 2500$  gram (8.1, 3.3 to 19.9), sepsis (7.3, 3.1 to 17.1), and gestational age  $< 37$  weeks (3.5, 1.6 to 7.8).

## Discussion

Early neonatal death remains to be a health problem and is the biggest component of neonatal mortality rate. Early neonatal mortality rate in Wangaya Hospital in this study was 38.7 per 1000 live births, higher than that observed in previous years (18.8 in 2002: 19.1 in 2003, 23.6 in 2004<sup>4</sup> and also higher

than that in Asia.<sup>3</sup> Our data could not explain why early neonatal mortality rate in Wangaya Hospital increased gradually every years. We do not have data whether it was caused by the decreased quality of human resources or by limited resource instruments in Wangaya Hospital or by the increased number of complicated pregnancy referred to Wangaya Hospital by private practitioner paramedic, resulting in more number of infants born with asphyxia-related outcome. There was no data either about the kind of complicated pregnancy or about the type of delivery.

There were several studies which investigated early neonatal mortality. Data of previous study has proved that prematurity (gestational age <37 weeks) was a risk factor of early neonatal death. The function of organs in premature newborns is not optimal, therefore, they more difficult to adapt and easier to have complication and have high risk of death.<sup>13</sup> Jimmy *et al*<sup>14</sup> conducted an audit of neonatal care at Madilon Hospital, Madang, Papua New Guanea, since 1995 to 1999. The overall perinatal mortality rate

**Table 1.** Basic characteristics of study subjects

Characteristics	Number (n)	Percentage (%)
Gender (male)	819	54.6
Gestational age (< 37 weeks)	238	15.9
Birth weight (< 2500 gram)	307	20.5
Asphyxia (yes)	370	24.7
Congenital anomaly (yes)	7	0.5
Respiratory distress (yes)	14	0.9
Sepsis (yes)	84	5.6
Maternal age (< 20 or ≥ 36 years old)	192	12.8
Parity (1 or ≥ 5)	738	49.2

**Table 2.** Univariate analysis of risk factors of early neonatal death

Risk factors in END	END n (%)	Non END n (%)	P	OR	95% CI
Gender (male)	36 (4.4)	783 (95.6)	0.24	1.4*	0.8; 2.4
Gestational age (< 37 weeks)	43 (18.1)	195 (81.9)	0.00	18.3*	9.9; 33.6
Birth weight (< 2500 gram)	49 (16.0)	258 (84.0)	0.00	24.9*	12.1; 51.5
Asphyxia (yes)	48 (13.0)	322 (87.0)	0.00	16.7*	8.4; 33.4
Congenital anomaly (yes)	1 (14.3)	6 (85.7)	0.24	4.2 <sup>F</sup>	0.5; 35.5
Respiratory distress (yes)	11 (78.6)	3 (21.4)	0.00	112.3 <sup>F</sup>	30.3; 415.7
Sepsis (yes)	15 (17.9)	69 (82.1)	0.00	6.9*	3.7; 13.1
Maternal age (< 20 / ≥ 36 yo)	9 (4.7)	183 (95.3)	0.53	1.3*	0.6; 2.6
Parity (1 or ≥ 5)	29 (3.9)	709 (96.1)	0.90	1.0*	0.6; 1.7

\* Univariate analysis was performed using chi-square test

<sup>F</sup> Univariate analysis was performed using Fisher's exact test

END = Early Neonatal Death

**Table 3.** Multivariate analysis of risk factors of early neonatal death

Risk factors of END	β	P	OR	95% CI
Gestational age < 37 weeks	1.262	0.00	3.5	1.6; 7.8
Birth weight < 2500 gram	2.091	0.00	8.1	3.3; 19.9
Asphyxia	2.606	0.00	13.5	6.1; 29.9
Respiratory distress	2.819	0.00	16.8	3.7; 76.6
Sepsis	1.986	0.00	7.3	3.1; 17.1

END = Early Neonatal Death

was 51.1 per 1000 total births with an early neonatal mortality rate of 12.7 and a stillbirth rate of 38.5. The major cause of death were prematurities, low birth weight (27%), sepsis (23%), and asphyxia (17%). In a cohort study conducted by Young *et al*<sup>15</sup> in Utah 1999-2004, it was found that early neonatal mortality rate at gestational age of 34 weeks, 35 weeks, and 36 weeks, were higher than that at term pregnancy, with risk ratios and their 95% confidence interval of 3.25 (1.4 to 7.7), 3.21 (1.5 to 6.1), 2.69 (1.5 to 4.7), respectively. In our study, it was found that gestational age less than 37 weeks and low birth weight were also significant risk factors of early neonatal death.

Early neonatal death was found four times more frequent in premature neonates. Hypoxic-ischemic encephalopathy due to perinatal asphyxia is recognized as an important cause of neonatal morbidity and mortality. The incidence of perinatal asphyxia is about 1.0 to 1.5% of live births in most centers and is inversely related to gestational age and birth weight.<sup>16</sup> Heller *et al*<sup>17</sup> in their study on 513,315 live birth infants in America 1990-1999, found that early neonatal mortality in term infants with Apgar scores of 0-3 within the first 3 minutes had RR: 1193 (95% CI 801 to 1778) compared with that in baby born with score 7-10. Casey *et al*<sup>18</sup> in a retrospective cohort study carried out on 151,891 live birth infants in Parkland Hospital, Dallas in 1988-1998, found that neonatal death in preterm newborns with Apgar score 0-3 within first 3 minutes had RR: 59 (95% CI 40 to 87) compared to that in non-asphyxia newborns, whereas neonatal death in term newborns with Apgar score 0-3 within first 3 minutes had RR: 1460 (95% CI 835 to 2555) compared to that in non-asphyxia newborns. Weinberg *et al*<sup>19</sup> in a cohort study in three hospitals in New Jersey conducted in 1984-1987 concluded that low Apgar scores were associated with increased neonatal morbidity and mortality in preterm newborns. Antenatal maternal history and pregnancy complications are not clearly associated with low Apgar scores. Therefore, Apgar scores is a useful tool in assessing neonatal short-term prognosis and the need for intensive care for preterm newborns. In our study, asphyxia was a significant risk factor for early neonatal death.

Indeed, severe congenital anomaly (neural tube defect) is a risk factor of early neonatal death. Birth defects were the single most common cause

of death in both term and preterm newborns.<sup>20</sup> However, in our study we found that congenital anomaly was not a risk factor, possibly because of the congenital anomaly was a mild anomaly or not life threatening.

Bacterial sepsis and meningitis continue to be major causes of morbidity and mortality in newborns, particularly in low birth weight infants and also at risk for nosocomial acquired sepsis. In 1990s, improvements in neonatal intensive care have decreased morbidity and mortality from early onset sepsis in term infants.<sup>21</sup> Lawn *et al*<sup>22</sup> in a systematic review of data from 44 countries and 56 studies, found that the major cause of neonatal death globally were estimated to be infections (sepsis/pneumonia, tetanus, and diarrhoea: 35%), preterm birth (28%), and asphyxia (23%). Our study showed that sepsis and or respiratory distress were risk factors for early neonatal death.

There are several studies that show correlation between maternal age and neonatal mortality. Chen *et al*<sup>23</sup> in a cohort study conducted in US from 1995-2000, concluded that all teenage groups were associated with increased risks for preterm delivery, low birth weight and neonatal mortality. Infants born to teenage mothers aged 17 years or younger had a higher risk for low Apgar scores at 5 minutes. Joseph *et al*<sup>24</sup> in their study on 157,445 pregnancies in Canada between 1988 and 2002 to, found that preterm birth and small for gestational age rate were also higher, compared with women aged 20-24 years, adjusted rate ratio for preterm birth among women aged 35-39 years and 40 years or older of 1.61 (95% CI 1.42 to 1.82) and 1.80 (95% CI 1.37 to 2.36), respectively. Adjusted rate ratio for perinatal mortality/morbidity were 1.46 (95% CI 1.11 to 1.92) among women 35-39 years and 1.95 (95% CI 1.31 to 3.35) among women 40 years or older. Our study showed that maternal age was not a risk factor of early neonatal death in Wangaya Hospital. This result was different compared which that of other studies, which maybe because of most subjects in our study were within 20-35 years old.

Data regarding the question of whether multiparous is a risk factor for adverse outcome is inconsistent. Wu *et al*<sup>25</sup> in retrospective cohort study performed on 3697 pregnancy from 1999 to 2000 in China, found that perinatal mortality rate increased notably with parity and was higher in township having lower income per capita. Aliyu *et al*<sup>26</sup> analyzed

22,463,141 singleton deliveries at 29 weeks or more of gestation in the US from 1989-2000, found that the overall crude rates for low birth weight, very low birth weight, preterm birth, very preterm birth, and small and large for gestational age were 55, 11, 97, 19, 83, and 129 per 1000 live birth, respectively. The adjusted odds ratio for low birth weight, very low birth weight, preterm and very preterm delivery increased consistently and in a dose-effect fashion with ascending parity (P for trend <0.001). Because of very few subjects with parity  $\geq 5$  (data not shown), we did not find that parity was a risk factor for early neonatal death.

The limitation of this study is that we did not conduct adjustment for all risk factors of early neonatal death, especially risk factors in maternal, such as social economic status, maternal nutrient status, any maternal illness or complicated pregnancy, previous pregnancies or deliveries, delivery assistances, and type of delivery. Finally, we do not know how many mothers were referred caused by complicated pregnancy.

In conclusion early neonatal mortality rate in Wangaya Hospital was 38.7 per 1000 live births. From 58 neonates died in early neonatal period, 59% died in first 24 hours of life. Significant risk factors for early neonatal death were respiratory distress, asphyxia, birth weight more than 2500 gram, sepsis, and gestational age less than 37 weeks. Further study on risk factors in early neonatal death which have not been evaluated yet such as : maternal social economic status, maternal nutritional status, maternal illness, and previous pregnancies or deliveries in Wangaya Hospital.

### Acknowledgments

Appreciation is addressed to DR. Dr. Raka Widiana, SpPD, KGH for supervising the statistical analysis. Also for Director of Wangaya Hospital for the approval and help in subjects sampling and data collecting.

### References

1. Purnomo W. Safe Motherhood (Upaya penurunan kematian ibu dan bayi baru lahir) [cited 2007 October 1]. Available from: URL: <http://www.fkm.unair.ac.id/Kespro>
2. Komalasari K. Kematian bayi, tragedi yang terlupakan [cited 2007 October 4]. Available from: URL: <http://www.pikiran-rakyat.com/cetak/0802/24>
3. WHO. Neonatal and perinatal mortality. Country, regional and global estimates (cited 2007 October 7). Available from: URL: [http://www.who.int/publications/2006/9241563206\\_eng](http://www.who.int/publications/2006/9241563206_eng).
4. Suanti BY. Faktor predisposisi dan sebab kematian perinatal di ruang perinatologi RSUD Wangaya periode 2002-2004 [thesis]. Denpasar: Universitas Udayana, 2005.
5. Madiyono B. Perkiraan besar sampel. In: Sastroasmoro S, Ismael S, editors. Dasar-dasar metodologi penelitian klinis. 2<sup>nd</sup> ed. Jakarta: CV Sagung Seto; 2002. p. 270-1.
6. Sugito, Purwanto A, Ismandari F. Glosarium data dan informasi kesehatan. Pusat data dan informasi Departemen Kesehatan Republik Indonesia; 2005. p. 1-127.
7. Kardana M. Asfiksia neonatorum. In: Suraatmaja S, editor. Neonatologi praktis. Denpasar: Bag./SMF Ilmu Kesehatan Anak; 2006. p. 33-6.
8. Hamid A. Asfiksia neonatorum. In: Suraatmaja S, Soetjningsih, editors. Pedoman Diagnosis dan Terapi Ilmu Kesehatan Anak RSUP Sanglah Denpasar. Denpasar: Bag./SMF Ilmu Kesehatan Anak; 2006. p. 178-9.
9. Fanaroff AA, Fanaroff JM. Clinical examination. In: Donn SM, Sinha SK, editors. Manual of neonatal respiratory care. 2<sup>nd</sup> ed. Philadelphia: Mosby Elsevier; 2006. p. 89-97.
10. Gomella TC, Cunningham D, Eyal FG, Zenk KE. Neonatology: Management, Procedures, On-Call Problems, Disease, and Drugs. New York: Lange Medical Books/McGraw-Hill; 2004. p. 434-68.
11. Kardana M. Sepsis neonatorum. In: Suraatmadja S, editor. Neonatologi praktis. Denpasar: Bag./SMF Ilmu Kesehatan Anak; 2006. p. 41-7.
12. Hamid A. Sepsis neonatorum. In: Suraatmaja S, Soetjningsih, editors. Pedoman Diagnosis dan Terapi Ilmu Kesehatan Anak RSUP Sanglah Denpasar. Denpasar: Bag./SMF Ilmu Kesehatan Anak; 2000. p. 180-3.
13. Winkjosastro GH. Ilmu Kebidanan. 3<sup>rd</sup> ed. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo; 2002. p. 723-90.
14. Jimmy S, Kemiki AD, Vince JD. Neonatal outcome at Madilon Hospital, Madang: a 5-year review. PNG Med J 2003;46 Suppl 1-2:8-15.
15. Young PC, Glasgow TS, Li X, Guest-Warnick G, Stoddard G. Mortality of late-preterm (near-term) newborns in Utah. Pediatrics 2007;119:e659-65.
16. Aurora S, Snyder EY. Perinatal asphyxia. In: Cloherty JP, Eichenwald EC, Stark AR, editors. Manual neonatal care. 5<sup>th</sup> ed. Philadelphia: Williams & Wilkins; 2004. p. 536-55.

17. Heller G, Schnell RR, Misselwitz B, Schmidt S. Umbilical blood pH, Apgar scores, and early neonatal mortality. *Z Geburtshilfe Neonatol* 2003;207 Suppl 3:84-9.
18. Casey BM, Donald D, Leveno KJ. The continuing value of the Apgar score for the assessment of newborn infants. *N Engl J Med* 2001;344 Suppl 7:467-71.
19. Weinberger B, Anwar M, Hegyi T, Hiatt M, Koons A, Paneth N. Antecedents and neonatal consequences of low Apgar scores in preterm newborns. *Arch Pediatr Adolesc Med* 2000; 154:294-300.
20. Zupancic JAF. Neural tube defect. In: Cloherty JP, Eichenwald EC, Stark AR, editors. *Manual neonatal care*. 5<sup>th</sup> ed. Philadelphia: Lippincott Williams @ Wilkins; 2004. p. 555-63.
21. Puopolo KM. Bacterial and fungal infections. In: Cloherty JP, Eichenwald EC, Stark AR, editors. *Manual neonatal care*. 5<sup>th</sup> ed. Philadelphia: Lippincott Williams @ Wilkins; 2004. p. 287-312.
22. Lawn JE, Wilczynska-Ketende K, Cousens SN. Estimating the causes of 4 million neonatal deaths in the year 2000. *International Journal of Epidemiology* 2006;35:706-18.
23. Chen XK, Wen SW, Fleming N, Demissie K, Rhoads GG, Walker M. Teenage pregnancy and adverse birth outcomes: a large population based retrospective cohort study. *International Journal of Epidemiology* 2007;36:368-73.
24. Joseph KS, Allen AC, Dodds L, Turner LA, Scott H, Liston R. The perinatal effects of delayed childbearing. *Obstet Gynecol* 2005;105:1410-8.
25. Wu Z, Viisainen K, Wang Y, Hemminki E. Perinatal mortality in rural China: retrospective cohort study. *BMJ* 2003;327:1319-22.
26. Aliyu MH, Salihu HM, Keith LG, Ehiri JE, Islam A, Jolly PE. High prity and fetal morbidity outcomes. *Obstet Gynecol* 2005;105:1045-51.