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Disease Outcome and Associated Factors among Neonates Admitted to Neonatal Intensive Care Unit at Jimma University Medical Center, Jimma, Southwest Ethiopia

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ABSTRACT

Background: Neonatal period is a susceptible time in which the newborn has to adapt to a new environment and is vulnerable to many problems. This study aimed to assess the disease outcome and associated factors among neonates.

Methods: This retrospective cross-sectional study was conducted from March 15, 2018, to March 30, 2018, on neonates (n=341) admitted to the Neonatal Intensive Care Unit for two years. The systematic sampling technique was employed to perform the sampling. The data were entered the Epi-data (version 3.1) and analyzed in SPSS software (version 23). A p-value less than 0.05 at a 95% confidence interval (CI) was considered statistically significant. Finally, statements, tables, charts, and graphs were used for data presentation.

Results: Regarding the outcome, 81.52% of the admitted neonates were improved and the others (18.48%) died. Prematurity and perinatal asphyxia (PNA) were factors associated with increased risk of death (P<0.001, Adjusted Odds Ratio (AOR) =0.26, 95% CI: [0.14, 0.46]) and (P<0.05, AOR=0.44, 95% CI: [0.21, 0.91]), respectively.

Conclusion: Prematurity, PNA, and place of delivery (i.e., outborn) were predictors of death. Therefore, the adequate resource should be put in place to improve neonatal outcomes.

Keywords: Association, Neonate, Neonatal intensive care unit, Outcome

Introduction

Neonatal period is defined as the period from birth up to the first 28 days of life (1). It can also be divided into very early (birth to < 24 h), early (24h to < 7 days), and late neonatal period (7 days to < 28 days) (1). The period is characterized by the transition to extra uterine life and rapid growth and development. Newborn health is the key to child health survival and is the most hazardous period, compared to any other time during the child's first year of life (2).

Neonatal morbidity and mortality are a concern with health problems among low- and middle-income countries (3). The neonatal mortality rate is associated with prematurity, birth asphyxia, and sepsis, whereas prematurity and malformations are the leading causes in developed countries (4-7).

Out of the estimated 8.7 million deaths in under five-year-old children worldwide, 41% occurred in neonates (8). Moreover, more than half of all deaths occur within 24 h of birth and 81% within the first week of life in low- and middle-income countries. In these countries, neonatal death contributes to 98% of the total death, of which more than three-quarters occurred in Sub-Saharan Africa and South Asia (9).

According to the report of the United Nations of Children Fund, one of the main causes of neonatal death in Ethiopia is preterm birth which accounts for 23% of all other causes (10). Before

2000, neonatal deaths were rarely mentioned; however, recently newborn health has begun to emerge as a global and national public health priority (11).

The Every Newborn Action Plan launched in June 2014 by the World Health Assembly provided a stimulus to accelerate progress by implementing effective cause-specific interventions that can rapidly reduce neonatal mortality (12). In addition, Sustainable Development Goals 3 ensures healthy lives and promotes the well-being of all at all ages (13).

The management of common neonatal problems requires clinical expertise and training, as well as access to suitable equipment, and well-organized referral pathways (14). This ensures health care to be of sufficient quality, which is important to monitor outcomes of care provided (15).

Despite the improvements in the diagnosis and management of neonatal diseases, neonatal mortality is still ongoing in neonatal units, especially in developing countries due to different conditions. As indicated in different studies conducted in developed and developing countries, there is a variation of the prevalence of neonatal mortality from place to place. Therefore, there is a need for the assessment of outcome diseases and associated factors among neonates admitted to the Neonatal Intensive Care Units (NICUs).

Methods

This hospital-based retrospective study was conducted from March 15, 2018, to March 30, 2018, on all neonates admitted to the NICU of Jimma University Medical Center (JUMC) from January 1, 2016, to December 31, 2017. The JUMC is located in Jimma, 352 km south-west of Addis Ababa, Ethiopia. It is worth mentioning that this is the only hospital having NICU in Jimma, Ethiopia. Moreover, JUMC is one of the biggest and oldest university specialized hospitals in the country established in 1922 which provides more than 15 million people in the catchment area with services. Currently, it is the only teaching and referral hospital in the southwestern part of the country. This center has major clinical departments, such as internal medicine, surgery, pediatrics, and gynecology/obstetrics along with other clinical departments, including dentistry, ophthalmology, psychiatry, anesthesia, and dermatology. Annually, around 1350 neonates are admitted to the NICU of JUMC.

Sampling Procedure

Since the prevalence of the problem was not known in the study area, the sample size was determined by taking into account a 95% confidence interval (CI) with a 5% margin of error using the following single population proportion formula.

$$n = \frac{(Z\alpha/2)^2 \, p \, (1-p)}{d^2}$$
$$1 + n/N$$

By adding 10% sample attrition, the final sample size was estimated at 370 cases.

Inclusion Criteria

All neonates admitted to the NICU of the JUMC from January 1, 2016, to December 31, 2017, were included in this study. On the other hand, the neonates admitted to the NICU whose medical records were incomplete were excluded from the study.

Data Processing and Analysis

The data were checked for completeness, and subsequently, they were compiled, coded, cleaned, and imported into Epi-data (version 3.1) and analyzed in SPSS software (version 23) thorough descriptive statistics, including frequency, percentage, mean, and standard deviation. Crude odds ratio with 95% CI was carried out to identify the association between each independent variable with outcome variables using binary logistic regression. Those variables with p-value ≤0.25 on binary logistic regression were further considered for multivariable logistic regression to control the confounding factors. Finally, a p-value less than 0.05 at 95% CI on multivariable logistic regression was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Ethics Committee of School of Nursing and Midwifery, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia. Moreover, permission to conduct this study was obtained from the JUMC administrative office. To keep confidentiality, all collected data were coded and locked in a separate place and used only for the research purpose.

Operational Definition

Outcome refers to the condition of the patient registered on the database at discharge either improved or death.

The improved condition includes discharged

with improvement, referred, and left against medical advice

Results

Socio-demographic Characteristics of the Neonates Admitted to the NICU

Out of 370 cases, 29 (7.8%) neonates were excluded from the study due to incomplete medical records; therefore, 341 newborns were eligible to be included in this study. Out of these neonates, 211 (61.9%) cases were male making the male to female ratio 1.6:1. Furthermore, the majority of the newborns (n=233, 68.3%) were admitted to the NICU in less than 24 h of their birth. Concerning the place of residence, about two-thirds (n=228, 66.9%) of the newborns lived outside of Jimma, Ethiopia. Regarding the birthplace, more than half (n=205, 60.1%) of the neonates were inborn (Table 1).

Maternal, Delivery, and Neonatal Factors

Regarding parity, 184 (54%) mothers were multiparous. Out of all mothers, 123 (36.7%) cases had different diseases. Moreover, 123 (36.7%) mothers had maternal diseases, including infections (n=38, 30.9%) followed by hypertensive disorder of pregnancy (n=32, 26.1%). Concerning the gestational age and weight, more than two-thirds (69.5%) of the neonates were term, and more than half (n=207, 60.7%) of the neonates were 2500-4000g, respectively. Concerning anthropometry, almost all (n=317, 93%) of them were appropriate for their gestational age. Although the majority (n=298, 87.4%) of the neonates were singleton, 41 (12%), and 2 (0.6%) newborns were twins and triplets, respectively. Regarding the mode of delivery, about half (51.6 %) of the neonates were delivered spontaneously (Table 2).

Table 1. Socio-demographic characteristics of neonates admitted to the NICU of JUMC, Jimma, Oromia, Southwest Ethiopia, 2018 (n=341)

Characteristics		Frequency	Percent
Sex	Male	211	61.9
	Female	130	38.1
Age	Less than 24 h	233	68.3
	24h-7 days	88	25.8
	Greater than 7 days and <28 days	20	5.9
Place of residence	Jimma Town	113	33.1
	Outside of Jimma Town	228	66.9
Place of delivery	In born	205	60.1
	Out born	136	39.9

Table 2. Maternal, delivery, and neonatal factors of newborns admitted to the NICU of JUMC, Jimma, Oromia, Southwest Ethiopia, 2018 (n=341)

| Characteristics		Frequency	Percent
Parity	Primipara	157	46.0
	Multipara	184	54.0
Mode of delivery	Spontaneous vaginal delivery	176	51.6
	Cesarean section	113	33.1
	Instrumental	52	15.2
Maternal diseases	Gestational diabetes	2	1.6
	Hypertensive disorder of pregnancy	32	26.0
	Infections	38	30.9
(n =123)	HIV/AIDS	7	5.7
	Antepartum hemorrhage	13	10.6
	Premature Rupture of Membrane	27	21.9
	Others	4	3.3
Gestational age	Preterm (3< 37 weeks)	102	29.9
	Term (37-42 weeks)	237	69.5
	Post-term (> 42 weeks)	2	0.6
Birth weight	Low birth weight(<2500gm)	207	60.7
	Normal birth weight(2500-4000gm)	128	37.5
	Macrosomia(>4000gm)	6	1.8
Birth Size	Appropriate for Gestational Age (AGA)	317	93.0
	Small for Gestational Age (SGA)	18	5.3
	Large for Gestational Age (LGA)	6	1.8
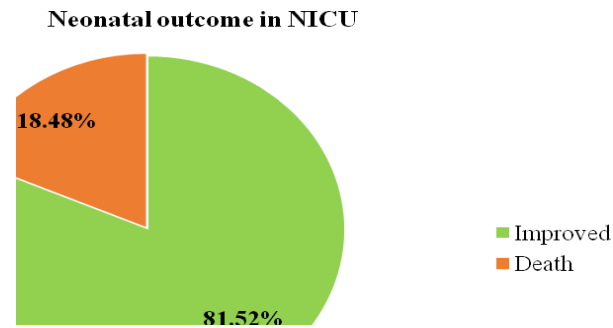
Figure 1. Outcome of neonates admitted to the NICU of JUMC, Jimma, Oromia, Southwest Ethiopia, 2018 (n=341)

Neonatal outcome in NICU

Out of all admitted neonates, 278 (81.52%) ones were discharged after improvement, and out of 63 deaths, 35 (55.56%) of them occurred at ages of 24h to 7 days (Figure 1 and Table 3).

Factors Associated with the Outcome of Neonates

Prematurity, perinatal asphyxia (PNA), and place of delivery were significantly associated with the outcome of neonates. Those neonates who were diagnosed with prematurity (P=0.000, Adjusted Odds Ratio (AOR)=0.26, 95% CI: [0.14,

Table 3. Ages of neonates at death admitted to the NICU of JUMC, Jimma, Oromia, Southwest Ethiopia, 2018(n=63)

Characteristics		Frequency	Percent
Age of neonate at death	Less than 24 h	15	23.8
	24h-7 days	35	55.56
	Greater than than7 days and < 28days	13	20.6

Table 4. Multiple variable analysis of factors associated with the outcome of neonates admitted to the NICU of JUMC, Jimma, Oromia, Southwest Ethiopia, 2018 (n=341*)*

Characteristics		Outcome of Neonate in NICU		COR (95%CI)	AOR (95%CI)	P-Value
		Improved	Death			
Prematurity	Yes	68	34	0.27 (0.15,0.48)	0.26 (0.14,0.46)	0.000*
	No	210	29		1	
Perinatal asphyxia	Yes	36	14	0.52 (0.26,1.03)	0.44 (0.21,0.91)	0.027*
	No	242	49		1	
Sex	Male	178	33		1	
	Female	100	30	0.61 (0.35,1.07)	0.67 (0.37,1.22)	0. 199
Hypoglycemia	Yes	5	36	1.72 (0.64, 4.59)	1.96 (0.70,5.45)	0.194
	No	242	58		1	
Parity	Primipara	133	24	1.42 (0.77,2.62)	1.49 (0.82,2.72)	0. 187
	Multipara	145	39		1	
Place of delivery	Inborn	173	32	0.62 (0.36,1.08	1	
	Outborn	105	31		0.39 (0.18,0.84)	0.016*

*Significant association, 1= reference categories

0.46]) were 74% less likely improved than those who were not diagnosed with this condition. Similarly, those neonates diagnosed to have PNA (P=0.027, AOR=0.44, 95% CI: [0.21, 0.91]) were 56% less likely improved than those who were not diagnosed with it. Moreover, outborn neonates (P=0.016, AOR=0.39, 95% CI: [0.18, 0.84]) were 61% less likely improved than those who were inborn (Table 4).

Discussion

This study aimed to assess the disease outcome and associated factors among neonates admitted to the NICU. In this study, the overall neonatal mortality rate was obtained at 18.48%, which was higher than that in other studies carried out in Nigeria (14.2%), South Africa (13.8%), Cameroon (12.6%), and Tamale (16.0%); however, it was lower than that in St. Paul's Hospital (Addis Ababa) (23.2%) and Pakistan (25.8%) (7, 16-19, 22). This difference in mortality patterns could be due to the smaller sample size and differences in socio-demographic characteristics. Additionally, it might be attributed to the differences in care provided, as well as the presence of infections and complications.

This finding revealed that prematurity increased the risk of neonates' death. This result is consistent with the findings of the studies conducted in different settings (i.e., studies conducted at the tertiary care center, Cameroon; St. George university hospital, Germany; government hospital, Amman, Jordan,) (20-21, 22). The similarity among these findings might be

due to the immature organ of the preterm neonates and different complications related to prematurity that led to death. This implies the necessity of early identification and management of risk factors resulting in prematurity.

In this study, PNA was also one predictor of neonatal mortality which was in line with the results of a study conducted in Cameroon (22). This might be due to poor antenatal services, late referral of complicated pregnancies, and poor neonatal resuscitation facilities both in terms of equipment and trained manpower.

Furthermore, outborn neonates less likely improved in this study which was in line with the findings of a study conducted at a tertiary care hospital in Bangalore (23). This can be due to the problems associated with the incidence of hypothermia and hypoglycemia during neonatal transport. Moreover, this can be attributed to complications that happen during the birth process which may cause severe diseases and complications to the neonate.

More than half (55.7%) of the deaths occurred 24 h to 7 days after delivery in this study, which was not consistent with the results of the studies performed in Nigeria (55%) and South Africa (56.7%) in which death occurred 24h after admission (4, 18). This variation might be explained by differences in supportive care provided, strict follow-ups, and establishment of equipment in the NICU.

Conclusion

The neonatal death rate in this study was high (18.48%) which showed the need for quality care improvements. Moreover, the significant predictors of neonatal death included the place of delivery (i.e., outborn), diagnosis of prematurity, and PNA.

Acknowledgments

Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of the study.

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