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Original Article

Outcomes of the Neonates Admitted to Intensive Care Unit

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ABSTRACT

Background: *For the survival of high-risk newborns, the neonatal intensive care unit (NICU) is a fundamental sector. The outcomes of neonatal intensive care unit (NICU) patients directly depend upon the clinical status of the patients. In Bangladesh, we have very limited research-based information regarding this issue.* ***Aim of the study:*** *This study aimed to assess the outcomes of neonates admitted to the intensive care unit.* ***Methods and materials:*** *As an observational cohort study, this study was conducted in the intensive care unit (ICU) of Dhaka Shishu Hospital, Dhaka, Bangladesh from October 2009 to September 2010. In total 230 neonates admitted to the NICU, after fulfilling the inclusion criteria were enrolled in this study as study subjects. Properly written consent was taken in favor of all the participants before data collection.* ***Results:*** *In this study, 37% and 33% of the total cases were with perinatal asphyxia (PNA) and preterm low birth weight (PTLBW), respectively which was noticeable. Besides 6%, 3% and 21% of patients were with sepsis, pneumonia and congenital anomalies, respectively. Among the total of 230 participants, the majority of the patients died which was 51%. On the other hand, the rest of the patients (49%) were found as improved in condition at the end of this study.* ***Conclusion:*** *Perinatal asphyxia (PNA) and preterm low birth weight*

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(PTLBW) are very common diseases among NICU-admitted neonates. Prompt admission and diagnosis can reduce the mortality of neonates admitted to the intensive care unit.

Keywords: *Outcomes, Neonates Neonatal intensive care unit, ICU, NICU, perinatal asphyxia*

INTRODUCTION

Every year, over 4 million babies die in the 1st 4 weeks of life; 3 million of these deaths occur in the early neonatal period [1]. Neonatal outcome especially that of LBW infants reflects the standard of perinatal care in a country [2]. Across the globe, there are significant variations in IMR (Infant mortality rate) rates by nation. Most of the decline in IMR in the USA and other industrialized countries since 1970 is attributable to a decrease in the birth-weight-specific IMR related to neonatal intensive care units (NICU), not to the prevention of LBW [3]. In developing countries, the majority of infant deaths result from infectious diseases, even in the neonatal period 24% of the deaths are caused by severe infections, 29% from PNA, 7% from tetanus and 24% from complications of prematurity [3]. Bangladesh has made noteworthy progress in child survival over the last few decades with under 5 mortalities declining to 53 per 1000 live births in 2011 from 133 deaths per 1000 live births in 1991, while infant deaths reduced from 87 to 43 per 1000 live births and neonatal deaths declined from 52 to 32 deaths per 1000 live births [4]. The mortality rate of Dhaka Shishu Hospital, a tertiary-level pediatric teaching hospital in Bangladesh is 237/1000 against admissions [5]. Intensive care of these infants carries the potential for significant reduction of both mortality and morbidity [6]. There are many reports on mortality rates of NICU from different developed and developing countries since the 1970s starting with Daga [7] who found 23.6%, Kapil and Bagga [8] found 25.7%, while mortality of critically ill neonates in the ICU of Dhaka Shishu Hospital was 491/1000 admission [9] from July 1995 to June 1996; 530/1000 admission [10] during 1997 to 1999 and 452/1000 from July 2003 to December 2003 [11]. Over the past 3 decades, neonatal mortality has fallen steadily. This improvement has been attributed in large part to the development of the NICU [12]. The objective of this current study was to assess the outcomes of neonates admitted to the intensive care unit.

METHODS & MATERIALS

As an observational cohort study, this study was conducted in the intensive care unit (ICU) of Dhaka Shishu Hospital, Bangladesh from October 2009 to September 2010. In total 230 neonates, admitted to the neonatal intensive care unit (NICU), after fulfilling the inclusion criteria were enrolled in this study as study subjects. The study was approved by the ethical committee of the mentioned hospital. Properly written consent was taken in favor of all the participants before data collection. The whole intervention was conducted following the principles of human research specified in the Helsinki Declaration [13] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [14]. As per the inclusion criteria

of this study, all the neonates admitted into the ICU of Dhaka Shishu Hospital that were preterm, term and post-term neonates, neonates of both sexes, both medical and surgical cases and neonates having all types of congenital anomalies (both single and multiple) were included. On the other hand, according to the exclusion criteria of this study, those neonates who discontinued the treatment and neonates whose parents were unwilling to participate were excluded from this study. All the demographic and clinical data of the participants were recorded. A predesigned questionnaire was used in data collection. All data were processed, analyzed and disseminated by using MS Excel and SPSS version 23.0 program as per necessity.

RESULTS

In this study, among the total of 230 participants, 63.5% were male whereas the rest 36.6% were female. So, the male-female ratio was 1.7:1. Among the total patients 40% were preterm, 53% were <7 days and 37.8% were <2500 gm (**Table I, Figure 1**).

Table I: Distribution of neonates by gestational age, age and weight (N=230)

Variables		n	(%)
Gestational age (week)	<37	92	40
	>37	138	60
Age (Days)	<7	122	53
	>7	108	47
Weight (gm)	<2500	87	37.8
	>2500	143	62.2

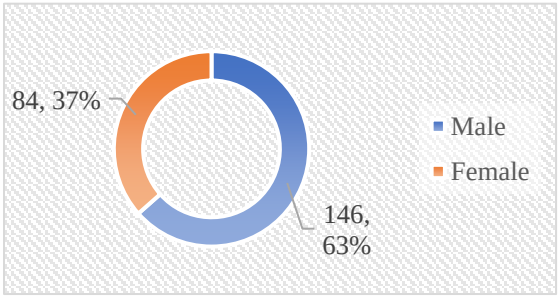

Figure 1: Distribution of participants by gender (N=230)

As per the distribution of neonates by congenital anomalies, we observed that diaphragmatic hernia was present in the highest number (n=17) of cases as a single congenital anomaly followed by congenital heart diseases (n=16) and tracheoesophageal fistula (n=14) (**Figure 2**).

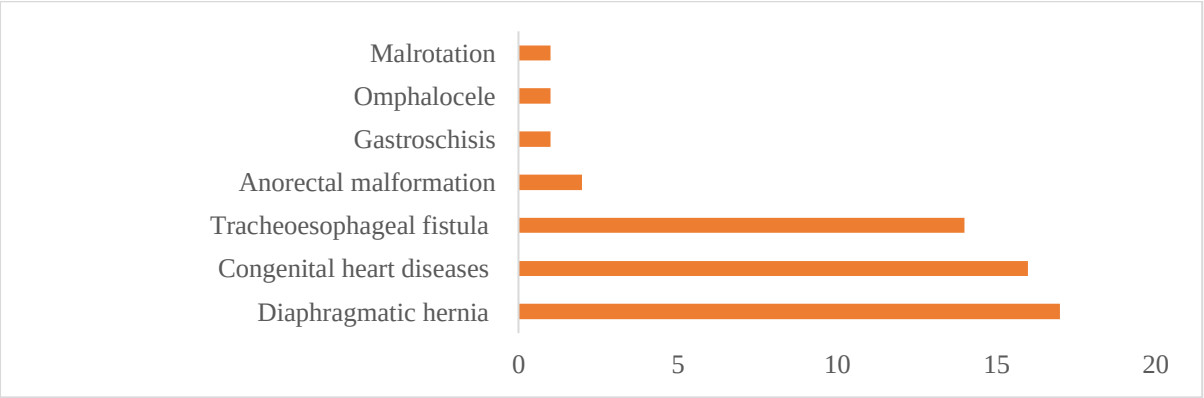

Figure 2: Distribution of neonates by congenital anomalies (N=230)

The frequency of different types of acid-base imbalance was analyzed and it was observed that 17.8% neonates had only metabolic acidosis, 13.9% patients had only respiratory acidosis, 23.9% patients had combined metabolic & respiratory acidosis and 44.3% of the total 230 neonates were with normal acid-base balance. Neonates presented with any form of acid-base disorder were significantly associated with mortality (P<0.05) (**Table II)**.

Table II: Distribution of neonate with different acid-base derangements (N=230)

Acid-base derangements		Outcome		Odds ratio	Confidence interval	P value
		Death	Improved			
Metabolic acidosis	Present	30	11	3.06	1.45 – 6.47	<0.001
	Absent	89	100			
Respiratory acidosis	Present	23	9	2.71	1.19 – 6.16	< 0.02
	Absent	96	102			
Mixed acidosis	Present	37	18	2.33	1.23 – 4.40	<0.001
	Absent	82	93			

In this study, 43% neonates had BE (Base excess/deficit) within the range of +5 to -5 while 20.4% neonates had > -12 (**Table-III)**.

Table-III: Distribution of neonates by the level of BE (N=230)

BE groups	n	%
+5 to -5	99	43.0%
-6 to -12	84	36.5%
-12 to -16	24	10.4%
> -20	23	10.0%

In this study, 37% and 33% of the total cases were with perinatal asphyxia (PNA) and preterm low birth weight (PTLBW), respectively which was noticeable. Besides 6%, 3% and 21% of patients were with sepsis, pneumonia and congenital anomalies, respectively. Among the total of 230 participants, the majority of the patients died which was 51%. On the other hand, the rest of the patients 49% were found as improved in condition at the end of this study (**Table IV)**.

Table IV: Diseases wise outcomes of participants (N=230)

Diseases	Total (n=230)		Improved		Died	
	n	%	n	%	n	%
PNA	84	37%	49	21%	35	15%
PTLBW	76	33%	35	15%	41	18%
Sepsis	14	6%	8	3%	6	3%
Pneumonia	7	3%	4	2%	3	1%
Congenital anomalies	49	21%	16	7%	33	14%
Total	230	100%	112	49%	118	51%

PNA = Perinatal asphyxia, PTLBW = Preterm low birth weight

DISCUSSION

This study aimed to assess the outcomes of neonates admitted to the intensive care unit. Bangladesh is one of the 7 countries on track to achieve Millennium Development Goal (MDG) 4 for a reduction in child mortality by two-thirds by 2015 [15]. The gender distribution of this study was - male 63.5 % (146/230) and females were 36.5 % (84/230). This male predominance status so far agreed with other studies [16][17].The main reasons for NICU admission were perinatal asphyxia with complications (24.8%), problems related to preterm low birth weight (20.4%) and major congenital anomalies (23%) in this study. It was observed that 55.2% of the critically ill newborns treated in the NICU had acid-base derangements and had higher mortality than those without acid-base imbalances. A highly significant correlation was found between mortality outcome and acidosis. The odds ratio for mortality outcome in comparison to blood gas abnormalities was statistically significant in all modalities of acidosis which were comparable with another study by Hossain et al [17]. Among different modalities of acid-base imbalances, metabolic acidosis was found in 17.8%, respiratory acidosis in 13.9%, and mixed acidosis in 23.9% of patients. Neonates were with normal arterial blood gases where a 44.3% significant correlation was observed between metabolic acidosis (measured by $HCO_3 < 20$ mmol/l) with the outcome (death). In this study, those having a base deficit > -10 had significant mortality outcomes in comparison with having < -10 mmol/l. Base deficit (or excess) is a parameter often used to guide further treatment in acidotic children and is taken as a measure of how sick they are [18]. Among the total of 230 participants, the majority of the patients died which was 51%. On the other hand, the rest of the patients (49%) were found as improved in condition at the end of this study. In this study, 23 preterm low birth weight babies who had both sepsis and acid-base derangements (ABD) died, while with these 7 improved. Several studies have shown that septicemia influences both mortality and duration of hospitalization in neonatal intensive care units [19]. Bacterial sepsis continues to be the major cause of mortality and morbidity in newborn infants despite improvements in antimicrobial therapy, advances in neonatal life support measures and the prompt recognition of perinatal risk factors for infection [20].

Limitation of the study

This was a single-centered study with small-sized samples. Moreover, the study was conducted over a very short period. So, the findings of this study may not reflect the exact scenario of the whole country.

CONCLUSION & RECOMMENDATION

As per the findings of this current study, we can conclude that perinatal asphyxia (PNA) and preterm low birth weight (PTLBW) are very common diseases among NICU-admitted neonates. Prompt admission and diagnosis can reduce the mortality of neonates admitted to the intensive care unit. For getting more specific results we would like to recommend conducting similar studies in several places with larger-sized samples.

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REFERENCES

1. *Tinker A, Parker R, Lord D, Grear K. Advancing newborn health: the saving newborn lives initiative. Global public health. 2010 Jan 1;5(1):28-47.*
2. *Begum SA. Incidence and risk factors of neonatal sepsis in Special Care Nursery Unit of Edinburgh (U K). Bangladesh J Child Health 1992; 16(3/4): 84-89.*
3. *Bonita F, Richard EB. Overview of Pediatrics. In: Behrman RE, Kliegman RM, Stanton (eds). Nelson Textbook of Pediatrics. 19th ed. Philadelphia: WB Saunders Company; 2011. 1: 1-5.*
4. *National Institute of Population Research and Training. Bangladesh Demographic and Health Survey, 2011. Dhaka: Govt. of Bangladesh; 2011.*
5. *Chowdhury MAKA, Banu K, Rahaman M. Birth asphyxia- a Prospective study in Dhaka Shishu Hospital. DS (Child) H J 1996; 12: 18-22.*
6. *Tabib SB. Management of Low Birth Weight Babies. Bangladesh J Child Health 1987; 11(3): 43- 45.*
7. *Daga SR. Mortality in infants discharged from Neonatal Intensive Care Units. Indian Paediatrics 1984; 21:453-455.*
8. *Kapil D, Bagga A. The profile and outcome of patients admitted to Paediatric Intensive Care Unit. Indian J Paediatr 1993; 60: 5-10.*
9. *Hossain MM. Predictor of outcome among critically ill newborn treated in ICU [Thesis]. Dhaka: Bangladesh Institute of Child Health. 1997.*
10. *Akhter S, MAKA C AR, Ibrahim H, Quader A. Outcome of Neonatal ICU-Care in Dhaka Shishu Hospital. In1st National conference & Scientific Session, Bangladesh Neonatal forum 1999 (Vol. 23).*
11. *Niven GR, Harding JE. Another outcome of neonatal intensive care: first year mortality and hospital morbidity. Journal of paediatrics and child health. 1995 Apr;31(2):137-42.*
12. *Niven GR, Harding JE. Another outcome of neonatal intensive care: first year mortality and hospital morbidity. Journal of paediatrics and child health. 1995 Apr;31(2):137-42.*
13. *World Medical Association. (2001). World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. Bulletin of the World Health Organization, 79 (4), 373 - 374. World Health Organization. https://apps.who.int/iris/handle/10665/268312.*
14. *Voigt P, von dem Bussche A, Voigt P, von dem Bussche A. Enforcement and fines under the GDPR. The EU General Data Protection Regulation (GDPR) A Practical Guide. 2017:201-17.*
15. *Policy - National Neonatal Health Strategy and Guidelines for Bangladesh [Internet]. Who.int. [cited 2023 May 20]. Available from: https://extranet.who.int/nutrition/gina/en/node/8272*
16. *Kapil D, Bagga A. The profile and outcome of patients admitted to a*

pediatric intensive care unit. The Indian Journal of Pediatrics. 1993 Jan;60:5-10.

17. *Ayengar V, Vani SN. Neonatal sepsis due to vertical transmission from maternal genital tract. The Indian Journal of Pediatrics. 1991 Sep;58:661-4.*
18. *Skellett S, Mayer A, Durward A, Tibby SM, Murdoch IA. Chasing the base deficit: hyperchloraemic acidosis following 0.9% saline fluid resuscitation. Archives of disease in childhood. 2000 Dec 1;83(6):514-6.*
19. *Bennet R, Bergdahl S, Eriksson M, Zetterström R. The outcome of neonatal septicemia during fifteen years. Acta Pædiatrica. 1989 Jan;78(1):40-3.*
20. *Ayengar V, Vani SN. Neonatal sepsis due to vertical transmission from maternal genital tract. The Indian Journal of Pediatrics. 1991 Sep;58:661-4.*