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ORIGINAL ARTICLE

A 1 year Study on Pattern of Neonatal Admissions and Mortality Related to Neonatal and Maternal Influences in A Tertiary Care Teaching Hospital of Barishal

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Abstract

Background: *Morbid conditions during the neonatal period possess a serious risk to the health and well-being of the baby. The death rate among neonates is very high in Bangladesh and various factors are responsible for this other than neonatal diseases.*

Objectives: *The objective was to compare different aspects of neonatal conditions in a tertiary care teaching hospital and to inspect the effects of neonatal/maternal influences over neonatal morbidity and mortality. Another primary goal was to study if there was any interconnection between neonatal morbid conditions and mortality.*

Methods: *This prospective study was carried out at Special Care Neonatal Unit of Sher-e-Bangla Medical College and Hospital, Barishal from April 2019 to March 2020. A total of 142 mothers were enquired according to our questionnaire. Data about both mothers and neonates were included in the questionnaire. Data were analyzed by using SPSS version 26.*

Results: *A total of 142 mothers and their 150 admitted neonates were included in our cohort. Among 150 neonates, we analyzed 133 and excluded 17. During the hospital stay, 9.8% of 133 neonates died. Mortality and morbidity were dependent on factors like gestational age, birth weight, and twin pregnancy. The causes of admission were PNA with HIE (58.6%), neonatal sepsis (28.6%), neonatal jaundice (9.8%), congenital anomalies (8.3%), RDS (4.5%), IUGR (3.8%), pneumonia (2.3%), and diabetes mellitus (0.8%). Neonates having PNA with HIE showed significant p-value when correlated with the cause of LUCS- oligohydramnios, gestational age, birth weight. Pre-term neonates had substantial cases of RDS (9.8%). Neonatal sepsis was observed more on the initiation of breastfeeding on the first day (39.1%) than later (23%), and oligohydramnios, less fetal movement, prolonged labor were found to be significant causes of it.*

Conclusion: *The study acknowledged LBW, PNA with HIE, sepsis, neonatal jaundice, congenital anomalies, and RDS as the major factors for neonatal admissions, and reasons behind mortality were LBW, prematurity, and twin pregnancy. Awareness among parents and improved infrastructure of the hospital might be helpful to reduce the gravity of the condition in the future.*

Key words: *Neonatal morbidity, mortality, neonatal and maternal influences.*

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Introduction

The first 28 days are considered to be the most vulnerable period in a baby's life.[1] It is called the neonatal period and has been a pivotal factor in child health. Any morbidities during the neonatal period carry grave threat to the health of the baby**.** In 2019, 2.4 million neonates died, which was about 6,700 neonatal deaths per day.[1] About one-third of all neonatal deaths occurred within the first day.[1] One in every 35 babies born in South Asia died within their first month of life, and they were nine times more likely to die in the first month compared to a child from a high-income country.[2] The birth rate in Bangladesh is 18.1 births/ 1000 population.[3] The neonatal mortality rate was 19.06 per 1000 live births in our country.[4] It is estimated that 29.7% is contributed by prematurity in Bangladesh, the direct cause of mortality being sepsis (19.9%), asphyxia and birth trauma (22.9%), congenital anomalies (12.7%), respiratory distress (5.9%).[5] The Sustainable Development Goal 3.2 for child survival cannot be met without a substantial neonatal mortality reduction.[6] Not many studies have been done on the information on the neonatal conditions in our country. This prospective study was done at Sher-E-Bangla Medical College and Hospital (SBMCH), Barishal, to identify the main reasons behind neonatal morbidity and mortality in Bangladesh's context.

Materials and Methods

The prospective study was carried out at the Special Care Neonatal Unit (SCANU) of the Department of Pediatrics, Sher-E-Bangla Medical College and Hospital, Barishal for a period of 1 year (Apr 2019-Mar 2020). This is a tertiary care teaching hospital, where most of the admitted neonates are critically ill. All neonates were admitted on a structured protocol of data entry including particulars of the patient, mode of delivery, the weight of the baby at admission (measured by an electronic machine having Gram as the smallest unit), diagnosis, treatment and discharge criteria. The diagnosis was made based on clinical, radiological and laboratory findings. The inclusion criteria adopted in this study encompassed newborns aging <28 days with their mothers being alive. A questionnaire was prepared including information about both mother and the baby, and consisting of the name of mother and contact details of the parents with telephone numbers. A total of 142 mothers were asked for data related to pre-planned pregnancy, the continuation of oral contraceptive pills (OCP) during early pregnancy unknowingly, para, number of gestations, weeks of gestation, illness during pregnancy (HTN/ DM/APH/Others), number of antenatal care (ANC) visits, TT injection dosage, mode of delivery and causes of LUCS. Birth weight, the need for resuscitation after birth, the day of introduction to breast milk, pre-lacteal food administration, diagnosis, treatment, and hospital outcome of 150 babies were also documented in the relevant sections of the questionnaire. All the data were analyzed with IBM Statistical Package for Social Sciences (SPSS version 26) and Microsoft Excel 2019. Numbers and percentages were compared in groups using Chi-Square. A p-value of <0.05 was considered significant. The risk ratio was also calculated.

Results

In this study information about 142 mothers and their 150 neonates admitted to SBMCH were included. Among 150 cases, we excluded 17(11.3%) from our analysis because of lacking one or more data. Therefore, we analyzed the remaining 133 data. Among the study population 12(9.0%) mothers continued taking OCP during the early days of pregnancy unknowingly. Of 133 cases, 57.9% of the pregnancies were pre-planned. The percentages of primigravida (48.9%) and multigravida (51.1%) were almost equal. The incidence of twins was 14(10.5%) (Table I).

The preterm, term, and postdated births amount to 45.9%, 51.9%, and 2.3%, respectively. Among 35 mothers suffering from gestational diseases, 13 were hypertensive, two were diabetic, and 14 had episodes of antepartum hemorrhage (APH). About two-thirds of the mothers were administered TT injections during pregnancy. While 83 mothers went through vaginal delivery, 50 had lower uterine cesarean sections preceded by various conditions such as oligohydramnios (28%), pre-eclampsia (4%), previous history of C/S (28%), twin pregnancy (12%), prolonged labor (4%), PROM (22%), postdated pregnancy (2%), eclampsia (4%), less fetal movement (LFM) (10%) and APH (6%). The percentages of Macrosomia, NBW, LBW, VLBW and ELBW neonates were 0.8%, 36.8%, 45.1%, 15.8% and 1.5%, correspondingly. Among 133 neonates, 71.4% needed immediate resuscitation after birth. There were 46 (34.6%)

Table I
Demographic table

Variables	Attributes	Frequency	Percentage
OCP taken during gestation	Yes	12	9.0
Pre-planned pregnancy	Yes	77	57.9
	No	56	42.1
Para	Primigravida	65	48.9
	Multigravida	68	51.1
Number of gestations	Singletons	119	89.5
	Twins	14	10.5
Gestational age	Preterm (<37 weeks)	61	45.9
	Term (37 - <42 weeks)	69	51.9
	Post-term (≥42 weeks)	3	2.3
Illness during pregnancy	No illness	104	78.2
	Gestational HTN	13	9.8
	Gestational DM	2	1.5
	APH	14	10.5
TT injection dosage	No TT after pregnancy	43	32.3
	TT taken after pregnancy	90	67.7
Mode of delivery	NVD	83	62.4
	LUCS	50	37.6
Cause of LUCS	Oligohydramnios	14	28
	Pre-eclampsia	2	4
	PHO C/S	14	28
	Twin baby	6	12
	Prolonged labor	2	4
	PROM	11	22
	Post dated	1	2
	Eclampsia	2	4
	Less fetal movement	5	10
	APH	3	6
Birth weight	4 kg and more (Macrosomia)	1	0.8
	2.5-3.999 kg (NBW)	49	36.8
	1.5-2.499 kg (LBW)	60	45.1
	1-1.499 kg (VLBW)	21	15.8
	Less than 1.00 kg (ELBW)	2	1.5
Resuscitation after birth	Needed	95	71.4
	Not needed	38	28.6
Introduction to Breastmilk	On 1st day	46	34.6
	After 1st day	87	65.4
Pre-lacteal feed	Given	12	9
	Not given	121	91
ANC visits	Less than 8	114	85.7
	8 and above	19	14.3
Immediate Outcome	Survived	120	90.2
	Expired	13	9.8

newborn babies; who were given breastmilk on their 1st day after birth. Twelve neonates were given prelacteal food. We got 114 (85.7%) cases where mothers did not complete ANC visits (according to new WHO guideline). During the hospital stay, 13 (9.8%) out of 133 neonates died, and 120 (90.2%) survived.

There were various types of neonatal morbid conditions such as PNA with HIE (58.6%), neonatal sepsis (28.6%), neonatal jaundice (9.8%), congenital anomaly (8.3%), RDS (4.5%), IUGR (3.8%), pneumonia (2.3%) and DM (0.8%) within 133 cases (Table II).

Among the mothers with the cause of LUCS-oligohydramnios, 28.6% of their babies developed asphyxia. On the other hand, 61.1% of the neonates

Table II
Demographic table for diseases

Morbidities	Count	Percentage
PNA with HIE	78	58.6
Neonatal Sepsis	38	28.6
Neonatal Jaundice	13	9.8
Congenital Anomaly	11	8.3
RDS	6	4.5
IUGR	5	3.8
Pneumonia	3	2.3
Diabetes Mellitus	1	0.8

Table III
Factors vs morbidities

Factors		Yes	No	Risk ratio	*p value
		PNA with HIE			
Cause of LUCS- Oligohydramnios	Yes	4 (28.6%)	10 (71.4%)	0.47	0.039
	No	22 (61.1%)	14 (38.9%)		
Gestational age	Preterm	26 (42.6%)	35 (57.4%)	—	<0.005
	Term	49 (71.0%)	20 (29.0%)		
	Postdated	3 (100%)	0 (0.0%)		
Birth weight	4.0 kg and more	1 (100%)	0 (0.0%)	—	0.005
	2.5-3.999 kg	37 (75.5%)	12 (24.5%)		
	1.5-2.499 kg	33 (55%)	27 (45%)		
	1-1.499 kg	6 (28.6%)	15 (71.4%)		
	Less than 1 kg	1 (50%)	1 (50%)		
		RDS			
Gestational age	Preterm	6 (9.8%)	55 (90.2%)	—	0.025
	Term	0 (0.0%)	69 (100%)		
	Postdated	0 (0.0%)	3 (100%)		
		Neonatal Sepsis			
Cause of LUCS- Oligohydramnios	Yes	7 (50%)	7 (50%)	2.57	0.031
	No	7 (19.4%)	29 (80.6%)		
Cause of LUCS-Less Fetal Movement	Yes	4 (80%)	1 (20%)	3.6	0.006
	No	10 (22.2%)	35 (77.8%)		
Cause of LUCS- Prolonged Labor	Yes	2 (100%)	0 (0.0%)	4	0.021
	No	12 (25%)	36 (75%)		
Introduction to Breast Milk	On 1st day	18 (39.1%)	28 (60.9%)	1.7	0.05
	After 1st day	20 (23%)	67 (77%)		
		Congenital Anomaly			
Mode of Delivery	NVD	10 (12%)	73 (88%)	—	0.042
	LUCS	1 (2%)	49 (98%)		
Cause of LUCS- Prolonged Labor	Yes	1 (50%)	1 (50%)	—	<0.005
	No	0 (0.0%)	48 (100%)		
Prelacteal Food	Given	3 (25%)	9 (75%)	—	0.027
	Not Given	8 (6.6%)	113 (93.4%)	—	

*χ^2 test

whose mother had a LUCS because of other reasons developed PNA with HIE, and this data was statistically significant (p=0.039 & RR= 0.47). In our study, 42.6% of preterm babies, 71.0% of term babies, and all of the postdated babies developed PNA with HIE, and this data was significant statistically (p<0.005). The correlation between birth weight and PNA with HIE was significant, with a p-value of 0.005. The only macrosomic baby we had in our data suffered from birth asphyxia. Furthermore, 75.5% of the NBW neonates and 55% of the LBW neonates had asphyxia. Among VLBW and ELBW neonates, the percentages of being affected by PNA with HIE were 28.6% and 50%, respectively (Table-III).

Respiratory distress syndrome showed a significant result when linked with gestational age (p=0.025). No term and postdated babies developed RDS, while 9.8% of premature babies suffered from it (Table-III). According to our data, 50%, 80%, and 100% of the neonates developed sepsis whose mothers had LUCS due to oligohydramnios (p=0.031 & RR= 2.57), LFM (p=0.006 & RR=3.6) and prolonged labor (p=0.021 & RR= 4.0), accordingly. Moreover, 39.1% neonates developed sepsis among those who were given breastmilk on their 1st day of birth. On the contrary, 23% of neonates who were given breastmilk after 1st day, developed sepsis. This data was found statistically significant (p=0.05) and the risk ratio was 1.7 (Table III).

In our data, neonates who had any of the congenital deformities were mostly born through NVD (10 out of 11) {p=0.042}. Mothers' LUCS due to prolonged labor had a significance, with 50% being diagnosed with congenital anomalies (p=<0.005). Three of 12 neonates were given pre-lacteal food and had congenital anomalies (p=0.027) (Table III).

A significant result (p=0.013) was seen in the relation between gestational age and mortality. Premature babies were more prone to die (18% out 61 died) than term or postdated babies. According to our data, 42.9% (6) of the twins died, and 5.9% (7) of the singletons deceased (p=<0.005 & RR= 7.29). Moreover, when twin pregnancy was followed by preterm delivery, the result was the same as previous data with similar risk ratio and p-value. The death and survival rate were equal in the case of neonates born through LUCS because of twin pregnancy. This data showed statistical significance (p=<0.005) (Table IV).

With a p-value of <0.005, birth weight showed significance when related to immediate outcome. The relation between weeks of gestation and mortality was disproportionate, which means when the birth

Table IV
Factors vs mortality

Factors		Expired	Survived	Risk ratio	p value*
Gestational age	Preterm	11 (18%)	50 (82%)	—	0.013
	Term	2 (2.9%)	67 (97.1%)		
	Post-term	0 (0%)	3 (100%)		
Twin pregnancy	Yes	6 (42.9%)	8 (57.1%)	7.29	<0.005
	No	7 (5.9%)	112 (94.1%)		
Twin pregnancy with Prematurity	Yes	6 (42.9%)	8 (57.1%)	7.29	<0.005
	No	7 (5.9%)	112 (94.1%)		
Cause of LUCS - Twin pregnancy	Yes	3 (50%)	3 (50%)	—	<0.005
	No	0 (0%)	44 (100%)		
Birth weight	≥4.0 kg (Macrosomia)	0 (0.0%)	1 (100%)	—	<0.005
	2.5-3.999 kg (NBW)	1 (2%)	48 (98%)		
	1.5-2.499 kg (LBW)	4 (6.7%)	56 (93.3%)		
	1-1.499 kg (VLBW)	7 (33.3%)	14 (66.7%)		
	<1kg (ELBW)	1 (50%)	1 (50%)		

*χ^2 test

weight decreased, the death rate increased. Macrosomic (0.0%) and NBW (2%) babies showed fewer death percentages than those with LBW (6.7%) and VLBW (33.3%), among all neonates. The rate of survival and death were equal (one survived and one died) in the case of ELBW neonates (Table IV).

In our data, 14.5% of LBW (other than NBW and Macrosomia) neonates died. In other words, most of the expired neonates were with LBW (12 out of 13). This data was also statistically significant (p=0.019 & RR= 7.23). A total of 53 neonates were premature LBW, and 18.9% of them expired (p=<0.005 & RR= 5.03). Neonates who were twins with LBW showed a higher mortality rate (41.7%). It was also statistically significant with a p-value of <0.005 & a risk ratio of 10.31. Moreover, the death rate, survival rate, and risk ratio were equal to the previous data, when LBW was associated with both prematurity and twin pregnancy (p=<0.005) (Table V).

In total, 66.7% of VLBW neonates survived, while 33.3% died. The relative risk was very high (6.22), and the p-value was <0.005. Those 7 expired VLBW neonates were also premature (p=<0.005 & RR= 6.22). When sepsis was associated with twin pregnancy, we got a significant result (p=<0.005 & RR= 11.91). Two of the twin neonates developed sepsis, and both of them died. Lastly, the death rate of neonates with PNA with HIE (7.7%), neonatal sepsis (13.2%), RDS (0.0%), neonatal jaundice (7.7%), pneumonia (0.0%), IUGR (0.0%), congenital anomaly (9.1%), and diabetes mellitus (0.0%) did not show any significant result when related to mortality, individually (Table V).

Table V
Mortality vs morbidities

Morbidities		Expired	Survived	Risk ratio	p value*
LBW (other than NBW & macrosomia)	yes	12 (14.5%)	71 (85.5%)	7.23	0.019
	no	1 (2%)	49 (98%)		
LBW with prematurity	yes	10 (18.9%)	43 (81.1%)	5.03	<0.005
	no	3 (3.8%)	77 (96.3%)		
LBW with twin	yes	5 (41.7%)	7 (58.3%)	10.31	<0.005
	no	8 (6.6%)	113 (93.4%)		
LBW with prematurity with twin	yes	5 (41.7%)	7 (58.3%)	10.31	<0.005
	no	8 (6.6%)	113 (93.4%)		
VLBW	yes	7 (33.3%)	14 (66.7%)	6.22	<0.005
	no	6 (5.4%)	106 (94.6%)		
VLBW with prematurity	yes	7 (33.3%)	14 (66.7%)	6.22	<0.005
	no	6 (5.4%)	106 (94.6%)		
PNA with HIE	yes	6 (7.7%)	72 (92.3%)	—	0.336
	no	7 (12.7%)	48 (87.3%)		
RDS	yes	0 (0%)	6 (100%)	—	0.409
	no	13 (10.2%)	114 (89.8%)		
Neonatal sepsis	yes	5 (13.2%)	33 (86.8%)	—	0.406
	no	8 (8.4%)	87 (91.6%)		
Neonatal sepsis with twin	yes	2 (100%)	0 (0%)	11.91	<0.005
	no	11 (8.4%)	120 (91.6%)		
Neonatal jaundice	yes	1 (7.7%)	12 (92.3%)	—	0.79
	no	12 (10%)	108 (90%)		
Pneumonia	yes	0 (0.0%)	3 (100%)	—	0.564
	no	13 (10.0%)	117 (90%)		
IUGR	yes	0 (0%)	5 (100%)	—	0.453
	no	13 (10.2%)	115 (89.8%)		
Congenital anomaly	yes	1 (9.1%)	10 (90.9%)	—	0.936
	no	12 (9.8%)	110 (90.2%)		
Diabetes Mellitus	yes	0 (0.0%)	1 (100%)	—	0.741
	no	13 (9.8%)	119 (90.2%)		

*χ test

Discussion

In our study, 42.1% of pregnancies were unplanned, which is about 1.5 times higher than the report from Turkey.[7] The rate of NVD in a study in Karachi was 68%, which is almost similar to our data.[8] Besides, research in Pakistan showed the opposite ratio of NVD and LUCS in comparison with our study.[9] The percentage of neonates introduced to early initiation of breastfeeding (On 1st day) is half in our study compared to the data by Edmond et al.[10] The report from Edmond et al[10] also showed a percentage of newborns having pre-lacteal feed and is higher than the result in our investigation. A report from Iran showed that almost 36% of Afghan women completed at least 8 ANC visits according to the latest WHO guideline and this percentage is 2.5 times higher than the data in our records.[11] Future interventions towards the improvement of neonatal healthcare should focus on the awareness regarding ANC visits among mothers.

The overall death percentage was 9.8% (number of death was 13), which is almost four times less than the study from Haryana et al[12] and a little higher than the report from Sri Lanka.[13]

The incidence of twins (10.5%) in our research is almost similar to a study from Addis Ababa.[14] Twin pregnancy had been a major cause of mortality for neonates, and the risk of death for twins seemed to be 7.29 times greater than the singletons. If twin pregnancy was followed by premature delivery, the risk ratio and death rate had been as same as twin-mortality relation. The mortality rate was very high in LBW twins, and risk decreased 10.31 times when a neonate was not a twin and LBW at the same time. The death rate in this category is 1.5 times higher than a study in Nigeria.[15] All LBW twins were also premature in our data. The death rate (41.7%) among them is nearly 1.5 times higher than a study in Nigeria.[15] All the twins who developed sepsis died in the hospital. Neonates who were born through LUCS because of twin pregnancy showed a high mortality rate (50%).

The percentage of premature births in our research is approximately 1.5 times higher than the studies from Pakistan.[16,9] The rate of term birth (51.9%) is nearly analogous to the report from Addis Ababa [14]. The premature death rate (18%) was six-folds higher than the term death (2.9%) in our study. However, the preterm mortality rate is lower than the study in a secondary health care center in Nigeria.[17]

In a study from Addis Ababa, the percentage of neonates with a birth weight of at least 2.5 kg is almost 1.5 times higher than ours, and the rate of neonates with a birth weight of less than 1 kg is also 1.5 times more compared to our study.[14] The mortality rate increased with the fall in birth weight. Therefore, birth weight plays a pivotal role in neonatal mortality. In a study from Egypt, mortality among LBW neonates was ten times higher than NBW ones[18], but in our report, the death was 7.23 times higher in LBW neonates. The risk of death for premature LBW neonate was five-folds higher. All expired VLBW neonates were premature. The death rate among preterm VLBW babies was very high (33.3%) with about 6 times more risk to die than those who were not both preterm and VLBW. The mortality seems to be affected in the neonates having preterm birth and also under the category of VLBW.

Birth asphyxia was always followed by hypoxic-ischemic encephalopathy in our investigation. PNA with HIE acted as a substantial cause of hospital admission in our data. About 59% of admitted neonates suffered from PNA with HIE, which is almost 3.5 times higher than the study from Uttarakhand.[19] The neonates born through LUCS for reasons other than oligohydramnios had a higher risk of birth asphyxia. Most of the term babies were exposed to birth asphyxia, while the incidence of PNA with HIE was less in preterm births. All of the postdated babies suffered from PNA in our data. More NBW neonates suffered from asphyxia than LBW and VLBW babies. Birth asphyxia was common in all kinds of neonates irrespective of causes of LUCS, gestational age and birth weight. Though the death rate due to PNA with HIE is 2.3 times less than the study from South-East Nigeria, it was very high (7.7%) in our hospital.[20]

Neonatal sepsis comprised high percentages in neonatal morbidity (28.6%) and mortality (13.2%). Turhan et al[21] showed that the incidence of neonatal sepsis was about 11% (351 out of 3219), and mortality due to sepsis was about 7% (24 out of 351), respectively. Their morbidity and mortality rates are much less than ours. Cause of LUCS-Oligohydramnios was one of the main reasons for neonates suffering from sepsis. In our report, 50% of the neonates who were born through LUCS because of oligohydramnios developed sepsis, and

the others had 2.57 times less chance of getting it. Another reason behind sepsis was the cause of LUCS- less fetal movement. Babies who were born through LUCS because of LFM had 3.6 times more chance of developing sepsis than others. All the neonates who were born through LUCS because of prolonged labor had four times more risk of sepsis than the others do. According to our data, those who were given breastmilk on their 1st day of birth had 1.7 times more risk of developing sepsis. Further research and projects in this issue might reveal more about the relation between early breastfeeding and neonatal morbidity/mortality in the context of Bangladesh.

Neonatal jaundice was the third predominant cause of neonatal morbidity and mortality in our study. With about 10% incidence in our data, the similarity is noticed (but four times less mortality rate) with the data from Nigeria.[17] The incidence of congenital anomaly in our study is much higher than the studies from Uttarakhand and Nigeria.[19,17] Most of the babies with congenital defects were born through normal vaginal delivery (10 out of 11). One-fourth of the babies with congenital defects were given pre-lacteal food, as they did not have efficient suction power. The incidence of respiratory distress syndrome (RDS) in neonates of our study was about ten times less than the data showed by Lee et al.[22] According to our analysis, prematurity was the main reason for developing RDS. In our data, all the RDS patients were preterm, while no term and postdated babies suffered from it.

Conclusion

The study acknowledged LBW, PNA with HIE, sepsis, neonatal jaundice, congenital anomalies, and RDS as the major factors for neonatal admissions, and reasons behind mortality were LBW, prematurity, and twin pregnancy. Awareness among parents and improved infrastructure of the hospital might be helpful to reduce the gravity of the condition in the future.

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