Perinatal Asphyxia and Associated Factors among Neonates Admitted to a Tertiary Hospital in Chattogram, Bangladesh

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Abstract

Background: Perinatal Asphyxia (PNA) continues to be a significant clinical concern around the world as the consequences can be devastating. While the incidence, risk factors and outcomes of PNA have been characterized in developed countries, less is known in low resource settings. This study aimed to evaluate the risk factors of PNA and outcomes of this condition among neonates admitted in a tertiary hospital in the southeastern part of Bangladesh.

Materials and methods: The observational study included 500 consecutively admitted neonates (With PNA, n=188 and without PNA=312) in the neonatal unit of ChattogramMaa-O-Shishu Hospital, Bangladesh from March 2020 to April 2021. Information regarding sociodemography, peri-natal history (Including antepartum, intrapartum and fetal risk factors) were collected by face to face interview and reviewing the medical records on a case record form. In-hospital outcome data were recorded and compared between two groups.

Results: Significant risk factorsfor PNA were maternal medical disorders during pregnancy (aOR:2.58, 95% CI, 1.45-4.61) preterm labour (aOR:2.83, 95% CI, 1.21-6.60) home vagianl delivery (aOR:2.78, 95% CI, 1.76-4.40), meconium stained liquor (aOR:3.08, 95% CI, 1.80-5.26), and birth weight less than 2500 g. The predischarge mortality rate was 7.4% in the PNA group and risk of mortality was 2.87 times higher in babies with PNA (OR: 2.87, 95% CI, 1.27-6.49) compared to the baby without PNA.

Conclusion: Identified obstetric and neonatal risk factors for PNAcould have been prevented or managed even with our limited resources. Focus on early identification and timely treatment of PNA could reduce related mortality.

Key words: Neonates; Perinatal asphyxia; Risk factors.

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Introduction

PNA is one of the leading causes of neonatal deaths in the world following severe infections and prematurity.[1,2] PNA results from the loss of the blood supply or impairment of gas exchange to or from the fetus before, during, or after the birth process.[3] PNA may lead to severe metabolic acidosis, hypercarbia, progressive hypoxemia, neonatal encephalopathy, multi-system organ failure, and even death.[4] Those who survive asphyxia at birth may have a chance to develop neurological complications, including epilepsy, cerebral palsy and developmental delay.[5] So, PNA creates a great burden for the family, as well as for society.

Since the condition could have been preventable in a developing country like Bangladesh, an urgent need to understand the pathophysiology and risk factors of PNA is thus obvious. Various maternal and fetal risk factors are involved in PNA. Maternal risk factors were reported as the mother's age, inappropriate antenatal care, preeclampsia, and intake of diuretics and adrenergic drugs. Significant Intrapartum risk factors were home delivery by midwives, breech presentation, prolapsed umbilical cord, cephalopelvic disproportion and fever. Significant fetal risk factors were oligohydramnios, meconium-stained amniotic fluid, premature delivery and low birth weight.[6,7]

Reduction of neonatal death to less than 12 per 1000 live births for each country by 2030 is one of the targets of Sustainable Development Goal 3.2.[8] Although Bangladesh has substantially reduced neonatal mortality since 1990, increased efforts to improve progress are still needed to achieve the SDG target by 2030.[9] To the best of our knowledge, there are very few clinical studies in

Bangladesh addressing the risk factors of PNA.[10-12] Considering these facts, the studyis an attempted to gain insights into how different maternal and fetal risk factors related to PNA, the short-term outcomes of the affected babies.

Materials and methods

This prospective analytical observational study was conducted in the Neonatal Unit of Chattagram Maa-O-Shishu Medical College Hospital between March 2020 to April 2021. The Neonatal Ward has 52 beds, including 22 ICU beds, and operates at full capacity at all times. Trained consultant paediatricians and residents are responsible for the medical care of the neonates. Prior approval of the study was obtained from the Ethical Review Committee of the inistitution and considering the nature of the study only verbal consent was approved and taken from the parents or the caregivers.

Consecutively admitted 500 neonates were included in the study. Out of them 188 had PNA and other 312 newborns had no PNA. PNA was considered when there was a history of failure or delayed onset of spontaneous respiration after birth or when a baby needed positive pressure ventilation for more than 1 minute or delayed cry with or without cyanosis (For newborns born other than our hospital).[4] Those with congenital anomalies, Rh incompatibility or birth weight less than 1000 gm were excluded from the study.

Enrollment was done within 12 hours of admission, after informed verbal consent from the mother or the caregiver of each case. Data were collected by interviewing and from registers using a pretested structured case record form prepared in English. The study collected data about maternal age, education, working status, monthly family income, residence, past medical and obstetric history, parity, history of present pregnancy including associated medical conditions, whether antenatal checkup was taken or not, etc. Information about place and mode of delivery, conducting person, duration of labour, use of any drug, colour of liquor, babies condition at birth, need for any form of resuscitation, with specification, length of hospital staty and outcomes were also included.

SPSS version 23.0 for Windows was used for data recording and analysis. Variavles were categorized and for comparison between the groups Chi-square test was used. Binary logistic regression analysis was done for obstetric and neonatal factors to assess the level of independent association with PNA and results were expressed as adjusted Odds Ratio (aOR) with 95% Confidence Interval (CI). A p-value of < 0.05 was considered statistically significant.

Results

The overall prevalence of PNA was 37.6% (188/500). Maternal age of <18 years were significantly associated with PNA as compare to elder mothers (p =0.006). The mothers who reside in rural area, were of low socioeconomic status, and have low level of education demonstrated significantly higher PNA than their counterparts (Table I).

Table I Sociodemographic characteristics of the studied neonates (n=500)

Characteristics	With PNA (n=188)	Without PNA (n=312)	p value*
Maternal age at delivery			
<18 years	8 (4.3)	0 (0)	
18-34 years	167 (88.8)	278 (89.1)	0.006
>34 years	13 (6.9)	34 (10.9)	
Residence			
Urban	85 (45.2)	186 (59.6)	0.002
Rural	103 (54.8)	126 (40.4)	
Monthly family income			
<20,000 Taka	112 (59.6)	209 (67.0)	0.094
≥20,000 Taka	76 (40.4)	103 (33.0)	
Educational level of mother			
Below primary	42 (22.3)	24 (7.7)	
Primary to <SSC	111 (59.0)	177 (56.7)	<0.001
SSC and above	35 (18.6)	111 (35.6)	
Maternal occupation			
Housemaker	162 (86.2)	301 (96.5)	<0.001
Employed outside	26 (13.8)	11 (3.5)	

Data were expressed as frequency (%), *Chi-square test, Significant values were in bold face.

Among the neonates 78% (340) were male and 32% (160) were female. The male to female ratio was 2.1:1 (in PNA group 1.9:1). Table II shows that, primigravida, presences of bad obestetrict history, less ANC, presence of maternal disease during pregnancy, preterm labour, vaginal delivery, presence of meconium stained liqour, and low birth weight were significantly associated with PNA in univasriate analysis.

Table II Antenatal and perinatal factors associated with perinatal asphyxia

Characteristics	With PNA (n=188)	Without PNA (n=312)	p value*
Pregnancy status			
Primigravida	111 (59.0)	151 (48.4)	0.021
Multigravida	77 (41.0)	161 (51.6)	
Bad obestetrict history			
Absent	153 (81.4)	277 (88.8)	0.021
Present	35 (18.6)	35 (11.2)	
Antenatal check up			
<4 times	74 (39.4)	82 (26.3)	
4 times	82 (43.6)	122 (39.1)	<0.001
>4 times	32 (17.0)	108 (34.6)	
Maternal disease during pregnancy			
Absent	137 (72.9)	271 (86.9)	<0.001
Present	51 (27.1)	41 (13.1)	
Preterm labour			
Absent	164 (87.2)	299 (95.8)	<0.001
Present	24 (12.8)	13 (4.2)	
Mode of Delivery			
Vaginal delivery	137 (72.9)	156 (50.0)	<0.001
Cesarean delivery	51 (27.1)	156 (50.0)	
Place of delivery			
Home	55 (29.3)	107 (34.3)	0.243
Hospital	133 (70.7)	205 (65.7)	
Meconium stained liquor			
No	124 (66.0)	278 (89.1)	<0.001
Yes	64 (34.0)	34 (10.9)	
Sex of the neonates			
Male	123 (65.4)	217 (69.6)	0.338
Female	65 (34.6)	95 (30.4)	
Birth weight			
<2500 gm	91 (48.4)	101 (32.4)	<0.001
≥2500 gm	97 (51.6)	211 (67.6)	

Data were expressed as frequency (%), *Chi-square test, Significant values were in bold face.

In multivariate analysis, mothers with medical disorders during pregnancy had more than two times higher risk of delivering baby with PNA (aOR:2.58, 95% CI, 1.45-4.61) and preterm labour was associated with about three times higher chance (aOR:2.83, 95%CI, 1.21-6.60) of delivering neonates with PNA. Babies born with vaginal delivery had more than two times the risk of developing PA than those with cesarean delivery (aOR:2.78, 95% CI, 1.76-4.40). Meconium stained liquor during labour resulted in an three timed increased risk of PNA (aOR:3.08, 95% CI, 1.80-5.26). Babies weighing < 2500 g had a 2.24-fold increased risk of having PNA (aOR:2.24, 95% CI, 1.45-3.46) compared to babies with birth weight of ≥2500g (Table III).

Table III Factors associated with PNA in multivariate logistic regression analysis

Variables	β	OR	95% CI for OR Lower	Upper	p value
Maternal age at delivery, years	-0.784	0.457	0.197	1.058	0.067
Residence (Rural vs. urban)	0.359	1.432	0.919	2.232	0.113
Maternal education	0.214	1.212	0.489	2.223	0.095
Maternal occupation	-0.114	0.145	0.140	1.848	0.120
Parity	0.215	1.240	0.801	1.919	0.334
Bad obestetrict history	-0.164	0.849	0.440	1.637	0.625
Number of ANC	0.290	1.337	0.996	1.794	0.053
Medical disorder during pregancy	0.950	2.586	1.450	4.611	0.001
Preterm labour	1.040	2.829	1.212	6.602	0.016
Mode of delivery (Vaginal vs. CS)	1.024	2.783	1.762	4.395	<0.001
Meconium stained liquor	1.124	3.077	1.801	5.255	<0.001
Birht weight (<2.5kg vs.≥2.5kg)	0.807	2.241	1.453	3.457	<0.001

ANC: Antental Care, CS: Cesarean Section, OR: Odds Ratio, CI: Confidence Interval.

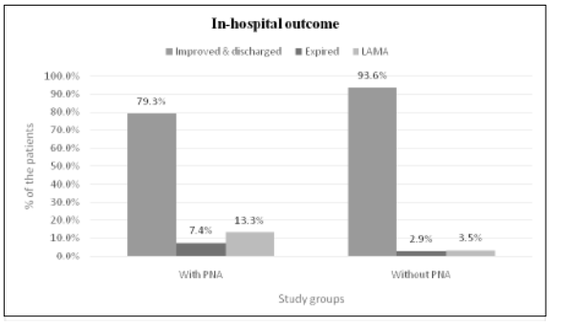

Figure 1 Comparison of outcome between neonates with and without PNA (LAMA: Leave against Medical Advice).

Out of 500 admitted neonates, 88.2% were discharged after improvement, 23 died, giving an in-hospital mortality rate of 4.6%. Rest of 7.2% neonates left the hospital against medical advice. Figure 1 shows that, in-hospital mortality and LAMA rate was significantly higher among the neonates with PNA than the neonates without PNA (p<0.001). Babies with PNA had 2.87 times higher risk of pre-discharge mortality (OR: 2.87, 95% CI, 1.27-6.49) as compared to babies who did not have PNA.

Discussion

The objective of this prospective analytical study was to evaluate the outcome and materno fetal risk factors of birth asphyxiated babies admitted in a large hospital in Chattogram, Bangladesh. The number of studies done so far in Bangladesh in this regard was only a few as reported from KYAMC Hospital, Matlab hospital, Dhaka

Medical College Hospital and Dhaka Shishu Hospital.[10-13] To the best of our knowledge, this was the first study in this part of Bangladesh of this type.

The findings from this study revealed that the magnitude of PNA was 37.6%, which is quite higher compared to a study done in southern India (2.7%), Sweden (5.4%), but lower than that observed in previous study from Bangladesh (56.9%) and Ethiopia (41.2%).[14-16] This discrepancy could be explained by the socioeconomic variation between the study area, the facility type, and due to different operational definitions for birth asphyxia adopted by different researchers. Moreover, it is to be noted that, the study site is a specialized referel hospital for the newborn and infant. So, more complicated cases are admitted here, which might increase the prevalence of PNA in the present study.

Neonates born to mothers with medical disorders during pregnancy had greater risk of developing PNA in the present study. Preterm labour and meconium stained liquor during labour resulted in an higher risk of PNA. Intrauterine meconium release can complicate respiratory status at birth with risk of profound hypoxia resulting in PNA.[17] Meconium stained liqour in our dataset conferred the highest of all risks with adjusted OR of 3.08. Babies born by vaginal delivery had more than two times the risk of developing PNA than those with cesarean delivery in the present study which was similar to the previous study conducted in Bangladesh.[10] Home vaginal births by untrained midwives results in unexpected delays, timely prediction of high risk pregnancies and leads to development of PNA as well as other perinatal problems and the delayed referral to tertiary care center. Babies weighing < 2500 g had two-fold risk of having PNA compared to babies with birth weight of ≥2500g. LBW babies may have higher chances of perinatal complications due to placental insufficiency.[18]

Notably, the present study identified, that pre-discharge mortality rates associated with PNA was 7.4%, which was lower than rate mentioned in other studies conducting in Bangladesh (16%) and Nepal (17%).[12,19] Focus on early identification and timely treatment of PNA in the study site which is well equipped with advance facilities might results in comparatively low mortality rate.

Limitation

The limitation of this studyis it was a cross-sectional study which might not indicate a cause-effect relationship. Sample size was relatively small and as it was a hospital-based study, the results might lack generalization to the entire population in the catchment area.

Conclusion

This study provides some obstetric and neonatal risk factors associated with PNA and mortality outcomes in a tertiary level hospital in Chattogram, Bangladesh. Study found home pregnancy complicated with medical disorders, preterm labour, meconium stained liquor, home vaginal delivery, and low birth weight were significant risk factors associated with PNA.

Recommendation

Majority of the identified factors are manageable and careful monitoring of the possible presence of these risk factors throughout the perinatal period is highly recommened. By this we can reduce the occurance of PNA and its complications within our limited resources. Future community-based study with larger sample size is necessary to find the temporal relationship between PNA and different maternal and neonatal risk factors of PNA.

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Contribution of authors

FA-Conception, acquisition of data, drafting & final approval.

SD-Acquisition of data, data analysis, drafting & final approval.

MZR-Acquisition of data, interpretation of data, drafting & final approval.

MPR-Data analysis, critical revision & final approval.

WA-Design, critical revision & final approval.

Disclosure

All the authors declared no conflict of interest.

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