Clinicoepidemiologic Correlates of Perinatal Asphyxia During the Peripartum Period

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Abstract

Aim: To identify the clinicoepidemiologic factors during the peripartum period that may contribute to a low 1-minute Apgar score in neonates born in a tertiary care hospital

Materials and Methods: This is a cross-sectional, observational study done over 6 months from January 2018 to June 2018. Neonates with a birth weight ≥ 2 kg and 1-minute Apgar score of 0 to 3 and their mothers were considered for the study. Neonates born at gestational age < 34 weeks and those with any congenital anomaly were excluded. Epidemiologic data such as maternal age, education, and occupation and clinical risk factors related to pregnancy and delivery (including antepartum and intrapartum) were recorded and statistically analyzed.

Result: A total of 59 mother–neonate pairs were included in this study. Among the mothers, 27.12% and 20.3% mothers had a history of abortion and neonatal death/severe disease, respectively, while 23.7% had antepartum risk factors, 28.8% had intrapartum maternal risk factors, and 5.1% had fetal risk factors.

Conclusion: We found that there is a significant association of 1-minute Apgar score with maternal age, education, and occupation, whereas there was no obvious correlation with maternal residence, parity, and the number of antenatal visits.

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According to the outcome of multiple logistic regression analysis, a history of abortion, antepartum risk factors, and fetal risk factors remain the statistically significant predictors of the 1-minute Apgar score.

Key Words: 1-min Apgar score, 5-minute Apgar score, birth weight, maternal age, maternal education, antepartum risk factors, intrapartum risk factors

Introduction

The Apgar scoring system developed by Dr Virginia Apgar (in 1952) continues to be a time-tested tool in identifying birth asphyxia and predicting early neonatal deaths. The Apgar scoring system is not only a rapid but also a more accurate predictor of neonatal deaths— a 5-minute Apgar score of 0 to 3 in term neonates is associated with 8 times higher risk of neonatal death than those with an umbilical artery pH of ≤ 7.[1,2] While the 1-minute Apgar score identifies neonates in need of resuscitation, the 5-minute Apgar score helps assess the effectiveness of resuscitation.[3-5] A low Apgar score and a long duration of low score carries a high risk of death and neurologic sequelae.[2]

In our study, we aimed at identifying the maternal risk factors for neonatal asphyxia. This type of hospital-based study can help formulate protocols to prevent peripartum complications at the earliest, and thereby help reduce the incidence of perinatal asphyxia and death.

Aim

To identify peripartum factors that may contribute to a low 1-minute Apgar score in neonates born in a tertiary care hospital

Materials and Methods

Study design

This is a cross-sectional, observational study conducted across 6 months, from January 2018 to June 2018. It was conducted at the Department of Obstetrics and Gynecology, Medical College Kolkata (Kolkata, West Bengal, India), a tertiary care teaching hospital.

The protocol was approved by the institutional ethics committee.

Inclusion and exclusion criteria

Neonates with a birth weight of ≥ 2 kg, with birth asphyxia specifically in the first 1 minute of life, were included. In our study, a 1-minute Apgar score of 0 to 3 was considered as birth asphyxia. Exclusion criteria were gestational age < 34 weeks, neonates with congenital anomalies, and neonates of mothers who were unable to provide details of their medical history.

Study procedure

A total of 59 mother–neonate pairs were included in this study. Mothers of asphyxiated neonates were interviewed using a predesigned, pretested, structured schedule, and relevant variables were also recorded from their case record form. Variables included in the study were maternal age, education, occupation, residence, parity, prior abortion, antepartum risk factors, neonatal severe illness in other siblings, number of visits to the antenatal clinic (ANC), intrapartum risk factors, fetal risk factors, mode of delivery, and 1- and 5-minute Apgar scores (Table 1).[6-12]

Statistical analyses

All the collected data were concurrently entered in a Microsoft Excel spreadsheet. All the variables were modified into dichotomous categories, and their statistical association was tested using the χ^2 test. Variables that showed a significant association with perinatal asphyxia by the χ^2 test were further tested by multiple logistic regression analysis to estimate the adjusted effect.

Table 1. Demographic Characteristics of the Study Population (*N* = 59)

Characteristic	Frequency (%)
Maternal Age, y	
< 20	6 (10.2)
20–25	32 (54.2)
26–30	17 (28.8)
> 30	4 (6.8%)
Maternal Education	
Illiterate	8 (13.6)
Lower than primary	1 (1.7)
Primary	11 (18.6)
Secondary	21 (35.6)
Higher secondary and above	18 (30.5)
Maternal Occupation	
Homemaker	49 (83.1)
Working	10 (16.9)
Residence	
Rural	23 (39)
Urban	36 (61)
Prior Abortion	
Yes	16 (27.12)
No	43 (72.88)
Antepartum Risk Factor(s)	
Present	14 (23.7)
Absent	45 (76.3)
Severe Illness in or Death of a Neonate in Previous Deliveries	
Present	12 (20.3)
Absent	47 (79.7)
No. of ANC Visits	
≥ 7	16 (27.1)
4–6	18 (30.5)
≤ 4	25 (42.4)
Intrapartum Risk Factor(s)	
Present	17 (28.8)
Absent	42 (71.2)
Fetal Risk Factors	
Present	3 (5.1)
Absent	56 (94.9)
ANC, antenatal clinic.	

Table 2. Univariate Analysis Indicating the Association Between Low 1-min Apgar Score and Maternal Predictors

Variable	1-min Apgar Score < 3	*P* Value
Maternal Age, y		
≤ 25	38	.02
> 25	21	
Maternal Education		
Primary	20	.01
Above Primary	39	
Maternal Occupation		
Home Makers	49	< .01
Working	10	
Residence		
Rural	23	.09
Urban	36	
Parity		
Primiparous	33	0.36
Multiparous	26	
Prior Abortion		
Yes	16	< .001
No	43	
Antepartum Risk Factors		
Present	14	< .001
Absent	45	
Mode of Delivery		
Vaginal	45	< .001
Cesarean	14	
Severe Illness or Death of a Neonate in Previous Deliveries		
Present	12	.001
Absent	47	
No. of ANC Visits		
≥ 7	16	.092
4–6	18	
≤ 4	25	
Intrapartum Risk Factors		

Results

During the 6 months of this study, totally 5082 live births took place in our hospital, of which 3845 neonates had a birth weight of ≥ 2 kg. Of these, 59 (1.53%) neonates had a 1-minute Apgar score of

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Present	17	.001
Absent	42	
Fetal Risk Factors		
Present	3	.001
Absent	56	

ANC, antenatal clinic.

0 to 3. Analysis of the data revealed that 83% of mothers were in the age group of 20 to 30 years, 66% of mothers had secondary or higher education, 83.1% of mothers were homemakers, 61% of mothers resided in urban areas, and 39% of mothers resided in rural areas. Of the 59 mothers, 16 (27.12%) had a history of prior abortions, 14 (23.7%) presented with antepartum risk factors such as pregnancy-induced hypertension, gestational diabetes mellitus, antepartum hemorrhage, and premature rupture of membranes. Among the 59 mothers, 12 (20.3%) mothers reported severe illness in or death of their previous child, and the remaining 47 (79.7%) mothers did not report any such incidences. Most of them visited the ANC > 4 times (34 women visited the ANC > 4 times and 25 visited < 4 times). No intrapartum risk factors were found in 42 (71.2%) asphyxiated neonates, only 17 (28.8%) neonates had withstood intrapartum adverse events such as prolonged labor, prolonged rupture of membranes (> 18 h), hemorrhage, and obstructed labor. Fetal risk factors (intrauterine growth restriction, macrosomia, and congenital diseases) were present in 3 (5.1%) neonates. When these data were subject to univariate analysis, to assess the association of the 5-minute Apgar score (< 7) with the predictors, a significant correlation was observed between perinatal asphyxia and maternal age, education, and occupation. Prior abortion was found to have a highly significant association with neonatal asphyxia, and similar highly significant associations were found in cases with antepartum risk factors, presence of fetal risk factors, and the mode of delivery (Table 2). Multiple logistic regression analysis for the variables that were significant by the univariate model established the significant correlation between perinatal asphyxia and presence of antepartum risk factors, fetal risk factors, and history of prior abortion (Table 3).

Table 3. Outcome of Multiple Logistic Regression Analysis of the Variables that Were Significant By the Univariate Analysis

Variable	Adjusted Odds Ratio	95% CI	P Value
Maternal Age, y			
≤ 25	0.377	0.084–1.699	.204
> 25	Ref	NA	
Maternal Education			
Primary	1.002	0.229–4.381	.998
Above primary	Ref	NA	
Maternal Occupation			
Homemaker	0.795	0.098–6.480	.831
Working	Ref	NA	
History of Prior Abortion			
Yes	0.131	0.022–0.794	.027[a]
No	Ref	NA	
Antepartum Risk Factor(s)			
Present	34.230	1.455–805.031	.028[a]
Absent	Ref	NA	
Mode of Delivery			
Vaginal	8.000	0.353–181.441	.192
LSCS	Ref	NA	
Severe Illness in or Death of a Neonate in Previous Deliveries			
Present	0.724	0.121–4.338	.724
Absent	Ref	NA	
Intrapartum Risk Factor(s)			
Present	0.169	0.027–1.071	.059
Absent	Ref	NA	
Fetal Risk Factors			
Present	1.619	1.619–1.619	.000[a]
Absent	Ref	NA	

Ref = 1.
All the predictors significant by χ^2 test were modeled for multiple logistic regressions.
[a]In this model, history of prior abortion, antepartum risk factors, and fetal risk factors were found to be the statistically significant predictors of the 1-min Apgar score.
LSCS, lower segment cesarean section. NA, not applicable.

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Discussion

In our study, we identified the risk factors of perinatal asphyxia, in a tertiary care teaching hospital, which mainly serves people of low and middle socioeconomic status. Most of the asphyxiated neonates were born to mothers in the age group of 20 to 30 years. This may be because most of the mothers admitted for delivery belonged to this age group. Studies by Tabassum et al[9] and Hall et al[10] do not show any association between maternal age and perinatal asphyxia, which is according to the findings in other similar studies.[2,4,5]

Among the 59 mothers in our study, 39 (66%) mothers had secondary or higher education, indicating no significant association between maternal education and perinatal asphyxia; however, the findings in some community-based studies establish a significant association between perinatal asphyxia and poor maternal education.[2,6-8] The findings of a study conducted by Shireen et al[5] are consistent with the findings of our study. This can be explained by the positive correlation between education and institutional deliveries, that is, educated mothers seek institutional deliveries. Most of the mothers in our study were from different urban areas surrounding our hospital, and the univariate analysis failed to establish any correlation between maternal residence and 1-minute Apgar score. Even in Hall et al's[10] study, maternal residence, antenatal booking, and regular ANC checkup did not establish any negative correlation.

Intrapartum risk factors were present in only 17 of the 59 mothers (28.8%), but univariate analysis showed that all the intrapartum adverse events including prolonged labor, meconium-stained liquor, intrapartum hemorrhage, and convulsions had a significant association with the 1-minute Apgar score. These findings are similar to that in other community- and hospital-based studies.[5,10,12-15] We found a highly significant association between mode of delivery and incidence of perinatal asphyxia, which is consistent with the results of other hospital-based studies.[3,5,9,11] A possible explanation for this is that cesarean deliveries may play a protective role to some extent by avoiding prolonged labor, postterm delivery, and malpresentation-related complications.

The final analysis using the multiple logistic regression model showed that prior abortion; antepartum risk factors; and fetal factors such as meconium-stained liquor, low birth weight, and prematurity were all significant risk factors for the reduced 5-minute Apgar score. This finding is in accordance with that in other hospital-based studies.[5,12]

Limitation

The 5-minute Apgar score is a more useful tool for predicting the long-term neurologic outcome of neonates with perinatal asphyxia, but the differences of 5-minute Apgar score from 1-minute Apgar score are mostly determined by the effectiveness of resuscitation. However, in our study, antepartum and intrapartum factors were analyzed, keeping aside the postpartum resuscitation details, thus 1-minute Apgar score was considered.

Conclusions

A history of prior abortion and antepartum risk factors were the 2 main causes found to be strongly associated with perinatal asphyxia even after removing all the confounding factors. Strengthening antenatal care can help reduce these cases of perinatal asphyxia by reducing the incidence of antepartum maternal complications.

References

1. Casey BM, McIntire DD, Leveno KJ. The continuing value of the Apgar score for the assessment of newborn infants. *New Engl J Med.* 2001;344(7):467–471.

2. Ehrenstein V. Association of Apgar scores with death and neurologic disability. *Clin Epidemiol.* 2009;1:45–53.

3. Apgar V. The newborn (Apgar) scoring system. Reflections and advice. *Pediatr Clin North Am.* 1966;13(3):645–650.

4. Hogan L, et al. How often is a low 5-min Apgar score in term newborns due to asphyxia? *European J Obstet Gynecol Reprod Biol.* 2007;130(2):169–175.

5. Shireen N, Nahar N, Mollah AH. Risk factors and short-term outcome of birth asphyxiated babies in Dhaka Medical College Hospital. *Bangladesh J Child Health.* 2009;33(3):83–89.

6. Kaye D. Antenatal and intrapartum risk factors for birth asphyxia among emergency obstetric referrals in Mulago Hospital, Kampala, Uganda. *East Afr Med J.* 2003;80: 140–143.

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7. Owais A, et al. Maternal and antenatal risk factors for stillbirths and neonatal mortality in rural Bangladesh: a case-control study. *PloS One.* 2013;8(11):e80164.

8. Ibrahim NA, Muhye A, Abdulie S. Prevalence of birth asphyxia and associated factors among neonates delivered in Dilchora Referral Hospital in Dire Dawa, Eastern Ethiopia. *Clin Mother Child Health.* 2017;14(4):279.

9. Tabassum F, et al. Risk factors associated with birth asphyxia in rural district Matiari, Pakistan: a case control study. *Int J Clin Med.* 2014;5(21):1430–1441.

10. Hall DR, Smith M, Smith J. Maternal factors contributing to asphyxia neonatorum. *J Tropical Pediatr.* 1996;42(4): 192–195.

11. Gane B, et al. Antenatal and intrapartum risk factors for perinatal asphyxia: a case control study. *Curr Pediatr Res.* 2013;17(2):119–122.

12. Lee ACC, et al. Risk factors for neonatal mortality due to birth asphyxia in southern Nepal: a prospective, community-based cohort study. *Pediatrics.* 2008;121(5):e1381–e1390.

13. Ekwochi U, et al. Incidence and predictors of mortality among newborns with perinatal asphyxia: a 4-year prospective study of newborns delivered in health care facilities in Enugu, South-East Nigeria. *Clin Med Insights Pediatr.* 2017;11:1–10.

14. Cruz-Anguiano V, et al. The importance of quality of care in perinatal mortality: a case-control study in Chiapas, Mexico. *Arch Med Research.* 2004;35(6):554–562.

15. Krishnan MP, Padarthi S. A prospective study on intrapartum risk factors for birth asphyxia. *J Dent Med Sci.* 2016;15(9): 4–7.

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