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Original Research Article

Study of clinical-etiological profile, outcome and maternal risk-factors of birth asphyxia: a hospital based observational study

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ABSTRACT

Background: Birth asphyxia is an important cause of neonatal morbidity and mortality. According to world health organization (WHO) out of the 130 million babies born every year, about 4 million die in the first 4 weeks of life the neonatal period. This study is aimed to assess the incidence, risk factors, complications and maternal variables associated with birth asphyxia.
Methods: This is a prospective observational study conducted at pediatric newborn stabilization unit (NBSU) district hospital, Bageshwar (Uttarakhand) over a period of 12 months from January 2021 to December 2021. Total 110 newborns with no spontaneous breathing or APGAR score <7 at 5-minute requiring basic/advanced neonatal resuscitation as per NRP AHA protocol were enrolled in this study. Detailed mother's antenatal history, risk factors along with clinical course of neonate was documented as per NICU protocol till the hospital stay in pre-designed pro-forma.
Results: Total 110 newborns were admitted with incidence of 6.2% and mean birth weight of 2760±575 gm. Male gender (71%), Term delivery (82.7%), majority 85.4% neonates were revived by basic, 27.2% developed HIE grade 1. Outcome wise majority 71% (78) were discharged, 22.7% (25). Among maternal variables, majority 82.7% (91) were booked pregnancy with mean maternal age 25.69-year, multigravida 54% (59), anemia 54.5% (60) and meconium-stained amniotic fluid (MSAF) constitutes most common risk factor.
Conclusions: Birth asphyxia is an important contributor of perinatal morbidity and mortality. Focus on early identification and timely management along with proper antenatal care and identification of high-risk pregnancy is crucial.

Keywords: Birth asphyxia, Neonatal mortality, HIE

INTRODUCTION

Birth asphyxia is an important cause of neonatal morbidity and mortality in developing countries and constitutes for 30% mortality worldwide.[1]

Perinatal asphyxia is the fifth largest cause of under-5 deaths (8.5%) after pneumonia, diarrhea, neonatal infections and complications of preterm birth.[2]

In developing countries around 3.6 million neonates suffer from moderate to severe birth asphyxia with nearly 840,000 babies (23%) die or may develop serious neurological sequelae.[3]

In India perinatal asphyxia constitutes 28.8% of neonatal mortality and 45.1% of stillbirths.[4]

The WHO defines birth asphyxia as a failure to trigger and sustain breathing automatically at birth.[5] It is a

combination of hypoxia, hypercarbia and metabolic acidosis due to the blockage of umbilical vessels, placental insufficiency in utero, or ineffective breathing after delivery.[6]

Birth asphyxia is diagnosed as APGAR score of four to seven in the first minute of life as moderate prenatal asphyxia, whereas zero to three suggests severe asphyxia.[7]

According to WHO out of the 130 million babies born every year, about 4 million die in the first 4 weeks of life the neonatal period. In low-income countries 23% of all neonatal deaths occurred due to birth asphyxia. It is the fifth largest cause of under-5 deaths (8.5%) after pneumonia, diarrhea, neonatal infections and complications of preterm birth.[8]

Risk factors of birth asphyxia have been divided into antepartum, intrapartum and fetal.

Maternal factors like prolonged labor, gestational diabetes, antepartum hemorrhage, preeclampsia, ante-partum and intrapartum anemia and multiple pregnancies have a significant role in the development of neonatal asphyxia.[1]

Neonatal factors for birth asphyxia (HIE) are post-dated, cord around the neck, oligohydramnios, meconium-stained amniotic fluid (MSAF) as well as the malpresentation, etc.[9]

The sustainable development goal (SDG) stated a plan to keep NMR to at least as low as 12 deaths per 1000 live births and under-five mortality to at least as low as 25 deaths per 1000 live births by 2030 in all countries.[10] This could be achieved through better prevention and treatment of the three leading causes, preterm births, severe infections, and perinatal asphyxia as the key. Worldwide, 5-10% of babies require simple stimulation at birth, 3-6% need a bag and mask ventilation, and <1% breath with endotracheal intubation, chest compression, and drugs each year.[11] Evidence have show that the risk of death increases by 16% for every 30 s delay in initiating ventilation up to six minutes and every 6% for every minute of delay of applied bag and mask ventilation.[12] Effective resuscitation at birth can prevent a large proportion-approximately 30% of these deaths.[13] Furthermore, resuscitation may avert 5-10% of deaths due to complications of preterm birth.

According to American heart association and other recent authorities, neonatal resuscitation is categorized into 3 steps as follows.[14]

Initial steps

Immediate assessment, providing warmth, drying the baby and tactile stimulation.

Basic resuscitation

Clearing airways, (suctioning if necessary), positioning the head and giving positive pressure ventilation via bag and mask

Advanced resuscitation

Basic resuscitation (as above) plus endotracheal intubation, chest compression and epinephrine/volume administration as required.

METHODS

This is a prospective observational study carried out at pediatric newborn stabilization unit (NBSU) district hospital, Bageshwar (Uttarakhand) over a period of 12 months from January 2021 to December 2021.

Inclusion criteria include all newborn (inborn/outborn) admitted in pediatric NBSU during the study period that required basic/advanced resuscitation after birth. Exclusion criteria include newborn resuscitated with initial steps only and associated with congenital anomalies.

All newborn included during study period were resuscitated as per neonatal resuscitation program (NRP) protocol by American heart association (AHA).

Initial steps

Immediate assessment, providing warmth, drying the baby and tactile stimulation.

Basic resuscitation

Clearing airways, (suctioning if necessary), positioning the head and giving positive pressure ventilation via bag and mask.

Advanced resuscitation

Basic resuscitation (as above) plus endotracheal intubation, chest compression and epinephrine/volume administration as required.

Detailed mother's antenatal history with risk factors was included. Clinical course of neonate was managed and documented as per NICU protocol till the hospital stay in pre-designed pro-forma.

Operational definitions

Perinatal asphyxia

Five-minute APGAR less than 7, can be perinatal asphyxia.

Prolonged labour

Labour exceeds 12 hours in primigravida or 8 hours in multigravida mothers after the latent 1st stage of labour was diagnosed.

Prolonged rupture of membrane

Rupture of membrane or leaking for >12.

Data analyzed using SPSS software version 21.0. For statistical significance p<0.05 considered significant.

RESULTS

The present study was a prospective observational study carried out with 110 neonate admitted in functional level 2 NICU of a first referral unit district hospital, over period of one year.

In the present study total number of newborns included after fulfilling inclusion and exclusion criteria were 110 (n=110). During the study period total 1754 newborns were delivered in our hospital. Out of which 110 inborn neonates were diagnosed with birth asphyxia and were admitted amounting to incidence of 6.2%.

Out of 110 newborns 29% (32) were female and 71% (78) were male. There was a male preponderance which is statistically significant.

Out of 110 neonate 75.4% (83) were inborn and 24.5% (27) were outborn. Majority 93.6% (103) were delivered by normal vaginal delivery whereas only 6% (7) were delivered by cesarean section. As per gestational age 82.7% (91) neonates born term, 14.5% (16) were preterm and only 2% (3) were post term. Birth weight of 110 neonates ranges from 1200 to 4200 gm with a mean birth weight of 2.7605 gm and standard deviation of 575 gm.

Majority 81% (89) were above 2500 gm, 16% (18) were low birth weight and only 2% (3) were very low birth weight babies. 85.4% (94) neonates were revived by basic resuscitation only 14.5% (16) required advanced resuscitation as per NRP/AHA protocol.

Outcome wise majority 71% (78) neonates were discharged, 22.7% (25) were referred to higher centre in view of complications and better management, 4% (5) subjects left against medical advice and 1% (2) neonates were succumbed to death.

Among maternal variables, majority 82.7% (91) were booked pregnancy under Janani Shishu Suraksha Karyakram (JSSK) only 17.2% (19) were unbooked. Age wise maternal age varies between 19 to 36 year and mean maternal age is 25.69 year. Majority 65.4% (72) mothers were ≥25 years and only 34.5% (38) were <25-year-old out of which 89% were primigravida. This can be attributed to the fact that early age marriage is still prevalent in hilly regions of Uttarakhand. Overall 46% (51) were primigravida and 54% (59) were multigravida.

Table 1: Neonatal characteristics (n=110).

Variables		No. of neonates, (%)
Type of birth	Inborn	83 (75.4)
	Outborn	27 (24.5)
Gender	Male	78 (71)
	Female	32 (29)
Type of delivery	NVD/ assisted VD	103 (93.6)
	LSCS	7 (6)
Gestation	Preterm	16 (14.5)
	Term	91 (82.7)
	Post term	3 (2)
Birth weight (gm)	<1000	0 (0)
	1000-1499	3 (2)
	1500-2499	18 (16)
	≥ 2500	89 (81)
Resuscitation	Basic	94 (85.4)
	Advanced	16 (14.5)
HIE	No HIE	51 (46.3)
	Grade 1	30 (27.2)
	Grade 2	20 (18.1)
	Grade 3	9 (8)
Outcome	Discharged	78 (71)
	Referred	25 (22.7)
	LAMA	5 (4)
	Expired	2 (1)

Table 2: Maternal characteristics, (n=110).

Variables	No. of mothers, (%)	
Maternal age (years)	<25	38 (34.5)
	≥25	72 (65.4)
Parity	Primigravida	51 (46.3)
	Multigravida	59 (53.6)
ANC status	Booked	91 (82.7)
	Unbooked	19 (17.2)
Socioeconomic status (As per modified Kuppuswamy classification)	Upper	5 (4.5)
	Upper middle	30 (27.2)
	Lower middle	34 (30.9)
	Upper lower	35 (31.8)
	Lower	6 (5.4)
Hemoglobin (gm/dl)	<6.5	2 (1.8)
	6.5-8.0	18 (16.3)
	8.1-10.0	40 (36.3)
	≥10.1	50 (45.4)
Antenatal risk factors	MSAF	26 (23.6)
	Prolonged labour	20 (18.1)
	Oligohydramnios	15 (13.6)
	Obstructed labour	10 (9)
	PPROM	10 (9)
	Cephalo pelvic disproportion	10 (9)
	Polyhydramnios	4 (3.6)
	Malpresentation	3 (2.7)

As per distribution of socio-economic status of mothers according to modified Kuppuswamy scale the lower middle and upper lower class formed the majority 31% each followed by upper middle (27.2%), lower (5%) and upper class (4%) class.

As per hemoglobin status majority 54.5% (60) of mothers were anemic only 45.4% (50) had hemoglobin within normal range.

Among the maternal risk factors, meconium-stained amniotic fluid (MSAF) constitutes most common risk factors for newborns requiring resuscitation (23.6%) followed by prolonged labour (18.1%), Oligohydramnios (13.6%), cephalo-pelvic disproportion, Obstructed labour and premature prolong rupture of membrane (9% each), polyhydramnios (4%) and breech (3%).

DISCUSSION

In the present study, a total of 110 neonates were enrolled. During the study period total 1754 newborn were born in our institute out of which 110 inborn neonates were diagnosed with birth asphyxia and were admitted amounting to incidence of 6.2% which was similar to other studies.[14,15,16]

The birth weight of admitted neonates (n=110) ranges from 1200gm to 4200gm with a mean birth weight of 2760±575 gm as compared to 2.24 kg by Yadav et al.[17] In the present study males (71%) were more affected than female (29%) similar to Mohan et al (72%: 28%) and Mamo et al (61.7%: 38.3%).[18,19]

Several explanations for increased perinatal and neonatal mortality observed in male gender have been proposed. The risks of intrauterine growth restriction, prematurity, respiratory distress syndrome, and birth asphyxia are higher in male infant.[20,21] Also This could be explained by the protective effect of the additional "x" chromosome in female.[22]

Majority of the newborn admitted (93.6%) were born by vaginal delivery as compare to 6% by cesarean section in present study similar to Aslam et al (62.6%: 16.2%), Dubie et al (77%: 23.1%), Mamo et al (76.9%: 23.2%), Mohan et al (77.6%: 22.4%).[18,19,23,24]

Studies have shown that use of vaccum or forceps in vaginal delivery has led to risk of hemorrhagic cranial injuries like cephalhematoma and subgaleal hemorrhage.[25]

In present study we found birth asphyxia was significantly high in term delivery (82.7%) than preterm babies (14.5%) This also correlates with several studies.[14,18,19,24] However other studies have shown preterm were more affected than term neonates.[23,26] However prematurity is a known risk factor for birth asphyxia. In present study birth asphyxia in term delivery could be attributed to early referral of high-risk pregnancies, associated co-morbid risk factor in neonates as well as low sample size.

We found that majority 85.4% neonates were revived by basic resuscitation only 14.5% required advanced resuscitation similar to other studies.[18,23] This emphasizes importance of first golden minute after birth as a critical window to establish neonatal ventilation and demands skill training at delivery room personals for timely intervention in low resource settings.

Perinatal asphyxia may lead to severe metabolic acidosis, hypercarbia, progressive hypoxemia, neonatal encephalopathy. In present study, 27.2% developed HIE grade 1, 18.1% developed HIE grade 2 and only 8% landed up in HIE grade 3 as compare to Babu et al (54.9DD% no HIE, 12.6% grade 1 HIE, 17% grade 2, 15.3% grade 3) and Mohan et al (61.6% no HIE, 10.4% grade 1 HIE, 24% grade 2, 4% grade 3).[14,18]

Among the maternal variables, age-wise majority 65.4% mothers were ≥25 years and only 34.5% were <25-year-old which is comparable with Mamo et al (24.8%: 75.3%) and Dubie et al (40.9%: 59%). However other studies like Yadav et al (52.5%: 47.5%) and Aslam et al (75.6%: 24.4%) shown younger age of mother was more associated with perinatal asphyxia.[17,19,24]

In the present study 53.6% were multigravida than 46.3% were primigravida. This is similar to studies like Dubie et al (42%: 58%), Mamo et al (37%: 63%), Mohan et al (37.6%:62.4%).[18,19,24] However other studies like Babu et al (54.9%: 45.1%), Aslam et al (56.9%: 43.1%), Yadav et al (51.2%: 48.7%) shown primigravida mothers were more associated with birth asphyxia.[14,17,23]

Majority 82.7% were booked pregnancy (under Janani Shishu Suraksha Karyakram, JSSK) only 17.2% were unbooked, similar to Dubie et al (95.1%: 4.9%), Yadav et al (68.7%: 31.2%) and Mamo et al (63.3%: 36.7%) in contrast other studies like Babu et al (28.1%: 71.9%), Aslam et al (37.9%: 74.7%) and Dalal et al (41.9%: 58.1%).[14,15,19,23,24]

In the present study as per modified Kuppuswamy scale lower middle and upper lower class formed the majority 31% each, similar to Yadav et al (60%: 28.8%).[17]

Poor socioeconomic status influences maternal nutritional status, access to healthcare system and affects the antepartum and intrapartum care of mother and neonate.

We found that majority 54.5% mothers were anemic, similar to studies like Yadav et al (91.2%: 8.8%) and Dalal et al (52.2%: 47.8%).[15.17] Maternal anemia leads to poor placental growth and neonatal development which can result in babies having low APGAR scores and birth asphyxia.

Among maternal risk factors meconium stained amniotic fluid (MSAF) contributes as major risk factor for newborns requiring resuscitation (23.6%) followed by prolonged labour (18.1%) This is similar to Dalal et al, Bahubali et al, Solayman et al.[15,27,28]

Dalal et al have also shown the presence of meconium staining of liquor was observed in 40% subject and is an important contributing factor for birth asphyxia.

Presence of meconium in the amniotic fluid may cause aspiration of meconium-stained amniotic fluid which can block small airways, deactivate surfactants and may also inhibit surfactant synthesis, resulting in birth asphyxia.[29]

History of prolonged labour was seen in 18.1% subjects. Prolong 2nd stage of labour causes high uterine contraction and involves period of relative lack of oxygen. As the infant's head and the umbilical cord are compressed by contractions in the birth canal, prolonged second stage of labor increase fetal hypoxia and acidemia which leads to low 1st minute APGAR.

Other risk factors include oligohydroamnios (13.6%), obstructed labour (9%), PPROM (9%), cephalo-pelvic disproportion (9%), polyhydramnios (3.6%) and malpresentation (2.7%).

Limitations

Limitation of study was that it is a hospital-based study which cannot be attributed to the entire population. Also, this study is based on APGAR score to diagnose birth asphyxia. Other investigations like umbilical cord blood gas analysis were not included.

CONCLUSION

Birth asphyxia is an important contributor of perinatal morbidity and mortality in developing nations. Implementing proper antenatal, intrapartum and neonatal care services is paramount including training of delivery personals especially in resource limited settings for identification of high-risk pregnancy, proper management during labour and delivery, neonatal resuscitation and timely referral of sick neonates is the key to reduce the burden of birth asphyxia.

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REFERENCES

1. Lawn JE, Blencowe H, Waiswa P. Stillbirths: rates, risk factors, and acceleration towards 2030. Lancet. 2016;387:587-603.
2. United Nations. The Millenium Development Goals Report. New York. 2010.
3. Vashishtha VM. The state of the world's children 2009: maternal health is the key to achieve MDGs 4 and 5. Indian Pediatr. 2009;46:233-4.
4. NNPD Network, Indian Council of Medical Research, National Neonatology Forum. 2005. Available at: https://www.newbornwhocc.org/pdf/nnpd_report_2002-03.PDF. Accessed on 12 June 2022.
5. WHO. Perinatal Mortality: A Listing of Available Information. Geneva: WHO; 1996.
6. Leuthner SR, Das UG. Low Apgar scores and the definition of birth asphyxia . Pediatr Clin North Am. 2004;51:737-45.
7. Cunningham FG, Bloom SL, Hauth JC, Rouse DJ, Spong CY et al. Williams obstetrics. 23. USA: McGraw-Hill. 2010.
8. Gleason C, Devaskar S, Avery M. Avery's diseases of the newborn. Philadelphia, PA: Elsevier/Saunders. 2012.
9. Chandra S, Ramji S, Thirupuram S. Perinatal asphyxia: multivariate analysis of risk factors in hospital births. Indian Pediatr. 1997;34:206-12.
10. WHO. World Health Statistics: Monitoring Health for Sustainable Development Goals (Sdgs). WHO Library Cataloguing-in-Publication Data, 2016. Available at: https://apps.who.int/iris/handle/10665/. Accessed on 12 June 2022.
11. Wall SN, Lee AC, Niermeyer S. Neonatal resuscitation in low-resource settings: what, who, and how to overcome challenges to scale up? Int J Gynaecol Obstet. 2009;107(1):S47-64.
12. Ersdal HL, Mduma E, Svensen E, Perlman J. Birth asphyxia: a major cause of early neonatal mortality in a Tanzanian rural hospital. Pediatrics. 2012;129(5):e1238-43.
13. Little GA, Keenan WJ, Niermeyer S, Singhal N, Lawn JE. Neonatal nursing and helping babies breathe: an effective intervention to decrease global neonatal mortality. Newborn Infant Nurs Rev. 2011;11(2):82-7.
14. Babu BVA, Devi SS, Kumar BK. Birth asphyxia-incidence and immediate outcome in relation to risk factors and complications. Int J Res Health Sci. 2014;2(4):1064-71.
15. Dalal EA, Bodar NL. Astudy on birth asphyxia at tertiary health centre. Natl J Med Res. 2013;3:374-6.
16. Sunny AK, Paudel P, Tiwari J. A multicenter study of incidence, risk factors and outcomes of babies with birth asphyxia in Nepal. BMC Pediatr. 2021;21:394.
17. Yadav N, Damke S. Study of risk factors in children with birth asphyxia. Int J Contemp Pediatrics. 2017;4(2):518.
18. Mohan K, Mishra PC, Singh DK. Clinical profile of birth asphyxia in newborn. Int J Sci Tech. 2013;3(1):10-9.
19. Mamo SA, Teshome GS, Tesfaye T, Goshu AT. Perinatal asphyxia and associated factors among neonates admitted to a specialized public hospital in

South Central Ethiopia: A retrospective cross-sectional study. PLoS ONE. 2022;17(1):e0262619.
20. Simchen MJ, Weisz B, Zilberberg E, Morag I, Weissmann-Brenner A, Sivan E et al. Male disadvantage for neonatal complications of term infants, especially in small-for-gestational age neonates. J Matern Fetal Neonatal Med. 2014;27:839-43.
21. Aibar L, Puertas A, Valverde M, Carrillo MP, Montoya F. Fetal sex and perinatal outcomes. J Perinat Med. 2012;40:271-6.
22. Pongou R. Why is infant mortality higher in boys than in girls? A new hypothesis based on preconception environment and evidence from a large sample of twins. Demography. 2013;50(2):421-44.
23. Aslam HM, Saleem S, Afzal R, Iqbal U, Saleem SM, Shaikh MW et al. Risk factors of birth asphyxia. Ital J Pediatr. 2014;40(1):94.
24. Dubie AG, Kokeb M, Mersha AT. Prevalence and associated factors of perinatal asphyxia in newborns admitted to neonatal intensive care unit at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, Ethiopia. BMC Pediatr. 2021;21:525.
25. Cunningham FG, Bloom SL, Hauth JC, Rouse DJ, Spong CY. Williams obstetrics. 23rd ed. USA: McGraw-Hill. 2010.
26. Berhe YZ, Kebedom AG, Gebregziabher L. Risk Factors of Birth Asphyxia Among Neonates Born in Public Hospitals of Tigray, Northern Ethiopia. Pediatric Health Med Ther. 2020;11:13-20.
27. Bahubali G, Vishnu BB, Rao R, Nandakumar S, Adhisivam B, Rojo J et al. Antenatal and intrapartum risk factors for perinatal asphyxia: A case control study. Curr Pediatr Res. 2013;17(2):119-22.
28. Solayman M, Hoque S, Akber T, Islam MI, Islam MA. Prevalence of Perinatal Asphyxia with Evaluation of Associated Risk Factors in a Rural Tertiary Level Hospital. KYAMC J. 2017;8:1.
29. Herting E, Rauprich P, Stichtenoth G, Walter G, Johansson J, Robertson B. Resistance of different surfactant preparations to inactivation by meconium. Pediatr Res. 2001;50:44-9.

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