www.jmscr.igmpublication.org
Impact Factor 5.244
Index Copernicus Value: 83.27
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v4i10.84

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

# Risk Factors and Short Term Outcome of Hypoxic Ischemic Encephalopathy in Term Neonates with Perinatal Asphyxia

Authors
**Sonia Rosalind Martina. S[1*], Saravanan. S[2], Venkatadesikalu. M[3]**
[*1]Post Graduate, Department of Paediatrics, RMMCH, Chidambaram-608002, Tamilnadu, India
[2]Associate Professor Department of Paediatrics, RMMCH, Chidambaram-608002, Tamilnadu, India
[3]Professor, Department of Paediatrics, RMMCH, Chidambaram-608002, Tamilnadu, India

**Abstract**
**Objectives:** *to determine the risk factors and short term outcome (till discharge) of neonates with perinatal asphyxia at RMMCH, Chidambaram.*
**Material and Methods:** *A prospective (case-control) study was conducted between January 2015 and July 2016 in the Neonatal Intensive Care Unit, Department of Paediatrics, Rajah Muthiah Medical College & Hospital. Venous blood collected from 50 term asphyxiated neonates comprising cases & 50 healthy neonates comprising controls constituted the material for study. Details of mother and baby were collected and compared between cases and controls.*
**Results:** *There is no statistical significant difference in the age, parity status, gestational age of mother, birth weight and mode of delivery between cases and control newborns. Antepartum risk factors were maternal age of 20 to 25 years, Pre eclampsia (16%), Anemia (8%), primigravidity (58%). Intra partum risk factors were breech presentation (4%), prolonged second stage of labour (44%), meconium staind amniotic fluid (26%) and cord around the neck (6%). Among the babies, 48% had stage 2 HIE& there is statistically positive correlation between stages of HIE & short term outcome with NRBC count.*
**Conclusion:** *Early identification of high risk mothers and timely referral to tertiary care center can reduce the mortality. Furthermore, there is need to carefully evaluate and monitor the babies with perinatal asphyxia immediately after birth. NRBC count can serve as simple and cost effective test in evaluating perinatal asphyxia thus reducing mortality and morbidity.*
**Keywords:** *Perinatal asphyxia, risk factors, short term outcome, hypoxic ischemic encephalopathy (HIE), neucleated red blood cells (NRBC).*

## INTRODUCTION

Perinatal asphyxia is a common problem world-wide. It is a major cause of acute mortality and chronic neurologic disability amongst survivors.

The data from National Neonatology Forum NNPD Network suggests that Perinatal Asphyxia contributes to almost 20% of neonatal deaths in India.[1] Of the 1.2 million neonatal deaths in India every year, 300,000 - 350,000 infants die due to Perinatal Asphyxia mostly within first 3 days of life.[2] A gold standard definition of Birth Asphyxia does not exist. It is thus appropriate to use the term Perinatal Asphyxia as asphyxia may occur in utero, during the process of labor, at birth or in the postnatal period. World Health Organization (WHO) has defined Perinatal Asphyxia as a "failure to initiate and sustain breathing at birth".[2] The National Neonatology Forum NNPD Network

of India defines moderate asphyxia as slow gasping breathing or an APGAR score of 4 - 6 at 1 min of age and severe asphyxia as no breathing or an APGAR score of 0 - 3 at 1 min of age.[1]

Causes of perinatal asphyxia may be maternal or fetal. Those who survive asphyxia at birth may have chance to develop neurological complications including epilepsy, cerebral palsy and developmental delay.[3] Risk factors of birth asphyxia has been divided into antepartum, intrapartum and fetal. Risk factors include increasing or decreasing maternal age, prolonged rupture of membranes, meconium stained fluid, multiple births, non-attendance for antenatal care, low birth weight infants, malpresentation, augmentation of labour with oxytocin, ante partum hemorrhage, severe eclampsia and pre-eclampsia, ante partum and intrapartum anemia.[4,5]

The prognosis and severity of the symptoms of child with birth asphyxia depend on the risk factors and management of the patient.

During the recent years, Nucleated RBCs at birth emerged as a newer indicator of severity of Birth Asphyxia. Considering the hematopoietic response to hypoxia in utero, the elevated NRBC count was investigated as a possible marker of asphyxia in various studies.[6,7,8]

## METHODOLOGY

A minimum sample size calculated was 100 term neonates (50 cases and 50 controls). A total of 50 term neonates with perinatal asphyxia and 50 normal controls were taken up for the study.

### Cases

### Inclusion Criteria

Term neonates with perinatal asphyxia with 1-min Apgar of <6/10 as defined by WHO1and NNPD2

### Exclusion Criteria

Preterm, Newborns with severe congenital malformations, Chromosomal anomalies like Down's syndrome, TORCH infections, Septicemia, Rh incompatibility resulting in haemolysis.

### Controls

Term neonates with Apgar score> 7 at 1 minute, Absence of meconium stained amniotic fluid, Meeting the exclusion criterion described for the cases group.

Before enrolling the baby in the study an informed consent of the parents was taken after explaining in detail about the methods and procedures involved in the study in their vernacular language (Annexure I). The study was approved by the institutions of Human ethics committee, RMMCH, Annamalai University. Details of the mother like age parity blood group, haemoglobin level, past obstetric history, present pregnancy, medical history, medications taken during pregnancy, details of labour and delivery were recorded in a proforma.

## RESULTS

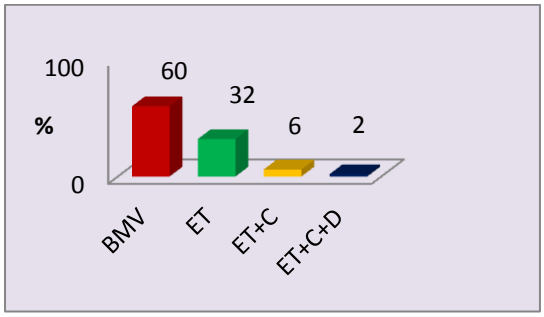
The sex distribution of newborn among cases and controls were compared. In both the groups, male babies were comparatively higher (cases – 68%, controls – 54%). The majority of mothers in both the groups were primigravida (cases – 58% and controls – 58%). About 44% of pregnant women in cases and 56% of pregnant women in controls were delivered by cesarean section. 44% of mothers in cases and controls had normal vaginal delivery. About 8% in the cases had forceps vaginal delivery. Most of the presentation in both the groups are cephalic (vertex). About 26% of cases have meconium stained amniotic fluid and 6% of cases have cord around neck, 44% of cases had prolonged second stage of labour. These risk factors were absent in control group. But in other parameters there is no statistical difference is observed between cases and controls. That is parity status, age of mother, gestational age of mother and birth weight of babies is almost similar in both the groups.

**Risk Factors**

| Risk Factors | Cases | | Control | | 'P' value |
|---|---|---|---|---|---|
| Age of Mother (Mean) | 24.76 ± 3.67 | | 25.02 ± 4.35 | | - |
| **Parity** | **N** | **%** | **N** | **%** | - |
| Primi | 29 | 58% | 29 | 58% | 0.255 |
| Multi | 21 | 42% | 21 | 42% | 0.255 |
| Gestational Age (Mean) | 39.28±1.16 | | 38.7 ±0.91 | | 0.215 |
| Birth Weight (Mean) | 2.62± 0.42 | | 2.63 ±0.42 | | 0.283 |
| Meconium Stained | 13 | 26 | - | - | - |
| Cord Around Neck | 3 | 6 | - | - | - |
| Prolonged second stage of labour | 22 | 44 | - | - | - |

**Resuscitation Methods**

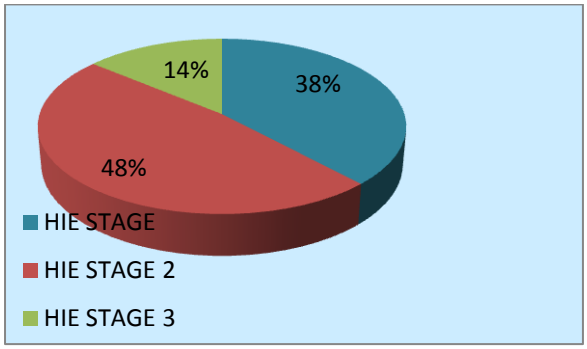
It is observed that 60% of babies had bag and mask ventilation and 32% required endotracheal intubation. Endotracheal intubation with chest compression was required for 6% of new born.



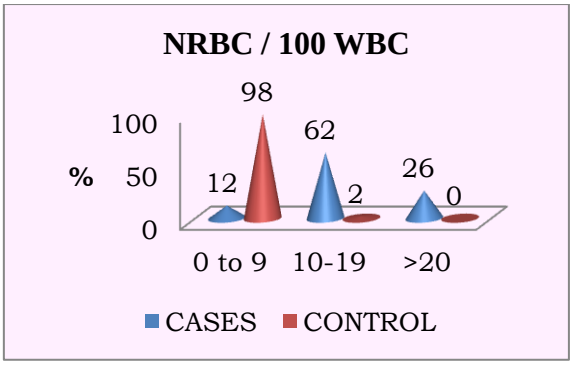

**Distribution of NRBC**

NRBC is statistically significant (P = 0.001 < 0.05) with comparatively much higher values were observed in babies with Hypoxic Ischemic Encephalopathy. The mean value of NRBC in cases is 16.76 ± 11.46 per 100 WBC whereas it is 3.78 ± 2.76 (per 100 WBC) in controls.

**Different Stages of HIE**




About 48% of babies were in stage two of HIE. In stage one HIE, 38% of babies were observed. About 14% of babies were classified as stage three HIE.




The mean count of NRBC is highest (M = 21.14 ± 7.20) for HIE stage 3 when compared to HIE stage 2 (M = 20.83 ± 14.01) and HIE stage 1 (10.00 ± 3.40).

**NRBC count and various immediate outcomes in cases**

| NRBC | Time taken for DBF in days | NICU Stay in days | Neonatal Reflex recovery in days | C/S/A recovery in days | Hospital Stay (days) |
|---|---|---|---|---|---|
| 0-9 | 3.00 ± 0.63 | 3.17 ± 0.98 | 2.17 ± 0.41 | 2.00 ± 0.00 | 4.67 ± 0.82 |
| 10-19 | 4.74 ± 2.49 | 5.45 ± 2.84 | 4.10 ± 2.88 | 3.87 ± 2.90 | 7.84 ± 3.30 |
| ≥ 20 | 4.46 ± 3.57 | 6.23 ± 4.95 | 4.38 ± 3.55 | 3.85 ± 3.05 | 9.46 ± 4.59 |

All the parameters are delayed if NRBC count is more. The delay is maximum for cases with ≥ 20 NRBC count. But the difference is statistically significant for hospital stay alone (P = 0.029 < 0.05).

## DISCUSSION

This study was on analysis of risk factors and short-term outcome of birth asphyxiated babies admitted in Neonatal Unit of RMMCH. The frequency of birth asphyxia was 10% in our study, while it varies from 9%[10] to 13%[11] in different studies. This variation was due to different operational definition of birth asphyxia adopted by different researchers, APGAR score at 1 min and 5 min, duration of resuscitation, breathing effort at 1 min etc.[9]

Mortality in our study is mainly contributed to Stage 3 HIE. In this study maternal age did not show any association with mortality among asphyxiated babies. This finding was consistent with Bhuinyan[12] and Crawford.[13] They also found that maternal age is an isolated event and cannot be considered as a risk factor for birth asphyxia.

In order to reduce the burden of birth asphyxia, Women need to educate with not respect to just about her pregnancy but also with respect to the complications which may arise during deliveries. Meconium stained amniotic fluid was found to be present as one of the risk factor, findings were comparable with previous study also.[14] In healthy, well oxygenated fetuses, this diluted meconium is readily cleared from the lungs by normal physiological mechanism, however in few cases meconium aspiration syndrome occurs. Breech presentation exhibited a 2.96 times higher risk of birth asphyxia than other presentations, results were similar to previous studies.[14,15] It may be due to the fact that breech presentation had higher risk of umbilical cord prolapse, head entrapment, birth trauma and perinatal mortality.[14]

Pre-eclampsia and anemia were found more common in cases as compare to control, same as observed in past studies. Hypertension can cause a decrement in blood flow resulting in asphyxia while anemia causes intrapartum hypoxia. Pre-eclampsia found to be associated significantly with increased risk of birth asphyxia.[16]

Also, in the present study, we found higher NRBC/100WBC with higher degree of HIE, 10±3.40 in HIE stage 1, 20.83±14.01 in stage 2, and 21.14±7.20 in stage 3 with p value of 0.003 which is significant. This correlates with the study done by Hermansen et al,[17] Sikarwar et al,[18] Phelan et al[19] and Philip Acr[20] et al who found that NRBC increases with increase in stages of HIE. Our study also reveled increased NRBC/100WBC count with low Apgarn scores many authors like Ghosh B et al[7], Boskabadi[21] and Saracoglu F et al[22] had reported similar findings in their studies.

## CONCLUSION

The study demonstrates multiple risk factors affecting mortality of birth asphyxiated neonates. Early identification of high risk mothers and timely referral to tertiary care center can reduce the mortality. Furthermore, there is need to carefully evaluate and monitor the babies with perinatal asphyxia immediately after birth. Assessment of clinically diagnosed perinatal asphyxia cases with parameters like cord blood ph, blood gas study is not easy in rural settings with limited population. The NRBCs count can be easily done in the laboratory. Thus NRBC count parameter can serve as simple and cost effective

test in early diagnosis of perinatal asphyxia and in instituting early treatment, thus reducing neonatal morbidity & mortality.

**REFERENCES**


1. National Neonatal and Perinatal Database Report. 2002- 2003:1-58.
2. World Health Organization. Neonnatal and Perinatal Mortality; Country, Regional and Global estimates, 2004; WHO,Geneva. 2006; 1-25.
3. Haider BA, Bhutta ZA: Birth asphyxia in developing countries: current status and public health implications. Curr Probl Pediatr Adolesc Health Care. 2006, 36 (5): 178-188. 10.1016/j.cppeds.2005.11.002.
4. 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 (3): 140-143.
5. Majeed R, Memon Y, Majeed F, Shaikh NP, Rajar UD: Risk factors of birth asphyxia. J Ayub Med Coll Abbottabad. 2007, 19 (3): 67-71.
6. Forestier F, DaVos F, Catherine N, et al. Developmental Hematopoiesis In Normal Human Fetal Blood. Blood 1991;77:2360–3.
7. Ghosh B, Mittal S, Kumar S, Dadhwal V. Prediction Of Perinatal Asphyxia With Nucleated Red Blood Cells In Cord Blood Of Newborns. Int J Gynaecol Obstet. 2003;81(3):267-271.
8. Lippman HS. Morphologic And Quantitative Study Of Blood Corpuscles In The Newborn Period. American Journal of Diseases in Children 1924;27:473–515.
9. Black RE, Kelley L. Reducing Perinatal and Neonatal Mortality. Child Health Research Project. Special Report1999. p1-48.
10. Shrestha M, Shrestha L, Shrestha PS. Profile of asphyxiated babies at Tribhuvan University Teaching Hospital. J Nepal Pediatr Soc 2009;29:3-5.
11. Thornberg E, Thiringer K, Odeback A, Milsom I. Birth asphyxia: Incidence, clinical course and outcome in a Swedish population. Acta Paediatr 1995;84:927-32.
12. Bhuiyan SJ. Incidence, risk factors and immediate outcome of asphyxia neonatorum in hospitalized neonates. Department of Paediatrics IPGMR [Dessertation]. Dhaka: BCPS; 1996.
13. Crawford JS. Maternal age as an isolated factor in the incidence of perinatal asphyxia. Am J Obstet Gynecol 1966;95:569-71.
14. Pitsawong C, Panichkul P: Risk factors associated with birth asphyxia in Phramongkutklao Hospital. Thai J Obstet Gynaecol. 2012, 19 (4): 165-171.
15. Chandra S, Ramji S, Thirupuram S: Perinatal asphyxia: multivariate analysis of risk factors in hospital births. Indian Pediatr. 1997, 34 (3): 206-212.
16. Lee AC, Mullany LC, Tielsch JM, Katz J, Khatry SK, LeClerq SC, Adhikari RK, Shrestha SR, Darmstadt GL: Risk factors for neonatal mortality due to birth asphyxia in southern Nepal: a prospective, community-based cohort study. Pediatrics. 2008, 121 (5): e1381-e1390. 10.1542/peds. 2007-1966.
17. Hermansen MC.(2001). Nucleated red blood cells in the fetus and newborn. Arch Dis Child Fetal Neonatal Ed, 84(3), F211-F215.
18. Sikarwar S, Gupta S. (2011). The correlation of clinical perinatalsphyxia with counts of NRBC/100 WBC in cord blood. Webmed central Obset Gynaecol, 2 (1), WMC001511.
19. Phelan JP, Korst LM, Ahn MO, Martin GI. (1998). Neonatal nucleated red blood cell and lymphocyte counts in fetal brain injury. Obset Gynecol, 91(4), 485-9.
20. Philip AG, Tito AM. (1989). Increased nuclelated red blood cell counts in small for gestational age infants with very low

birth weight. Am J Dis Child, 143(2), 164-9.

21. Boskabadi H, Maamouri G, Sadeghian MH, Ghayour-Mobarhan M, Heidarzade M, Shakeri MT, et al. (2010). Early diagnosis of perinatal asphyxia by nucleated red blood cell count, a case-control study. Arch Iran Med, 13(4), 275-81.
22. Saracoglu F, Sahin I, Eser E, Gol K, Turkkani B. (2000). Nucleated red blood cells as a marker in acute and chronic fetal asphyxia. Int J Gynaecol Obstet, 71(2), 113-8.