

ORIGINAL RESEARCH

A study of correlation between birth asphyxia and cord blood nucleated RBCs

¹Dr. Foram Patel, ²Dr. Ketan Gadhavi, ³Dr. Gabharu Khachar, ⁴Dr. Kamleshkumar G Rathod, ⁵Dr. Bharat Muliya

¹Junior Resident, ^{2,4}Associate Professor, ³Assistant Professor, ⁵Professor, Department of Pediatrics, C.U. Shah Medical College and Hospital, Surendranagar, Gujarat, India

Corresponding Author

Dr. Kamleshkumar G Rathod

Associate Professor, Department of Pediatrics, C.U. Shah Medical College and Hospital, Surendranagar, Gujarat, India

Email: kamleshkrathod1711@gmail.com

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ABSTRACT

Introduction: Fetal and neonatal death's leading cause world over is perinatal asphyxia. Perinatal asphyxia can be defined as clinical or biochemical evidence of decrease of oxygen and an increase of carbon dioxide in the body because of the deficient respiratory function at birth with resultant hypoxia and acidemia. Aims and Objectives: To correlate the NRBC levels in neonates. **Material and Methods:** This cross sectional study was done in C.U. Shah Medical College and Hospital, Surendranagar between March 2021 to 2022 in 100 patients who have undergone emergency delivery irrespective of indication have been taken to know NRBC's (nucleated red- blood cell/100WBC's) as an indicator of Birth asphyxia. **Results:** Maximum number of asphyxiated babies delivered from women in the age group of 21-25 years i.e. 53% followed by 36% who were in 26-30 years age group. A total of 44% asphyxiated babies born from primigravida women and 56% from multigravida women. Various indications of LSCS showed that 11 asphyxiated babies born due to failed induction, 14 due to fetal distress, 2 due to deep transverse arrest. In 6 babies, cephalo pelvic disproportion, 7 had breech presentation and 6 women had previous LSCS. Fetal heart rate variability shows that it was positive in 56% asphyxiated babies. Association between asphyxia and Apgar score at 1 minute shows that 21% babies had Apgar score 1, 36% had 2 and 43% had 3. Similarly, Apgar score at 5 minute shows that 18% babies had <5 Apgar score and 82% had 6-10 Apgar score. The incidence of birth asphyxia is 56% when there is a fetal heart variability compared to absence of it. The incidence of birth asphyxia is 90% when the NRBCs levels are >15/100WBCS. **Conclusion:** The study proved evidence that higher nucleated RBC/100 WBCs count was seen in umbilical cord venous blood sample in new born with acute birth asphyxia. Higher nucleated RBC/100 WBC in umbilical venous sample was also correlated with poor, early neonatal outcome i.e., neonatal NICU admission. The level of nucleated RBCs/100 WBCs correlates with acute birth asphyxia and can also be used as an index of early neonatal outcome.

Keywords: Birth asphyxia, Cord blood, Nucleated RBCs

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INTRODUCTION

Science has allowed medicine to penetrate the hidden World of the fetus and to begin diagnosis and treat fetal conditions. To obstetricians, the fetus is "the patient within the patient", and part of the discipline of Obstetrics is the care of the fetus¹. Fetal and neonatal death's leading cause world over is perinatal asphyxia. Perinatal asphyxia can be defined as clinical or biochemical evidence of decrease of oxygen and an increase of carbon dioxide in the body because of the deficient respiratory function at birth with resultant hypoxia and acidemia². Currently, many parameters are used to define or predict perinatal asphyxia. Commonly used parameters are: (i) Apgar Score, (ii) Umbilical arterial acidemia/base excess³, (iii)

Presence of meconium in amniotic fluid and 4.Nucleated RBCs/ 100 WBCs in Umbilical cord smear.

NRBCs are commonly seen in the circulation of newborns. The number of NRBCs per 100 WBCs varies and it is usually less than 10. Conditions where there is >10 NRBC's are usually seen are prematurity, Rh sensitization, maternal diabetes mellitus and intra uterine growth retardation. Asphyxia is also said to cause an increase in the nucleated RBC'S in the newborns⁴.

Though perinatal asphyxia is commonly encountered there are no single variable that could assess the severity of the same, there are combination of various

indices that could assess the degree of the severity are being used now.

The present study was done to evaluate the significance of presence of nucleated red blood cells/100 white blood cells in a blood smear made from umbilical cord venous blood sample.

MATERIAL AND METHODS

This prospective cross sectional study was done from March 2021 to March 2022 for a period of one year in C. U. Shah medical college and hospital, Surendranagar. A total of 100 patients who have undergone emergency delivery irrespective of indication have been taken to know NRBC's (nucleated red- blood cell/100WBC's) as an indicator of Birth asphyxia. Written informed consent and Ethical committee approval obtained from the Institutional Ethics Committee.

Singleton term pregnancies primigravida/multigravida babies of more than 2.5kg appropriate for gestational age delivered by emergency delivery irrespective of indication without any maternal co-morbid factors were included.

Those women having pregnancies associated with Rh isoimmunisation, gestational diabetes mellitus, Post term pregnancy, IUGR, Preeclampsia, newborn with congenital anomalies and preterm babies were excluded.

METHODOLOGY

Sample was processed immediately. In case of any delay between the time of collection of sample and the timing of taking the reading, the samples were refrigerated.

PROCEDURE

- From all subjects, samples of cord blood collected immediately after clamping and cutting the umbilical cord.
- Patients Name, Age, IP NO, Time of collection have been written on the test tube
- Sample taken in EDTA coated bottle for purpose of making smears.
- Smear focused under high power microscope and RBCs (nucleated) counted against 100 WBCs.
- The nucleated RBC count of cord blood was determined.

STATISTICAL ANALYSIS

Descriptive statistics was done for all data. Continuous variables were analyzed with the unpaired t- test and categorical variables were analyzed with the Chi-Square Test. Statistical significance was taken as $p < 0.05$. The data was analyzed using EpiInfo software

(7.1.0.6 version; Center for disease control, USA) Microsoft Excel 2010.

RESULTS

In the present study, maximum number of asphyxiated babies delivered from women in the age group of 21-25 years i.e. 53% followed by 36% who were in 26-30 years age group. Only 6 babies observed in >30 months age group. Association between the birth asphyxia and age was not statistically significant ($p > 0.05$).

A total of 44% asphyxiated babies born from primigravida women and 56% from multigravida women. Association between the birth asphyxia and gravid found to be statistically insignificant ($p > 0.05$). Various indications of LSCS showed that 11 asphyxiated babies born due to failed induction, 14 due to fetal distress, 2 due to deep transverse arrest. In 6 babies, cephalo pelvic disproportion, 7 had breech presentation and 6 women had previous LSCS. Association between the birth asphyxia an Indications for Emergency LSCS (fetal distress and deep transverse arrest) found to be statistically significant ($P < 0.05$). In emergency LSCS, the incidence of birth asphyxia is more when there is a fetal distress as an indication for emergency LSCS ($p < 0.001$). In the present study, the incidence of birth asphyxia was more when there was a deep transverse arrest as an indication for emergency LSCS ($p < 0.03$).

Fetal heart rate variability shows that it was positive in 56% asphyxiated babies. In emergency LSCS, the incidence of birth asphyxia was more when there was a fetal heart variability compared to absence of it and found to be statistically significant ($p < 0.001$).

Colour of liquor shows that association between colour of liquor and asphyxia babies was clear in 71%, meconium stained was in 29% babies. Asphyxia and age was considered to be statistically insignificant ($p > 0.05$).

Association between asphyxia and Apgar score at 1 minute shows that 21% babies had Apgar score 1, 36% had 2 and 43% had 3. None of the babies had >3 Apgar score. Association between the birth asphyxia and Apgar scores at 1 minute considered to be statistically significant ($p < 0.05$). In emergency LSCS, the incidence of birth asphyxia found to be more when the Apgar scores at 1 minute decreased and found to be statistically significant ($p < 0.001$).

Similarly, Apgar score at 5 minute shows that 18% babies had <5 Apgar score and 82% had 6-10 Apgar score. Association between the birth asphyxia an Apgar scores at 5 minute found to be statistically significant ($p < 0.05$). In emergency LSCS, the incidence of birth asphyxia was more when the Apgar scores at 5 minute decreased and statistically significant ($p < 0.001$).

Table 1: Relation between NRBCS and Asphyxia (n=100)

NRBCS	No of Asphyxiated baby	Percentage
<10	00	00%
<15	10	10%
15 - 25	43	43%
26 - 30	26	26%
>30	21	21%

Table 1 shows that association between the birth asphyxia and elevated NRBCs found to be statistically significant ($p < 0.05$). In emergency LSCS, the incidence of birth asphyxia was more when the NRBCs levels are significantly elevated ($p < 0.05$).

Table 2: Birth weight and relation between birth asphyxia

Birth weight (kgs)	No of asphyxiated baby	Percentages
<2	04	4%
2 – 2.5	28	28%
2.6 - 3	49	49%
3.1 – 3.5	11	11%
>3.5	08	8%

Table 2 shows association between the birth asphyxia and birth weight found to be statistically insignificant ($p > 0.05$).

DISCUSSION

All mothers in the present study had no significant correlation with their age and number of NRBC's. Association between the Birth Asphyxia and age found to be statistically insignificant ($p > 0.05$).

In the present study, no significant correlation with their gravidity and number of NRBC's was observed. Association between the Birth Asphyxia and Gravida found to be statistically insignificant ($p > 0.05$).

In the present study there exists an association between the Birth Asphyxia and Indication for Emergency LSCS and found to be statistically significant. In emergency LSCS, the incidence of birth asphyxia was more when there was a Fetal Distress and Deep transverse arrest compared to other indications for emergency LSCS ($p < 0.001$). The occurrence of birth asphyxia was meaningfully more (32.5%) when the indication for emergency LSCS was Fetal Distress and Deep transverse arrest (4.3%) compared to other indications like failed induction (23.9%) and previous LSCS (13%). This difference is true and significant and has not occurred by chance. Present study conclude that there was real intrapartam obstetric risk factor for developing Birth asphyxia if the indication for emergency LSCS was fetal Distress and deep transverse arrest.

A significant correlation was found between Apgar score and number of nucleated RBC/100 WBC with higher number of nucleated RBCs seen in those with lower Apgar score. Contradictory reports are available regarding correlation of nucleated RBC with Apgar score. Thilaganathan et al (1994)⁵ refuted the assumption that higher nucleated RBC levels are seen in new born with lower Apgar Scores. In 1997 however, Hanlon-Lundberg et al⁶ demonstrated significantly higher levels of nucleated RBCs in newborns with Apgar Score of 0-3 than those in with a score between 7 and 10.

Association between the Birth Asphyxia and fetal heart variability shows that incidence of birth asphyxia was more when there is a fetal heart variability compared to absence of it. The occurrence of birth asphyxia was meaningfully more (56%) when there is presence of fetal heart rate variability compared to its absence (44%).

In the present study a significant higher level of nucleated RBC/100 WBC in umbilical venous blood was seen at birth in new born who develop hypoxic ischemic encephalopathy in the early neonatal period. This finding is consistent with previous studies (Phelan et al⁷, 1995, Korst et al⁸1996) which showed higher nucleated RBC levels in neonates with neurological impairment. Korst et al⁸ (1996) compared the maximum level of nucleated RBC and also the clearance time in addition to measuring initial levels of nucleated RBC/100 WBCs. Such analysis was not included in the present study. In this study significantly higher NRBCs level was found in those who developed hypoxic ischemic encephalopathy in early neonatal period ($p < 0.001$).

Hanlon-Lundberg et al in two different studies (1997 and 1999)^{4,6} had concluded that an elevated nucleated RBC level was seen in newborns with meconium stained liquor since the presence of meconium indicated some form of fetal distress which could trigger off a reactionary erythroblastosis in the fetus. In the present study, however, no significant correlation could be demonstrated between presence of meconium and number of nucleated RBC/100 WBC.

CONCLUSION

Present prospective cross-sectional study on prediction of perinatal asphyxia by the presence of nucleated RBCs/100 WBCs provided evidence that higher nucleated RBC/100 WBCs count was seen in umbilical cord venous blood sample in new born with acute birth asphyxia (as evidence by Lower Apgar

Score). Higher nucleated RBC/100 WBC in umbilical venous sample was also correlated with poor, early neonatal outcome i.e., neonatal NICU admission. However, no correlation could be demonstrated between the number of nucleated RBC/100 WBC and neurological development of baby. This study proved that meconium stained liquor per se, is not the cause/predictor/ indicator of intrapartum asphyxia. Low Apgar score at 5 minutes of life denote chronic asphyxia and definitely can be considered as clinical marker of asphyxia. However, this study lacked the corroboration of these facts with measurement of umbilical venous pH or fetal blood gas analysis, postnatally. Low Apgar scores together with umbilical venous pH and arterial blood gas analysis can most definitely be marker of asphyxia and predictor of adverse neonatal outcomes. To conclude estimating the number of nucleated RBC/100 WBC in umbilical cord venous blood sample of new born is an important test, the sample being obtained non-invasively from otherwise discarded specimen and analyzed by personnel or equipment readily available in most hospital laboratories. The level of nucleated RBCs/100 WBCs correlates with acute birth asphyxia and can be used as an index of early neonatal outcome.

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