



ORIGINAL RESEARCH PAPER

Paediatric Medicine

A HOSPITAL-BASED STUDY OF BLOOD GLUCOSE AND SERUM URIC ACID LEVELS IN THE CORD BLOOD OF ASPHYXIATED NEONATES AND THEIR CORRELATION WITH THE SEVERITY OF BIRTH ASPHYXIA.

KEY WORDS: HIE, Perinatal asphyxia, Cord blood, blood glucose, uric acid.

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ABSTRACT

BACKGROUND: Perinatal life constitutes the most crucial part of an individual's life. Any abnormality during this period brings multiple changes in the body and has the potential to cause permanent damage to the developing organs. Perinatal asphyxia is one such factor. The objective of our study was to find out the changes in blood glucose and uric acid due to asphyxia and their correlation, if any, with the severity of the asphyxia.

METHOD: A cross-sectional observational study was conducted in the Neonatal Intensive Care Unit, RIMS, Ranchi from June 2019 to May 2020 involving 89 inborn asphyxiated term neonates weighing 2.5-4 kg at birth. Detailed clinical examination, relevant perinatal history and lab findings were recorded on a pre-designed proforma.

Results: Out of the 89 inborn asphyxiated neonates evaluated during this period, 40 were female (44.9%) and 49 were male (55.1%). 50 cases were born by vaginal delivery (56.2%) while 39 by caesarean section (43.8%). 5.6% had no HIE, 50.6% developed HIE I, 33.7% HIE II and 10.1% HIE III. Comparison among the cases showed decreasing levels of glucose and an increasing trend of uric acid with the severity of HIE stages. Correlation coefficient of cord blood glucose and uric acid with severity of HIE staging in our study were found to be -0.366 and 0.812 respectively, which were both statistically significant (P<0.001).

CONCLUSION: Umbilical cord blood investigations can be easily carried out in the existing medical facilities in a country like India with lots of patient load and limited resources. The correlation observed in our study will help to predict the extent of tissue damage likely to occur in an asphyxiated baby, from the cord blood parameters soon after birth and hence help us manage more efficiently.

INTRODUCTION:

'Asphyxia' derived from a Greek word 'as-ffik-se-ah' means "stopping of the pulse". Perinatal asphyxia refers to both intrauterine and extrauterine situation in which impaired gas exchange leads to fetal hypoxemia and hypercarbia. Birth asphyxia can affect any organ and lead to multisystem failure (kidney-50%, heart-25%, brain-28%). It is estimated to account for 23% of the neonatal deaths worldwide and 26% of the stillbirths every year.¹ In India, among the 26 million births each year, 4-6% newborns fail to establish spontaneous breathing at birth, 8.4% of the inborn babies have an Apgar score of <7 at 1 minute of birth and 1.4% of them suffer from HIE.² Approximately 20-30% of infants with HIE die in the neonatal period, and ~33-50% of survivors are left with permanent neurodevelopmental abnormalities (cerebral palsy, mental retardation).

Transition from fetal to neonatal life involves several steps of metabolic adaptation to ensure that energy supply to vital organs is maintained after separation from placenta. Normally, this is achieved by utilising alternate cerebral fuels (fatty acids, ketone bodies, lactate) when blood glucose concentration falls. Severe hypoxia is associated with several derangements of this metabolic adaptation.³ Hypoglycemia is an important risk factor for perinatal brain injury. Continuous tissue hypoxia and consequent reperfusion injury also result in hypoxanthine oxidation to xanthine and uric acid. Elimination of this excess uric acid is further decreased due to asphyxia-damaged kidneys causing hyperuricemia.

Not many studies have been conducted on the biochemical parameters in the cord blood of neonates. So, through this study we aim to find out whether cord blood values of various biochemical parameters are altered in birth asphyxia and whether they correlate with various HIE stages.

MATERIALS AND METHODS:

This observational cohort study was conducted on 89 birth asphyxiated neonates admitted in the NICU, Department of Pediatrics and Neonatology, RIMS, Ranchi from **June 2019 to**

May 2020.

Inclusion Criteria:

1. Term, inborn neonates, admitted in the Neonatal intensive care unit at RIMS, RANCHI.
2. Appropriate for gestational age.
3. With birth asphyxia as per WHO definition- "failure to initiate and sustain breathing at birth" and based on APGAR score as an APGAR score of <7 at one minute of life.⁴
4. Whose attendants had given consent.

Exclusion Criteria: Preterms, IUGR babies, with gross congenital malformations or suspected metabolic diseases, babies of mothers with any systemic illness or on drugs.

Methodology:

Cord blood samples were collected immediately after delivery and detailed history, clinical examination and investigations were documented on a pre-designed proforma. According to the severity of perinatal asphyxia, three groups of neonates were compared with the findings of cord blood uric acid and glucose levels. Uric acid and glucose were estimated by uricase & glucose oxidase-peroxidase methods respectively.

Statistical Analysis: Data was stored in Microsoft excelsheet and analyzed with appropriate statistical tests to determine significance and power of the study.

Statistical Test: Anova and Student's T tests were applied to compare findings within the 3 groups of HIE.

Data Analysis: SPSS 21.00 Software version was used for data analysis.

Results:

89 inborn asphyxiated neonates admitted in the NICU, RIMS, Ranchi over a period of 1 year from May 2019 to June 2020, were enrolled as cases among which 40 (44.9%) were females

and 49 (55.1%) were males. The mean age of the neonates included was 53.46 ± 7.58 hours. 50 cases were born by vaginal delivery (56.2%) while 39 cases were born by LSCS (43.8%). Mean birth weight of the cases was 2.72 ± 0.31 kg and the mean gestational age 38.40 ± 1.35 completed weeks. The mean APGAR at 1 minute and 5 minutes were 3.90 ± 1.05 and 5.84 ± 1.40 respectively. During the stay, 5.6% had no HIE, 50.6% developed HIE I, 33.7% HIE II and 10.1 % HIE III. 78 cases (87.60%) were discharged, 6 cases (6.70%) left against medical advice while 5 cases (5.60%) expired.

Table 1: Mean Serum Uric Acid And Blood Glucose Levels In Various Grades Of Hie Staging And Their Correlation With The Severity Of Hie.

	Serum uric acid levels (mg/dl)	Blood glucose levels (mg/dl)
Mean value in 'No HIE' group	3.24 ± 0.63	126.96 ± 7.50
Mean value in 'HIE 1' group	4.05 ± 1.37	77.94 ± 33.33
Mean value in 'HIE 2' group	7.30 ± 1.16	65.05 ± 37.85
Mean value in 'HIE 3' group	9.88 ± 2.45	54.27 ± 26.12
Mean in the study population	5.69 ± 2.52	73.95 ± 36.42
Correlation coefficient	0.812	-0.366
P value	<0.001	<0.001

This table shows significant positive correlation of serum uric acid with the severity of birth asphyxia ($P < 0.001$); and significant negative correlation between blood glucose levels and the severity of birth asphyxia ($P < 0.001$)

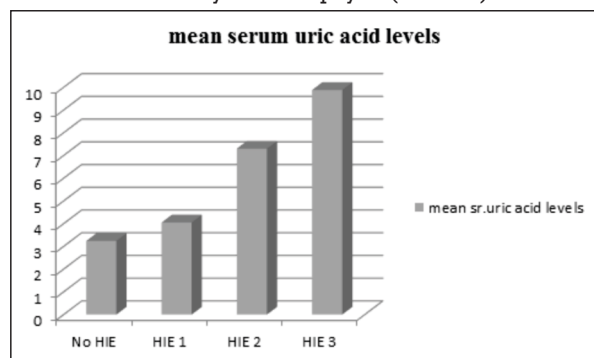


Fig 1: Mean Serum Uric Acid Levels (mg/dl) In Relation To Various Grades Of Hie Staging.

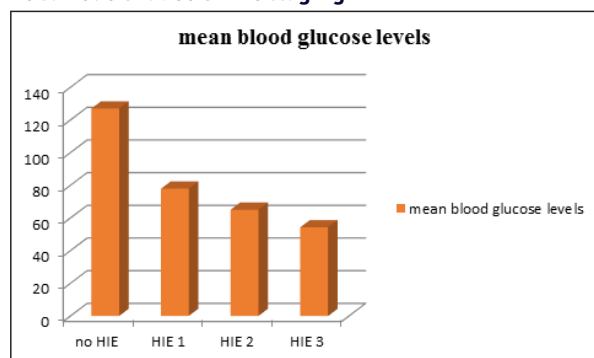


Fig 2: Mean Serum Blood Glucose Levels (mg/dl) In Relation To Various Grades Of Hie Staging.

DISCUSSION:

In our present study, we found a significant negative correlation of blood glucose and positive correlation of serum uric acid levels with the severity of HIE. There was no statistically significant metabolic difference when the parameters like gender, birth weight and gestational age of the neonates were compared.

In our study, the mean blood glucose level was 73.95 ± 36.42

mg/dl in the study population. Basu et al⁵, Rai et al⁶ and Prithviraj et al⁷ found the mean cord blood glucose levels as 35.1 ± 11.4 mg/dl, 54.40 ± 10.91 mg/dl and 64.67 ± 0.52 mg/dl in their respective studies. Jayprakash et al⁸ and Rai et al⁶ showed that babies with perinatal asphyxia develop hypoglycemia after birth proportionate to the severity of asphyxia while Prithviraj et al⁷ did not find any such correlation. In our study, we also found a statistically significant decreasing trend of blood glucose levels with the severity of HIE.

In our study, we have found the mean serum uric acid level as 5.69 ± 2.52 mg/dl. Basu et al⁵ and Jayprakash et al⁸ found that the mean serum uric acid level were 8.00 ± 1.20 mg/dl and 5.53 ± 1.01 mg/dl respectively among the cases. Present study showed an increasing trend of serum uric acid with increasing severity of HIE which was statistically significant. Jayprakash et al⁸ did not find any correlation between serum uric acid and severity of HIE while Prithviraj et al⁷ found a rising trend in concentration of serum uric acid with severity of HIE staging and the difference was statistically significant between different groups of HIE.

Correlation coefficient of blood glucose and serum uric acid with severity of HIE staging in our study were found to be -0.366 and 0.812 respectively, which were both statistically significant ($P < 0.001$). In the study by Basu et al⁵, within the perinatal asphyxia group, a significant negative linear correlation was observed between the glucose level and different stages of HIE ($r = -0.875, P < 0.001$) while a strong positive linear correlation was present between the uric acid and HIE stages ($r = 0.734, P < 0.001$). Rai et al⁶ also found a significant negative correlation between blood glucose and severity of HIE ($r = -0.50, P < 0.01$).

Thus in our study, we found umbilical cord blood glucose and serum uric acid levels to be simple, affordable, easily available and accessible test to know the severity of asphyxia. The correlation of these metabolic derangements with various groups of HIE may further help to suggest the extent of perinatal injury in the admitted birth asphyxiated patients much earlier during the NICU stay and hence improve anticipation and management of complications.

CONCLUSION:

Both morbidity and mortality due to birth asphyxia are influenced by the duration and severity of asphyxia. Hypoxic ischemic encephalopathy may cause permanent damage to brain tissues that may lead to neonatal death or later manifest as developmental delay or cerebral palsy. Hence we require more and more reliable and easily available predictors to detect the neonates at high risk of damage at the earliest so that early anticipation and interventions can help in improving the outcome in NICU. There are only a few studies that compare the umbilical cord blood values of glucose, uric acid etc. with the Sarnat stages of HIE. Severity of the derangements of these metabolic parameters e.g. hypoglycaemia, hyperuricemia etc. also compromise the developing brain of neonates.

From our present study, we can infer that cord blood glucose and uric acid levels can be a highly valuable test in birth asphyxiated patients for early detection of damage to prevent neonatal brain injury so that the child can have a normal neurological outcome and can lead a productive life useful to the society.

Owing to a limited number of birth asphyxia cases in our hospital, our study had a small sample size. Hence a multicentric study for workup of a larger population is required to further confirm the findings and implement them in clinical practice.

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