



## Study on Effects of Cord Blood PH and Biochemical Markers on Severity of Perinatal Asphyxia in a Term Neonate

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#### ABSTRACT

This study aimed to utilize biomarkers present in cord blood to predict the severity and prognosis of birth-related hypoxia. The investigation focused on the correlation between the severity of hypoxic-ischemic encephalopathy (HIE), as assessed by the Thompson score and cord blood markers including lactate dehydrogenates (LDH), lactate and uric acid. Additionally, the relationship between these cord blood markers and clinical outcomes, as well as their association with high-risk pregnancies, was examined. A total of 120 neonates who met the specified inclusion and exclusion criteria were enrolled in the study. Cord blood samples were collected and analyzed for LDH, lactate and uric acid levels. Following resuscitation, the infants were transferred to the neonatal intensive care unit (NICU), where HIE staging was performed using the Thompson score within the first 24 hours of life, alongside the documentation of other relevant clinical details in a pre-designed proforma. The analysis revealed that neonates classified as stage 2 and stage 3 of HIE exhibited significantly elevated levels of LDH (with a sensitivity of 74.82% and specificity of 80.42%), lactate (sensitivity of 69.12% and specificity of 80.9%) and uric acid (sensitivity of 74.32% and specificity of 84.32%). HIE remains a critical contributor to morbidity and mortality in newborns. The concurrent measurement of LDH, lactate and uric acid levels presents a promising diagnostic approach for assessing the severity of HIE prior to the onset of clinical symptoms, thereby facilitating timely interventions aimed at reducing associated morbidity and mortality.

## INTRODUCTION

According to the World Health Organization's (WHO) most recent estimates, roughly 4 million infants die each year before they turn one month old. 98% of these newborn fatalities occur in underdeveloped nations. Together, birth traumas and perinatal asphyxia account for nearly 29% of these fatalities<sup>[1]</sup>. In underdeveloped nations, most deliveries take place at home with untrained birth attendants in attendance. The CNS has been linked to hypoxia ischemic injury when respiration is not initiated and maintained right away after delivery., this injury's clinical manifestations are known as hypoxic ischemic encephalopathy (HIE). Since it is not always possible to establish the HI insult and there may be multiple other plausible etiologies at play, some doctors prefer the term "neonatal encephalopathy<sup>[2]</sup>". "HIE in an asphyxiated baby is concerning because it can produce substantial, protracted motor sequelae in survivors. There is no internationally recognized definition of birth asphyxia. Since asphyxia can happen in utero, at birth, or in the postnatal period, it is perhaps preferable to use the term perinatal asphyxia. Birth asphyxia is described by WHO as "failure to initiate and sustain breathing during birth." A 4-minute Apgar score or gasping breathing were used to diagnose mild hypoxia. Without respirations/apgar 3 at one min of age, severe asphyxia was classified as 6 at 1<sup>[3]</sup>. According to the American Academy of Pediatrics and the American College of Obstetrics and Gynecology, the following must present to diagnose asphyxia: (a) A cord with profound metabolic 7.00. (b) The persistence of mixed academic or Apgar scores of 0 for >5 minutes. Neonatal neurologic consequences (c) (e.g, seizures, coma, Hypotonia). (d) Involvement of multiple organs (e.g, of the kidney, lungs, liver, heart, intestine) Defining concepts based on Apgar scores could be helpful since they can be used to create standards for post-asphyxial management of newborns. Additionally helpful for predicting long-term outcomes in newborns decreased oxygen supply after birth are Apgar ratings<sup>[4]</sup>. Between 250,000 and 350,000 children in India pass away each year from PA, most frequently before the 1ST 72 hrs of life. PA is causing factor in over 20% of new born fatalities in India, according to statistics from the NNPD. Additionally, antepartum and intrapartum hypoxia cause up to 3-4 lakh intrapartum deaths annually. In India, 1.4% of infants with hypoxic ischemic encephalopathy and eight percent of neonates had one-minute Apgar scores below 7. (HIE) As there are no standard protocol for usage in primary care settings and lack of vital registry places where large number of infant deaths occur limit estimates of newborn death rate due to birth asphyxia. In India, just one third deliveries are institutional and parents bring asphyxiated babies to hospitals after their deaths. Pregnancies that carry a higher risk of abortion, foetal

death, early delivery, intrauterine growth restriction, poor cardiopulmonary or metabolic development at birth, foetal or neonatal illness, congenital malformations, mental retardation, or other disabilities are referred to as high risk pregnancies.

## MATERIAL AND METHODS

120 term neonates were included in this study. Comparison of severity of birth asphyxia by using Thompsons score with cord blood markers like Lactate, LDH and Uric acid. Neonates delivered with perinatal asphyxia fulfilling the mentioned criteria were enrolled in this study. After taking the informed written consent from the parent or guardian, the relevant information from the history, physical examination entered in pre designed proforma. A maternal characteristic record includes age, parity, gestational age, antenatal risk factors and mode of presentation and delivery. Also perinatal risks, mode of resuscitation, Apgar score were recorded. Babies were shifted to NICU and HIE staging was done by using Thompson score within 24 hours of life. Cord blood collected for estimation of Lactate, LDH and Uric acid. Reference of this biochemical markers as follows: B LDH (640U/l), Lactate (20-80mg/dl) and Uric acid(3.5-6.5mg/d), these babies were monitored and followed up till outcome.

### Inclusion Criteria:

- GA between 37-42weeks born intramurally who fulfilled the following criteria included in this study: WHO criteria for failure to initiate breathing at birth including high risk pregnancies and infants.

### Exclusion Criteria:

- Congenital anomalies.
- Known chromosomal/genetic anomalies.
- Twin gestation.
- Infant of diabetic mother.

## RESULTS AND DISCUSSIONS

Out of 120 cases, 48 (40%) cases were HIE II followed by 40 (33.33%) cases were HIE I. 59.1% of HIE cases had risk factors like C-section, Me conium stained liquor, a short inter pregnancy interval. Out of 120 cases, 49 cases had LDH value >2800 U/L. Among 40 babies, 20 babies with HIE stage I had LDH value <1800., whereas among 32 babies, 18 cases with stage III had LDH value greater than 2800 (p value 0.001). Out of 120 cases, 31 cases had Lactate value more than 100 mg/dl. 32 out of 40 cases with HIE stage I had levels <80, whereas 15 cases out of 32 with HIE stage III had levels >100 (p value of 0.01). Among 120 cases, 43 (35.83%) had value >6.5 mg/dl. 20 out of 40 cases with HIE I had UA levels <3.5, 19 out of 32, cases with stage-III had levels >6.5 (p value of <0.013). 20 cases out of 30, discharged without anticonvulsant had LDH

value <1800 and 15 cases out of 27 death had value >2800 (p value of 0.001). 32 cases out of 48, discharged without anti consultant had Lactate value <80 and 21 cases out of 27 death had value >100 (p value of 0.001). 25 cases out of 48, discharged without anticonvulsant had UA value <5.5 and 18 cases out of 27 death had value >6.5 (p value <0.001). Uric acid had highest specificity (86.25%) and NPV (68.77%), whereas LDH had highest sensitivity (76.55%) and Lactate had highest PPV (73.87%).

**Table 1: Outcome in Different Stages of HIE**

Outcome	Stage-I	Stage-II	Stage-III	Total
Discharged without Anticonvulsant	40	7	1	48
Discharged with Anticonvulsant	0	35	10	45
Death	0	6	21	27
Total	40	48	32	120

PA is a serious clinical condition that contributes to newborn death and poor outcome. PA is a preventable cause of cerebral injury occurring during birth causing permanent and irreversible damage to almost every organ system in the body. PA is a devastating state causing permanent damage, even death of the newborn. Prediction of outcome of PA important so as in anticipation of complications. Though The Apgar score is a prognostic indicator has a limited role in predicting the immediate outcome and the long-term sequelae. Many studies shown that cerebral function monitoring with various non invasive techniques, like EEG 1st six hours of life, NSG, cranial topography, Doppler study of cerebral blood flow, MRI and monitoring of biochemical indicators such as CK-BB, brain specific LDH isomer, glutamate and neuron specific enolase in CSF are useful in predicting the early dysfunction and outcome. But these facilities are not routinely available in many centers in India. Other factors like low socio economic status, lack of knowledge and medical facilities and obstetric care contributes to intensity of the incidence of PA in our country. Few studies have compared the umbilical vein sample values of Na<sup>+</sup>, K<sup>+</sup>, glucose, UA, LDH calcium, Lactate, creatinine with different degree of asphyxia and various stages of HIE. In our study, efforts were to assess the severity and outcome with HIE using umbilical cord biochemical markers. Sample size of 120 was taken. 64% of study group are males considering our hospital annual statistics which showed that male deliveries (56%) were more compared to females. Average weight of newborn at birth in our study was 2.86 kg which included only term babies with birth weight appropriate<sup>[5]</sup> for gestational age. The inference of study is compared to serdar *et al* with average birth weight 2.92kg and 3.2kg respectively. Our hospital annual statistics are vaginal delivery being 80% and LSCS 20%. In present study Vaginal delivery being 78% and LSCS 22%, compared to study done by Serdar *et al*. were LSCS was more. The reason for low LSCS in our study is being LSCS is practiced only in strictly indicated

cases. We found elevated levels of LDH, Lactate and Uric acid are significantly elevated in neonates with Stage III HIE( p value of <0.001 ) and results are comparable with study done by Serdar *et al*. Lactate mean values in HIE all stages comparable to study done by serdar *et al*. Mean values of Uric acid of HIE in all stages comparable to study done by sardar *et al*. In our study we also compared biochemical markers with risk factors for asphyxia. Babies with risk factors, had high LDH, Lactate and uric acid compared to babies with no risk factors, all the markers had high specificity and sensitivity with risk factors compared without risk factors.

## CONCLUSIONS

Measurement of LDH, Lactate and UA levels together is a promising method of diagnosing the severity of HIE before development of clinical manifestations and thereby helping in appropriate early intervention to reduce poor outcomes and prevent deaths. All the mean values of markers studied were significantly higher in stage II and stage III. Mean values of these biochemical markers can be used as predictor of severity and outcome of HIE. Comparison of the levels of LDH and Lactate with regards to 3 stages in HIE showed that babies with stage 2 and S3 had significantly elevated range of LDH (sensitivity of 70.93% and specificity of 80.42%), Lactate (sensitivity of 69.81% and specificity of 81.9%), Uric acid (sensitivity of 74.83% and specificity of 86.42%). All the markers have high specificity and sensitivity when associated with risk factors.

## REFERENCES

1. World Health Organization., 1996. Perinatal mortality: a listing of available information. FRH/MSM.96.7. Geneva:WHO., Vol.
2. Casey, B.M., D.D. McIntire and K.J. Leveno, 2001. The Continuing Value of the Apgar Score for the Assessment of Newborn Infants. New Engl. J. Med., 344: 467-471.
3. NNPD network., 2005. National Neonatal Perinatal Database-report for the year 2002- 2003. NNF NNPD network., New Delhi.
4. Indian Institute of Population Studies., 2000. National Family Health Survey (NFHS- 2)1998-99. Mumbai., Vol.
5. Serdar B., A. Banu., D. Dilek, E. Sara, Z. Aysegül and O. Nurullah., 1291. Can biochemical markers predict the 9. severity of hypoxicischemic encephalopathy.