



To study Laboratory Findings (CK-MB and LDH) in Assessing the Severity of Perinatal Asphyxia at medical college, Hospital Bikaner Rajasthan

Dr.Kuldeep Meena^{1*}, Dr.Nishaat Ahmed², Dr.R.K.Soni³, Dr.Nitesh⁴, Dr.Anita verma⁵

^{1,4} Resident, ²Assistant Professor, ³ Professor, ⁵Associate Professor

¹⁻⁴Department of Paediatrics, ⁵Department of Biochemistry

Sardar Patel Medical College, Bikaner, Rajasthan

Correspondence Author: Dr.Kuldeep Meena¹, Resident Doctor, Department of Paediatrics, Sardar Patel Medical College, Bikaner, Rajasthan.

Conflicts of interest: None to Declare

Abstract

Introduction: Perinatal asphyxia contributes significantly to neonatal morbidity and mortality.

Materials and Methods: A Hospital based prospective study conducted in Neonatal Intensive Care Unit (NICU) and Post natal wards of PBM Hospital, Bikaner. 100 babies were included in the study with perinatal asphyxia. The clinical and neurological examination was done for all the neonates included in the study. Blood samples for different systemic biomarkers were taken from all the babies.

Results: Among the 50 neonates in , 30 (60%) were survival and 20(40%) were died. The mean CK-MB level at 8±2 hours was 98.22±10.99 U/L in died neonates and 79.43±16.13 U/L in the survival neontes. The mean value is significantly higher in died compared to survival with P<0.001. The mean LDH level at 72±2 hours was 552.46±66.01 U/L in survival neonates and 601.3±13.50 U/L in thedied neonates. The mean value is significantly higher in died compared to survival neonates with P<0.001.

Conclusion: HIE is the most severe manifestation of perinatal asphyxia which can be predicted by early

laboratory evaluation of biomarkers so as that early treatment can be initiated.

Keywords: Hypoxic-ischemic encephalopathy, Perinatal asphyxia, Sarnat and Sarnat staging.

Introduction

Perinatal asphyxia is a condition wherein there is an impairment of transfer of the respiratory gasses resulting in hypoxemia and hypercapnia, accompanied by metabolic acidosis. The WHO defi nes perinatal asphyxia as “Failure to initiate or sustain breathing at birth.” Perinatal asphyxia is a third most common cause of neonatal death (23%) after preterm birth (28%) and sepsis (26%). The asphyxial injury may involve virtually every organ system of the body, but hypoxic-ischemic encephalopathy (HIE) is the most common sequelae.¹

HIE characterized mainly by abnormal muscle tone and refl exes, an altered level of consciousness, and commonly by convulsions is an outcome of perinatal asphyxia.² HIE is a cause of death in newborns, and who survive are prone to serious neurological disorders such as cerebral palsy.²

Materials and Methods

Study design: Hospital based prospective study.

Study duration: 12 months

Study place: Neonatal Intensive Care Unit (NICU) and Post natal wards of PBM Hospital, Bikaner.

Study population: asphyxiated recruited from Neonatal Intensive Care Unit (NICU) and Post natal wards of PBM Hospital, Bikaner.

Sample size: 50 Cases comprised of asphyxiated and non-asphyxiated neonates, respectively.

The case group: It included 50 neonates fulfill the inclusive criteria

Inclusion Criteria

1. Gestational age ≥ 37 weeks.
2. Appropriate for gestational age.
3. The neonates will be identified to have experienced perinatal asphyxia when at least 3 of the following are present:
 - a. Intrapartum signs of fetal distress, as indicated by non reassuring NST on continuous electronic fetal monitoring and/ or by thick meconium staining of the amniotic fluid.
 - b. Apgar score of <7 at one minute of life.
 - c. Resuscitation with >1 minute of positive pressure ventilation before stable spontaneous respiration.
 - d. Profound metabolic or mixed acidemia ($\text{pH} < 7.00$) in an umbilical artery blood sample, if obtained.
 - e. Mild, moderate or severe hypoxic ischemic encephalopathy (HIE), as defined by sarnat and sarnat 1976.

Exclusion Criteria

1. Congenital malformations.
2. Maternal drug addiction.
3. Neonates born to mothers who would have received magnesium sulphate within 4 hours prior to delivery or opioids (pharmacological depression).
4. Hemolytic disease of the newborn.
5. Neonates born to mothers consuming alcohol
6. Neonates born to mothers who are smokers

7. Neonates born to mothers on anti epileptics

The control group: It will include term apparently healthy neonates appropriate for gestational age without signs of perinatal asphyxia as evidenced by normal fetal heart rate patterns, clear liquor and one minute Apgar score >7 .

Method of data collection

All neonates included in the study had the following done:

-Detailed maternal history, assessment of intra-uterine fetal well being by continuous electronic fetal monitoring, meconium staining of amniotic fluid, birth events, Apgar score, sex of the baby and weight of the baby were recorded. Gestational age was assessed by New Ballard scoring system. Arterial blood gas analysis (ABG) was done if umbilical arterial blood was obtained.

-Thorough clinical and neurological examination was done for all the neonates included in the study.

-Blood samples were collected from the neonates and sent for:

- A. Creatine Kinase Muscle-Brain fraction (CK-MB) levels.
- B. Blood sugar.
- C. Lactate Dehydrogenase (LDH) levels.

Blood for CK-MB was drawn at 8 ± 2 hours³. Blood for LDH was drawn at 72 ± 2 hours of age. The upper limit of the normal range of CK-MB at 5-8 hours of life is 7.9% of 1,175 U/L which is ≈ 92.6 U/L taken as the cut-off level⁴. The normal reference value of LDH in neonates and infants <1 year is 170-580 U/L⁴. A value >580 U/L at 72 hours was taken as the cut-off level.

Sample Collection

Blood was collected each time from the peripheral venous site at 8 ± 2 hours for CK-MB and 72 ± 2 hours of age for LDH respectively under aseptic precautions. Serum CK-MB was analyzed by immunoassay on 1mL

clotted blood . Serum LDH was analyzed by the liq-uiUV test on lmL clotted blood .

Data Analysis

Data will be recorded on a Performa. The data analysis will be computer based; SPSS-22 will be used for analysis. For categoric variables chi-square test will be used. For continuous variables independent samples’s t-test will be used. p-value <0.05 will be considered as significant.

Results

This prospective study was conducted in NICU of Pediatrics PBM hospital Bikaner attached with S.P.M. college Bikaner. The blood samples from 50 neonates constituted the material for the study. Among the 50 neonates in, there were 33 (66%) males and 17 (34%) females. Among the 50 neonates, 33 (66%) neonates weighed between 2.5-3.0 kg, 15 (30%) weighed between 3.0-3.5 kg and 2 (4%) weighed > 3.5 kg. The mean weight was 2.97±0.29 kg .Among the 50 neonates, 26 (52%) were born to primi mothers and 24 (48%) were born to multi gravida mothers.

Table: 1. Distribution of HIE as per Sarnat and Sarnat in cases.

HIE	Number of neonates (n=50)	%
I	20	40
II	12	24
III	18	36

Among the 50 neonates in the case group, 20 (40%) had HIE I, 12 (24%) had HIE II and 18 (36%) had HIE III during the course in NICU.

Table: 2. Correlation of CK-MB and LDH with severity of HIE.

Variables	HIE			P value
	I	II	III	
CK-MB(U/L)				
<92.6	19(95%)	6(50%)	5(27.77%)	0.0001
>92.6	1(5%)	5(5%)	13(72.22%)	
LDH(U/L)				
<580.0	18(90%)	3(25%)	1(5.66%)	0.0001
>580	2(10%)	9(75%)	17(94.44%)	
Total	20(100.0%)	12(100.0%)	18(100.0%)	

Among the 50 neonates in the case group, 30 (60%) had CK-MB levels <92.6 U/L and 20 (28%) had CK-MB levels >92.6 U/L. Out of the 50 neonates, 50 (100%) developed HIE. 19 (95%) case of HIE I , 6 (50%) cases of HIE II and 5(27.77%) case of HIE III had CK-MB levels <92.6 U/L. 1 (5%) cases of HIE I, 6 (50%) cases of HIE II and 13 (72.22%) cases with HIE III had CK-MB levels >92.6 U/L. The correlation of cut-off CK- MB level of 92.6 U/L with the severity of HIE is significant (P=0.0001).

Out of the 50 neonates, 22 (44%) had LDH levels<580 U/L and 28 (56%) had LDH levels >580 U/L. 50(100%) cases developed HIE. 18 (90%) case of HIE I, 3 (25%) cases of HIE II and 1(5.55%) case of HIE III had LDH levels <580 U/L. 2 (10%) cases of HIE I, 9 (75%) cases of HIE II and 17 (94.44%) cases with HIE III had LDH levels >580 U/L. The correlation of cut-off LDH level of 580U/L with the severity of HIE is significant (P=0.0001).

Table: 3. Correlation of CK-MB and LDH with Died and survival neonates.

CK-MB(U/L)	Died neonate	Survival neonate
Mean	98.22	79.43
S.D.	10.99	16.13
P-value	0.0001	
LDH(U/L)		
Mean	601.3	552.46
S.D.	13.50	66.01
P-value	0.0001	

Among the 50 neonates in , 30 (60%) were survival and 20(40%) were died. The mean CK-MB level at 8±2 hours was 98.22±10.99 U/L in died neonates and 79.43±16.13

U/L in the survival neonates. The mean value is significantly higher in died compared to survival with $P<0.001$.

The mean LDH level at 72 ± 2 hours was 552.46 ± 66.01 U/L in survival neonates and 601.3 ± 13.50 U/L in the died neonates. The mean value is significantly higher in died compared to survival neonates with $P<0.001$.

Discussion

Perinatal asphyxia causes multiorgan dysfunction mainly the nervous system leading to encephalopathy, which may take 72 h for neurological manifestations to appear. As it requires nearly 3 days for the systemic manifestations and categorization into different stages, early laboratory analysis will be helpful so that initiation of the treatment is started, as treatment is effective only when it is administered in the first 6 h of life.

In study done by Fernandez et al. measured the serum CKBB (brain isoenzyme) activities of 33 full-term newborns in the 4th and 10th h of life and discovered that babies who died of severe HIE or developed neurologic sequelae had significantly higher serum CK-BB activities than babies who did not have neurological abnormalities. Based on this observation, they claimed that a high serum CK-BB activity is a sensitive marker of brain injury. In our study, the babies with HIE Stage 3 had higher CK-BB levels compared to that of the children in Stage 1 and 2.⁵

In our study, the levels of serum lactate and LDH levels are high in Stage 3 of HIE and, as the stage of HIE progressed, the results of the two tests used in measuring serum lactate and LDH levels showed a statistically significant increase and same result was observed by Basu et al⁶. Based on the results of our study, we can claim that the CK-BB and LDH level which were done at admission had higher prognostic factors in predicting the mortality before the clinical determination of the HIE stage in newborns with perinatal asphyxia according to the Sarnat and Sarnat

scoring system. Further, determining the cutoff values for these biochemical markers would help clinicians to differentiate Stage 1 HIE from the advanced stages so that therapeutic hypothermia treatment can be initiated

Conclusion

HIE is the most severe manifestation of perinatal asphyxia which can be predicted by early laboratory evaluation of biomarkers so as that early treatment can be initiated.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee.

References:

1. Sarnat HB, Sarnat MS. Neonatal encephalopathy following fetal distress. A clinical and electroencephalographic study. *Arch Neurol* 1976;33:696-705.
2. Van de Riet JE, Vandenbussche FP, Le Cessie S, Keirse MJ. Newborn assessment and long-term adverse outcome: A systematic review. *Am J Obstet Gynecol* 1999;180:1024-9.
3. Jedeikin R, Makela SK, Shennan AT, Rowe RD, Ellis G.. Creatine kinase isoenzymes in serum from cord blood and the blood of healthy full-term infants during the first three postnatal days. *Clin Chem* 1982; 28: 317- 322.
4. Primhak RA, Jedeikin R, Ellis G, Makela SK, Gillan JE, Swyer PR, et al. Myocardial ischaemia in asphyxia neonatorum. Electrocardiographic, enzymatic and histological correlations. *Acta Paediatr Scand* 1985; 74: 595-600.
5. Hansen AR, Soul JS. Perinatal asphyxia and hypoxic - Ischaemic encephalopathy. In: Cloherty JP, Eichenwald EC, Hansen AR, Stark AR, editors. *Manual of Neonatal Care*. 7th ed. Philadelphia:

Lippincott Williams and Wilkins, a Walters Kluwer
Business; 2012. p. 711-28.

6. Basu P, Som S, Choudhuri N, Das H. Contribution of the blood glucose level in perinatal asphyxia. *Eur J Pediatr* 2009;168:833-8.