



URINARY LACTATE TO CREATININE RATIO IN NEONATES BORN WITH RISK OF PERINATAL ASPHYXIA

Neonatology

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ABSTRACT

Neonates with perinatal asphyxia are prone to development of hypoxic ischemic-encephalopathy (HIE). There are no reliable methods for prediction of HIE in these neonates. This study was designed to determine urinary lactate to creatinine ratio in neonates with perinatal asphyxia. A prospective study was carried out at NICU at Department of Pediatrics, G.R. Medical College Gwalior. 50 neonates born at > 36 weeks gestation with perinatal asphyxia, admitted in neonatal intensive care unit were taken as cases and 50 normal newborns with gestational age > 36 week included as control. We measured the ratio of lactate to creatinine in urine sample by colometric technique within 24 hr after birth both in cases and controls. All newborns were followed for 7 days during their stay in hospital for development of HIE. The results were correlated with the subsequent presence or absence of HIE. The study revealed that mean urinary lactate to creatinine ratio during first 24 hours of life was higher in asphyxiated neonates than control group. The grade of HIE correlated with the greater urinary lactate to creatinine ratio among cases.

KEYWORDS

Neonate, Urinary lactate to creatinine ratio, perinatal asphyxia.

INTRODUCTION

Perinatal asphyxia is one of the most important causes of neonatal mortality and subsequent neurological disability among the infants who survive^{1,2,3}. It occurs in 2.9 to 9 per 1000 term newborns. Neurological sequelae are present in 25% to 28% of the affected infants⁴. The World Health Organization reports that approximately 1 million children worldwide die due to birth asphyxia, and about the same number may survive with significant long-term neurological disability.⁵ It is important to identify infants at high risk for hypoxic ischemic encephalopathy in order to provide them proper treatment soon after birth.^{6,7} However, most newborns with perinatal asphyxia have unpredictable course.^{2,3,7}

Severe tissue hypoxia causes accumulation of intermediary metabolites which are excreted by the kidneys. Lactate is produced by anaerobic metabolism during an asphyxial insult and continues to be excreted in urine for long time. measurement of urinary lactate may also reflect the blood lactate level and the degree of metabolic derangement as a result of hypoxia and ischemia. Creatinine excretion is dependent upon glomerular filtration and is reduced in asphyxia. Babies continue to excrete lactate but creatinine excretion is reduced. Thus the ratios increase accordingly.

MATERIAL AND METHODS

The study conducted in the Neonatology department of pediatrics at G R medical college Gwalior for period of one year from December 2015 to november 2016. All newborns (both inborn and outborn babies) with gestational age > 36 weeks with perinatal asphyxia were included in study.

Inborn babies were included in study group if they were satisfied all the following criteria. 1. Presence of intrapartum fetal distress with or without the presence of meconium staining of amniotic fluid. 2. An apgar score < 5 at 5 minutes of birth 3. Need for immediate neonatal resuscitation with ventilation by bag and mask or via an endotracheal tube for more than one minute. Out born babies were included in study group if they were satisfied all the following criteria. 1. Failure to cry after birth. 2. Needed assistance for breathing soon after birth. 3. Neurological picture compatible with hypoxic ischemic encephalopathy with no alternative diagnosis.

Only inborn babies were enrolled as control and comprised of newborn babies born after an uncomplicated pregnancy of >36 weeks, having an apgar score >7 at 5 minutes of birth, no signs of asphyxia and a normal course during the first week of life.

The infants in both groups were examined daily during the first week after birth by a single examiner who did not know the results of the urinary testing. After taking informed consent from parents, detail history regarding maternal age, parity, gravidity, acute or chronic medical illness, mode of delivery, prolonged labour, presence of neonatal cyanosis and/or bradycardia or delayed first cry was taken.

Urinary lactate to creatinine (urinary L/C) ratio was measured by collecting spot urine samples within first 24 hours of life both from the control and study group using sterile bags attached to the perineum.

RESULTS

Birth weight, gestational age, and sex were similar among the normal infants and the infants with asphyxia that developed hypoxic-ischemic encephalopathy. The disease was judged to be mild (HIE 1) in 18, moderate (HIE 2) in 19, and severe (HIE 3) in 13 patients. The mean ratio of Urinary L/C in urine within 24 hours after birth was 5.35±4.59 in the infants who subsequently developed hypoxic-ischemic encephalopathy which is about 30 times as high as the ratio in normal infants (0.18±0.07, P<0.0001) (Table 1). There was a significant trend for the ratio to increase with the severity of the hypoxic-ischemic encephalopathy in 24 hours. Further, Urinary L/C ratio of control group was compared with Urinary L/C ratio of cases with HIE 1, HIE 2 and HIE 3 respectively and the difference was found to be highly significant (p<0.0001) (Table2).

Table 1. comparison of means of different parameters between cases and controls

parameters	Cases (n=50)	Controls (n=50)	Z	P
Urinary lactate(mg/dl)	147.6	23.06	9.3	<0.0001
Urinary creatinine(mg/dl)	58.9	126.3	4.3	<0.0001
Urinary lactate to creatinine ratio	5.35	0.18	7.9	<0.0001

Table 2: comparison of different parameters in different HIE grades and controls

Parameters	HIE1	HIE2	HIE3	Controls
Urinary lactate/creatinine ratio	0.94	4.67	11.85	0.18
Significance				
Control vs HIE 1	Control vs HIE2		Control vs HIE3	
26.08 P<0.0001	59.64 P<0.0001		34.33 P<0.0001	

DISCUSSION

In our study results suggest that the urinary L/C ratio within twenty four hours after birth is related to the occurrence and degree of hypoxic-ischemic encephalopathy. Urinary L/C ratio was found to be 30 times higher in babies with HIE compared to normal.

CONCLUSION

Urinary lactate to creatinine ratio can be used as early, simple, quick and non-invasive biochemical marker and a tool for predicting the development of hypoxic ischemic encephalopathy, and determine its severity.

REFERENCES

1. Synder EY, Aurora S. Perinatal asphyxia. In: Cloherty JP, Eichenwald EC, Stark AR (eds). *Manual of Neonatal Care*. 5th edition. Lippincott Williams & Wilkin. Philadelphia; 2004: 536-55.
2. Perlman JM, Risser R. Can asphyxiated infants at risk for neonatal seizures be rapidly identified by current high-risk markers? *Pediatrics*. 1996 Apr;97(4):456-62.
3. Volpe JJ, editor. *Neurology of the Newborn*. 5th ed. Philadelphia: Elsevier Science; 2008. Hypoxic-Ischemic Encephalopathy: Biochemical and Physiological Aspects; pp.221-372.
4. Zanardo V, Demi M, Padovani E. [Hypoxicischemic brain damage in the newborn] *Pediatr Med Chir*. 1997 Jan-Feb;19(1):1-2.
5. Martínez-Pérez B, de la Torre-Díez I, López-Coronado M. Mobile health applications for the most prevalent conditions by the World Health Organization: review and analysis. *J Med Internet Res*. 2013 Jun 14;15(6):e120. doi: 10.2196/jmir.2600.
6. Vannucci RC, Perlman JM. Interventions for perinatal hypoxic-ischemic encephalopathy. *Pediatrics*. 1997 Dec;100(6):1004-14.
7. Johnston MV. Selective vulnerability in the neonatal brain. *Ann Neurol*. 1998 Aug;44(2):155-6.