



Prediction of Neonatal Seizures in HIE by APGAR Score and Umbilical Cord Blood pH

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Abstract

Background: Hypoxic Ischemic Encephalopathy (HIE) due to Perinatal asphyxia is one of the commonest cause of symptomatic seizures in newborn period. In fact, about two-thirds of cases of neonatal seizures are due to HIE. The present study was aimed at determining the role of APGAR score and Umbilical cord pH to predict the occurrence of neonatal seizures in HIE.

Methods: An observational hospital based prospective study was conducted at the inborn NICU of Rajah Muthiah Medical College Hospital, Annamalai University, Chidambaram, Tamilnadu from July 2017 to December 2017. 50 inborn term asphyxiated newborns, admitted in the NICU were enrolled as cases. Conventional APGAR Scoring and umbilical cord blood gas analysis were done in the study population soon after birth. The study population was observed for occurrence of neonatal seizures in the first 24 hours of life. The results were analyzed statistically.

Results: The mean APGAR score at 1 min, 5 min and mean cord blood pH in asphyxiated babies with no neonatal seizures were 3.36 ± 0.85 , 5.75 ± 0.41 and 7.25 ± 0.11 ; In asphyxiated babies who developed neonatal seizures, the mean APGAR score at 1 min, 5min and mean cord blood pH were 2.59 ± 0.40 , 3.66 ± 0.70 and 6.96 ± 0.09 , respectively. Correlation coefficients of APGAR 1 min, 5 min and cord blood pH to predict neonatal seizures in asphyxiated babies were -0.633 , -0.666 and -0.624 .

Conclusions: Conventional APGAR score, along with Umbilical cord blood pH can be used to predict the occurrence of neonatal seizures in perinatal asphyxia. APGAR score and cord blood pH are inversely related with occurrence of neonatal seizures in perinatal asphyxia.

Keywords: Neonatal seizures, APGAR score, Umbilical cord blood gas, HIE, Perinatal asphyxia.

Introduction

Perinatal Asphyxia is one of the commonest conditions in newborn period that necessitates hospitalization and interventional treatment modalities^(5,6). From a pathophysiological point of view, asphyxia is the combination of both a lack

of oxygen (hypoxia) and perfusion (ischemia) to the body organs, especially to the brain⁽¹⁾. Perinatal asphyxia is the major cause of neonatal encephalopathy at present, denoted as Hypoxic Ischemic Encephalopathy⁽⁶⁾.

HIE is defined by clinical and laboratory evidence of acute or subacute brain injury due to asphyxia (ie, hypoxia and acidosis) with abnormal consciousness level⁽¹⁾. Most often, the actual time of hypoxic insult to the fetus and the exact underlying cause of asphyxia remains unknown⁽²⁾. The clinical spectrum of HIE is divided into mild, moderate and severe HIE. Seizures occur in up to 50% of newborns with HIE and most commonly occur within first 12 to 24 hours of birth. Seizures in HIE denote the increasing severity of the encephalopathy.

Materials and Methods

This is an observational hospital based prospective study, conducted at the inborn NICU of Rajah Muthiah Medical College Hospital, Annamalai University, Chidambaram, Tamilnadu from July 2017 to December 2017. With the approval of the institutional ethical committee and after getting written consent from both the parents, 50 term asphyxiated newborns, delivered at Rajah Muthiah Medical College Hospital were enrolled for the study.

Inclusion Criteria

Term newborns, weighing appropriate for gestation age with:

1. No spontaneous cry/breathing within 1 minute of birth

Results

Table 1: Mean APGAR scoring in Asphyxiated newborns

HIE	No. of Cases	Mean 1 min APGAR Score Mean \pm SD	Mean 5 min APGAR Score Mean \pm SD
Without Neonatal seizures	23	3.36 \pm 0.85	5.75 \pm 0.41
With Neonatal seizures	27	2.59 \pm 0.40	3.66 \pm 0.70

The mean APGAR score at 1 min and 5 min in asphyxiated babies who did not develop neonatal seizures were 3.36 \pm 0.85 and 5.75 \pm 0.41. In

2. Need for resuscitative measures at birth to establish normal breathing
3. Willingness for consent to the study.

Exclusion Criteria

Term asphyxiated newborns with

1. Gross congenital malformations.
2. No willingness for consent to the study

Soon after birth of the asphyxiated newborn, 1ml of umbilical cord blood was collected in a heparinized syringe from double clamped segment of the cord and sent for cord blood gas analysis^(2,4). Conventional APGAR Scoring was done at 1 minute and 5 minutes and documented.

The study population was admitted at the hospital NICU of Rajah Muthiah Medical college hospital and assessed and staged for HIE as per Sarnat and Sarnat staging for Hypoxic ischemic encephalopathy⁽³⁾. The cases were monitored for the occurrence of neonatal seizures in the first 24 hours of life⁽⁸⁾. HIE, neonatal seizures and other complications that occurred during the NICU stay were dealt with as per standard treatment protocols⁽⁷⁾.APGAR scoring and Umbilical cord blood pH were statistically correlated with the occurrence of neonatal seizures in the study population and the results were analysed.

asphyxiated babies who developed neonatal seizures, the mean APGAR score at 1 min and 5 min were 2.59 \pm 0.40 and 3.66 \pm 0.70, respectively.

Table 2: Mean Cord blood pH in Asphyxiated newborns

HIE	No. of Cases	Mean Cord blood pH
Without Neonatal seizures	23	7.25 \pm 0.11
With Neonatal seizures	27	6.96 \pm 0.09

The mean cord blood pH in asphyxiated babies who did not develop neonatal seizures was 7.25 \pm 0.11. In asphyxiated babies who developed

neonatal seizures, the mean cord blood pH was 6.96 \pm 0.09.

Table 3: Mean Cord blood pCO₂, pO₂ & HCO₃ in Asphyxiated newborns

HIE	No. of Cases	Mean cord blood pCO ₂	Mean cord blood HCO ₃	Mean cord blood pO ₂
Without Neonatal seizures	23	53.5 ± 7.45	20.2 ± 2.44	29.4 ± 5.32
With Neonatal seizures	27	62.4 ± 8.55	17.6 ± 3.64	25.2 ± 4.85

The mean cord blood pCO₂ in asphyxiated newborns who developed seizures was significantly higher than that of the pCO₂ in cases with no neonatal seizures. There is no significant difference with respect to the pO₂ & HCO₃ values.

Table 4: Correlation Coefficient of APGAR score & Cord blood pH to predict Neonatal seizures

Parameter	Correlation Coefficient R
APGAR Score at 1 min	- 0.633
APGAR Score at 5 min	- 0.666
Cord blood pH	- 0.624

There is a significant negative correlation of APGAR score at 1 min, 5 min and cord blood pH with neonatal seizures in asphyxiated babies.

Table 5: ‘p’ value of APGAR score & Cord blood pH to predict Neonatal seizures

Parameter	‘p’ value
APGAR Score at 1 min	< 0.001
APGAR Score at 5 min	< 0.001
Cord blood pH	< 0.001

The ‘p’ value of < 0.001 shows a significant association between APGAR Score & Cord blood pH with neonatal seizures in HIE.

Discussion

Neonatal encephalopathy, presenting with abnormal level of consciousness in the newborn period has numerous causes, of which, Perinatal asphyxia remains a major cause⁽⁵⁾. Among the two pathologic components of perinatal asphyxia, namely hypoxia and ischemia (1), the severity of cerebral ischemia leading to neuronal injury determines the progression of perinatal asphyxia to Hypoxic ischemic encephalopathy and the subsequent development of neonatal seizures due to hypoxic insult to the neonatal brain⁽¹¹⁾. Out of the several clinical and laboratory parameters used

to quantify the severity of perinatal asphyxia, APGAR scoring and Umbilical cord blood gas analysis are widely used, even in resource poor settings⁽⁶⁾.

Umbilical cord blood gas analysis has been used to assess fetal acidemia and immediate neonatal outcome and is quite useful for the assessment of perinatal asphyxia. Umbilical cord pH and the other blood gas values provide valuable information regarding the metabolic status of the neonate at birth, quantifying the magnitude of metabolic acidosis, thereby predicting the risk of hypoxic insult induced neuronal damage⁽⁹⁾. Cord blood pH at birth, along with the conventional APGAR score can be used to predict the severity of birth asphyxia and serious short-term outcome such as neonatal seizures. APGAR score and cord blood pH are inversely related with the duration and severity of perinatal asphyxia⁽⁸⁾.

In our study, incidence of seizures in HIE correlated significantly with decrease in umbilical arterial pH (<7), consistent with studies done by Ross GM et al⁽⁹⁾. Decrease in umbilical arterial pH was significantly associated with low Apgar score in our study (p< 0.001), which agrees with the result of other studies done by Kaveh et al and Malin et al^(10,11). Significant association was found between Apgar score and cord blood gas parameters in the first hour of life, with umbilical cord pH being the most important factor of cord blood gas⁽¹⁰⁾. In our study, low umbilical cord blood pH (< 7.0) had a strong, consistent and temporal association with neonatal mortality and morbidity, especially with the occurrence of neonatal seizures in the setting of HIE.

Conclusion

In our study we concluded that low apgar score at 1 minute & 5 minutes of birth, along with severe acidosis in umbilical cord blood gas had

significant correlation with incidence of neonatal seizures in the setting of HIE. Lower the APGAR score and cord blood pH at birth, higher is the risk for the occurrence of neonatal seizures in HIE, demonstrating a significant inverse relationship. Hence intensive monitoring and care of those newborns with these risk factors will improve the long term prognosis of the asphyxiated newborns.

References

1. Volpe JJ. Hypoxic-Ischemic Encephalopathy: Biochemical and Physiological Aspects *Neurology of the Newborn*. 4th ed. Philadelphia: WB Saunders; 2000. 217-276.
2. Lombroso CT. Neonatal seizures: gaps between the laboratory and the clinic *Epilepsia*. 2007. 48 Suppl 2:83-106.[Medline].
3. Perlman JM, Risser R. Can asphyxiated infants at risk for neonatal seizures be rapidly identified by current high risk markers? *Pediatrics*. 1996; 97(4):456-62
4. White CR, Doherty DA, Henderson JJ, Kohan R, Newnham JP, Pennell CE. Benefits of introducing universal umbilical cord blood gas and lactate analysis into an obstetric unit. *Aust NZ J ObstetGynaecol*. 2010;50(4):318–28.
5. National Neonatal and Perinatal Database Report; 2002- 2003:1-58.
6. World Health Organization. Neonatal and Perinatal Mortality; Country, Regional and Global estimates, 2004; WHO, Geneva; 2006:1-25.
7. American Academy of Pediatrics and American College of Obstetrician and Gynaecologists. In: Guidelines for Perinatal Care. Gilstrap LC, Oh W (Eds.) 5th Ed. Elk Grove Village III. American Academy of Pediatrics; 2002:187.
8. Armstrong L, Stenson BJ. Use of umbilical cord blood gas analysis in the assessment of the newborn. *Arch Dis Child Fetal Neonatal Ed*. 2007;92(6):430-4.
9. Ross GM, Cola R. Use of umbilical artery base excess: Algorithm for the timing of hypoxic injury. *AM J Obstet Gynecol*. 2002;187(1):1-9.
10. Kaveh M, Davari FT, Farhani MSH. APGAR score and arterial blood gas in the first hour of birth. *Iran J Pediatr*. 2004;14(1):27-32.
11. Malin GL, Morris RK, Khan KS. Strength of association between umbilical cord pH and perinatal and long-term outcomes: systematic review and meta-analysis. *BMJ*. 2010;340: 1471.