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Original Research Article

Correlation of APGAR score and cord blood pH with severity of birth asphyxia and short-term outcome

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ABSTRACT

Background: Birth/Perinatal asphyxia is one of the common cause of neonatal morbidity and mortality. Morbidity and mortality in asphyxia depends on duration and severity of asphyxia. The present study was carried out to find out the correlation of APGAR score and cord blood pH with severity of birth asphyxia and short-term outcome.
Methods: An observational hospital based prospective study was conducted at inborn NICU, of Medical College Hospital of Southern Rajasthan from March 2015 to September 2015. We enrolled total 50 inborn asphyxiated newborns as cases. The cord blood was collected immediately at delivery for measurement of cord blood arterial blood gas analysis including pH. All the enrolled cases were admitted in the NICU for treatment and observation for complication and immediate neurological outcome. All the admitted newborns were followed till discharge/death for final outcome. The correlation of APGAR score, cord blood pH and outcome was analysed statistically.
Results: The mean APGAR score at 1 min, 5 min and mean cord blood pH in babies with HIE-I were 4.40±0.89, 6.80±0.45 and 7.21±0.11; HIE-II 3.70±0.67, 6.0±1.25 and 7.20±0.06; HIE-III 2.69±0.60, 3.56±0.8 and 7.03±0.11, respectively. Correlation coefficients of APGAR 1 min, 5 min and cord blood pH to predict the severity of birth asphyxia were -0.633, -0.666 and 0.624.
Conclusions: Cord blood pH at birth in combination with APGAR score can be used to predict the severity of birth asphyxia and short-term outcome. APGAR score and cord blood pH are inversely related with the duration and severity asphyxia.

Keywords: APGAR score, Cord blood pH, Hypoxic ischemic encephalopathy, Perinatal/birth asphyxia

INTRODUCTION

Birth/Perinatal Asphyxia is a serious neonatal problem globally and it is a common cause of neonatal mortality and long-term morbidity. It ranks as a second most common cause of neonatal death after infection accounting for around 30% mortality Worldwide. The data from National Neonatology Forum NNPD Network suggest that Perinatal Asphyxia contributes to almost 20% of neonatal deaths in India.[1] Of the 1.2 million neonatal deaths in India every year, 300,000-350,000 infants die due to Perinatal Asphyxia mostly within first 3 days of life.[2]

Common consensus regarding gold standard definition of Birth Asphyxia does not exist. It is thus appropriate to use the term Perinatal Asphyxia as asphyxia may occur in utero, during the process of labor, at birth or in the postnatal period. Various definitions and criteria to define birth asphyxia were given by World Health Organization (WHO), National Neonatal-Perinatal Database (NNPD), American Academy of Pediatrics (AAP) and American

College of Obstetrician and Gynaecologist (ACOG).[1-3] But, definitions given by WHO and National Neonatology Forum NNPD Network of India are used widely to define the birth asphyxia.

Presently various indicators are used to predict the birth asphyxia and its severity which includes APGAR score, cord blood pH and base deficit at the time of birth of a baby.

The present study was done to evaluate the relation of APGAR score and cord blood pH to predict the severity of perinatal asphyxia and short-term outcome in term newborns

METHODS

This was an observational hospital based prospective study carried out at inborn NICU of tertiary care hospital attached to medical college in southern Rajasthan from March 2015 to September 2015. Prior approval was sought from institutional ethical committee of medical college. After written informed consent from both the parents total 50 term asphyxiated newborns, who delivered at MCH centre of institute were enrolled for the study.

Inclusion criteria

Term AGA newborns with APGAR score <7 at 1 min of life or normal respiration not established at 1 min after birth or requiring resuscitative measures and willing for consent.[1]

Exclusion criteria

Term asphyxiated newborns with severe congenital malformations, Chromosomal abnormalities and or not willing for consent.

Immediately after birth of asphyxiated newborn, 1 mL of blood was collected in heparinised syringe from doubly clamped segment of umbilical cord for Arterial Blood Gas Analysis (ABG) and another 2mL blood collected in EDTA vial for routine investigations.

All the asphyxiated newborns were shifted to neonatal intensive care unit (NICU) after resuscitation for further monitoring, screening and staging of Hypoxic Ischemic Encephalopathy (HIE) as per Sarnat and Sarnat staging system.[4]

The admitted newborns were observed for immediate outcome during first 24 hours of life and classified as neurologically normal or abnormal on the basis of absence or presence of signs and symptoms of HIE. The HIE and other complication detected during hospital stay were managed as per standard protocols. All the cases were followed up till the discharge or death for final outcome. The correlation of APGAR score, cord blood pH, HIE Staging and short-term outcome was evaluated and analysed statistically.

RESULTS

Total 50 asphyxiated newborns were enrolled as cases for the study. Various clinical and laboratory variables were studied and analysed. In the cases 27 (54%) were males and 23 (46%) females.

The mode of delivery was LSCS in 25 (50%) cases and NVD in rest 25 (50%) and the mode of presentation was vertex in 46 (92%) and breech in 4 (8%) cases. The meconium stained liquor was present in 24 (48 %) of cases. The mean APGAR scores at 1 min and 5 min were 3.76±1.04 and 5.82±1.88, respectively (Table 1).

Table 1: Clinical variables in cases (asphyxiated newborns).

Clinical variables	Cases (n=50)
Male	27 (54%)
Female	23 (46%)
Mean maternal age (years)	23.76 ± 2.75
Mean Hb of mother (gm/dl)	10.83 ± 0.96
Mean GA (weeks)	39.20±1.05
Mean birth weight (kg)	2.92 ± 0.33
Mode of delivery	
NVD	25 (50%)
LSCS	25 (50%)
Presentation	
Vertex	46 (92%)
Breech	04 (8%)
Type of amniotic fluid	
Clear	26 (52%)
Meconium stained	24 (48%)
APGAR	
Mean APGAR at 1min	3.76±1.04
Mean APGAR at 5 min	5.82±1.88

Table 2: Laboratory variables in cases (asphyxiated newborns).

Lab parameter	Cases (n=50)
Hematological	
Baby Hb (gm/dl)	16.81 ± 1.68
WBC Count (10^3/mm^3)	16.78 ± 6.32
TRBC(10^6/µL)	5.73 ± 0.60
S. Electrolytes	
Na^+ (mEq/L)	134.11 ± 5.91
K^+ (mEq/L)	4.76 ± 0.57
Ca^{++} (mg/dl)	9.72 ± 0.83
Cord blood ABG	
pH	7.18±0.14
HCO3 (mmol/L)	15.70 ± 3.68
pCO2 (mmHg)	46.72 ± 11.22
pO2 (mmHg)	63.52 ± 16.69

The mean of S. Potassium value in cases was 4.76±0.57. Mean cord blood pH and bicarbonate were 7.18±0.14 and 15.70±3.68, respectively (Table 2). The APGAR scores and cord blood pH in relation to birth asphyxia with or without HIE were analysed (Table 3).

Table 3: Mean APGAR score and cord blood pH according to HIE staging.

Birth asphyxia	HIE staging	Mean APGAR score at 1 min (Mean±SD)	Mean APGAR score at 5 min (Mean±SD)	Mean cord blood pH (Mean±SD
Without HIE	No (n=15)	4.53±0.70	7.37±0.96	7.28±0.08
With HIE	1 (n=8)	4.40±0.89	6.80±0.45	7.21±0.11
	2 (n=10)	3.70±0.67	6.00±1.25	7.20±0.06
	3 (n=17)	2.69±0.60	3.56±0.81	7.03±o.11

The mean APGAR score at 1 min, 5 min and mean cord blood pH in the babies without HIE were 4.53±0.70, 7.37±0.96 and 7.28±0.08, respectively. Whereas the mean APGAR at 1 min, 5 min and mean cord blood pH in the babies with HIE-I were 4.40±0.89, 6.80±0.45 and 7.21±0.11; HIE-II 3.70±0.67, 6.0±1.25 and 7.20±0.06; HIE-III 2.69±0.60, 3.56±0.8 and 7.03±0.11.

All the cases were observed for immediate outcome during the first 24 hours of life. Out of 50 cases, 11 (21%) were neurologically normal, 38 (72%) abnormal and one patient died within first 24 hours. The mean cord blood pH in neurologically normal babies was 7.27±0.13, whereas in neurologically abnormal babies mean cord blood pH was 7.16±0.14. In one baby who died the cord blood pH was 6.98 (Table 4).

Table 4: APGAR score and cord blood pH with immediate outcome.

Immediate outcome	Cases	APGAR score at 1 min (Mean±SD)	APGAR score at 5 min (Mean±SD)	Cord Blood pH (Mean±SD)
Neurologically Normal	11 (21%)	4.54±1.06	6.00±1.88	7.27±0.13
Neurologically Abnormal	38 (72%)	3.76±1.04	5.82±1.88	7.18±0.14
Death	1 (2%)	2.00	3.00	6.98

Table 5: APGAR score and cord blood pH with final outcome.

Final outcome	Cases	APGAR score at 1 min (Mean±SD)	APGAR score at 5 min (Mean±SD)	Cord blood pH (Mean±SD)
Discharge	34 (68%)	4.26±1.04	5.28±1.86	7.25±0.13
LAMA	1 (2%)	2.00	3.00	6.91
Death	15 (30%)	2.73±1.04	5.77±1.89	7.04±0.13

Table 6: Correlation coefficient of APGAR score at 1 min, APGAR score at 5 min and cord blood pH to predict the severity of birth asphyxia.

Parameter	R	p
APGAR score at 1 min	-0.633	<0.001
APGAR score at 5 min	-0.666	<0.001
Cord blood pH	-0.624	<0.001

The relation of APGAR score at 1 min, 5 min and cord blood pH with final outcome was also analysed. The mean values of these parameters in discharged group (n=34) were 4.26±1.04, 5.28±1.86 and 7.25 (Table 5). Amongst the cases who died (n=15) mean values of APGAR at 1 min, 5 min and cord blood pH were 2.73±1.04, 5.77±1.89 and 7.04±0.13. There was a significant negative correlation of APGAR score at 1 min, 5 min and cord blood pH at birth with the severity of birth asphyxia (Table 6).

DISCUSSION

Birth Asphyxia is an important cause of morbidity and mortality in newborns. Birth Asphyxia and it's severity is detected at birth in newborn by APGAR Score at 1 min and 5 min.[5] The Umbilical Cord blood pH is further

measures the degree/severity of asphyxia.[7] This study was carried out to find out the correlation between APGAR score and Cord blood pH with the severity and short- term outcome of birth asphyxia.

In our study, the mean APGAR score at 1 min and 5 min was 3.76±1.04, 5.82±1.88, respectively and mean umbilical cord blood pH was 7.18±0.14, which is consistent with asphyxia of intrauterine or intra partum onset.

The relation between HIE staging, APGAR score and cord blood pH was analysed in the cases. It was noted that as the severity of HIE increases, the values of mean APGAR score and cord blood pH decreases, which is inversely proportion to duration and severity of intrauterine/intra partum asphyxia. Lower umbilical cord blood pH is also associated with unfavourable immediate outcome in terms neurological abnormalities and poor final outcome in terms of death at the time of discharge. Similar short-term outcome association of APGAR score and cord blood pH was reported by other authors.[6,8-11] In this study, we found a significant negative correlation coefficient of APGAR score and cord blood pH to predict the severity of birth asphyxia. This shows that as the severity of Birth Asphyxia increases the APGAR score and pH decreases.

In present study, it was found that cord blood pH is well correlated with APGAR score and this could be used as an indicator to predict the severity and outcome of birth asphyxia in addition to APGAR score.

CONCLUSION

We concluded that the when umbilical cord blood pH is available at birth it is a better marker of perinatal asphyxia. As the duration and severity of asphyxia increases it will further decrease the cord blood pH. Cord blood pH can be used to predict the severity and outcome of birth asphyxia in newborns in addition to APGAR score.

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