

Research Article

Neonatal Outcome in High Risk Pregnancies Based on Umbilical Arterial Blood Gas Analysis

Mamta¹, Ghanshyam Chaudhary², Manisha Verma^{3*}, Aradhana Kankane⁴, Vidya Chaudhary⁵

¹Senior Resident Pediatrics, ESIC Hospital, Pandepur, Varanasi, UP, India

²Department of Pediatrics, Government Medical College, Orai, Jalaun, UP, India

³Assistant Professor, Department of Pediatrics, Dr. Ram Manohar Lohia Institute of Medical Sciences, India

⁴Associate Professor, Department of Pediatrics, Maharani Laxmi Bai Medical College, Jhansi, UP, India

⁵Associate Professor, Department of Obstetrics and Gynaecology, Government Medical College, Orai, Jalaun, UP, India

*Corresponding author: Manisha Verma, Assistant Professor, Department of Pediatrics, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, UP, India

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Abstract

The purpose of this study is to evaluate the correlation between umbilical arterial blood gas and short term outcome of the neonates born. This prospective observational cohort study was carried out at Department of Paediatrics, MLB Medical College, Jhansi on 120 term neonates delivered by caesarean sections or normal vaginal delivery of high risk mother based on Neonatal Resuscitation Program (NRP) between July 2017 to July 2018. All neonates were divided into two groups: 1) Group I (52 cases) consists of neonates with umbilical cord pH less than 7.2, whereas Group II (68 cases) consists of neonates with umbilical cord pH more than 7.2.

Male babies and LSCS delivery were higher in both groups. The most common risk factors in mother are anemia (26%) and MSL (23%). All the cases were full term babies and have normal birth weight. Mean PO₂ level was 11±6 and in group II it was 14±8. Mean PCO₂ in group I was 63.7±13.7 while in group II it was 52.1±7.9. Mean bicarbonate was 21.36±3.54 and in group II it was found to be 24.13±3.25. On statistical analysis difference between pH, PCO₂, PO₂, BE and bicarbonate was significant. In group I, neonates required resuscitation in 57.69% (30 out of 52 cases), but in group II, only (10.29) (7 out of 68) cases required resuscitation. In group I, 48.07% (25 of 52) newborns were admitted to the NICU, whereas 5.88% (4 of 68) neonates in group II were admitted to the NICU. Encephalopathy is observed in 15 instances (28.85%) in Group I, but only 4 cases (5.88%) in Group II. HIE symptoms were frequently seen in the initial hours or days following delivery. Convulsion occurred in 11 instances (21.15.0%) in Group I, but only 3 cases (4.41%) in Group II. Convulsive disorders as sign of moderate encephalopathy had been presented more in neonates who had acidosis in 24 to 48 hours after birth. In group I, 26 cases (50.0%) had delayed in attaining oral feed until an hour, but in group II, only 4 cases (5.88%) cases had delay in attaining oral feed until an hour. The statistical association between delayed attainment of full meal and infant pH is significant. HIE is significantly higher in group 1. The average hospital stay among academic newborns in Group I was 3.9613.199 days. The length of hospital stay in academic newborns exhibited an inverse connection with umbilical cord pH. In group II, the average length of hospital stay is 2.151.479 days. When compared to group II, group I experienced a considerably longer hospital stay. At 1 and 5 minutes of birth, a new-born with cord blood pH <7.2 had an APGAR score of 5.60±1.963 and 7.88±1.437, whereas a baby with cord blood pH >7.2 had an APGAR score of 8.70±0.964 and 8.70±0.964. According to statistical study, the APGAR score is significantly related to the pH of the cord blood.

Umbilical cord blood ABG has been conducted as a definitive factor for fetus evaluation. The pH of umbilical cord blood is the best current criteria for diagnosing foetal hypoxemia during labour and determining appropriate postnatal care decisions.

Keywords: Neonatal; High risk pregnancies; Outcome; Umbilical arterial blood gas; Analysis; India

Introduction

According to the WHO, around 9 million neonates suffer from birth asphyxia each year, 1.2 million of them die [1], and the same number suffers from severe repercussions such as cerebral palsy, epilepsy, and delayed developmental milestones.

Numerous researches have been conducted to identify the risk

factors and how intrapartum hypoxia affects the health of term babies [2]. It is widely acknowledged that labour has a relatively small role in the genesis of cerebral palsy, even after term delivery [3]. The majority of estimations indicate that only up to 15% of children who are impacted are the result of labour. However, these incidents are seen to be theoretically preventable, they frequently result in litigation, and efforts to prevent them result in greater intervention and the use of

significant resources.

Fetal hypoxia is addressed in this intrapartum cerebral palsy prevention method. "The monitoring of newborns in labour seeks to discover hypoxia before it is adequate to lead to harmful acidosis and long-term neurologic consequence for the baby," according to the National Institute for Health and Clinical Excellence (NICE) [4]. This has included Electronic Foetal Monitoring (EFM) in high-risk pregnancies, and intermittent auscultation in low-risk pregnancies with a fallback to EFM in the event of anomalies. If EFM is abnormal, foetal acidemia should be assessed by scalp sample. By convention, although the data on the relationship between scalp, pH and outcomes is restricted largely to Apgar scores, a normal level of scalp pH is >7.24 at <7.20 urgent delivery is advised [5]. Identification and prevention of fetal acidemia is therefore the main aim of intrapartum fetal monitoring, so that's why the cord pH is considered a crucial outcome measure.

Suspected fetal distress detected by cardiotocography or non-stress tests and by presence of meconium stained liquor have been the most common indication for caesarean section for the past few decades. Fetal distress may be defined as a physiological state in which there is metabolic acidosis secondary to hypoxia [6]. When CTG was introduced in 1970, it was hoped that this technique would reduce the incidence of cerebral palsy and mental retardation by 50% [7]. Disappointingly, the results of randomized trials showed little or no benefit with respect to long term neurological outcome despite widespread use of CTG. It was found that the CTG results in no long term benefit in neonatal outcome; on contrary it results in fourfold increase in caesarean section rates [8,9]. Various studies implicate that CTG interpretation is inconsistent inaccurate, may fail to predict early neonatal outcome and is subject to influence by the medicolegal climate [10,11]. Furthermore the significance of meconium in amniotic fluid is also widely debated subject [12]. Traditionally meconium has been viewed as a sign of impending or ongoing fetal compromise, however some investigators believe that it is not associated with fetal hypoxia, acidosis or fetal distress [13]. Many babies born with meconium stained amniotic fluid have normal umbilical artery pH, so recent literature tends to disregard the importance of intrapartum meconium as a sign of fetal hypoxia [12], hence clear liquor is an indication of fetal well-being and meconium staining of amniotic fluid is not always associated with an ill infant [14].

There was also a significant relation between umbilical cord pH and low Apgar score with the incidence of selective neonatal outcome like NICU admission, need for resuscitation. The most widely used method for assessment of neonatal outcome is Apgar score which is semiobjective, alone is not a reliable indicator for intrauterine asphyxia or immediate neonatal mortality. So umbilical cord blood pH is the best available criteria for detecting fetal hypoxemia during labour and making appropriate decisions about care after birth.

Perinatal hypoxia, ischemia, asphyxia, refers to relative lack of oxygen, blood flow, gas exchange to foetus or new-born.

Perinatal or neonatal depression refers to condition of the infant on physical examination in immediate postnatal period (first hour of life). The infant may show muscle hypotonia, depressed mental

status, disturbed respiratory and cardiovascular function [15].

Fetal acidemia is defined as umbilical artery pH less than 7.2, significant acidemia if pH less than 7, some authors defined significant acidemia 2SD below the mean for given population [16].

The diagnosis of intrapartum asphyxia mandates the presence of severe cord blood acidemia, and thus normal values refute this diagnosis. Umbilical blood gas parameters can be used to assess neonates in pregnancies complicated by meconium stained amniotic fluid in which tracheal visualization, intubation and suctioning may lead to low Apgar score that may be wrongly attributed to new-born asphyxia.

As a general rule, adverse events are observed more when pH is on lower side or base deficit is high. These babies would have a low apgar usually. Adverse outcomes mostly noticed in babies are low Apgar, NICU admission, need for assisted ventilation, delay in attained full feeds. Very adverse outcomes like demise, encephalopathy, and organ system failure (though rare) are seen in cases with very low pH almost less than 7. Now a days, very adverse outcomes are observed only in a few numbers, this might be due to the interference of an experienced pediatrician during resuscitation in an asphyxiated new-born or opting for an emergency caesarean section for uteroplacental insufficiency or fetal indications (tachycardia or deceleration). This hinders degree of insult due to asphyxia at a considerably early stage.

When a fetus is subjected to a massive perinatal hypoxic ischaemic insult, fetus may suffer sufficient damage to cause intrauterine death and still birth. In less severe non-fatal cases, prolonged or severe intrauterine hypoxia may lead to serious neonatal complication like hypoxic ischaemic encephalopathy, cerebral palsy, impaired myocardial function, seizures, intraventricular haemorrhage and delayed development. Cerebral palsy is thought to occur more frequently at an arterial cord blood pH <7 . However these criterions have been derived through consensus and not through summary of evidence leading to clinical uncertainty. Since the association between umbilical cord blood pH at birth and perinatal outcome have been derived through consensus and not through evaluation of evidences. It is therefore necessary that validating of this association be supported with high quality evidence.

Short term outcome - need to resuscitation, admission to new-born services and/or NICU, convulsion, delay in oral feeding and duration of hospital stay. Low arterial cord pH was significantly associated with perinatal and long term neonatal outcomes like mortality, hypoxic ischemic encephalopathy, intraventricular haemorrhage or periventricular leukomalacia and cerebral palsy [2]. No such study has been conducted in this part of India, though there is high prevalence of LSCS, birth asphyxia and high rates of SNCU admission. As a result, this study attempts to correlate umbilical arterial blood gas parameters with the short-term outcome of newborns.

Methodology

This prospective observational cohort study was carried out between July 2017 and July 2018 at the Department of Paediatrics, MLB Medical College, Jhansi, on all term neonates delivered by cesarean section and normal vaginal birth to a high risk mother

based on the Neonatal Resuscitation Programme (NRP). The ethics committee approved the study, and parents provided informed consent. There were 120 neonates in all, divided into two groups: 1) Group I (52 cases) consist of neonates with umbilical cord pH less than 7.2, whereas Group II (68 cases) consist of neonates with umbilical cord pH more than 7.2.

Inclusion Criteria

- Baseline fetal heart rate <110/mm, variability <5 bpm
- Meconium stained amniotic fluid.
- All high risk pregnancies
- Elderly primi (>30 years)
- Short statured primi (<140cms)
- Malpresentation
- APH, threatened abortion
- Preeclampsia/eclampsia
- Anemia
- Twins, polyhydramnios
- Previous still birth, IVD
- Elderly grand multipara
- Prolonged pregnancy >14 days of EDD
- H/o previous LSCS or instrumental delivery
- Pregnancy associated with diseases like CVS, kidney, diabetes,
- TB, liver diseases.

Exclusion Criteria

- Prenatal infection, any major congenital anomaly.
- Intrauterine fetal death
- Patient refusal

Statistical Analysis

Data will be analysed by Epi info version 18, x2 test, Mann-Whitney and Spearman test will be used. p less than 0.05 was considered as being significant.

Sample Collection & Investigations

An about 20-cm piece of cord must be separated between two sets of two clamps immediately after birth, ideally before the baby's first breath. The acid-base characteristics of clamped cord blood remain stable at room temperature for 60 minutes after being separated from maternal/neonatal circulation. To get blood for examination, the cord section is first cut between the two clamps at either end, allowing the clamped segment to be removed from the baby's close vicinity. Needle aspiration is used to collect arterial blood into a preheparinized syringe. Within 30 minutes of birth, the samples will be analysed by an ABG analyzer (Gem Premier, USA).

Blood was drawn from the cord and placed in the analyzer. The analyzer draws blood into a measuring chamber equipped with

an iron selective electrode (i.e. electrodes that sensitive only to measurement of interest).

The pH electrode compares an electrode tip potential to a reference potential; the resultant voltage is proportional to the concentration of hydrogen ions, [H+].

The pCO₂ electrode is a pH electrode with a Teflon or silicone rubber CO₂ semi permeable membrane covering the tip. CO₂ combines with H₂O in the space between the membrane and the electrode tip to produce free hydrogen ions in proportion to the partial pressure of CO₂. The voltmeter, although actually measuring [H+], is calibrated in pCO₂.

For pO₂, oxygen permeates a polypropylene membrane and reacts chemically with a phosphate buffer. The O₂ combines with water in the buffer, producing current in proportion to the number of oxygen molecules. The current is measured and expressed as partial pressure of oxygen.

The blood is immediately ejected into a trash receptacle after measurement, and the sample passage is cleaned in preparation for the next sample. The results can be printed, displayed, or sent to the Laboratory Information System.

Short Term Outcomes Were Noted

- Need to Resuscitation: Resuscitate neonates with meconium stained amniotic fluid, lack of spontaneous or effective respiratory effort and lack of appropriate muscular tone.
- Need to being admitted to neonatal ward or NICU: Neonates who required positive pressure ventilation will be admitted to SNCU and/or NICU.
- Convulsion: Diagnosis of convulsion made by clinical observation. All neonates with convulsion will be admitted and treated in neonatal ward or NICU.
- Encephalopathy: Any asphyxiated neonate with neurologic signs and symptoms defined and classified based on the Sarnat and Sarnat staging system.
- Delayed Start of Oral Feeding and/or Feed Intolerance: Because of feed intolerance or respiratory distress, oral feeding started after stabilization. All neonates admitted to the NICU will be kept NPO and on IV fluid till stabilization.
- Hospital Stay: This period is calculated from birth to discharge and declared as days.
- Death: Any cases of death in both groups will be recorded.
- Babies were followed for maximum 28 days or 7 days after discharge.

Results

This prospective observations cohort study was conducted on 120 term neonates delivered by cesarean sections or normal vaginal delivery of high risk mother based on neonatal resuscitation program (NRP). 52 had a pH less than 7.2 and 68 had a pH more than 7.2 (Table 1).

Male babies were higher than female babies in both acidemic

Table 1: Distribution of cases according to pH value.

pH value	No. of cases	Percentage
6.6-<6.7	1	0.83
6.7-<6.8	1	0.83
6.8-<6.9	1	0.83
6.9-<7.0	3	2.5
7.0-<7.1	24	20.0
7.1-<7.2	22	18.33
7.2-<7.3	33	27.5
7.3-<7.4	30	25.0
7.4-<7.5	1	0.83
7.5-<7.6	2	1.66
7.6-<7.7	2	1.66
Total	120	100
Median (Range)	7.223 (6.69-7.65)	

Table 2: Distribution of cases according to sex and mode of delivery.

	Group 1 pH<7.2		Group 2 pH>7.2		Chi square value	P-value and significance
	No.	%	No.	%		
Gender						
Male	29	56.0	40	59.0	2.516	0.133
Female	23	44.0	28	41.0		
Total	52	100	68	100		
Mode of delivery						
LSCS	38	73.08	48	77.42	7.110	0.0077 (HS)
NVD	14	26.92	20	22.58		
Total	52	100	68	100		

Table 3: High risk factors in mother.

High risk factor	Group 1	Group 2	%	Chi square value	P-value
	pH<7.2	pH>7.2			
Fetal distress	6	4	8		
Meconium	12	16	23		
Stained liquor				10.64	0.322
Antepartum haemorrhage	5	4	11		
Malpresentation	4	8	10		
Anemia	14	18	26		
Twin pregnancy	2	0	1.6		
Prolonged pregnancy	2	1	2.5		
Eclampsia/Preeclampsia	1	11	10		
Diabetic mother	1	0	0.8		
Previous LSCS	3	5	6.6		
Elderly Primi	2	1	2.5		
Total	52	68	100		

and non academic group. LSCS delivery were higher in both groups (73.08%) in group I (pH <7.2) and (77.42%) in group 2 (pH >7.2). On statistical analysis it has significant correlation between mode of delivery and cord blood ABG (Table 2). The most common risk

Table 4: Distribution of weight (kg) of new-born and gestational age (wks) of study group (n=120).

	Group I (pH<7.2)	Group II (pH>7.2)	z	P value
Weight (mean±SD) (Kg)	2.6185±0.56308	2.4810±0.34753	1.646	0.102
Gestational age (mean±SD) (wks)	39±1	38±1		

Table 5: Comparison of ABG parameters in the two neonatal groups with normal and abnormal cord ABG.

ABG parameters (mean±SD)	Group I (pH<7.2)	Group II (pH>7.2)	p value
pH	7.073±0.101	7.309±0.0085	0.001
PO ₂ (mmHg)	11±6	14±8	0.001
PCO ₂ (mmHg)	63.7±13.7	52.1±7.9	0.001
B.E mmol	-11.85±4.920	-7.44±5.371	0.001
Bicarbonate (mean±SD)	21.36±3.54	24.13±3.25	0.001

Table 6: Distribution of cases according to NICU admission with pH.

NICU admission	Group I (pH<7.2)		Group II (pH>7.2)		Chi square value	p value
	No.	%	No.	%		
NICU admission						
Yes	25	48.07	4	5.88	28.626	<.0001HS
No	27	51.93	64	94.12		
Total	52	100	68	100		
Convulsion						
Yes	11	21.15	3	4.41	8.015	0.005 S
No	41	78.85	65	95.59		
Delay in attaining full feed						
Yes	26	50.0	4	5.88	31.131	<0.001 HS
No	26	50.0	64	94.12		
Need of Resuscitation						
Needed	30	57.69	7	10.29	31.041	<0.001 HS
Not needed	22	42.31	61	89.71		
Total	52	100	68	100		
Encephalopathy						
Present	15	28.85	4	5.88	11.60	<0.001 HS
Absent	37	71.15	64	94.12		
Total	52	100	68	100		

Table 7: HIE grading between the groups.

Grading of HIE	Group I (pH<7.2)	Group II (pH>7.2)
HIE I	2	1
HIE II	11	3
HIE III	2	0

factors in mother is anemia (26%) and MSL (23%) (Table 3). All the cases were full term babies and have normal birth weight (Table 4).

The mean pH level in group I was 7.073±0.101 in comparison to group II i.e. 7.309±0.0085. Mean PO₂ level was 11±6 and in group II

Table 8: Showing the duration of hospital stay.

Duration of hospital stay (days)	Group I (pH<7.2)	Group II (pH>7.2)	%	Chi square value	p value and significance
1	9	20	29		
2	15	33	48		
3	3	12	15		
4	6	0	6	36.437	<0.0001 HS
5	6	0	6		
6	4	1	5		
7	4	0	4		
8	4	1	5		
10	0	1	1		
20	1	0	1		
Total	52	68	120	t_value	
(Mean±SD)	3.961±3.199	2.15±1.479		4.138	<0.001 HS

Table 9: APGAR score in one and five minute with pH.

	Group I (pH<7.2)	Group II (pH>7.2)	%	Chi square value/z value	p value and significance
Apgarscore in 1 minute					
3	6	1	7	33.057	<0.0001
4	16	5	21		
5	8	1	9		
6	3	9	12		
7	4	20	24		
8	12	26	38		
9	3	6	9		
Total	52	68	120		
mean±SD	5±2	8±1		5.019	<0.001 HS
Apgar score in 5 minutes					
5	2	1	3	33.057	<0.0001 Significant
6	10	3	13		
7	9	1	10		
8	7	10	17		
9	19	44	63		
10	5	9	14		
Total	52	68	120		
mean±SD	7.88±1.437	8.70±0.964		4.009	<0.001 HS

it was 14±8. Mean PCO₂ in group I was 63.7±13.7 while in group II it was 52.1±7.9. Mean bicarbonate was 21.36±3.54 and in group II it was found to be 24.13±3.25. On statistical analysis difference between pH, PCO₂, PO₂, BE and bicarbonate was significant (Table 5).

In group I (pH<7.2), 57.69% (30 out of 52 cases) neonates were needed resuscitation while in group II (pH>7.2) only (10.29) (7 out of 68) cases were need resuscitation. On statistical analysis p<0.05 that shows significant relationship between cord blood pH and need of resuscitation (Table 6). In group I (pH<7.2) 48.07% (25 out of 52) were admitted in NICU while in group II (pH>7.2) 5.88% (4 out of 68) neonates were admitted in NICU. On statistical analysis p<0.05 which shows significant relationship between cord blood pH and need of NICU admission.

In group I (pH <7.2) 15 cases (28.85%) present with encephalopathy while in group II (pH>7.2) only 4 cases (5.88%) having encephalopathy. On statistical analysis there is significant relationship with encephalopathy and cord blood pH. Signs of HIE often had been presented during first hours or days after birth. Some patient presented with mild signs such as decreased alertness irregular respiratory efforts and hypotonicity along with normal pupillary reflex (Table 6).

In group I (pH <7.2) 11 cases (21.15.0%) had convulsion while in group II (pH>7.2) only 3 cases (4.41%) had convulsion. On statistical analysis there is significant relationship between convulsion and acidosis. Convulsive disorders as sign of moderate encephalopathy had been presented more in neonates who had acidosis in 24 to 48

Table 10: Distribution of cases according to death and pH.

Outcome	Group I (pH<7.2)		Group II (pH>7.2)		Chisquare value	p value and significance
	No.	%	No.	%		
Discharge	50	96.15	68	100	2.66	0.103
Expiry	2	3.85	0	0		
Total	52	100	68	100		

hours after birth (Table 6). In group I (pH <7.2) 26 cases (50.0%) had delayed in attaining oral feed until an hour while in group II (pH >7.2) only 4 cases (5.88%) cases had delay in attaining oral feed until an hour. On statistical delayed in attaining full feed and pH of baby have significant correlation (Table 6).

HIE is significantly high in study group 1 (pH <7.2) (Table 7). In group I Mean duration of hospital stay in academic neonates was 3.961 ± 3.199 days. In academic neonates the length of hospital stay had reverse relationship with umbilical cord pH. While in group II mean duration of hospital stay is 2.15 ± 1.479 . on statistical analysis there is significant relationship between duration of hospital stay and pH. In group I (pH <7.2) had significantly long stay of hospital as compared to group II (pH >7.2) (Table 8).

Baby with cord blood pH <7.2 had mean APGAR score of 5.60 ± 1.963 and baby with cord blood pH >7.2 had mean APGAR score of 8.70 ± 0.964 at 1 minute of birth (Table 9). Baby with cord blood pH <7.2 had mean APGAR score of 7.88 ± 1.437 and baby with cord blood pH >7.2 had mean APGAR score of 8.70 ± 0.964 at 5 minute of birth. On basis of statistical analysis APGAR score is significantly correlated with cord blood pH (Table 9).

2 neonates who had severe acidosis were intubated, one of them expired within 24 hours and another one was expired on day 20 of admission, due to HIE III. Only 2 babies of group I expired and there was no demise from group II. On statistical analysis there is no significant correlation between death and pH (Table 10).

Discussion

This study has been carried out for comparison of outcome in normal and abnormal umbilical cord pH groups, showed that outcomes including need to resuscitation, encephalopathy, convulsion, NICU admission and duration of hospital stay, delay in commencement of oral feeding in abnormal umbilical cord pH group are more common than in normal umbilical cord pH group. Male babies were higher than female in both academic and non academic groups. As in current scenario people are more possessive for their male child in comparison to female child, this could be a reason for more male babies in our study population.

In group I (pH <7.2), almost 57% cases (30 out of 52) needed active resuscitation while in group II (pH >7.2) only 10% cases (7 out of 68 cases) were resuscitated. Ahmandpor-Kacho et al., (2015) observed the outcome of 120 high risk new-born. 42 babies among 60 belonging to group I (pH < 7.2) needed resuscitation against 13 in the other group with pH > 7.2. They concluded that pH of 7.2 can be taken as cut off for determining the prognosis of short term outcome in neonates [17].

In the current study, 48% of cases in Group 1 required NICU

hospitalisation, whereas only 6% of cases in Group II required NICU admission. On statistical analysis, the relationship between NICU admission and pH of cord blood ABG is highly significant. Rogers et al., (2014) showed similar observation that among those with pH > 7.2 only 36.36% babies needed NICU admission while all required NICU admission when the pH was between 6.80 and 7.02 [18].

According to the current study, 21.66% of those in group I experienced convulsions, while only 47% of those in group II had convulsions. On statistical analysis, there was a significant link between convulsion and pH of cord blood ABG ($p < 0.05$). The study also shows that in group I, 15 individuals (28%) had encephalopathy, but just 4 cases in group II had encephalopathy. On statistical analysis, there was a significant link between encephalopathy and the pH of cord blood ABG ($p < 0.05$). Ahmandpor-Kacho et al., (2015) demonstrated that in academic group 17 (28.3%) cases had encephalopathy but in non academic group only 4 (6.7%) cases were encephalopathic with a calculated risk ratio of 4.25. So there was significant relationship between encephalopathy and perinatal acidemia ($p = 0.002$) [17]. Goldaber et al. (1991) investigated the link between umbilical arterial acidosis and neurologic complications (encephalopathy and seizures) [19]. The cut-off value at which seizures become more likely was pH < 7.05 and for unexplained seizures pH < 7.0. They suggested that realistic value for defining pathological acidemia was pH < 7.0. Neonatal death was much more likely at pH < 7.0.

In present study, 2 babies of group I (pH <7.2) with pH 6.5 and 6.7 died due to HIE III and there was no demise in group II (pH > 7.2). In our study group I, 26 cases (50%) had delayed in attaining oral feed initiation until an hour, in group II, only 4 cases (6%) had delay in attaining oral feed. Because of feeding intolerance, abdominal distension, or respiratory disorder encephalopathy, oral feeding started after stabilization till that all neonates admitted to NICU were kept NPO and IV fluid was administered. On statistical analysis delay in oral feed initiation attaining an hour and pH of cord ABG had significant correlation. Similar results were also found in the study by Ahmandpor-Kacho et al., (2015), they correlated pH with delay in starting feed. 48% babies in academic group had delay in oral feeding and only 17.7% had delay in oral feeding in non academic group [17].

In current study the mean duration of hospital stay in group I was 3.96 ± 3.199 days while in group II it was 2.15 ± 1.479 days. This is almost similar to study by b in their study the mean duration of hospital stay in group I (pH < 7.2) was 3.78 ± 3.07 days while in group II non academic group 2.28 ± 0.98 days [17].

In this study, mean Apgar score at 1 min in group I was 5 ± 2 and in group II was 8 ± 1 . Mean Apgar score at 5 min in group I was 8 ± 1 and in group II was 9 ± 1 . On statistical analysis p value is <0.05 which had significant relationship with cord blood pH. According to the study by Kanani et al., (2016) most of the patients (11 out of 12) having Apgar score at <7 at birth are academic and all the patients having Apgar score <7 after 5 minutes (6 out of 6) have pH < 7.25, $PCO_2 > 50$ and $PO_2 < 40$. There is a significant relationship between umbilical cord pH, PCO_2 , PO_2 and the selected neonatal outcomes like Apgar less than 7 at 5 minutes [20].

In our study it was found that babies in group I (had more incidence of adverse outcome like need for resuscitation, NICU

admission, encephalopathy, convulsion, delay to start oral feeding, more hospital stay, low Apgar score in comparison to non acidemic group. This implies that babies with a cord blood pH should be carefully monitored during the entire neonatal period. This finding is similar to study done by Ahmandpor-Kacho et al., (2015) [17]. Therefore, an umbilical cord pH less than 7.2 immediately after birth can be used as a prognostic factor for predicting unfavourable short term outcomes in new-borns. Study by Knutzen et al., (2015) discovered that variables other than pH and base deficiency influence new-born outcomes [21]. These included glutamate receptors, oxygen and nitrogen reactive species, hereditary variables, and obstetrics outcomes. These require more investigation.

This might be the rationale to why babies with almost similar cord blood gas values have different outcomes, as because outcomes depends not only one factor. In current study there is indirect correlation of umbilical cord pH with adverse outcome because it indicate intrauterine, intrapartum, compromise of baby.

Conclusion

The current research was designed and carried out in the department of paediatrics at MLB Medical College in Jhansi from July 2017 to July 2018. 120 new-born babies delivered to high-risk mothers were enrolled. Among high risk factor in mother Anemia and meconium stained liquor are the most common high risk factors in both group of mother. LSCS was the most preferred mode of delivery in high risk pregnancies. Term neonates born to high risk mother with cord pH <7.25 have an increased need for resuscitation, NICU admission, delay in attaining full feeds, when compared to those with pH > 7.25. There is significant correlation between cord blood pH and incidence of convulsions and encephalopathy in term new-born. In high risk new-borns, the median cord blood pH is significantly lower in those who required resuscitation, NICU admission, delay in feeding, convulsion, encephalopathy. There is no significant correlation between death and cord blood pH. Most of high risk term babies showing acidemia in umbilical cord arterial ABG. The pH of umbilical cord arterial blood was shown to be inversely related to a poor neonatal outcome.

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