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## A CLINICAL STUDY OF HYPOXIC ISCHEMIC ENCEPHALOPATHY AND ITS CORRELATION WITH UMBILICAL CORD BLOOD pH

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### ABSTRACT

**Introduction:** Birth asphyxia is the most common cause of mortality and morbidity in new borns. Asphyxia can cause damage to almost every tissue and organ of the new born baby secondary to hypoxia.

**Objective:** To study the neurological signs in term neonates with Hypoxic Ischemic Encephalopathy that appear following asphyxia and correlation of conventional umbilical cord blood pH.

**Materials and Method of study:** A prospective case control study was conducted in term babies from which 60 cases of birth asphyxia and 30 cases of normal newborn delivered in Rajah Muthiah Medical College, and Hospital, Chidambaram over a period of 1 year. Immediately after birth, blood was drawn from clamped umbilical cord, and sent for ABG analysis and parameter was pH observed.

**Results:** Increased risk of seizures, mortality was associated with severe birth asphyxia with decreased umbilical arterial pH.

**Conclusion:** pH < 7, was significantly associated with neurological outcome.

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### INTRODUCTION

Hypoxic-ischemic encephalopathy is the brain injury caused by oxygen deprivation to the brain. The newborn's body can compensate for brief periods of depleted oxygen, but if the asphyxia lasts too long, brain tissue is destroyed. Impairment can include epilepsy, developmental delay, motor impairment, neuro-developmental delay, and cognitive impairment. Perinatal depression leads to diminished exchange of oxygen and carbon dioxide and severe lactic acidosis<sup>1</sup>.

During the past decade umbilical blood gas analysis has increasingly been recognized as the most reliable indicator of fetal oxygenation and acid base condition at birth. The diagnosis of asphyxia mandates the presence of severe cord blood acidemia and normal values refutes the diagnosis. As it can provide important information about past, present and possibly the future condition of infant it is considered as the gold standard objective for the assessment of intrauterine asphyxia.

### MATERIALS AND METHOD OF STUDY

A prospective case control study was conducted in term babies from which 60 cases of birth asphyxia and 30 cases of normal newborn delivered in Rajah Muthiah Medical College and Hospital, Chidambaram over a period of 1 year. Immediately

after birth, blood was drawn from clamped umbilical cord, and sent for ABG analysis and cord blood pH was observed.

#### Inclusion criteria

Controls - Singleton, live born neonates of Gestational age > 37 weeks without evidence of fetal distress and HIE.

- Cases - Singleton, live born neonates of Gestational age > 37 weeks with Evidence of fetal distress and delayed cry after birth presenting with signs and symptoms of HIE.
- Those needing resuscitation at birth
- Low APGAR score <5 after 1 minute or 5 minutes after delivery or well defined episode of fetal distress like,

Fetal bradycardia/tachycardia (HR <110 bpm/>150 bpm respectively)

Reduce baseline variability

Decelerations and absence of accelerations on cardiotocogram

#### Exclusion criteria

- Evidence of congenital heart disease, traumatic cerebral injuries, hydrocephalus or infection.
- Those neonates born with major congenital anomaly.

All these infants were graded clinically into stages of hypoxic ischemic encephalopathy based on Sarnat and Sarnat classification without the electro-encephalographic criteria.

**METHODOLOGY**

Umbilical artery is identified on the cut section of the cord which is doubly clamped. A syringe of 2ml, flushed with 1/1000 of heparin solution is advanced into the artery and 1ml of blood is collected. Sample is kept air free and transported for analysis in ice packs within thirty minutes of collection. Analysis is done by AVL Compact 3 analyzer

**Statistical analysis**

Data was analysed by Student t test, Chi-square test and p value of <0.05 was considered significant

**RESULTS**

**Table 1** Distribution of cases and controls based on umbilical arterial pH values

pH level	Case		Control	
	N	%	N	%
<6.80	12	20.0	0	0
6.81-6.90	14	23.3	0	0
6.91-7.00	15	25.0	0	0
7.01-7.10	8	13.3	0	0
7.11-7.20	8	13.3	3	10.0
7.21-7.30	3	5.0	23	76.7
>7.31	0	0	4	13.3
Total	60	100.0	30	100.0

X2 – 68.240, p<0.000

By applying ACOG<sup>2</sup> CRITERIA, >95% cases were acidosis at birth. Majority of controls had pH >7.2. only 3 neonates among controls had acidosis with pH <7.2

**Table 2** Seizures and umbilical arterial pH in study cases

pH level	Seizures				Total	
	Present		Absent			
	N	%	N	%	N	%
<6.80	7	21.9	5	17.9	12	20.0
6.81-6.90	9	28.1	5	17.9	14	23.3
6.91-7.00	9	28.1	6	21.4	15	25.0
7.01-7.10	5	15.6	3	10.7	8	13.3
7.11-7.20	1	3.1	7	25.0	8	13.3
7.21-7.30	1	3.1	2	7.1	3	5.0
Total	32	100.0	28	100.0	60	100.0

X2 – 0.175, p=0.208

Majority of cases with seizures had a pH of <6.9s

**Table 3** Neonatal mortality and umbilical arterial pH level in study cases

pH level	Death				Total	
	No		Y			
	N	%	N	%	N	%
<6.80	10	17.5	2	66.7	12	20.0
6.81-6.90	14	24.6	0	.0	14	23.3
6.91-7.00	14	24.6	1	33.3	15	25.0
7.01-7.10	8	14.0	0	.0	8	13.3
7.11-7.20	8	14.0	0	.0	8	13.3
7.21-7.30	3	5.3	0	.0	3	5.0
Total	57	100.0	3	100.0	60	100.0

X2 – 5.263, p=0.385

Among the neonates in the case group all those who died has pH of <6.9. Among controls there was no death.

**Table 4** Mode of delivery in study cases and controls

MOD	Group				Total	
	Case		Control		N	%
	N	%	N	%		
LSCS	42	70.0	13	43.3	55	61.1
NVD	18	30.0	17	56.7	35	38.9
Total	60	100.0	30	100.0	90	100.0

X2 – 5.984, p=0.014

Above table shows that in our study 18 cases were delivered by NVD. Both cases and controls and LSCS in 42 cases and 13 in controls

**Table 5** Type of resuscitation and its outcome

Type of resuscitation	Total	%	Improved	Expired
BMV	39	65.0	39	0
ET	15	25.0	14	1
ET+C	6	10.0	4	2
Total	60	100.0	57	3

Table shows most of the cases needed resuscitation measures. Endotracheal intubation done for 15 cases, ET with chest compression done for 6 cases. BMV done for 39 Cases. In above cases 3 cases were died in stage 3 HIE. Mortality was more in cases with severe birth asphyxia who needed endotracheal intubation.

**DISCUSSION**

Hypoxic Ischemic Encephalopathy is the common cause of hospital admission in newborn

**Different stages of HIE**

Study	Stage I	Stage II	Stage III
Our study n = 60	29(48.3%)	21(41.7%)	06(10%)
N.N. Firmer et al <sup>3</sup> n=95	33 (35%)	48 (50%)	14(15%)
Sarnat and Sarnat etal <sup>4</sup> n=21	7(33%)	9 (43%)	5(24%)

Our study, shows 29 cases (48.3%) in HIE stage I, 21 cases (41.7%) in HIE stage II, 6 cases (10% in HIE stage III, but in the study of N.N. Finner and C.M. Robertson *et al* where, in their study of 33 cases (35%) were in stage-1, 50% were in stage II and 15% were in stage III and in the study by Sarnat and Sarnat *et al*, among 21 cases, 7 (33%) cases were in Stage-1, 9 cases (43%) were in stage-II and one (5%) case were in stage-III.

**Umbilical arterial pH and acidosis**

Study	pH value for acidosis
Our study	<7.2
Goldaber <sup>5</sup>	<7.1
Andres	<7.0
Goodwin <sup>6</sup>	<7.0
Winkler <sup>7</sup>	<7.2

In our study, 31% cases had umbilical arterial pH >7.00 and 69% had pH <7.00 similar to the study done by Goldaber and colleagues<sup>5</sup>, 28% cases had pH of >7.00 and 72% had pH <7.00. On the contrary Winkler and colleagues<sup>7</sup> found a low incidence of cases with pH <7.00, 6.4% and 93.6% had pH >7.00. This low incidence in their study could be explained on the basis, that cases irrespective of evidence of fetal distress were enrolled in the study

## Seizures

### Incidence of seizures

Study	Incidence of seizures
Our study	53.3%
Andres	5.2
Goodwin <sup>6</sup>	1%
Vandenberg <sup>9</sup>	5.5%

Incidence of seizures in our study was much higher at 53.3% when compared with other studies. Lower incidence was seen in study done by Goodwin and co-workers<sup>6</sup> and a higher incidence (10%) in study done by Sehdev and co-workers.<sup>8</sup>

### Seizures and umbilical arterial pH

Our results show significantly increase in incidence of seizures with the decrease in umbilical arterial pH <6.9.

In study done by Goodwin and colleagues<sup>6</sup> the incidence of seizures was 9% in pH between 6.90-6.99 and 80% in pH between 6.61-6.70.

### Neonatal mortality

	Mortality	
	pH<7.00	pH>7.00
Our study	5%	-
Goldaber <sup>5</sup>	5%	1.6%
Andres	4.5%	-
Goodwin <sup>6</sup>	2.3%	-
Vanderberg <sup>9</sup>	23%	1.1%
Naegel <sup>10</sup>	10%	-

### Neonatal mortality and mean umbilical arterial pH

In the present study total about 5% of the neonatal deaths occurred with pH<7.00 where as in other studies much less neonatal death were observed.

## CONCLUSION

Hypoxic Ischemic encephalopathy is probably the most important single cause of neurological disability in newborn infants. It is responsible for many neurological changes, mortality and morbidity in infants. Umbilical cord blood parameters like pH <7.00, is significantly associated in predicting the likelihood of seizures, and mortality. This study shows that the "Pathologic acidemia" is indicated by pH <7.00 rather than <7.20, laid down by ACOG<sup>2</sup>.

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