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A Study to Analyze the Effect of Perinatal Asphyxia on Blood Gas Analysis of Newborns

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Abstract

Aim: To Study and Analyze the Effect of Perinatal Asphyxia on Blood Gas Analysis of Newborns. *Background:* Perinatal asphyxia, neonatal asphyxia, or birth asphyxia is the medical condition resulting from deprivation of oxygen to a newborn infant that lasts long enough during the birth process to cause physical harm, usually to the brain. Hypoxic damage can occur to most of the infant's organs (heart, lungs, liver, gut, kidneys), but brain damage is of most concern and perhaps the least likely to quickly or completely heal. *Materials and Methods:* This was a tertiary care teaching hospital based, prospective case control study conducted on normal full term and full term asphyxiated neonates delivered and admitted in the Neonatal Intensive Care Unit at Adichunchanagiri Institute of Medical Sciences, B.G. Nagara from December 2012 to May 2014. *Results :* In cord blood, the values for pH, base excess, and PO2 means were lower and the values for PCO2 were higher in the group of asphyxiated newborns as expected. All the differences were statistically significant. *Conclusion*: . Within the 18-24 hours of life, there were no differences between the two groups in terms of the values obtained through gas analysis, except for PO2, and base excess which was lower in the group of asphyxiated newborns.

Keywords: NewBorn; Blood Gas; Asphyxia; Umbilical Blood.

Introduction

Asphyxia is a term used to indicate the consequences of complete lack of oxygen as a result of a number of primary causes. Hypoxia refers to decreased arterial concentration of oxygen. Ischemia refers to blood flow to cells or organs that is insufficient to maintain the normal function of the organs. Perinatal asphyxia provokes multiple alterations in the body due to failures in the gas exchange system. Among these alterations we find hypoxia, hypercapnia, and decrease of blood pH, thus causing redistribution of the blood flow from lesser vital organs to more vital organs such as the brain, heart, and adrenal glands [1].

Asphyxia is a lack of oxygen to the body. Asphyxia can have negative effects on all the organs, including the brain.

Asphyxia can occur in the womb, during delivery, or immediately after birth. Lack of oxygen, depending on how severe it is and how long it lasts, can have profound consequences to the brain and the rest of the body. At the same time, most babies can withstand a short period without oxygen without negative short or long-term effects. Most commonly, these short periods occur during labor and delivery or immediately following birth [2].

Brain damage from perinatal asphyxia results most commonly from a drop in maternal blood pressure or some other substantial interference with blood flow to the infant's brain during delivery. This can occur due to inadequate circulation or perfusion, impaired respiratory effort, or inadequate ventilation. Perinatal asphyxia happens in 2 to 10 per 1000 newborns that are born at term, and more for those that are born prematurely [3].

Objectives

To study the pH, PCO2 and PO2 in umbilical cord blood and blood of newborns.

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To find the association compare between pH, PCO2, PO2 among asphyxiated and non-asphyxiated newborns.

Materials and Methods

This was a tertiary care teaching hospital based, prospective case control study conducted on normal full term and full term asphyxiated neonates delivered and admitted in the Neonatal Intensive Care Unit at Adichunchanagiri Institute of Medical Sciences, B.G.Nagara from December 2012 to May 2014. A total of 50 newborns were included and analysed in our study.

The sample size was estimated on the basis of a single proportion design. We assumed the confidence interval of 95% and confidence level of 14.5%. The sample size actually obtained for this study was 50 neonates.

The study was a prospective case control study conducted on normal full term and full term asphyxiated neonates admitted in the Neonatal Intensive Care Unit. A total of 50 neonates on (n=25) normal full term and (n=25) full term asphyxiated neonates who were treated for the diagnosis of perinatal asphyxia were enrolled for the study. Pre Designed Pretested Proforma was ussed for Data Collection.

The study population consisted of full-term asphyxiated newborns (with 1 and 5 minute Apgar scores < 7 were included in asphyxiated newborns) and infants with Apgar score of 7 and above were included as non-asphyxiated group.

Results

A total of 50 newborns were included and analysed in our study. The mean gestational age of the infants was 39.32±1.115 months with average birth weight was 3002.0±1963.9. In our study 54% of the newborns were females. The maternal history of new born among all neonates were 40(80%) Primipara and 10(20%) Multipara respectively.

APGAR score distribution of newborns was at 1 min & at 5 min was 6 &7.5 respectively. Among all neonates delivery methods of new born were 33(66.0%) unassisted, 7(14.0%) forceps, 6(12.0%) emergency caesarean and 4(8.0%) elective caesarean respectively.

The mean values in respect of umbilical cord blood and blood of new born the data regarding pH, PCO2, PO2, Base excess where pH value with mean and standard deviation was 7.04±1.414 & 7.40±2.241 respectively, PCO2 was 53.70±15.832 & 27.94±2.034 respectively, PO2 was 53.70±15.832 & 27.94±2.034 respectively, Base excess was -9.90±6.456 & -4.54±1.669 respectively for all new born babies.

Table 1: Distribution of pH, PCO2, PO2 umbilical cord blood and blood of newborns

		Umbilical cord blood		Blood of newborns	
	Number	Mean±SD	Range	Mean±SD	Range
pH	50	7.04±1.414	(4 -9)	7.40±2.241	(3 - 12)
PCO2	50	53.70±15.832	(33 -76)	27.94±2.034	(24 - 32)
PO2	50	26.10±8.913	(10 - 42)	91.00±18.671	(68 - 113)
Base excess	50	-9.90±6.456	(-21 - -1)	-4.54±1.669	(-9 - -1)

Table 2: Distribution of biochemical indices in umbilical cord blood among asphyxiated and non-asphyxiated term neonates

Umbilical cord blood	Group		P value
	Asphyxiated	Non-asphyxiated	
pH	6.64±1.497	7.44±1.227	0.044
PCO2	68.44±3.110	38.96±7.033	0.000
PO2	22.64±8.495	29.56±8.068	0.005
Base excess	-15.64±3.534	-4.16±1.993	0.000

Table 3: pH and blood gases in the blood of newborns with 18-24 hours of life of asphyxiated and non-asphyxiated neonates

blood of newborns	Group		P value
	Asphyxiated	Non-asphyxiated	
pH	7.36±2.396	7.44±2.123	0.901
PCO2	28.36±2.018	27.52±2.002	0.146
PO2	109.40±1.915	72.60±1.658	0.000
Base excess	-5.44±1.325	-3.64±1.497	0.000

Table 4: Distribution of Hypoxic ischemic encephalopathy (HIE) stage in cases group

HIE Stages	Asphyxiated Newborn (%)
Stage 1	10 (40)
Stage 2	14 (56)
Stage 3	1 (4)
Total	25

Various biochemical indices are compared in respect of Asphyxiated as well as Non-asphyxiated term born infants. These indices have been arrived at after the analysis of umbilical cord blood samples. All factors are statistically significant (p value < 0.05).

Among cases and controls relative magnitude of biochemical indices, like pH value, PCO2, PO2 and base excess in the Blood Sample of new born after 18-24 hours of life were recorded. It has given a comparative value in respect of above indices for both asphyxiated as well as non-asphyxiated new born. Ongoing through the table we find that P value in respect of PO2 and the Base excess are statistically significant whereas values are non-significant in respect of pH and PCO2.

Among all, 25 neonates were normal in control group but among the 25 neonates in the case group, 10 (40%) had mild HIE, 14(56%) had moderate HIE and 1(4%) had severe HIE during the course in NICU.

Discussion

In the present study maximum number of subjects were in Hypoxic ischemic encephalopathy stage 2 which was similar to studies done by Ichiba H et al[4] in 2006 and 2002 [5]. In study conducted by Bhat MA et al [6] in 2009 the maximum number of subjects were in stage 3. In study by Bhat MA et al [6] in 2009, Ichiba H et al [4] in 2006 and 2002 all subjects were either in hypoxic ischemic encephalopathy stage 2 or stage 3. But in all studies there was no statistically significant difference in staging of hypoxic ischemic encephalopathy between cases and controls.

Most other studies had not included neonates with hypoxic ischemic encephalopathy stage 1 in their analysis. In the present study, we have included those neonates in stage 1 hypoxic ischemic encephalopathy as we wanted to evaluate the neuro protective role of thyroid hormone in infants with mild hypoxic ischemic encephalopathy also.

In cord blood, the values for pH, base excess, and PO2 means were lower and the values for PCO2 were higher in the group of asphyxiated newborns as expected. All the differences were statistically significant. Similar observation is also been made in the study by Pereira et al[7] for all the variables except mean PO2.

Within the 18-24 hours of life, there were no differences between the two groups in terms of the values obtained through gas analysis, except for PO2, and base excess which was lower in the group of asphyxiated newborns. Pereira et al [7] reported a similar pattern except a higher PO2 level in asphyxiated newborn as which authors attributed to the use of supplementary oxygen and/or mechanical ventilation in this group, with the highest oxygen supply.

Conclusion

In cord blood, the values for pH, base excess, and PO2 means were lower and the values for PCO2 were higher in the group of asphyxiated newborns, as expected. Within the 18-24 hours of life, there were no differences between the two groups in terms of the values obtained through gas analysis, except for PO2, and base excess which was lower in the group of asphyxiated newborns

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