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Research Article

The strength of correlation between umbilical cord pH and early neonatal outcome

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ABSTRACT

Background: Umbilical artery gas parameters have been used reliably to detect intrauterine asphyxia.
Methods: We analyzed umbilical arterial gas parameters in depressed children and compared it with normal children.
Results: Nearly one third of depressed babies had low pH. Umbilical cord acidosis correlated with increased incidence in seizures (P=0.000), incidence of HIE (P=0.000), risk of intubation (0.001) and thrombocytopenia (0.008). Overall mortality was one fourth, but a significant association could not be ascertained. Also we can confirm that pH less than 7.00 is significant as per AAP and NNF rather than 7.20, defined by ACOG.
Conclusions: We conclude that a decrease in umbilical arterial pH among cases was significantly associated with increased risk of intubation and need for mechanical ventilation, seizures, Hypoxic ischemic encephalopathy.

Keywords: Umbilical arterial pH, Perinatal asphyxia, Early neonatal outcome

INTRODUCTION

Perinatal asphyxia is an insult to the fetus or newborn due to a lack of oxygen (hypoxia) and/ or a lack of perfusion (ischemia) to various organs of sufficient magnitude and duration to produce more than fleeting functional and/ or biochemical changes. It is associated with tissue lactic acidosis. If accompanied by hypoventilation, it also may be associated with hypercapnia.[1]

Inspite of major advances in knowledge of fetal and perinatal medicine and monitoring technology, perinatal asphyxia is one of the significant causes of mortality and long term morbidity. Data from National Neonatal Perinatal database suggests that perinatal asphyxia contributes to almost 20% of neonatal deaths in India.[2] The most widely used methodology of assessment of neonatal outcome, the APGAR scoring is semi objective and is not a reliable indicator of intrauterine asphyxia as well as immediate neonatal morbidity. Umbilical artery / venous blood gas parameters have been used to assess fetal acidaemia and neonatal outcome and is considered as gold standard objective tool for the assessment of intrauterine asphyxia. To date, studies have demonstrated increased risk for several adverse outcome events like seizures, hypoxic ischaemic encephalopathy, need for intubation with acidosis at birth. Conversely, some authors have demonstrated little utility of umbilical blood gas parameters in determination of infants at risk for adverse outcome.

The previous studies which have been carried out are either retrospective case control studies or some prospective studies which are not matched with control groups.[3-5] Hence the present study is an attempt being done to correlate umbilical artery blood gas parameters with various measures of early neonatal outcome.

METHODS

This was a prospective case control study conducted in a tertiary multispecialty hospital during October 2013 to September 2014 after ethics committee approval.

Study population consisted of Singleton, live born, neonates of gestational age >28 weeks with Apnea at birth, heart rate <100/min at birth, requiring resuscitation for more than one minute. Sex matched controls were included. Neonates with gestational age <28 weeks, congenital anomalies, still births were excluded from this study. Immediately after delivery, umbilical cords were clamped on both ends and an arterial blood sample was collected anaerobically in a preheparinized insulin syringe. PH, base excess, carbon dioxide pressure (PCO_2), partial pressure of oxygen (PO_2) and bicarbonate (HCO_3) were measured at 37°C by pH and gas analyzer (ABL 800 BASIC blood gas analyser.). The gas analysis was done in less than 30 minutes after sampling. Umbilical arterial blood sampling is done as it exactly represents the fetal acid base status than umbilical cord venous blood.

RESULTS

Nearly one third of depressed babies had low pH. Umbilical cord acidosis correlated with increased incidence in seizures (P=0.000), incidence of HIE (P=0.000), risk of intubation (0.001) and thrombocytopenia (0.008). Overall mortality was one fourth, but a significant association could not be ascertained. Also we can confirm that pH less than 7.00 is significant as per AAP and NNF rather than 7.20, defined by ACOG.

Table 1: Analysis of umbilical arterial pH with other variables.

Variable	Cases/control		Significant acidosis pH<7		P value <0.05 significant
			Yes	No	
Fetal distress	Case	Yes	9	9	0.066
		No	2	11	
	Control	Yes	0	1	
		No	2	28	
Neonatal outcome HIE	Case	Yes	10	4	0.000
		No	1	16	
	Control	Yes	1	0	
		No	1	29	
Neonatal outcome seizure	Case	Yes	8	1	0.000
		No	3	19	
	Control	Yes	1	0	
		No	1	29	
Need for assisted ventilation	Case	Yes	7	1	0.001
		No	4	19	
	Control	Yes	1	0	
		No	1	29	
Thrombocytopenia	Case	Yes	10	8	0.008
		No	1	12	
	Control	Yes	2	0	
		No	0	29	
Neonatal outcome death	Case	Yes	1	0	0.355
		No	0	30	
	Control	Yes	0	0	
		No	0	31	

DISCUSSION

In our study, among cases mean maternal age was 25.10 ±3.0, mean birth weight was 2662±501. Eighteen (58.1%) were males and 13 (41.9%) were females. As there is no consensus with the definition of acidosis, we used AAP and Recent NNF criteria.[6] A pH of <7 was considered significant acidosis. 35.5% cases had umbilical arterial pH <7 and 64.5% cases had pH >7 comparable to the study done by Winkler et al.[7]

Our results shows Significant increase in incidence of seizure with decrease in umbilical arterial pH (p=0.000) correlating with studies done Andres et al, (p=0.02), Perlman, Risser (p=0.01).[3,13] In study done by Goodwin et al, incidence of Seizure was 9% in pH between 6.90-6.99 and 80% in pH between 6.61-6.70.[5] There was significant difference in PCO_2 (p=0.000) and base excess (p=0.014) between the cases with seizures and without seizures which correlates with studies by Andres et al[and Low et al.[3,4] In our study difference in PO_2 was not significantly associated with seizure (p=0.156) correlating with other studies.[3,4,8,9]

In the present study, HIE newborns were categorized into 3 different clinical stages according to Sarnat and Sarnat staging. [4] (28%) newborns had stage I, 9 (64%) had stage II and 1 (7%) had stage III encephalopathy. Decrease in umbilical arterial pH was statistically significant with increase in incidence of HIE correlating with studies done by Saade et al, Armstrong et al, and Belai et al.[3,10,11] The variations in the proportion of Hypoxic ischemic encephalopathy following perinatal asphyxia were probably due to Lack of generally accepted definition of asphyxia and the inclusion criteria for birth asphyxia are different in different studies. Incidence of intubation and mechanical ventilation in our study was 26% which is similar to the study done by Naegel, Goldaber et al, where as in Perlman and Risser it was found to be high.[12,14] Our results also showed significant increase in risk of intubation and need for mechanical ventilation among cases with decrease in umbilical arterial pH (p=0.001) as suggested by Goldaber et al, and Andres et al.[3,14]

Decrease in umbilical arterial pH was significantly associated with low Apgar score in our study (p=0.002) which was consistent with result of other studies done by Goldaber et al and Vandenberg et al.[14,15] The incidence of thrombocytopenia found in case group was 58%. The reported incidence in our study was similar to study done by Oren et al, Gunn et al, Gluck man et al.[16-18] In our study, out of 11 babies with significant acidosis 1 baby (9%) died. Other studies show varying results.

In our study the association umbilical arterial pH and mortality could not be established so also was in other studies which could be explained on the basis of very less number of deaths in respective studies.[3,19] Birth asphyxia still remains a major cause of morbidity and mortality during neonatal period in India. Overall mortality was 25.49%, which clearly indicates the need for early detection of maternal risk factors, better obstetric management and the prompt resuscitatory measures.

CONCLUSION

There was no significant difference between case and control groups with respect to maternal age, birth weight, and gestational age. The mean umbilical arterial blood gas parameters among cases was, pH of 7.059 , PCO_2 62.84 mmHg, PO_2 19.26 mmHg, HCO_3 - 14.26 mEq/l, Base excess -13.67 mmol/l. The mean umbilical arterial blood gas parameters among controls was, pH 7.271, PCO_2 44.24 mmHg, PO_2 43.90 mmHg, HCO_3 - 21.37 mEq/l, Base excess -3.48 mmol/l. According to AAP criteria, used in our study 35.5 % of cases had significant acidosis i.e. umbilical arterial pH <7. Decrease in umbilical arterial pH among cases was significantly associated with increased risk of intubation and need for mechanical ventilation, seizures, Hypoxic ischemic encephalopathy. There was no significant association between pH, PCO_2, PO_2, base excess and adverse neonatal outcome in controls.

Significant number of depressed babies has significant acidosis. Umbilical arterial pH <7, high PCO_2 and Base excess are significantly associated in predicting the likelihood of intubation, seizures, HIE. Umbilical arterial PO_2 levels are of little clinical utility. Though significant acidosis pH <7 can predict morbidity, it could not predict the mortality. Mortality is based on supportive care for multiorgan dysfunction after birth and it varies between institutions to institution. This present study shows that the "Pathologic acidemia" is indicated by pH <7 as suggested by AAP and recent NNF guidelines rather than <7.20, laid down by ACOG.

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