

## Original Research

### To observe the impact of delivery method on the acid-base balance of the umbilical cord arteries in full-term newborns

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#### ABSTRACT:

**Aim:** To observe the impact of delivery method on the acid-base balance of the umbilical cord arteries in full-term newborns. **Materials and Methods:** 100 singleton term neonates were divided into two groups: (group I) includes vaginal delivery (NVD) and (group II) non-emergency cesarean section (LSCS) under spinal anesthesia. In both the groups, after fetal birth, umbilical cord blood samples were taken by an obstetrician. The sampling from umbilical artery was provided immediately after birth with clamping of two ends of a segment of the umbilical cord. Umbilical cord blood gas analysis was performed for the umbilical artery and vein. **Results:** In the present study, a total of 100 infants entered into two groups. With regard to their gender, 58 (58%) and 42 (42%) of infants were male and female, respectively. Male were found in majority in both the groups. The mean gestational age and weight in the two groups, NVD and LSCS, were (39.88±1.16 weeks, 38.12±0.89 weeks) and (3.31±0.22 Kg., 3.21±0.35kg) respectively, and there was no statistical difference between the two groups. In vaginal delivery and cesarean section delivery newborns, the average umbilical artery pH was 7.32±0.12 and 7.41±0.11, respectively. The mean level of PO<sub>2</sub> was 19.15±2.45 in NVD group and 18.11±3.27 in LSCS group. In NVD and LSCS groups, the mean levels of pCO<sub>2</sub> were 48.21±2.43 and 43.21±3.44, respectively. Mean level of HCO<sub>3</sub> in NVD and LSCS group was 20.44±2.17 and 21.88±1.32, respectively. **Conclusion:** To accurately assess the prognosis of neonates experiencing stress during delivery, it is advisable to carefully measure the umbilical artery blood pH levels. This should be done for both vaginal births and caesarean sections, particularly in cases of stressful deliveries.

**Keywords:** NVD, LSCS, Blood Ph, HCO<sub>3</sub>

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#### INTRODUCTION

Childbirth refers to the procedure of expelling a baby, together with the placenta, membranes, and umbilical cord, either via the vaginal route or by a cesarean section. Vaginal delivery refers to the process of giving birth via the natural birth canal, using the inherent strength of uterine contractions. A Cesarean section, also referred to as a C-section, is a surgical procedure in which an incision is made through the mother's abdomen (laparotomy) and uterus (hysterotomy) to facilitate the delivery of one or more infants. There are two basic categories of cesarean section: primary and secondary.[1] Cesarean section (CS) rates have increased in both developed and developing world in the course of recent decades.

[2,3] Developed nations have seen an exceptional ascent in cesarean section from 1996 to-2011.[4] The developing countries also have seen a comparative ascent. Nations in south-east Asia and sub-Saharan Africa have recorded increment in cesarean section rates however they vary generally from one nation to the other. [5,6] The intrapartum acid-base status of the fetus is a significant component in setting up the connection between intra partum event and neonatal condition. Since all strategies for evaluating the acid-base condition during delivery, (for example, fetal heart rate following and direct pH appraisal from the fetal scalp) have a disappointingly low prescient value, umbilical cord artery blood gas levels are accepted to be the best portrayal of the fetal acid-base

status right away. In clinical practice, an umbilical cord artery blood gas investigation isn't in effect routinely performed on all infants. Rather, an umbilical cord artery blood gas examination was commonly carried out only in high-risk deliveries, as brought out by both the 1994 American College of Obstetrics and Gynecology Committee Opinion on Obstetric Practice and the 1993 Royal College of Obstetrics and Gynecology Study Group on Intrapartum Fetal Surveillance. [7,8] Intra-womb acid-base balance plays an imperative role in shaping the relationship amid the events encompassing the delivery and fetal asphyxia.[9] Constrained investigations with different results have been conducted in this area. [10,11] However, due to the high rate of cesarean section prevalence both in developed and developing nations, the current examination was attempted with the plan to contemplate the impact of mode of delivery on umbilical cord artery acid-base balance.

**MATERIALS AND METHODS**

100 singleton term neonates were divided into two groups: (group I) includes vaginal delivery (NVD) and (group II) non-emergency cesarean section (LSCS) under spinal anesthesia.

**INCLUSION CRITERIA**

- 37-42 weeks of gestation
- Babies cried immediately after birth
- Birth weight >2500 gms
- Postnatal course was uneventful
- Those who have signed the informed consent

**RESULTS**

**Table 1: Gender wise distribution of the comparison groups**

Variables		Gender		Total
		Female	Male	
Groups	NVD	19	27	46
		45.24%	46.55%	46%
	LSCS	23	31	54
		54.76%	53.45%	54%
		42	58	100
Total		100.0%	100.0%	100.0%

Table 1: In the present study, a total of 100 infants entered into two groups. With regard to their gender, 58 (58%) and 42(42%) of infants were male and female, respectively. Male were found in majority in both the groups.

**Table 2: Mean gestational age and birth weight in comparison groups**

Groups	NVD (N=46)	LSCS (N=54)
	Mean ± SD	Mean ± SD
Gestational age (weeks)	39.88±1.16	38.12±0.89
p-value	0.06 (NS)	
Birth weight (Kg.)	3.31±0.22	3.21±0.35
p-value	0.07(NS)	

Table 2: The mean gestational age and weight in the two groups, NVD and LSCS, were (39.88±1.16weeks, 38.12±0.89 weeks) and (3.31±0.22 Kg., 3.21±0.35kg) respectively, and there was no statistical difference between the two groups.

**EXCLUSION CRITERIA**

- Neonates delivered through emergency cesarean section.
- Mothers having any antenatal risk factor Ethical approval and Informed consent

The study protocol was approved by the Institutional Ethical Committee.

**METHODOLOGY**

In both the groups, after fetal birth, umbilical cord blood samples were taken by an obstetrician. The sampling from umbilical artery was provided immediately after birth with clamping of two ends of a segment of the umbilical cord. Umbilical cord blood gas analysis was performed for the umbilical artery and vein. If the umbilical artery of the umbilical vein was difficult to distinguish, two samples were taken, one sample from vein and another from umbilical artery, to distinguish artery from vein. Umbilical cord blood was collected using a syringe flushed with heparin after the umbilical cord was ligated. The umbilical cord was ligated closer to the fetus with a Kelly clamp after delivery at a length of 5-10 cm and 10 cm from the fetus. About 3 cc amount of umbilical arterial and venous blood was sampled with the syringe, and gas analysis was performed within 60 minutes after delivery.

**STATISTICAL ANALYSIS**

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages and means. Statistical test applied for the analysis were chi-square test and student t-test.

**Table 3: Comparison of ABG analysis between the groups**

Groups	NVD (N=46)	LSCS (N=54)
	Mean $\pm$ SD	Mean $\pm$ SD
pH	7.32 $\pm$ 0.12	7.41 $\pm$ 0.11
p-value	0.001	
pO <sub>2</sub>	19.15 $\pm$ 2.45	18.11 $\pm$ 3.27
p-value	0.23	
pCO <sub>2</sub>	48.21 $\pm$ 2.43	43.21 $\pm$ 3.44
p-value	0.02	
HCO <sub>3</sub>	20.44 $\pm$ 2.17	21.88 $\pm$ 1.32
p-value	0.22	

Table 3: In vaginal delivery and cesarean section delivery newborns, the average umbilical artery pH was 7.32 $\pm$ 0.12 and 7.41 $\pm$ 0.11, respectively. The mean level of PO<sub>2</sub> was 19.15 $\pm$ 2.45 in NVD group and 18.11 $\pm$ 3.27 in LSCS group. In NVD and LSCS groups, the mean levels of pCO<sub>2</sub> were 48.21 $\pm$ 2.43 and 43.21 $\pm$ 3.44, respectively. Mean level of HCO<sub>3</sub> in NVD and LSCS group was 20.44 $\pm$ 2.17 and 21.88 $\pm$ 1.32, respectively.

## DISCUSSION

Vaginal delivery is generally considered the optimal and typically least problematic method of childbirth. However, the prevalence of caesarean sections is causing a decline in the rate of natural childbirth. Globally, there has been a consistent rise in the prevalence of caesarean sections, without any justifiable explanation. [12] Carbon dioxide diffuses readily across the placenta. Fixed acids such as lactic acid and b-hydroxybutyrate, which account for the majority of the metabolic load, have a relatively slow passage across the placenta. [13] It is important to evaluate both the respiratory and metabolic components of each sample. There is no universal concurrence on the definition of acidosis with different countries reporting cut-off values from between pH 7.10 to 7.00. Our study showed that umbilical artery blood pH values among newborns from both of NVD and LSCS groups were in normal range. Mean pH and CO<sub>2</sub> levels varied significantly between the groups. This was found in agreement with the study conducted Lynn A (2007) reported newborn's arterial-cord pH values at birth after an elective caesarean section group are significantly better than the results obtained after a normal vaginal delivery. [14] When uterine contractions begin with the onset of labor, maternal blood flow to the placenta becomes intermittently strangulated once the intrauterine pressure exceeds 30 mmHg [13]. However, under normal circumstances, studies have shown that the umbilical artery blood flow is not adversely affected by uterine contractions [15,16] but all fetuses born vaginally show a fall in pH including increase in pCO<sub>2</sub>, which is more pronounced during the second stage of labor and during delivery. [17,18] On the other hand, infants born by elective caesarean section have been shown to have higher pH values reflecting the lack of a strenuous vaginal delivery.

## CONCLUSION

To accurately assess the prognosis of neonates experiencing stress during delivery, it is advisable to carefully measure the umbilical artery blood pH levels. This should be done for both vaginal births and

caesarean sections, particularly in cases of stressful deliveries. A prospective investigation might examine the association between immediate pH levels and the enduring neurological consequences.

Moreover, it would be intriguing to establish the precise threshold for the pathogenic pH.

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