Original Research Article

The effect of mode of delivery on umbilical cord artery acid-base balance among term neonates: an observational study

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Abstract

Background: Abnormal umbilical cord pH can be indicated distress imposed on newborns and can also be useful in determining the prognosis of the newborn. Objective: to study the effect of mode of delivery on umbilical cord artery acid-base balance among term neonates. Materials and methods: The present prospective analytical cross-sectional study was conducted in the Department of Pediatrics, Military Hospital Dehradun, India among 100 singleton term neonates which were included during 6 months period Jan 2020 to Jun 2020. The neonates were divided into two groups: (group I) includes vaginal delivery (NVD) and (group II) non-emergency cesarean section (LSCS) under spinal anesthesia. Results: The mean gestational age and birth weight in NVD group were 39.91±1.10 weeks and 3.28±0.36 Kg respectively. In LSCS group mean gestational age was 38.01±0.91 weeks and mean birth weight was 3.10±0.46 kg. The mean umbilical artery pH and pCO2 in NVD group and LSCS group were (7.26±0.07, 7.32±0.07) and (47.76±9.86, 42.76±10.84) p≤0.05 respectively. Conclusion: considering the effect of umbilical artery blood pH on studying the prognosis of newborns under stress, it is recommended that at least in the case of stressful deliveries either vaginal deliveries and caesareans, the umbilical artery pH values estimation should be done properly

Keywords: arterial blood gas analysis, pH, umbilical artery, vaginal delivery, cesarean delivery.

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Introduction

Childbirth is the process of delivering a baby and the placenta, membranes, and umbilical cord from the uterus by vaginal passage or by cesarean section.Vaginal delivery is defined as birth through natural birth canal with natural power of uterine contractions. Cesarean section also known as C-section, is a form of childbirth in which a surgical incision is made through mother's abdomen (laparotomy) and uterus (hysterotomy) to deliver one or more babies. There are two general types of cesarean section related to number 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 intrapartum 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

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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

The present prospective comparative study was conducted in the Department of Pediatrics, Military Hospital Dehradun, India among 100 singleton term neonates which were included during 6 months period Jan 2020 to Jun 2020). The samples were divided into two groups: (group I) includes vaginal delivery (NVD) and (group II) non-emergency cesarean section (LSCS) under spinal anesthesia. Inclusion Criteria

- 1. 37-42 weeks of gestation
- 2. Babies cried immediately after birth
- 3. Birth weight >2500 gms
- 4. Postnatal course was uneventful
- 5. Those who have signed the informed consent
- **Exclusion Criteria**

Neonates delivered through emergency cesarean section. 1. 2

Mothers having any antenatal risk factor

Ethical approval and Informed consent

The study protocol was approved by the Institutional Ethical Committee.

Methodology

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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 19 (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.

Study protocol



Results

| | Table 1. Ochu | ci wise distribution | rable 1. Ochuci wise distribution of the comparison groups | | | | |
|-------------|---------------|----------------------|--|--------|--|--|--|
| Variables - | | Gender | | T-4-1 | | | |
| | | Female | Male | Total | | | |
| | NVD | 20 | 27 | 47 | | | |
| Groups | INVD | 44.4% | 49.1% | 47.0% | | | |
| | LSCS | 25 | 28 | 53 | | | |
| | | 55.6% | 50.9% | 53.0% | | | |
| Total | | 45 | 55 | 100 | | | |
| | | 100.0% | 100.0% | 100.0% | | | |

Table 1. Gender wise distribution of the comparison groups

Table 1: In the present study, a total of 100 infants entered into two groups. With regard to their gender, 55 (55.0%) and 45 (45.0%) of infants were male and female, respectively. Male were found in majority in both the groups.

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| Table 2: Mean gestational age and birth weight in comparison groups | | | | | |
|---|---------------|---------------|--|--|--|
| Crowns | NVD (N=47) | LSCS (N=53) | | | |
| Groups | Mean \pm SD | Mean \pm SD | | | |
| Gestational age (weeks) | 39.91±1.10 | 38.01±0.91 | | | |
| p-value | 0.074 (NS) | | | | |
| Birth weight (Kg.) | 3.28±0.36 | 3.10±0.46 | | | |
| p-value | 0.0 | 61 (NS) | | | |

Test applied: student t-test

Table 2: The mean gestational age and weight in the two groups, NVD and LSCS, were (39.91±1.10 weeks, 38.01±0.91 weeks) and (3.28±0.36 Kg., 3.10±0.46 kg) respectively, and there was no statistical difference between the two groups. Table 3: Comparison of ABG analysis between the groups

| Croups | NVD (N=47) | LSCS (N=53) | |
|---------|---------------|---------------|--|
| Groups | $Mean \pm SD$ | $Mean \pm SD$ | |
| pH | 7.26±0.07 | 7.32±0.07 | |
| p-value | 0.001 (Sig.) | | |
| pO2 | 19.06±9.39 | 18.08±7.67 | |
| p-value | 0.569 (NS) | | |
| pCO2 | 47.76±9.86 | 42.76±10.84 | |
| p-value | 0.018 (Sig.) | | |
| HCO3 | 20.62±3.05 | 21.18±3.33 | |
| p-value | 0.383 (NS) | | |

Test applied: student t-test

Table 3: In vaginal delivery and cesarean section delivery newborns, the average umbilical artery pH was 7.26±0.07 and 7.32±0.07, respectively. The mean level of PO2 was 19.06±9.39 in NVD group and 18.08±7.67 in LSCS group. In NVD and LSCS groups, the mean levels of pCO2 were 47.76±9.86 and 42.76±10.84, respectively. Mean level of HCO3 in NVD and LSCS group was 20.62±3.05 and 21.18±3.33, respectively. Discussion

In most of the times, vaginal delivery has been regarded as the best and usually the most complication-free delivery type. Nonetheless, due to highly increasing caesarean trend, natural delivery type is experiencing a reducing trend. Overall, the degree of caesarean has been increasing all over the world, for which no acceptable reason has been introduced.[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 CO2levels 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 pCO₂, which is more pronounced during the second stage of labor and during delivery.[17,18] On the other hand, infants born by elective cesarean section have been shown to have higher pH values reflecting the lack of a strenuous vaginal delivery.[19]

Conclusion

Considering the effect of umbilical artery blood pH on studying the prognosis of newborns under stress, it is recommended that at least in the case of stressful deliveries either vaginal deliveries and caesareans, the umbilical artery pH values estimation should be done properly. A future study may focus on the correlation between immediate pH values and the long-term, neurological outcomes. Additionally, defining the cut-off value of the pathological pH would also be interesting.

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