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Study of Immediate Post-Partum Umbilical Cord Blood Gas Analysis in Relation to Foetal Heart Rate Patterns (NST/CTG) in High-Risk Pregnancies

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KEYWORDS

NST/CTG, Acidosis, High-Risk pregnancies, Umbilical cord blood ABG, Prospective Observational Study

ABSTRACT:

Introduction: CTG plays an important role in the identification of foetal hypoxia but also has high false-positive rates and is a poor predictor of foetal acidosis. Umbilical artery pH identifies newborns at risk of hypoxia and predicts neonatal outcomes. Hence, this study was conducted to study the correlation between Immediate post-partum umbilical cord gas analysis and Foetal heart rate patterns (NST/CTG) in High-risk pregnancies.

Objectives: Primary Objective: 1. Study of immediate post-partum umbilical cord arterial blood gas analysis in relation to foetal heart pattern (CTG/NST) in High-risk pregnancies.

Secondary Objective:

To assess foetal well-being by using NST/CTG in high-risk pregnancies in antenatal period.

To assess neonatal well-being by using Cord blood ABG in high-risk pregnancies.

Methods: Prospective Observational study. High-risk pregnant females fulfilling the inclusion criteria were enrolled in the study and NST/CTG was obtained before delivery. Immediately after birth blood sample from Umbilical cord artery was obtained and sent for ABG analysis and their correlation was studied.

Results: Out of 80 High-risk pregnant females, thirty-seven (46.25%) females had Reassuring CTG of which one (2.7%) baby had acidosis at birth and forty-three (53.75%) had Non-reassuring CTG, of which twenty-one (48.8%) babies had acidosis at birth. Thirty (69.76%) babies with non-reassuring CTG were admitted to the NICU and five (13.51%) babies with reassuring CTG were admitted to the NICU. A significant correlation (p-value <0.001) was found between CTG, Acidosis at birth, NICU admissions, and CTG.

Conclusions: Significant associations were found between non-reassuring CTG and pH, lactate values, and NICU admissions. No significant association was found between pH, Lactate, and non-reassuring CTG with perinatal outcomes for babies admitted to NICU.

1. Introduction

The antepartum assessment of foetal being is an essential component of the conduct of high risk or low-risk pregnancies. Any pregnancy in its course can turn into a high-risk pregnancy and therefore every pregnancy in danger needs to be recognised at an early stage to manage the complications later. High-risk pregnancy requires effective surveillance and intervention strategy to ensure an optimum outcome for both mother and foetus. [1]

The most commonly used method is Cardiotocography for antepartum surveillance.[2] In high-risk pregnancies, as fetal acidemia is anticipated, CTG has been indicated as a routine practice on admission. High-risk conditions such as Hypertensive disorders of pregnancy, Diabetes in pregnancy, IHCP, Hypothyroidism, Preterm births, and Foetal growth restriction impose a risk of acidemia on fetus.

Cardiotocography is a method to screen a fetus in utero that records the heart rate of the fetus, movements of the fetus, and contractions of the uterus [3]. CTG or NST on admission, a baseline recording, is done to monitor the fetus's well-being noninvasively for early identification of fetal hypoxia to prevent acidemia and neurological damage.

In 1958 James et al. advocated that stress caused in utero to foetus can be recognized by blood gas analysis of the umbilical artery.[4] Many clinical setups adopted Umbilical cord ABG for estimating the neonatal status at birth. When combined with other maternal and neonatal factors for predicting the neonates at risk for

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Encephalopathy, and cerebral palsy and implementing early initiation of Neuroprotective strategies. In our research, with careful antepartum surveillance and strict intrapartum electronic fetal monitoring, we tried to implement Umbilical cord ABG analysis in High-risk patients to assess the neonatal status at birth. Accordingly, CTG findings were correlated with findings of Umbilical cord ABG to predict the outcome of the neonate.

2. Objectives

Primary Objective: 1. Study of immediate post-partum umbilical cord arterial blood gas analysis in relation to foetal heart pattern (CTG/NST) in High-risk pregnancies.

Secondary Objective:

a. To assess foetal well-being by using NST/CTG in high-risk pregnancies in antenatal period.

b. To assess neonatal well-being by using Cord blood ABG in high-risk pregnancies.

3. Methods

A hospital-based, time-bound, Prospective observational study was conducted at the Department of Obstetrics and Gynaecology, Central Referral Hospital (CRH), Tadong, Sikkim over 12 months (1st July 2022- 31st July 2023). The study included all high-risk pregnant patients along with the ones fulfilling the inclusion and exclusion criteria who were admitted to the Central Referral Hospital during the study period undergoing Elective LSCS, Emergency LSCS and Normal Vaginal Delivery were included in the study. Therefore,80 High-risk pregnant women fulfilling the Inclusion and Exclusion Criteria after obtaining Consent were included in the study. The data were entered into MS Excel and analysed using SPSS version 21.0. Continuous data were presented as mean and standard deviation, while categorical variables were presented as percentages. The chi-square test was utilised to determine the association between categorical variables, with the Fisher test used if the expected cell counts were less than 5 in more than 20% of cells. An unpaired t-test was performed to compare the mean between the two groups. A significance level of $p<0.05$ seemed significant.

A. Inclusion Criteria: • Term gestation between 37- 40 weeks • Hypertensive disorders of Pregnancy • Gestational Diabetes Mellitus • Intra Hepatic Cholestasis of Pregnancy

B. Exclusion Criteria: • Pre-term gestation • Multiple Gestation • Females not giving consent.

After admission, CTG tracings were obtained and interpreted according to ACOG classification and following the delivery of the newborn, the placenta was delivered, and immediately after delivery, the umbilical cord was double clamped, A 10cm to 20 cm segment of umbilical cord was then obtained. After identifying the umbilical artery, blood was drawn from the maternal side of the umbilical cord into a pre-heparinised syringe. The sample was flushed with a 1000 microliter heparin solution and immediately sent to the laboratory for analysis of umbilical cord arterial ABG values.

ACOG in 2010 classified CTG interpretations according to Categories into Category I, Category II, and Category III accordingly.

“Category I- Baseline FHR- Defined as FHR between 110- 160 bpm, Baseline variability- 6-25 bpm, Late or variable decelerations- absent, Accelerations- present or absent

Category II- Includes all FHR Tracings which are not included in Category I or Category III. Baseline FHR- Bradycardia but with the presence of baseline variability or tachycardia Baseline Variability- Minimal variability, Absent variability with no recurrent decelerations, marked variability Accelerations- Absent or induced accelerations after fetal stimulation Periodic or episodic decelerations- Recurrent variable decelerations along with minimal or moderate baseline variability, Prolonged deceleration 2- 10 mins, Recurrent late decelerations with moderate baseline variability, variable decelerations with other characteristics such as slow return to baseline, overshoots or shoulders.

Category III- Absent baseline FHR variability with Recurrent late decelerations, Recurrent variable decelerations, Bradycardia Sinusoidal pattern.” [5]

In a study conducted by Shana et al., in 2016, with a pH value of <7.2 and with a Lactate value of >10 mmol given an interpretation of Acidosis at birth which was followed as a cut-off for ABG analysis in this study.[6]

4. Results

The maternal age in this study ranged from 24 years to 42 years. The mean age was 31.8 years, Three patients (3.8%) belonged to the age group of 41-45 years. Out of 80 patients, 37, (46.3%) were Primigravida, and 43, (53.8%) were Multigravida. Out of 80 patients, 14 (17.5%) underwent Vaginal delivery, 35 (43.8%)

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underwent Elective LSCS, 31 (38.8%) underwent Emergency LSCS.

Amniotic fluid was graded according to the presence of Meconium, there was 1 case of Abruptio placenta which had blood-stained Amniotic fluid, 54 patients (67.5%) had clear amniotic fluid, 13 patients (16.3%) had Grade 3 MSL, 7 patients (8.8%) had Grade 2 MSL, 5 (6.3%) patients had Grade 1 MSL.

Gestational hypertension had the maximum distribution in 53.8% of cases followed by Diabetes in pregnancy and IHCP of 23.8% respectively. CTG was divided into Categories given by ACOG, 46.3% of CTG tracings belonged to Category I, 26.3% belonged to Category II and 27.5% belonged to Category III. Category I was regarded as Reassuring CTG and Category II and III were regarded as Non-reassuring CTG. The indications of LSCS were, 16.7% of patients had Non-Reassuring CTG with Clear Amniotic fluid, 21.2% had MSL with Non- Reassuring CTG, and 21.2% of patients who had undergone previous LSCS for various reasons opted for LSCS on Request. 18.2% of Primigravida opted for LSCS on Request who refused IOL and had SGA babies.

The Mean APGAR at 1st Minute was 7.0 and at 5th Minute was 7.5. Twenty two babies (27.5%) had abnormal pH and 58 (72.5%) had normal pH and thirty babies (37.5%) had abnormal lactate values and 50 (62.5%) had normal pH. Twenty two (27.5%) babies had Metabolic acidosis and Fifty eight (72.5%) babies had Normal ABG.

In the first 24 hours, 22 (27.5%) babies were admitted to NICU for various reasons. 24 hours later amongst the 58 babies who were not admitted initially, 13 (22.4%) babies were admitted to NICU. Among the 13 babies who were admitted to NICU after 24 hours were shifted to NICU.

5. Discussion

In this study, 46.3% of patients had Reassuring CTG, 26.3 % had category II CTG and 27.5% had Category III (Non -Reassuring) CTG, almost similar to a study conducted by Sonika et al [7] having results of 51.6% of Category I, 34.8% of Category II and 13.6% of Category III. Similarly, a study conducted by Deepa et al [8] amongst which in cases of non-reassuring CTG, 54.9% were classified as suspicious CTG and 45.1% were classified as pathological CTG. Similarly, according to Ray C et al [2] in their study 50.2 % of subjects had Category I CTG, 36.5% had Category II CTG and 13.3% had Category III CTG [9].

In our study, out of 37 patients who had reassuring CTG, 36 (97.3%) had normal pH, and 1 (2.7%) had abnormal cord pH. Out of 43 subjects who had Non-reassuring CTG, 22 (51.2%) had Normal cord pH and 21 (48.8%) had abnormal PH. The data was statistically significant at a p-value of <0.001.

Out of 37 subjects with Reassuring CTG, 2 (5.4%) had Normal Lactate, and 35 (94.6%) had Abnormal Lactate values. Out of 43 Subjects who had Non-reassuring CTG, 28 (65.1%) had Normal Lactate values and 15 (34.9%) had abnormal Lactate values. The data was statistically significant at a p-value of <0.001. In a study conducted by V Paladugu et al.,[10] it was observed that among 56 patients with pathological CTG tracings, 15 newborns were found to be acidotic. Among 30 suspicious traces, 1 baby was acidotic. This difference was statistically significant with a p-value of 0.003.

In our study, out of 80 babies, 22 (27.5%) were admitted to NICU in the First 24 hours, amongst which 1 (2.7%) baby had reassuring CTG and 21 (48.8%) babies had Non-reassuring CTG. After 24 hours, 13 more (16.3%) Babies got admitted to NICU out of which, 4 babies (10.8%) babies had Reassuring CTG, and 9 babies (20.9%) had Non-reassuring CTG. The data was 54 statistically significant at a p-value of <0.001. Similar findings were observed in a study conducted by Leoni RS et al [3] where the rate of admission in NICU was lower in CTG Category I when compared to Category III (3.8 vs 30.0%, P value= 0.014).

Out of 22 babies admitted to NICU in the First 24 hours, 5 babies (8.6%) had Normal cord pH, and 17 (77.3%) babies had abnormal pH. 13 babies were admitted to NICU after 24 hours, 9 babies (15.5%) had Normal cord pH and 4 babies (18.2%) had abnormal pH. The data was statistically significant at a p-value of <0.001. These findings were similar to a study conducted by Kumar N et al [11] Where they found that Umbilical cord blood pH is the best indicator of fetal hypoxemia during labor,

Out of 22 babies admitted to NICU in the First 24 hours, 20 (66.7%) had Normal Cord Lactate values and 2 (4.0%) had Abnormal lactate values. Out of 13 babies who got admitted to NICU after 24 hours, 7 (23.3%) babies had Normal lactate values and 6 (12.0%) had abnormal lactate values. The data was statistically significant at a p-value of <0.001. Similar findings were found in a study conducted by Deshpande et al [12] Where 31 newborns who were admitted to NICU, 19 had High lactic acid levels and 12 had normal lactic acid levels out of 89 babies who were not admitted to NICU,

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81 had normal lactic acid levels and 8 had High lactic acid levels, these findings were highly significant at a p-value of <0.001.

Our study found that in 80 High-risk patients, the most encountered high-risk conditions were Gestational hypertension and Chronic Hypertension, Gestational diabetes mellitus, and Chronic Type II DM. On admission routine, CTG was done for all patients for identification of varying heart rate patterns and identifying high-risk pregnancies. Our study revealed significant associations between non-reassuring CTG and Meconium-stained liquor, and APGAR score at the 5th minute of newborn life. Significant associations were seen between Non-reassuring CTG and pH and Lactate values and NICU admissions. However, there was no significant association between pH, lactate, and non-reassuring CTG with Perinatal outcomes for babies admitted to the NICU. Moreover, if individual parameters are concerned with precise identification of foetal status, Cord blood Lactate, and pH were most accurate followed by CTG tracings.

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