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CORRELATION OF ADMISSION CARDIOTOCOGRAPHY SCORE AND FETAL CORD BLOOD PH IN PREDICTING PERINATAL OUTCOME

PATIL DS[*1], LADDAD M[2] AND YAMINI PATIL

1: Department of Obstetrics and Gynaecology, Krishna Institute of Medical Sciences, Karad

2: Department of Obstetrics and Gynaecology, Krishna Institute of Medical Sciences, Karad

3: Associate Professor, Krishna Institute Of Medical Sciences, Karad

***Corresponding Author: Dr. Manisha Manish Laddad: E Mail:drmanishald@gmail.com**

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ABSTRACT

Fetal heart rate monitoring was first started for knowing hypoxia and pH changes in the fetus, which can cause multiple fetal complications. The dreaded consequences of hypoxia and acidemia can lead to intrapartum or neonatal death. The less severe hypoxia may cause transient or long term effects in the fetus. CTG is very valuable in high-risk cases in which the abnormal fetal heart rate patterns had utmost impact on fetal outcome, in the mode of delivery and admission to neonatal intensive care unit. Normal umbilical cord pH is 7.2 to 7.4. Milder degrees of hypoxia/acidosis correspond to pH values between 7.0 and 7.20, while a pH below 7.0 denotes severe asphyxia and is associated with neurological dysfunction and neonatal death. The present study was conducted in a tertiary hospital in the Department of Obstetrics and Gynecology. The study included 340pregnant women above 37 weeks gestation with singleton pregnancy and cephalic presentation admitted in labour.CTG score was obtained and cord blood samples were collected after delivery for pH estimation. APGAR score was given to neonates at 1 minute and 5 minutes after delivery and history of NICU admission noted. This study showed that abnormal and suspicious CTG scores were significantly associated with NICU admission of neonates, lower APGAR scores and acidic blood pH of the neonates. More than 92% of the cases with suspicious and abnormal CTG scores required NICU admission. Not only APGAR score at 1 minute but also APGAR score at 5 minutes are significantly associated with CTG score.CTG score estimation is a helpful tool for earlier detection of unfavourable neonatal outcomes prompting earlier intervention.

Keywords: Cord blood pH;CTG score; Electronic fetal monitoring; Labour admission test; Neonatal outcome

INTRODUCTION

The development of the perfect diagnostic tests for identification of the fetus at risk, in-utero have been a challenge for perinatologists. Since maximum fetal deaths occur in antepartum period, it is important to monitor fetal heart rate not only during the intrapartum period but also during antepartum period (Bhartiya V *et al*., 2016).

Fetal heart rate monitoring was first started for knowing hypoxia and pH changes in fetus, which can cause multiple organ complications in the fetus. The dreaded consequences of hypoxia and acidemia can lead to intrapartum or neonatal death. The less severe hypoxia may cause transient or long term effects in the fetus. Detecting for fetal distress is a huge challenge for obstetricians. Labor admission test (LAT) by cardiotocography (CTG) can be used to segregate mothers, in whom continuous fetal heart rate monitoring is required and those requiring monitoring by intermittent auscultation (Bhartiya V *et al*., 2016).

Labour admission test is used to indicate the fetal status noninvasively. Thus, tracing a short recording of fetal heart beats on admitting the patient helps to know the ability of the fetus to withstand the process of labor. It is a dynamic admission test for knowing the state of oxygenation of the fetus on admission of the mother to labor ward. It looks for the fetal adaptivity by recording fetal heart rate during the transient occlusion of the utero-placental blood supply under physiological stress of repeated contractions of the uterus. The admission CTG, thus, has two potential roles. Firstly it can be used as a admission screening test in labor to know compromised fetuses and to segregate women in need of continuous electronic fetal monitoring during early labor. Except acute events likeuterine hyper stimulation, cord prolapse, meconium aspiration and placental abruption the admission CTG test is a good predictor of fetal well-being at the time of admission and during the next hours of labor process in full term fetuses. Electronic fetal heart rate monitoring (EFM) is used for knowing of fetal status and to detect early fetal distress occurring due to fetal hypoxia and metabolic acidosis. Another advantage of admission CTG includes closer intrapartum assessment of fetuses of high-risk mothers.

The aim of monitoring fetus intrapartum is to know fetal hypoxia at early stage in order to prevent following stage of acidemia and subsequent long term neurological damage to the fetus. Intrapartum fetal asphyxia and pH changes are a major cause of stillbirths and neonatal deaths. Acute hypoxia leads to decrease in

fetal heart rate, initially by chemoreceptor-mediated stimulation, but ultimately by myocardial hypoxic changes.

Today CTG has become a famous method to screen fetal status and it is helping the doctors in labour room in making decision of LSCS or vaginal trial to improve perinatal outcome. The admission test which was first described by Ingemarsson *et al* is a small strip of fetal heart rate during labour. It is a most efficient screening test for the fetal oxygenation and well-being on admitting mother in labour ward.

Table 1: Krebs Appresial method

ITEMS	ZERO	ONE	TWO
FHR BASELINE	<100,>180	100-119, 161-180	120-160
AMPLITUDE VARIABILITY	<5	5-9,>25	10-25
CYCLE VARIABILITY	<3	3-6	>6
ACCELERATION	WITHOUT	1-4	>4
DECELERATION	>=2	1	WITHOUT
FETAL MOVEMENTS	0	1-4	>4

CORDIOTOCOGRAPHY SCORE

0 – 3 – Abnormal

4 – 6 – Suspicious

7 – 12 - Normal

Normal umbilical cord pH is 7.2 to 7.4. Milder degrees of hypoxia/acidosis correspond to pH values between 7.0 and 7.20, while a pH below 7.0 denotes severe asphyxia and is associated with neurological dysfunction and neonatal death.

APGAR score is a scoring procedure for better understanding of clinical state of fetus. This also helps in comparison of results and standardization of methods of management. APGAR scoring is done in a new born baby at 1 and 5 minutes. Long term neurological correlation is obtained at 5 minutes score, which is of more value.

Hence this study was conducted to compare the accuracy of CTG score during intrapartum period in knowing fetal hypoxia and to analyze the comparison with the perinatal outcome in the form of fetal acidosis i.e pH analysis, APGAR score and admissions in neonatal intensive care unit.

RESULTS AND DISCUSSION

In the present study, it was observed that 178 (52.3%) cases had normal CTG score, 106 (31.2%) cases had suspicious CTG score and 56 (16.5%) cases had abnormal CTG score **(Table 1)**.

In asimilar study conducted by Hafizur R *et al*., it was observed that 123 (76.9%) cases had normal CTG score, 23 (14.4%) cases had suspicious CTG score and 14 (8.7%) cases had abnormal CTG score. Similar

findings were observed in the study conducted by Chandrima Ray *et al*.

In this study, it was observed that 66 (19.4%) cases had pH less than 7.2 and 274 (80.6%) cases had pH more than or equal to 7.2 **(Table 2)**.

Comparison of CTG score with Cord blood pH

In the present study, it was observed that among cord blood pH < 7.2 group, 8 (12.1%) cases had normal CTG score, 24 (36.4%) cases had suspicious CTG score and 34 (51.5%) cases had abnormal CTG score while among cord blood pH ≥ 7.2 group, 170 (62.0%) cases had normal CTG score, 82 (29.9%) cases had suspicious CTG score and 22 (8.0%) cases had abnormal CTG score. The correlation between CTG score and cord blood pH was statistically significant (p=0.001) **(Table 3)**.

In the study conducted by Chandrima Ray *et al*., it was observed that among 151 mothers with normal CTG, 11 (7.3%) cases had acidosis. While among the 110 mothers with suspicious CTG score, 25 (22.7%) cases had acidosis. It was also seen that the 40 mothers with abnormal CTG score, 19 (47.5) cases had acidosis. There was significant association observed among CTG score and cord blood pH. Hafizur R *et al*., also had similar results **(Figure 1)**.

Comparison of CTG Score with APGAR Score

In the present study, it was observed that in cases with APGAR score (1 minute) between 0 - 3, 2 (4.2%) had normal CTG score, 18 (37.5%) had suspicious CTG score and 28 (58.3%) had abnormal CTG score, in cases with APGAR score (1 minute) between 4 - 6, 28 (31.8%) had normal CTG score, 38 (43.2%) had suspicious CTG score and 22 (25.0%) had abnormal CTG score and in cases with APGAR score (1 minute) between 7 - 10, 148 (72.5%) had normal CTG score, 50 (24.5%) had suspicious CTG score and 6 (2.9%) had abnormal CTG score.

Similarly, in cases with APGAR score (5 minute) between 0 - 3, 2 (5.3%) had normal CTG score, 14 (36.8%) had suspicious CTG score and 22 (57.9%) had abnormal CTG score, in cases with APGAR score (5 minute) between 4 - 6, 25 (32.1%) had normal CTG score, 34 (43.6%) had suspicious CTG score and 19 (24.4%) had abnormal CTG score and in cases with APGAR score (5 minute) between 7 - 10, 151 (67.4%) had normal CTG score, 58 (25.9%) had suspicious CTG score and 15 (6.7%) had abnormal CTG score. The correlation between CTG score and APGAR scores at 1 and 5 minutes was statistically significant (p=0.001) **(Table 4)**.

In the study conducted by Hafizur R *et al*., 6.5% (8/123) reactive CTG cases had APGAR score less than 7, 26.1% (6/23)

suspicious CTG cases had APGAR score less than 7 and 64.3% (9/14) abnormal CTG cases had APGAR score less than 7 at 5 minutes.

Association of CTG score with NICU admission

In the present study, it was observed that among cases which required NICU admission, 4 (7.7%) cases had normal CTG score, 16 (30.8%) cases had suspicious CTG score and 32 (61.5%) cases had abnormal CTG score. In the cases which did not require NICU admission, 174 (60.4%) cases had normal CTG score, 90 (31.3%) cases had suspicious CTG score and 24 (8.3%) cases had abnormal CTG score. The correlation between CTG score and NIUC admission was statistically significant (p=0.001).

In the study conducted by Hafizur R *et al*., and Chandrima Ray *et al*., the number of NICU admissions with abnormal CTG score were observed to be similar **(Table 5)**.

Comparison of CTG score with mode of delivery

In this study among the vaginal delivery cases, 100 (48.5%) cases had normal CTG score, 78 (37.9%) cases had suspicious CTG score and 28 (13.6%) cases had abnormal CTG score. Among the emergency LSCS cases, 43 (50.0%) cases had normal CTG score, 20 (23.3%) cases had suspicious CTG score and 8 (26.7%) cases had abnormal CTG score. Among the elective LSCS cases, 35 (72.9%) cases had normal CTG score, 8 (16.7%) cases had suspicious CTG score and 5 (10.4%) cases had abnormal CTG score **(Figure 2)**.

Table 1: Distribution of cases according to CTG score

CTG Score	Frequency	Percent
Normal	178	52.3%
Suspicious	106	31.2%
Abnormal	56	16.5%
Total	340	100%

Table 2: Distribution of cases according to Cord blood pH

Cord blood pH	Frequency	Percent
< 7.2	66	19.4%
≥ 7.2	274	80.6%
Total	340	100.0%

Table 3: Comparison of CTG score with Cord blood pH

CTG Score	Cord blood pH		Total
	< 7.2	≥ 7.2	
Normal	8 (12.1%)	170 (62.0%)	178 (52.4%)
Suspicious	24 (36.4%)	82 (29.9%)	106 (31.2%)
Abnormal	34 (51.5%)	22 (8.0%)	56 (16.5%)
Total	66	274	340

P value 0.001 (Chi square test)

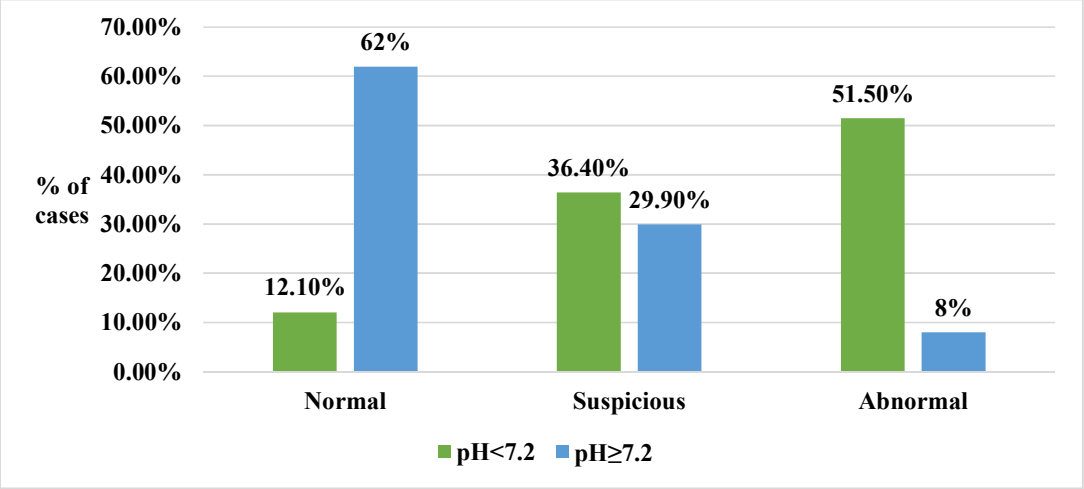

Figure 1: Comparison of CTG score with Cord blood pH

Table 4: Comparison of CTG score with APGAR Score (5 minute)

CTG Score	APGAR Score (5 minute)			Total
	0 - 3	4 - 6	7- 10	
Normal	2 (5.3%)	25 (32.1%)	151 (67.4%)	178 (52.4%)
Suspicious	14 (36.8%)	34 (43.6%)	58 (25.9%)	106 (31.2%)
Abnormal	22 (57.9%)	19 (24.4%)	15 (6.7%)	56 (16.5%)
Total	38	78	224	340

P value 0.001 (Chi square test)

Table 5: Association of CTG score with NICU admission

CTG Score	NICU Admission		Total
	Present	Absent	
Normal	4 (7.7%)	174 (60.4%)	178 (52.4%)
Suspicious	16 (30.8%)	90 (31.3%)	106 (31.2%)
Abnormal	32 (61.5%)	24 (8.3%)	56 (16.5%)
Total	52	288	340

P value 0.001 (Chi square test)

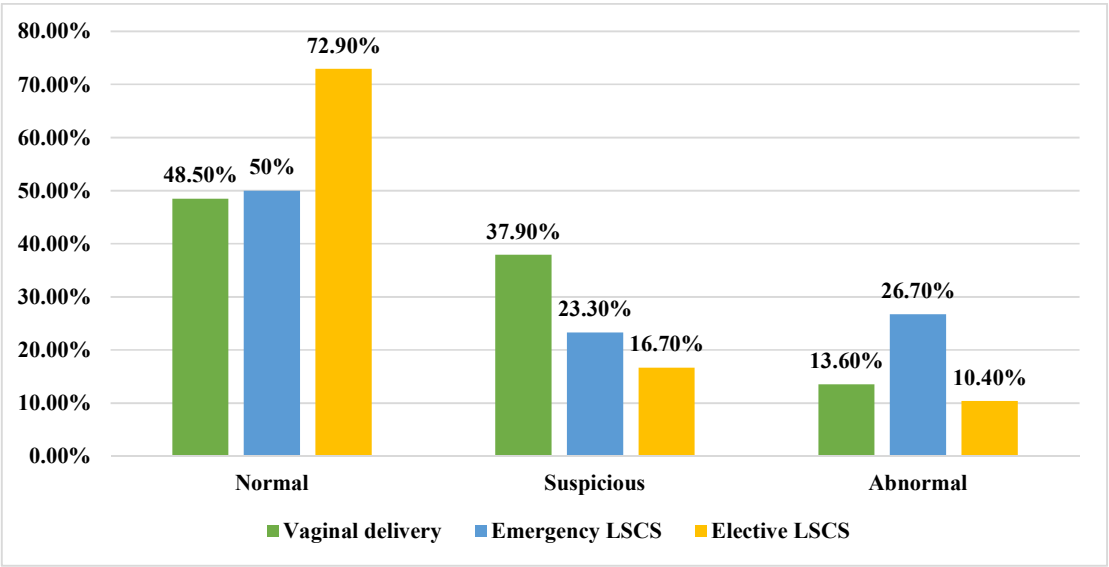

Figure 2: Comparison of CTG score with mode of delivery

CONCLUSION

This study showed that abnormal and suspicious CTG scores were significantly associated with NICU admission of neonates, lower APGAR scores and acidic blood pH of the neonates. More than 92% of the cases with suspicious and abnormal CTG score required NICU admission. Not only APGAR score at 1 minute but also APGAR score at 5 minutes were significantly associated with CTG score.57.9% cases with 0 – 3 APGAR score (5 min)had abnormal CTG score.CTG score estimation is a helpful tool for earlier detection of unfavourable neonatal outcomes prompting earlier intervention.

MATERIALS AND METHODS

This was a prospective observational study conducted in a tertiary care center from October 2018 to August 2020.The study included 340pregnant women above 37 weeks gestation both high risk and low risk, irrespective of parity, with singleton pregnancy and cephalic presentation who were admitted in labour. Women below 37 weeks gestational age, not in labour, women with twins/triplet pregnancies, malpresentations, antepartum hemorrhage, congenital fetal anomalies were excluded from the study. Detailed history of the patient was obtained including age, residence, registration of pregnancy, parity, gestational age, antenatal history including any antenatal complications and past history.

CTG assessment:

The Cardiotocography transducer and toco probe was put on the abdomen and the cardiotocograph was printed for 20 minutes. After completion of the test, Cardiotocography score was given by the machine. If the CTG score was suspicious, it was repeated after a gap of 15-20 minutes.

After delivery, cord blood samples were collected in heparinised syringes and sent for ABG test.

• APGAR score was assessed for neonates at 1 minute and 5 minutes after birth.

• If neonate was shifted to NICU it was noted and NICU admission for more than 24 hrs was considered to be significant.

Statistical Analysis

Data management and analysis was done using Microsoft excel and Epi-info software. The frequency distribution and graph were prepared for the variables. The categorical variables were assessed using Pearson chi-square. The test was considered significant only if the p value comes out to be less than 0.05. The CTG score was compared with pH, APGAR score and NICU admission.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose.

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