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RESEARCH ARTICLE

TO STUDY THE CATEGORY II CARDIOTOCOGRAPHY AND ITS CORRELATION WITH UMBILICAL CORD pH

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Abstract

Introduction: The purpose of intra-partum fetal monitoring is to identify early signs of developing hypoxia. Electronic fetal monitoring is performed using cardiotocograph, which is a paper record of the fetal heart rate (FHR) patterns plotted simultaneously in relation to uterine activity. In low resource settings umbilical cord artery blood gas analysis can provide important information about the fetuses exposed to intrapartum hypoxaemic events and can distinguish the infant at high risk for asphyxia and related sequelae. The aim of this study was to correlate intrapartum CTG findings with umbilical cord blood pH at birth in term pregnancies in labour and thus evaluate the success of CTG in predicting fetala cidosis during labour.

Methods: The present study included 100 women with term singleton pregnancies in labour and with Category II according to NICHD 2008 Classification (Adapted by ACOG 2013). Umbilical cord arterial blood was taken immediately after birth, in a pre-heparinised syringe and sent to the laboratory for pH study to detect acidosis. Cord blood pH <7.2 was taken as acidosis and cord blood pH ≥7.2 was taken as normal

Results: Among 100 patients, 78 had normal cord pH and 22 had abnormal cord pH(<7.20). On intrapartum CTG, maximum patients in our study group had variable decelerations,followed by decreased variability(<5bpm) and absent induced acceleration on fetal stimulation. Late decelerations and fetal bradycardia were observed to have most significant correlation with fetal acidosis.

Conclusions: From the analysis of this study, it can be concluded that an abnormal CTG should be managed appropriately, without delay, in order to prevent acidosis in the neonate. The obstetrician should be more vigilant in cases of Cat II CTG tracings with bradycardia and late decelerations and monitor such labours closely.

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Introduction:-

Fetal hypoxia can be described as reduced oxygen supply to fetus. This is usually associated with a prolonged drop in oxygen levels and an increase in carbon dioxide level in the fetal blood. Fetal hypoxia or intrauterine asphyxia is a common cause of long term neurological dysfunction and can also lead to death[1]. William Obstetrics quotes that fetal heart tracing with reduced variability is the most reliable indicator of fetal compromise[2]. Fetal compromise is manifested as fetal hypoxia. Normal FHR pattern indicates reassuring fetus, an abnormal FHR pattern may or may not equate with hypoxia. Non-reassuring fetal heart rate patterns are found in 15% of labours [2].

The American College of Obstetricians and Gynaecologists (ACOG), has developed a three tier classification for interpreting CTG [3] –

1. Category I FHR tracings are normal tracings which are not associated with asphyxia. They include baseline of 110-160bpm, moderate variability defined as fluctuations in the baseline heart rate that are irregular in amplitude and frequency of 6-25bpm, no late or variable decelerations.
2. Category II FHR tracings are indeterminate and include tracings that do not fit into category I or III. It includes bradycardia with variability, tachycardia, minimal variability, no variability with no recurrent decelerations, marked variability, absence of induced accelerations even after fetal stimulation prolonged decelerations lasting for >2 min, but <10 min, recurrent late decelerations with moderate variability, variable deceleration with slow return to baseline, overshooting the baseline or shoulders.
3. Category III FHR tracings are abnormal and indicative of hypoxic risk to fetus and acidemia.They include no baseline variability or presence of recurrent late decelerations, variabledeceleration, bradycardia or sinusoidal pattern.

Umbilical cord arterial blood provides important information about the foetuses exposed to intrapartum hypoxic event and can distinguish the infant at high risk and relates sequelae.Normal range of umbilical cord blood pH is 7.4+/- 0.20[4]. Fetal acidosis is defined as the measurement of umbilical art ery blood pH <7.2 and base deficit>12mMol/l.[4]

Fetal hypoxia and metabolic acidosis are often associated with baseline bradycardia, reduced baseline variability and FHR decelerations. Baseline tachycardia is an early sign of fetal hypoxia. Though bradycardia is indicative of fetal distress, it is a late sign of fetal hypoxia. The aim of my study is to study in the fetal heart rate patterns observed in Category II CTG and its correlation with umbilical cord pH.

Material And Methods:-

The study is a prospective study, carried out in the Department of obstetrics and gynaecology, Shri Ram Murti Smarak Institue of Medical Sciences, a tertiary Care centre in Bareilly.

The study group consists of total of 100 women with category II CTG according to NICHD classification (ACOG 2013) attending labour room of obstetrics and gynaecology department were selected.

Inclusion Criteria:

1. Women with singleton pregnancies with cephalic presentation.
2. Women at term pregnancy 37-42wk POG.
3. Women in active labour (essential cervical dilatation >4cm were included in study.)
4. With category II CTG

Exclusion Criteria:

1. Pregnant women with PROM or CPD.
2. Multiple gestation
3. Malpresentations
4. Congenital anomalies
5. Abnormal Doppler study
6. Antepartum haemorrhage
7. Placental abruption
8. Patients undergoing elective caesarean section

9. The patients who did not give consent to participate.

On admission, after obtaining consent from the patients, all patients underwent general, systemic and obstetric examination. Electronic fetal monitoring was performed using a cardiotocograph with transducers attached for detecting fetal heart as well as uterine activity. The "Philips series 50 A, Series 50 IP-2" CTG machine was used in this study for intrapartum monitoring.

Immediately at birth, before delivery of placenta umbilical cord was clamped at 2 points, 10cm apart, with kochers clamp and cut. The umblical artery was identified in the cord and 2-3 ml of blood was withdrawn with pre heparanised syringe and was delivered to the laboratory within 5 minutes. Cord blood was analysed by radiometer ABL 800 Basic machine used in our institute. The umbilical cord arterial blood pH was used for assessing fetal acidosis. An umbilical artery pH of ≤7.20 is identified as fetal acidosis.

Statistical Analysis:
Descriptive statistics was analyzed with SPSS version 17. 0 software. Nominal categorical data between the groups were compared using Chi-squared test or Fishers exact test as appropriate P value < 0.05 was considered statistically significant.

Results:-

Results of fetal heart rate pattern in CTG were studied along with the cord blood pH and results were correlated with the perinatal outcome in terms of NICU admission.

Distribution on the bases of features of category ii cardiotocography:

Characteristics of FHR	FHR Patterns	Number of Cases
Baseline	Bradycardia	10
	Tachycardia	5
Variability	Absent	11
	<5 bpm	19
	>25 bpm	-
Acceleration	Absent on fetal Stimulation	19
Deceleration	Late	16
	Variable	20

Among the characteristics of fetal heart rate patterns, variable decelerations were most commonly seen followed by absent acceleration on fetal stimulation, reduced variability of <5bpm and late decelerations.

Association Between Intrapartum Ctg Findings And Abnormal Cord Ph:-

FHR Pattern	Number of Cases	pH<7.2	pH >7.2	P value
Bradycardia	10	6	4	0.024
Tachycardia	5	2	3	0.031
Absent variability	11	6	5	0.029
<5bpm variability	19	2	17	0.380
Absent accelerations on fetal stimulation	19	1	18	0.420
Late decelerations	16	11	5	0.019
Variable decelerations	20	2	18	0.348

Most significant correlation of CTG with fetal acidosis was observed with late decelerations with p value-0.019. Fetal bradycardia was also observed to have good correlation with fetal acidosis with p value-0.024, followed by absent variability with p value 0.029 and fetal tachycardia with p value- 0.031.

Results Of Umbilical Cord Ph:-

Cord pH	Number of cases
≤7.2	22

>7.2	78
Total	100
Median	7.35

Among 100 patients with Cat II CTG, only 22 had umbilical cord pH ≤7.2 and remaining 78 patients had normal cord pH of >7.2.

Distribution of umbilical cord pH and mode of delivery:-

Umbilical artery pH	≤7.2 cases	%	>7.2 cases	%	Total
FTVD	11	18.5%	49	81.7%	60
LSCS	11	27.5%	29	72.5%	40
Total	22		78		

Among 100 patients, 60 had vaginal delivery and 40 underwent emergency LSCS for non reassurinf fetal heart rate pattern. Among vaginal delivery, 18.3% babies had cord pH≤7.2 and 81.7% had normal cord pH. Out of 40 patients who underwent LSCS, 27.5% has cord blood pH ≤7.2 and rest 72.5% had normal cord pH. The correlation **of u**mbilical cord pH with mode of delivery was not significant (p value 0.278).

Distribution of umbilical cord pH and NICU Admission:

Umbilical Cord pH	NICU Admission		Total	
	Present	Absent		
≤ 7.2		22	-	22
>7.2		18	60	78
Total		40	60	100

All neonates with umbilical cord pH ≤7.2 were admitted in NICU, whereas among neonated with normal cord pH only 18/78 were admitted in NICU. Significant correlation was observed between cord pH ≤7.2 and NICU admission.

Association of FHR pattern in category II CTG with NICU Admission:-

FHR PATTERN	Number of Cases	NICU Admission	P value
Bradycardia	10	10	0.001
Tachycardia	5	2	1
Absent variability	11	9	0.003
< 5 bpm variability	19	5	0.176
Absent accelerations on fetal stimulation	19	7	0.255
Late decelerations	16	11	0.036
Variable decelerations	20	3	0.811

It was observed that FHR pattern with strongest correlation with NICU admission was fetal bradycardia with p value 0.001 and with Absent variability with p value – 0.003. Late deceleration was also observed to have significant correlation with NICU admission of neonates with p value 0.036.

Discussion:-

Fetal surveillance is recommended in all pregnancies for evaluation of fetal well being. Intrapartum fetal surveillance reduces the incidence of intrapartum fetal asphyxia. It has been recognized that during labour the fetus is subjected to stress which can result in fetal jeoparady.

On performing intrapartum CTG, it was found that 10% patients had baseline bradycardia, 5% had baseline tachycardia and 30% had abnormal beat to beat variability. Of the patients who had abnormal beat to beat variability,11% had absent variability without any decelerations , 19% had reduced variability of < 5 bpm, 19% had

no accelerations on fetal stimulation and 36% had decelerations (16% late decelerations and 20% variable decelerations). Our study is in concordance with study by Abbasalizadeh et al 2015 [5], who reported 2.4 % patients with tachycardia, 28% patients with late decelerations, finding of his study were in accordance to our study with 5% with tachycardia on CTG and 20% patients with variable decelerations. The findings of our study are alsi in accordance with study by Ray C et al (2017) [6].

In our study, it was observed that bradycardia was the most common pattern on CTG associated with fetal acidosis with significant p value (0.002) followed by tachycardia(p value 0.003) and absent variability (p value 0.006). Our inference was in concordance with Williams K etal 2016[7], who observed on 488 term foetuses and suggested absent variability on CTG tracing as most significant parameter associated with fetal acidosis.

It was observed that out of 100 patients with category II CTG, only 22% neonates were found to have fetal acidosis that is umbilical cord pH ≤ 7.2. The result is similar to study by Jacson et al 2015[8], he interpreted 22.1% patients with category II CTG had fetal hypoxia. Our study is also in concordance with the study of Ray et al 2017, in which 22.7% patients developed fetal hypoxia (cord pH< 7.2).In study by Aboulghar et al[9] 2018, incidence of acidosis was higher being 34% .

Out of 40 women who underwent caesarean section , only 27.5% had fetal acidosis and required NICU admission. Similar results were seen in study of Kumar N et al [10], which included 30 pregnant females with suspicious CTG, out of which 76 % underwent caesarean section and only 23% of them had fetal acidosis.

The present study depicts revealed that umbilical cord blood pH is the best indicator of fetal hypoxia during labour. Out of 22 patients with pH ≤ 7.2, all these patient's babies were admitted in NICU, thus depicting positive correlation between fetal acidosis and subsequent need for NICU admission. The results was similar to study by Kumar N etal(2016) [12]who studied association of umbilical cord pH and fetal distress, in which out of 10 patients with pH ≤7.2 , only 6 were admitted in NICU.

In our study it was inferred that CTG pattern most significantly associated with NICU admission was bradycardia (p value-0.001), absent variability(p value- 0.003) and late decelerations (p value-0.036).The results of our study was in accordance with study by Ray et al (2017)[6], who observed that bradycardia and variable decelerations had the highest risk of NICU admission.

Conclusion:-

From the findings of our study it can be concluded that category II CTG is a good predictor of intrapartum fetal hypoxia and in presence of category II CTG, 22% patients had fetal acidosis. Category II CTG results in increased rate of caesarean section. But, it was observed that all caesarean sections done for fetal distress did not have fetal acidosis in real, as only 27.5% were seen to have umbilical cord blood pH<7.2.

There is high risk of fetal acidosis with category II CTG findings suggestive of Late decelerations, baseline bradycardia, absent variability and fetal tachycardia. High rate of NICU admission was observed in patients with bradycardia and absent variability. Therefore, Category II CTG should be evaluated promptly by clinician to prevent fetal hypoxia.

Category II CTG predicts fetal well being , but can cause undue increase in caesarean section rate, combining it with fetal scalp blood sampling, if available, can reduce the caesarean section rates and improve perinatal outcome significantly. However this is a small study and large randomized control trials are required.

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