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Original Research Article

Analysis of Normal and Abnormal Admission Cardiotocography (CTG) and Its Association with Perinatal Outcomes

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Abstract

Background: Cardiotocography (CTG) records changes in fetal heart rate and their temporal relation with uterine contractions. Its aim is to diagnose the hypoxia and prioritize the babies who need urgent delivery. **Objective:** The aim of the study is to assess the role and effectiveness of admission CTG and compare the abnormal and normal CTG regarding fetal outcomes. **Methods:** It is a prospective observational study held in Z.H. Sikder Women's Medical College & Hospital for the period of 1 year (July 2020 to June 2021). 500 pregnant women were studied in this period. Admission and intermittent CTG was done according to need. Statistical level of significance was set at p <0.05. **Result:** Total 500 cases were taken as study population according to inclusion criteria and divided into two groups, normal and abnormal CTG. Abnormal CTG includes both suspicious and pathological varieties. Difference in Apgar score, NICU admission and perinatal asphyxia was statistically significant (p<0.05). **Conclusion:** A CTG is a non-invasive, reliable and cost-effective screening method to evaluate the fetal condition and to predict perinatal outcome in high risk and also in low-risk pregnancies. Caesarean section rates may be dramatically reduced by appropriate use of CTG.

Keywords: Cardiography, fetal distress, perinatal outcome, high risk pregnancy.

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INTRODUCTION

Electronic fetal monitoring was introduced since 1970 [1]. Antepartum and postpartum diagnosis of fetal condition have reached a great progress after the invention of cardiotocography. It has the facility of gaining both fetal heartbeats and uterine contractions [2]. It is regarded as an obstetrician's window into the interplay of intra partum events and adverse intrapartum outcomes [3].

In present, almost all women are monitored cardiotocographically [4]. FIGO has introduced the terminologies for interpretation of CTG. This guideline describes its character and allow the assessment of CTG as normal, suspected and pathological [5].

It facilitates early detection of abnormal fetal heart rate which is associated with fetal hypoxia and let us play a role in early intervention to prevent neuronal damage and neonatal death [6]. Fetal hypoxia or asphyxia is a condition of disturbed gas exchange, leading to progressive hypoxemia and hypercapnia with significant metabolic acidosis [7]. In asphyxia baby can born with low Apgar score, acidosis, may die or present as hypoxic ischemic encephalopathy (HIE) and later neurodevelopmental disorder [8].

Advantage of cardiotocography is generally accepted and most widely used non -invasive method of fetal monitoring [9]. Usually there is no contraindication of CTG. Its great advantage is the findings are documented [10].

Cardiotocography

The fetal heart rate and maternal uterine contractions can be recorded electronically on a paper trace, is known as cardiotocograph [11]. This is done by a Doppler ultrasound transducer to monitor the fetal heart rate and a pressure transducer to monitor maternal uterine contractions, both are linked to a recording

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device [12]. It is known as external CTG. It is done by wearing a belt across the abdomen, which restricts mother's mobility [13].

Sometimes baby's heart rate monitoring is done by placing scalp electrode directly on fetal head and requires ruptured amniotic membrane. It is known as internal CTG [14].

We have done external CTG intermittently during labor for a duration of 20 minutes. According to ACOG, NICE and RANZCOG guidelines, fetal heart rate should be auscultated at least every 15 minutes in first stage of labor and at least every five minutes in the second stage of labor with each auscultation at least for 60 seconds [14, 15].

Interpretation

The term of electronic fetal monitoring is sometimes used synonymously with CTG, but it's less precise, CTG includes monitoring of maternal uterine contractions also.

According to FIGO guidelines, baseline fetal heart rate is 120-160 beats/min, mild tachycardia is 160-180 beats/min, severe tachycardia is 180beats/min and more, bradycardia is 100-120 beats/min and severe bradycardia is 100 beats/min or less. Beat to beat variability is 5-25/min. Transient increase and decrease are referred as acceleration and deceleration (early, late, variable) [16, 17].

According to NICE guidelines CTG may be normal and abnormal. Abnormal includes both the suspicious and pathological varieties.

Normal CTG

When all the 4 features (baseline FHR and variability are normal, no deceleration and accelerations are present) are reassuring that is defined as normal CTG.

Suspicious CTG

Among the 4 features, when 1 feature is non-reassuring, but the other 3 features are normal, that is a suspicious CTG.

Pathological CTG

When 2 or more features are non-reassuring, that is a pathological CTG.

Some aspects of labor cause natural alterations in FHR patterns. For example, the baby's sleep FHR pattern differs from the waking FHR pattern. During baby's sleep, silent CTG may be produced. External stimuli, such as uterine contractions and the mother moving, can cause FHR changes, as can administration of opiates to the mother. Consideration is needed about whether such information improves detection and outcomes for babies who are truly compromised and if there are technology-related disadvantages for those who are not compromised [18-20].

Sensitivity and specificity

Specificity to predict cerebral palsy from abnormalities of FHR in CTG, is low. False positive rate may be as high as 99.8%, even in the presence of multiple decelerations. FHR pattern recognition, including the relationship between uterine contractions and FHR decelerations, are fundamental to the use of continuous CTG monitoring. Algorithms have been developed to assess and record what is normal, what requires more careful attention, and what is considered abnormal requiring immediate delivery of the baby. However, CTG traces are often interpreted differently by different caregivers (inter-observer variation) and even by the same caregiver interpreting the same record at different times (intra-observer variation). Such variation in interpretation of CTG tracings may result in inappropriate interventions, or false reassurance and lack of appropriate intervention. However, FHR parameter of interest in intermittent auscultation is the baseline FHR, it is likely that inter- and intra-observer variation is less in intermittent auscultation [21-25].

False positive means that the record is pathological, and fresh undepressed child is born, without acidosis; false negative record means that with the normal CTG record asphyxic / depressed child with HIE is born and that will manifest later in neurodevelopmental disorders [26-28].

Inclusion Criteria

1. Pregnant women with singleton pregnancy with cephalic presentation with gestational age 37weeks to 42 weeks.

Exclusion Criteria

- 1. Women with DM and GDM
- 2. Multiple pregnancies
- 3. Scar uterus
- 4. Non cephalic presentation
- 5. Preterm and post term labor
- 6. APH
- 7. FGR
- 8. Ultrasound confirmed fetal congenital anomalies

MATERIALS AND METHODS

During admission a detailed history was taken including all the demographic characteristics. Informed consent was taken after explaining the procedure in detail. After admission a baseline CTG was done for a duration of 20 minutes in semi supine position.

Total 500 patients were included by purposive sampling. A prospective observational study was done. Patients were divided into 2 groups, normal and abnormal (pathological and suspicious).

Data Analysis

Statistical processing of data was done by SPSS, version 21.0. Variables will be listed as

frequencies and percentage. For statistical analysis, p value < 0.05 was taken as level of significance.

RESULTS

Features	Normal CTG	Abnormal CTG	P value
Age:			
<18years	20(21%)	75(78.9%)	< 0.05
18-35years	180(51.3%)	171(48.7%)	NS^*
>35years	30(55.6%)	24(44.4%)	NS^*
Pregnancy status:			
Primipara	53(34%)	103(66%)	< 0.001
Multipara	174(50.6%)	170(49.4%)	NS^*
Gestational age:			
Pre term (28-<37weeks)	52(56.5%)	40(43.5%)	NS^*
Term (37-42 weeks)	160(54.6%)	133(45.4%)	NS^*
Post term (>42 weeks)	21(18.3%)	94(81.7%)	< 0.001

Table 1: Demographic features of 2 groups

Table 2: Interpretation of CTG

CTG	Normal	Abnormal (Suspicios+Pathologica	
N=500	264(52.8%)	236(47.2%)	

Table 3: Findings of CTG

Abnormal CTG	Frequency(n=236)	Percentage
Bradycardia	49	21
Tachycardia	61	26
Early deceleration	27	11
Late deceleration	75	31
Variable deceleration	18	8
Silent	6	2.5

Table 4: Mode of deliveries

Mode of delivery	Normal CTG	Abnormal CTG	Total	P value
SVD (Spontaneous vaginal delivery)	303(77%)	91(23%)	394(79%)	< 0.001
Instrumental vaginal birth (Forceps)	0(0%)	3(100%)	3(0.6%)	< 0.001
LSCS (Emergency)	23(22%)	80(78%)	103(21%)	< 0.05

Table 5: Association of	CTG findings wit	h perinatal outcomes

Perinatal outcome	CTG (Normal)	CTG (Abnormal)	Total	P value
Low APGAR score at 1 st & 5 th minute	49(30.4%)	112(69.6%)	161	< 0.05
NICU admission	29(16.67%)	145(83.33%)	174	< 0.001
Perinatal asphyxia	21(22.8%)	71(77.17%)	92	< 0.05
Meconium aspiration	19(23.17%)	63(76.82%)	82	< 0.05
Neonatal seizure	3(30%)	27(90%)	30	< 0.001
Low birth weight	80(51.6%)	75(48.39%)	155	NS^*

*NS: Not significant

DISCUSSION

The goal of an Obstetrician is not only to prevent fetal death, but also to detect fetal compromise and take efficient steps for delivery at right time. About 2.6 million stillbirths occur annually throughout the world and among them about 40 percent occur during delivery [29, 30].

CTG is a commonly used test for antepartum and intrapartum fetal surveillance, although its clinical

impact on fetal outcome is controversial. But it's rational to use, because it gives a picture of fetal outcome which reflects fetal cerebral-cardiac response and fetal hypoxia. Neonatal asphyxia is 3.9 times higher in abnormal CTG and intrapartum fetal distress [31].

In our study, below18 years, 21% had normal CTG and 78.9% had abnormal, which was statistically significant. 24% of elderly group, more than 35 years had abnormal CTG. 51.3% had normal CTG within 18-

35 years of age. 66% nulliparous patients had significant numbers of non-reassuring CTG. 81.7% in post term patients had abnormal CTG.

Jing Lu *et al.*, found in their study that 33% were in adolescent group and 32% were in 23 -42 years. Among nulliparous patients, 49.1% patients had normal CTG and 84.1% had abnormal (p<0.05). In post term pregnancies they found significantly raised non-reassuring CTG [32].

I our study, 47.2% patients had suspicious and pathological CTG. Among these, 21% had bradycardia, 26% had tachycardia, 11% had early decelerations, 31% had late decelerations 8% had variable decelerations and 2.5% had silent CTG.

In our study, 77% patients with normal CTG and 23% had abnormal CTG delivered baby vaginally spontaneously. 3 patients with abnormal CTG needed low forceps delivery. 78% with abnormal CTG ended in emergency caesarean section.

Khursheed *et al.*, shows in their study that, patients with normal CTG delivered vaginally are 62.50% and via caesarean section are 37.5%, while with abnormal CTG delivered vaginally are 27.27% and by caesarean section are 72.72% [33].

In our study 69.6% low Apgar score babies were delivered from Mothers with abnormal CTG. With pathological and suspicious CTG, 83.33% babies needed NICU admission, 77.71% had perinatal asphyxia, 76.82% had meconium aspiration, neonatal seizure was present in 27 patients and low birth weight were 48.39% babies.

Significant low birth weight and Low Apgar score was present in the study of Jing Lu *et al.*, [32] Morokuma *et al.*, found that small for gestational age in non -reassuring CTG were significant [34].

We can conclude that, CTG is one of the most reliable methods of fetal monitoring in pregnancy and delivery. Pathological CTG is very likely associated with bad fetal outcome.

LIMITATIONS

Research should also address the possible contribution of the supine position to adverse outcomes for babies, and assess whether the use of mobility and positions can further reduce the low incidence of neonatal seizures and improve psychological outcomes for women.

CONCLUSION

Cardiotocography is one of the reliable methods of monitoring of fetus in pregnancy and during childbirth. Pathological CTG record with high probability indicates possibility of existence of perinatal asphyxia. Unfortunately, cardiotocography has also large number of false positive findings. Its sensitivity is 66%. Therefore, records from pregnancy, suspicion of fetal hypoxia / asphyxia should be confirmed by ultrasound Doppler examination; in birth suspicious (positive ones) records should be checked by pH monitoring.

Achieving low level of correlation between pathological intrapartal cardyotocographic findings and long-term outcome of children can be achieved by quick and adequate obstetric intervention and relatively short duration of fetal acidosis, and optimal procedures during intensive treatment of newborns.

Conflict of interest: None declared

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