

Admission Cardiotocography Screening Test to Predict Foetal Outcome and Mode of Delivery in IGIMS

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Abstract

Aim: Admission Cardiotocography screening test to Predict foetal outcome and mode of delivery in IGIMS.

Materials and Methods: This observational study was conducted in the Department of Reproductive Medicine, IGIMS, Patna, Bihar, India for two years. A total of 100 patients were included in the study. Patients with high-risk pregnancy conditions such as pregnancy-induced hypertension (PIH), eclampsia, diabetes, intrauterine growth restriction (IUGR), thyroid disorder, heart disease, anemia, bad obstetric history (BOH), oligohydramnios, post-dated pregnancy, diminished fetal movements, and premature rupture of membranes lasting more than 6 hours. Gestational age between 33 to 42 weeks were included in this study. Patients with normal pregnancy, Multifetal pregnancy, Gestational age less than 32 weeks, High-risk pregnancies that progressed to labor and Pregnancies with congenital fetal anomalies were excluded from the study.

Results: The distribution of fetal heart conditions, as measured by cardiotocography (CTG), showed that 73% of the subjects had normal CTG results, whereas 27% had abnormal CTG results. This difference was statistically significant with a p-value of 0.002. The relationship between CTG results and the method of delivery, it was found that 42.47% of spontaneous deliveries had normal CTG results, and 7.41% had abnormal results. In contrast, 57.53% of caesarean section deliveries had normal CTG results, while a significant 92.59% had abnormal CTG results, with a p-value of 0.001, indicating a significant association. The relationship between CTG results and birth weight indicated that among those with a birth weight less than 2.5 kg, 27.40% had normal CTG results, and 62.97% had abnormal results. For those with a birth weight over 2.5 kg, 72.60% had normal CTG results, while 37.03% had abnormal results, with a p-value of 0.01, showing a significant correlation. Lastly, the relationship between CTG results and the APGAR score at one minute showed that among those with an APGAR score of 7 or less, only 4.6% had normal CTG results, while 81.2% had abnormal results.

Conclusion: The rate of prompt resuscitation and admission of the infants to the newborn care unit was greater among this group. The cardiotocograph may be effectively used as a reliable screening technique for fetal monitoring. If the cardiotocography (CTG) displays an aberrant pattern, it is recommended to complement the antepartum CTG with a biophysical profile. In addition, the intrapartum CTG should be complemented with fetal scalp blood collection to assess the acid-base status before any intervention is performed.

Keywords: Antepartum Cardiotocography, Pregnancies, High risk, Fetal

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Introduction

Antepartum cardiotocography (CTG) is a pivotal tool in obstetric care, particularly for pregnancies deemed high-risk. This non-invasive monitoring technique assesses fetal well-being by simultaneously recording the fetal heart rate (FHR) and uterine contractions. Its primary purpose is to detect fetal hypoxia and other potential complications, thereby allowing timely interventions to improve fetal outcomes. In high-risk pregnancies, which may include conditions such as preeclampsia, intrauterine growth restriction

(IUGR), diabetes mellitus, and multiple gestations, the use of CTG becomes even more critical. High-risk pregnancies are associated with an increased likelihood of adverse perinatal outcomes. These pregnancies require vigilant monitoring to promptly identify and manage potential complications. CTG plays a crucial role in this context by providing real-time data on fetal heart rate patterns, which can indicate fetal distress. CTG monitors fetal heart rate through a transducer placed on the mother's abdomen, while uterine contractions are recorded

via a pressure sensor. The data are then plotted on a graph, allowing healthcare providers to assess the relationship between fetal heart rate and uterine activity. Interpretation of CTG involves evaluating baseline fetal heart rate, variability, the presence of accelerations, and decelerations. One of the primary benefits of CTG in high-risk pregnancies is the early detection of fetal distress. Studies have shown that timely identification of abnormal CTG patterns can lead to early interventions, such as expedited delivery, which can significantly improve neonatal outcomes. Consistent monitoring with CTG has been associated with a reduction in perinatal morbidity and mortality. [1-3] Nevertheless, any distant affront resulting from the labor method may only be detected via extended periods of monitoring. Various methodologies exist for assessing the fetus's vulnerability. Preferably, it should be readily accessible, and the test should be replicable without significant effort or cost. The cardiotocography (CTG) is the most often used test for monitoring the fetus throughout both the antepartum and intrapartum periods. Abnormal FHR tracing may reliably indicate the evaluation of labor complicated by MSL (meconium stain liquor). Enrollment CTG refers to the continuous electronic monitoring of fetal heart rate (FHR) for a duration of 20 minutes, while simultaneously documenting uterine activity upon admission to the labor room ward. A normal fetus can handle intrapartum stress, whereas a weakened fetus cannot endure hypoxia. Therefore, the occurrence of intrapartum hypoxia and consequent hypoxic ischaemic encephalopathy is frequent in pregnancies that are at a high risk. Birth asphyxia, which occurs during the course of childbirth, is the primary cause of perinatal death, as shown by sources [4,5]. The CTG is an effective screening test because to its simplicity and ability to be performed by nursing staff. It may be completed within 20-40 minutes and is well accepted by expecting women. The test can be repeated at any time and has high validity, making it a valuable intra-partum screening tool. While auscultating, it is possible to determine the baseline fetal heart rate (FHR), but quantifying other aspects of the FHR such as baseline variability, acceleration, and deceleration may be challenging. Therefore, a new examination is necessary to identify women who are deemed to have both a low risk and high risk of complications to their fetus during admission or during labor. Not only is it easy and affordable, but it is also non-invasive, readily executed, and understood.

Materials and Methods

This observational study was conducted in the Department of Reproductive Medicine, IGIMS, Patna, Bihar, India for two years. The research comprised a total of 100 patients. Patients with high-risk pregnancy conditions include those with

pregnancy-induced hypertension (PIH), eclampsia, diabetes, intrauterine growth restriction (IUGR), thyroid disorder, heart disease, anemia, bad obstetric history (BOH), oligohydramnios, post-dated pregnancy, diminished fetal movements, and premature rupture of membranes lasting more than 6 hours. This research comprised participants with a gestational age ranging from 33 to 42 weeks. The research excluded patients with uncomplicated pregnancies, pregnancies with multiple fetuses, pregnancies with a gestational age of less than 32 weeks, high-risk pregnancies that went into labor, and pregnancies with fetal deformities.

Methodology

Data were collected through interviews, brief medical history, general physical examination, and sonographic findings. A structured questionnaire containing all variables of interest was used to gather the data. All collected data were compiled and analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0 software. Tests of significance were performed using p-values and chi-square tests. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1 show that the study subjects' baseline characteristics indicate a diverse age distribution and delivery methods. Specifically, 8% of the subjects were below 20 years, 33% were aged 20-25 years, 43% were 25-30 years, and 16% were 30-35 years old. Regarding delivery methods, 33% of the subjects had spontaneous deliveries, while a majority of 67% underwent caesarean sections.

Table 2 show that the distribution of fetal heart conditions, as measured by cardiotocography (CTG), showed that 73% of the subjects had normal CTG results, whereas 27% had abnormal CTG results. This difference was statistically significant with a p-value of 0.002.

Table 3 show that in terms of liquor color, 62% of the subjects had normal liquor color, 27% had light meconium-stained liquor, and 11% had deep meconium-stained liquor. This distribution provides insight into the condition of the amniotic fluid at the time of delivery.

Table 4 show that the pregnancy status of the subjects revealed various conditions: 6% had chronic hypertension, 3% had gestational hypertension, 32% had preeclampsia, 17% had eclampsia, 14% had diabetes, 2% had heart disease, 12% had anemia, 6% had a history of poor obstetric outcomes (BOH), 7% had intrauterine growth restriction (IUGR), and 1% had other conditions.

Table 5 show that the Fetal birth weight was another critical measure, with 37% of the newborns weighing less than 2.5 kg (mean \pm SD: 2.66 \pm 0.19),

and 63% weighing more than 2.5 kg. The APGAR score at one minute revealed that 24% of the newborns had a score of 7 or less, indicating a need for immediate medical attention, while 76% had a score greater than 7, suggesting healthier conditions immediately after birth.

Table 6 show that Examining the relationship between CTG results and the method of delivery, it was found that 42.47% of spontaneous deliveries had normal CTG results, and 7.41% had abnormal results. In contrast, 57.53% of caesarean section deliveries had normal CTG results, while a significant 92.59% had abnormal CTG results, with a p-value of 0.001, indicating a significant association.

The relationship between CTG results and birth weight indicated that among those with a birth

weight less than 2.5 kg, 27.40% had normal CTG results, and 62.97% had abnormal results. For those with a birth weight over 2.5 kg, 72.60% had normal CTG results, while 37.03% had abnormal results, with a p-value of 0.01, showing a significant correlation.

Lastly, the relationship between CTG results and the APGAR score at one minute showed that among those with an APGAR score of 7 or less, only 4.6% had normal CTG results, while 81.2% had abnormal results. For those with an APGAR score greater than 7, 95.4% had normal CTG results, and 18.8% had abnormal results, with a p-value of 0.002, highlighting a significant relationship between APGAR scores and CTG results.

Table 1: Baseline characteristics of study subjects

Variables	Number	Percentage
Age group (years)		
Below 20	8	8
20-25	33	33
25-30	43	43
30-35	16	16
Method of delivery		
Spontaneous	33	33
Caesarean section	67	67

Table 2: Distribution of fetal heart condition in study subjects

CTG	Number	Percentage	p value
Normal CTG	73	73	0.002
Abnormal CTG	27	27	

Table 3: Distribution of liquor colour in the study subjects

Liquor	Number	Percentage
Normal colour	62	62
Light meconium	27	27
Deep meconium	11	11

Table 4: Pregnancy status of the study subjects

Pregnancy status	Number	Percentage
Chronic hypertension	6	6
Gestational HTN	3	3
Preeclampsia	32	32
Eclampsia	17	17
Diabetes	14	14
Heart disease	2	2
Anaemia	12	12
BOH	6	6
IUGR	7	7
Others	1	1

Table 5: Distribution of fetal birth weight and APGAR score

Birth weight	Number	Percentage
<2.5 kg	37	37
>2.5 kg	63	63
APGAR score		
≤7	24	24
≥7	76	76

Table 6: Relationship of CTG according to method of delivery

Mode of delivery	CTG				Total		p value
	Normal		Abnormal		No.	(%)	
	No.	(%)	No.	(%)			
Spontaneous	31	42.47	2	7.41	33	33	0.001
Caesarean section	42	57.53	25	92.59	67	67	
Birth weight							0.01
<2.5 kg	20	27.40	17	62.97	37	37	
>2.5 kg	53	72.60	10	37.03	63	63	
APGAR score							0.002
≤7	2	4.6	13	81.2	15	25.0	
≥7	42	95.4	3	18.8	45	75.0	

Discussion

The objective of the obstetrician and neonatologist is to both avoid fetal mortality by providing treatment for pregnant women and to identify fetal compromise and ensure the timely birth of the newborn. Between seventy and ninety percent of fetal fatalities occurred prior to the initiation of labor [7]. Technology has significantly progressed in the areas of antepartum fetal surveillance and intrapartum monitoring [6]. The evaluation of fetal distress during childbirth cannot be determined by any one clinical or laboratory assessment. Cardiotocography (CTG) is a widely used test for monitoring the health of the fetus before and during childbirth in most hospitals in industrialized nations. However, the effect of CTG on the result of newborns is still a topic of debate among medical professionals [7]. CTG offers immediate and accurate information on the fetal state, unlike other techniques. The purpose of this test is to provide an indicator of fetal brain activity by measuring the cerebro-cardiac response, which is altered in the presence of hypoxia. The acceleration of fetal heart rate (FHR) is caused by the intact central nervous system (CNS) response mechanism. The absence of fluctuations in fetal heart rate (FHR) or the presence of decelerations indicates a suppression of this central nervous system (CNS) mechanism. The non-reactive cardiotocography (CTG) may be attributed to several factors, including fetal hypoxia, acidosis, fetal slumber, fetal abnormalities, and the administration of sedatives and opiates to the mother. These factors contribute to the absence of any concerning outcomes in the CTG. Although lacking specificity, cardiotocography is a valuable technology for monitoring the fetus before birth and

continues to be the primary method for assessing the fetus throughout labor [6]. This research aimed to examine the antepartum cardiotocography and fetal outcome in pregnancies that are at a high risk. The baseline features of the research individuals suggest a varied age distribution and a range of delivery modalities. More precisely, 8% of the participants were younger than 20 years, 33% were between the ages of 20 and 25, 43% were between the ages of 25 and 30, and 16% were between the ages of 30 and 35. In terms of birth procedures, 33% of the participants had spontaneous deliveries, whilst the majority of 67% received cesarean sections. The research found that 73% of participants had a normal CTG, whereas 27% had an aberrant CTG. The research conducted by Khatun et al. reported an abnormal CTG in 37.7% of cases [8], whereas Bina I et al. observed an abnormal CTG in 20.7% of cases. When there are a greater number of risk variables, the overall consequences are more pronounced among the abnormal CTG group [9]. This research observed a higher occurrence of chronic hypertension, PIH, pre-eclampsia, eclampsia, BOH, diabetes, anaemia, IUGR, and aberrant outcomes. The risk factors for these conditions are interconnected, with one factor increasing the likelihood of others [10]. In the research, the newborns in the aberrant CTG group had an APGAR score of less than 7 at 1 minute, which was comparable to the findings of the study conducted by Dellinger et al. [11]. The aberrant CTG group exhibited a significantly higher percentage of newborns with an APGAR score of less than 7 at 1 minute compared to the normal CTG group, which aligns with findings from several previous research. Piazze et al. [8, 10, 12] propose that there may be a

correlation between fetal heart rate (FHR) tracing and a poor APGAR score at 5 minutes in postdated pregnancy. The APGAR grading system has traditionally been used to assess the condition of the newborn at the time of delivery. Typically, it is presumed that this number indicates the extent of prenatal hypoxia. Nevertheless, current research [9] using cord blood analysis and fetal scalp blood pH has raised significant concerns about the dependability of APGAR score in assessing hypoxia. Based on an examination of many published publications, the APGAR score has been shown to have the following approximate accuracy rates in predicting hypoxemia: The sensitivity is 47%, specificity is 89%, positive predictive value is 56%, and negative predictive value is 86%[13]. According to this research, the fetal birth weight was identified as an important factor. Specifically, 37% of the infants had a weight of less than 2.5 kg, with an average of 2.66 kg and a standard deviation of 0.19 kg. On the other hand, 63% of the babies had a weight beyond 2.5 kg. In the research conducted by Divon et al., it was shown that 53 infants with a birth weight of less than 4000g and 10 infants with a birth weight more than 4000g had aberrant CTG readings [14]. Multiple studies have shown a correlation between an atypical prenatal CTG tracing and worse fetal outcome [12, 15-18]. Regarding the method of delivery, there was a significant prevalence of caesarean section in this research. The high occurrence of caesarean section in this research, despite normal test results, may be attributed to obstetrical factors such as a history of prior caesarean section, cephalopelvic disproportion, failed induction, severe preeclampsia, and severe intrauterine growth retardation. The rate of caesarean delivery for fetal distress was notably elevated in the group with aberrant CTG results. This discovery aligns with the findings of the research conducted by Dellinger et al. [11]. No perinatal deaths were recorded in either the normal CTG group or the aberrant CTG group in the current investigation. The research did not aim to prove a reduction in cesarean birth rates or establish a connection between electronic fetal monitoring and long-term neurological function and cerebral palsy. The purpose was to provide the pregnancy outcome and early neonatal outcomes specifically in instances of both normal and abnormal CTG readings.

Conclusion

The rate of prompt resuscitation and admission of the infants to the newborn care unit was greater among this group. The cardiotocograph may be effectively used as a reliable screening technique for fetal monitoring. If the cardiotocography (CTG) displays an aberrant pattern, it is recommended to complement the antepartum CTG with a biophysical profile. In addition, the intrapartum CTG should be

complemented with fetal scalp blood collection to assess the acid-base status before any intervention is performed.

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