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ORIGINAL ARTICLE

Evaluation of the Role of Intrapartum Pathological Cardiotocography in Prediction of Fetal Outcomes in Term Pregnancies

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ABSTRACT

Background: Continuous intrapartum electronic fetal heart rate monitoring is essential for identifying fetuses at risk of fetal hypoxia and related complications. Fetal movements, uterine contraction patterns, and fetal heart rate are all recorded using cardiotocography. **Aim:** This study aimed to evaluate the ability of intrapartum pathological cardiotocography to predict unfavorable fetal outcomes in term pregnancies. **Methods:** This study was a cohort observational study conducted on 120 pregnant women admitted to Zagazig University emergency hospital during term pregnancy in labor. All women were subjected to full history-taking, clinical assessment, Obstetric Ultrasound to confirm the gestational age, and intrapartum CTG in low-risk pregnant women. The color of liquor studied perinatal outcomes, Apgar score at one minute and five minutes, and NICU admission. **Results:** In the Low-risk group 30(85.8%) of cases were Suspicious and 5(14.2%) were Pathological on admission CTG while in the high-risk group, 50 (59%) of cases were Suspicious and 35(41%) were Pathological on admission CTG. Meconium-stained liquor was present in 10 (30%) low-risk pregnancies and 72 (84.7%) high-risk pregnancies. All participants with pathological CTG tracing underwent an emergency cesarean section (100%) and the majority of participants in both groups with suspicious CTG had LSCS (88.7%). There were no perinatal deaths in our study up to one week. **Conclusions**: Getting in CTG is a non-invasive screening technique that can be very important in predicting the health of the fetus during labor and helps identify fetal distress that is already present at the time of admission.

Keywords: Cardiotocography, Perinatal outcome, Apgar score

INTRODUCTION

In every nation, perinatal mortality and morbidity is a significant issue. Fetal death can result from a variety of causes, including issues with the mother during pregnancy or labor, the placenta, or the fetus [1].

Cardiotocograph (CTG) devices are used in electronic fetal monitoring (EFM) to track the fetal heart rate (FHR), the mother's heart rate, uterine contractions, and (occasionally) the pressure inside the uterus during birth. Fetal scalp blood gas analysis is indicated as a supplement to EFM [2].

Electronic uterine contraction monitoring provides continuous data. In certain birth settings, electronic monitoring is standard practice for high-risk patients and women experiencing oxytocin-induced labor; at

other facilities, all laboring women are monitored. Electronic monitoring can be carried out internally using a bipolar electrode affixed to the fetal scalp or externally using a device pressed against the mother's belly [3].

According to other research, ongoing EFM increases the number of interventions but does not stop many unfavorable labor outcomes [4].

In addition to making several recommendations about the performance of EFM, Education and training in risk management indicate that NICE recommends intermittent auscultation for women with low-risk pregnancies, rather than continuous electronic fetal monitoring (EFM) [2].

Pregnancy screening and monitoring are crucial methods for keeping an eye on the health of the fetus, reducing stillbirths, and lowering perinatal morbidity and death [1]. Thus, in high-risk obstetric situations. This study aimed to evaluate the ability of intrapartum pathological cardiotocography to predict unfavorable fetal outcomes in term pregnancies.

METHODS

This study was a cohort observational study conducted at Zagazig University Hospital, Obstetrics and Gynecology Emergency Department from June 2023 to June 2024. Included 120 Pregnant Women admitted to Zagazig University emergency hospital term pregnancy in labor. The study received approval from the Institutional Ethics Committee of the Faculty of Medicine. Zagazig University (ZU-IRB#10837), Following an explanation of the specifics, advantages, and hazards, each participant provided written informed permission. The study complies with the World Medical Association's 1975 Helsinki Declaration, which establishes ethical standards for studies involving human participants.

Inclusion criteria were 18–35 years old, 37–41 weeks gestational age, cephalic presentation, and pregnancy in the active phase of labor with an irregular cardiotocograph pattern.

Exclusion criteria were age <18 years and >35 years, gestational age between 37 and 41 weeks, post-term pregnancies, numerous pregnancies, malpresentation, fetal congenital abnormalities, women with IUFD, women not in labor and maternal fever, thyrotoxicosis, and prior cesarean sections.

Sample size:

Assuming all cases met the inclusion criteria and exclusion criteria. During the study period (12 months) 10 cases/month, 120 cases were included as a comprehensive sample.

All patients were divided into two groups High-risk cases (N=85) and Low-risk cases (N=35).

A high-risk pregnancy is one in which the mother, fetus, and/or newborn have a higher chance of having their lives or health jeopardized than the average population [5]. For instance, anemia, pregnancy-related hypertensive diseases, Rh isoimmunization, and associated medical conditions, including diabetes, thyroid disorders, and renal disease. Postdated pregnancy, oligo/polyhydramnios, fetal development limitation, or prelabor membrane rupture.

All women underwent a complete medical history, an abdominal examination, and tests such as blood group and Rh type, as well as a complete blood picture that included hemoglobin level, hematocrit, and platelet count. The evaluation of the coagulation system (prothrombin time, prothrombin concentration, partial thromboplastin time, and international normalized ratio), the kidneys (serum creatinine and blood urea nitrogen), the liver (liver transaminase level, serum albumin level), and obstetric ultrasound to verify gestational age and rule out the presence of low-lying placenta or fetal abnormalities.

During labor: Patients were observed in the labor room, and vital signs and the status of the labor were documented in the partograph. The pelvic adequacy, Bishop score, presence or absence of membrane, liquor color, head descent, and fetal skull molding were all assessed during the vaginal examination, which was performed at the time of admission. Every 30 minutes, the length and intensity of the uterine contraction were recorded. Temperature, pulse, maternal blood pressure, and cardiotocography were measured every two hours. Labor progress by partogram. When hypotonic uterine inertia was identified as the reason for the labor delay, oxytocin infusion was used to assist the process. When indicated (fetal distress, arrest of dilatation, and descent), cesarean sections were carried out.

Cardiotocography (CTG):

Maternal temperature >38°C, use of oxytocin or misoprostol, meconium-stained liquor, abrupt vaginal hemorrhage, and FHR abnormalities auscultation by Doppler sonar are indications for doing intrapartum CTG in low-risk pregnant women.

Steps of performance of CTG:

After that, the individuals in both groups underwent 20 minutes of entry CTG at a speed of 1 cm/min. The woman was placed in either the left lateral decubitus posture or dorsal decubitus with the head of the bed raised to 45° to do the CTG examination. The sonar

was positioned near the fetal back for 20 minutes of continuous auscultation of the FHR, while the tocodynamometer was positioned beneath the uterine fundus. The expectant mother was given a sensor to indicate the movements of the fetus. According to the NICE standards, CTG was objectively evaluated and classified as normal, suspect, or abnormal.

Normal baseline heart rate was considered as fetal heart rate from 110 to 160 beats per minute. Normal baseline variability was within 5 to 25 beats per minute. Acceleration was defined as an increase in fetal heart rate of more than 15 beats per minute for 15 seconds or more.

Non-reassuring cardiotocographs were ones with baseline heart rate between 100 - 109 beats per minute, 161 - 180 beats per minute, variability <5 or >40 beats for <90 minutes, early deceleration, variable deceleration or prolonged deceleration less than the 3-minute duration.

Abnormal features of cardiotocography were a baseline heart rate of less than 100 beats per minute, more than 180 beats per minute, a sinusoidal pattern for more than 10 minutes duration, variability of less than 5 beats, absence of accelerations, and presence of late decelerations, atypical decelerations, prolonged deceleration for more than 3 minutes.

When every characteristic was comforting, a CTG was deemed typical. When there were two reassuring qualities and one unsettling feature, it was classified as suspicious. When a CTG showed two unsettling features or one aberrant feature, it was considered pathological.

Pathological cardiotocography was defined when: At least one of the aforementioned qualities fell into the abnormal category, or two or more fell into the non-reassuring category (Table 1).

Those with normal CTG tracing after admission cardiotocography underwent regular care of normal labor and intermittent auscultation every 30 minutes during the first stage of labor and every 5 minutes during the second stage. Fetal distress was indicated by any aberrant FHR tracing with severe decelerations (variable or sustained deceleration), baseline FHR < 110 bpm, or > 160 bpm with loss of variability. The babies were delivered by emergency cesarean section or instrumental delivery. A continuous cardiotocograph was used to monitor the ladies with questionable tracing. People who have abnormal CTG have had emergency surgery to give delivery.

Perinatal outcomes:

Mode of delivery, gestational age during delivery, the color of the amniotic fluid at delivery, and any dark green, viscous, tenacious, or meconium-stained fluid with meconium lumps were considered moderate to thick meconium-stained liquor [2].

Every newborn's Apgar score was calculated using the hospital's normal Apgar scoring system at one and five minutes following birth, respectively. Color, heart rate, breathing effort, muscle tone, and stimulus response were the factors that determined the Apgar score. The newborn was examined at predetermined intervals following delivery to evaluate it. Following the newborn's assessment, a score was assigned to each component. At one minute and five minutes after birth, the total score was given out of ten. For early newborn death, the Apgar score in the first minute is less than 7. A composite unfavorable perinatal outcome was defined as the occurrence of at least one adverse perinatal event.

Neonatal sepsis, hypoxic-ischemic encephalopathy, cerebral hemorrhage, seizures newborn death, neonatal resuscitation, and NICU hospitalization were all recorded. The relationship between the neonatal outcome and the CTG results was noted.

Outcome measures:

The outcome metrics were at five minutes, the Apgar score was less than seven. Beverage with a moderate to thick meconium stain. Admission for birth asphyxia to a special care infant unit or neonatal critical care unit. When there are no other known causes, a newborn has a seizure within the first twenty-four hours after birth. Neonatal mortality from asphyxia within the first twenty-four hours after birth.

Ethics Considerations:

This study was ethically approved by the Institutional Reviewer Board (IRB #10837) in the Faculty of Medicine, Zagazig University Hospital, and parental consent from every case of their caregivers that participated in this research was taken. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis:

Software (version 20) was used to statistically analyze all of the data; each continuous variable in the study was calculated to compare the two groups, and the t-test, x2, and Fischer exact test were applied appropriately. Statistical significance was defined as a P-value of less than 0.05

RESULTS

In table (2), they are between the ages of 20 and 35 (mean age 31.38), with gravidity ranging from 2 to 6, parity ranging from 0 to 6, and abortion ranging from 0 to 3. Of the group under study, 35 (29%) were low-risk, and 85 (71%) were high-risk. Thirty patients (25%) had PROM, twenty-five cases (20.8%) had FRH anomaly on auscultation, twenty-four cases (20%) had hypertensive disorders, fourteen cases (11.6%) had gestational diabetes, fifteen cases (12.5%) had hypertension disorders, and twelve cases (10%) had anemia. These were the criteria for CTG monitoring. Distribution of cases according to admission CTG: 80 (67%) of cases were suspicious while 40 (33%) were Pathological.

Table 3 shows that 30 (85.7%) and 50 (59%) of the patients in the high-risk group were suspicious, while 5 (14.3%) of the cases in the low-risk group had abnormal CTG upon admission, and 35 (41%) had pathological CTG.

Meconium-stained liquor was found in 10 (28.4%) of the low-risk pregnancies and 72 (84.7%) of the high-risk pregnancies, according to Table 4.

Table 5 revealed that all people with pathological CTG tracing had an emergency cesarean section (100%), while the majority of participants in both groups with suspicious CTG underwent LSCS (88.7%).

Table 6 demonstrated that the Apgar scores at 1 and 5 minutes, neonatal resuscitation, and NICU admission in the low-risk group were significantly correlated with the outcomes of the admission test.

Table 7 demonstrated that the Apgar scores at 1 and 5 minutes, neonatal resuscitation, and both high-risk and low-risk NICU admissions were significantly correlated with the results of the admission tests.

Table 8 revealed that there were 14 cases of NICU-admitted kids in the low-risk group and 41 cases in the high-risk group who were born to moms with suspicious and abnormal CTG.

Table 9 demonstrated statistically significant variations in the neonatal outcomes of infants delivered to mothers who were admitted to the NICU due to suspicious and abnormal CTG. There were no perinatal deaths in our research.

Table 10 demonstrates The sensitivity, specificity, negative and positive predictive values, and accuracy of the admission CTG in predicting the Apgar score at one minute between low-risk pregnancies showed that the test had high NPV and specificity in predicting fetal distress in low-risk participants: 51%, 96%, 52%, 98%, and 87.9%, respectively; 54%, 97%, 54%, 98%, and 89% for sensitivity, specificity, negative, and positive predictive value and accuracy of admission CTG in the prediction of NICU The corresponding admission rates were 30%, 95%, 54%, 94%, and 90%. The sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of Apgar score at 1-min between high-risk pregnancies were 70%, 75%, 60%, 76%, and 80% respectively; sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of Apgar score at 5-min between high-risk pregnancies were 73%, 76%, 65%, 77%, and 82% respectively; and sensitivity, the admission CTG's specificity, negative predictive value, positive predictive value, and accuracy in predicting NICU admission were 75%, 83%, 77%, 80%, and 85%, respectively. This suggests that the entrance test predicts fetal distress in high-risk patients with excellent specificity and NPV.

Table (1): Cardiotocography classification**[2].**

Category	Definition
Normal	A CTG where all four features fall into the reassuring category.
Suspicious	A CTG whose features fall into one of the non-reassuring categories and the remainder of the features are reassuring.
Pathological	A CTG whose features fall into two or more non-reassuring categories or one or more abnormal categories.

CTG: Cardiotocography.

Table (2): Demographic and obstetric history of the studied group

Demographic data	mean ± SD (median) (Range)	
Maternal age (years)	31.38±3.8 29 (20-35)	
Gestational age (weeks)	38.8±1.8 39 (37-41)	
Gravidity	3.5±1.1 3 (2-6)	
Parity	2.7±0.27 3 (0-6)	
Abortion	0.53±0.7 0 (0-3)	
Risk factors	**N**	**%**
Low-risk group	35	29%
High-risk group	85	71%
CTG indication distribution		
Intra-partum monitoring	**120**	**100.0%**
PROM	30	25%
FHR abnormality on auscultation	25	20.8%
Hypertensive disorders	24	20%
Gestational diabetes	14	11.6%
Hypertension	15	12.5%
Anemia	12	10%
CTG at presentation		
Suspicious	80	67
Pathological	40	33
Total	120	100

PROM: premature rupture of membrane **CTG:** Cardiotocography **FHR:** Fetal heart rate

Table (3): Relationship between Low risk and High-risk groups and admission CTG results

	Admission CTG (N&%)			
Group	**Suspicious(n=80)**	**Pathological(n=40)**	**Total**	**p-value**
Low risk (n=35)	30 (85.7%)	5 (14.2%)	35	<0.001
High risk (n=85)	50 (59%)	35(41%)	85	<0.001
Total	80	40	120	

Table (4): Relationship between the color of liquor and admission CTG results in both low- and high-risk pregnancies

	Admission CTG (N&%)			
Meconium Staining	**Suspicious (n=80)**	**Pathological (n=40)**	**Total**	**p-value**
Low risk (n=35)				
Clear	25 (71.6%)	0 (0%)	25 (71.6%)	<0.001
Meconium-stained	5 (14.2%)	5 (14.2%)	10 (28.4%)	
Total	30 (85.8%)	5 (14.2%)	35(100%)	
High risk (n=85)				
Clear	10 (11.8%)	3 (3.5%)	13(15.3%)	0.018
Meconium-stained	40 (47%)	32(37.7%)	72(84.7%)	
Total	50 (58.8%)	35(41.2%)	85(100%)	

Table (5): Relationship between the admission CTG results and the mode of delivery in the low-and high-risk groups

Groups (N&%)					
Admission CTG	**Mode of Delivery**	**Low Risk**	**High Risk**	**Total**	**p-value**
Suspicious (n=80)	**VD**	3(10%)	6 (12%)	9 (11.3%)	0.0001
	LSCS	27(90%)	44 (88%)	71 (88.7%)	
	Total	30(100%)	50(100%)	80 (100 %)	
Pathological (n=40)	**VD**	0(0%)	0 (0%)	0 (0%)	0.0001
	LSCS	5(100%)	35(100%)	40 (100 %)	
	Total	5(100%)	35(100%)	40 (100 %)	

V.D: vaginal delivery, LSCS: lower segment cesarean section

Table (6): Relationship between admission CTG and perinatal outcome in Low-risk group

Parameters	**Admission CTG**		**p-value**
	Suspicious(n=30)	**Pathological(n=5)**	
Apgar score at 1 minute			
≥ 7	10 (33%)	1 (20.0%)	0.0005
< 7	20 (67%)	4 (80.0%)	
Apgar score at 5 minute			
≥ 7	20 (67%)	4 (80.0%)	0.005
< 7	10 (33%)	1 (20.0%)	
Neonatal resuscitation			
Yes	15(50%)	4 (80%)	0.0005
No	15 (50%)	1(20%)	
NICU admission			
Yes	10 (33%)	4 (80.0%)	0.01
No	20 (67%)	1 (20.0%)	

Table (7): Relationship between admission CTG and perinatal outcome in high risk group

Perinatal outcome in high-risk group			
Parameters	**Suspicious(n=50)**	**Pathological(n=35)**	
Apgar score at 1 minute			
≥ 7	25 (50%)	12 (34.2%)	0.01
< 7	25 (50%)	13 (65.8%)	
Apgar score at 5 minutes			
≥ 7	35 (70%)	8 (23%)	0.05
< 7	15 (30%)	27 (77%)	
Neonatal resuscitation			
Yes	33 (66%)	30 (86 %)	0.03
No	17 (34%)	5 (14%)	
NICU admission			
Yes	16 (32%)	25 (71.4%)	0.001
No	34 (68 %)	10 (28.5%)	

Table (8): NICU admitted babies born to mothers with suspicious CTG and pathological CTG in Low and high risk group

Parameters	Admission CTG		Total	p-value
	Suspicious (n=26)	Pathological (n=29)		
NICU admission				
Low-risk group	10 (38.4%)	4 (13.7%)	14	0.01
High -risk group	16 (61.6%)	25 (86.3%)	41	
Total	26(100%)	29 (100%)	55(100%)	

Table (9): Neonatal outcome of NICU admitted babies born to mothers with suspicious and pathological CTG

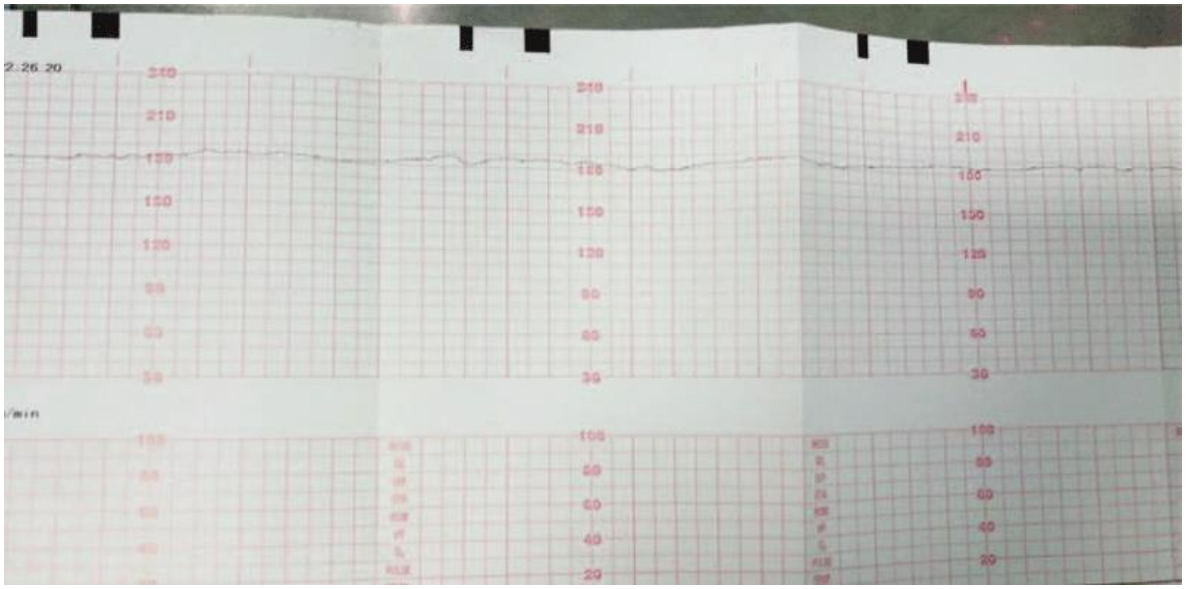
Parameter	Suspicious(n=26) (N&%)	Pathological(n=29) (N&%)	p value
Mechanical ventilation	5 (19.2)	7 (24)	0.001
Convulsions	2 (7.6)	5 (17.2)	
Respiratory distress	7 (27)	11 (38)	
MAS	4 (15.3)	8 (27.5)	
Early Onset sepsis (EOS)	3 (11.5)	7 (24)	
Perinatal asphyxia	5 (19.2)	8 (27.50)	
Congenital pneumonia	2 (7.6)	2 (6. 8)	
Hypoglycemia	1 (3. 8)	4 (13.6)	
Hypoglycemia with EOS	1 (3.8)	3 (10.2)	
Hypoglycemia with TTNB	0 (0)	1 (3. 4)	
Hypoxic ischemic encephalopathy	1 (3.8)	2 (6.8)	
Mortality	0 (0)	0 (0)	

MAS: Meconium aspiration syndrome **TTNB:** Transient tachypnea of newborn
N.B: more than one findings may presented in the same case

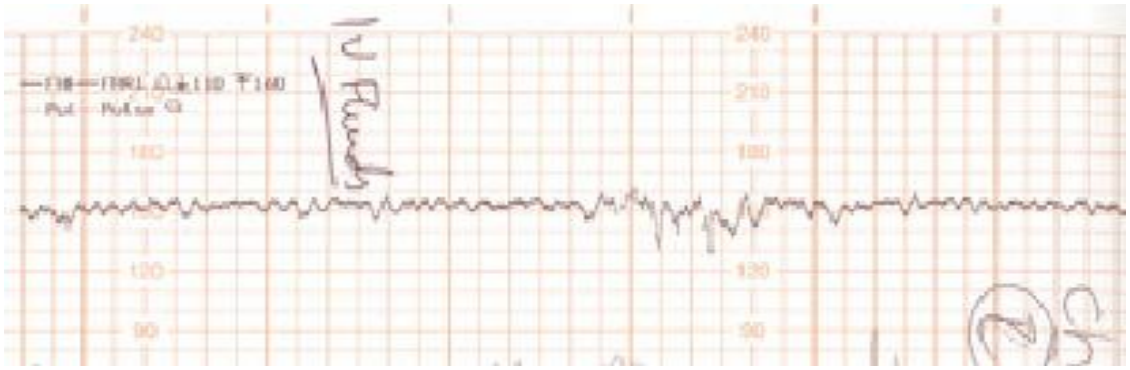
Table (10): Validity of CTG in the prediction of neonatal outcomes between low- risk pregnancies and high-risk pregnancies

Parameter	Sensitivity	Specificity	PPV	NPV	Accuracy
low- risk pregnancies					
Apgar score at 1-min	51.0%	96%	52	98%	87.9%
Apgar score at 5-min	54%	97%	54	98%	89%
NICU Admission	30%	95%	54%	94%	90%
high- risk pregnancies					
Apgar score at 1-min	70%	75%	60%	76%	80%
Apgar score at 5-min	73%	76%	65%	77%	82%
NICU Admission	75%	83%	77%	80%	85%

PPV: Positive Predictive Value, **NPV:** Negative Predictive Value



Fig(1): Persistent increase in heart rate and loss of normal variation in heart rate



Fig(1): Non-reactive و Pseudo sinusoidal/intermittent sinusoid segments.

DISCUSSION

There were 120 participants in the study, there were 85 individuals in the high-risk group and 35 in the low-risk group. Of these, 30 (25%) had PROM, 25 (20.8%) had FRH abnormality on auscultation, 24 (20%) had hypertensive disorders, 14 (11.6%) had gestational diabetes, 15 (12.5%) had hypertension disorders, and 12 (10%) had anemia.

Of the 100 participants in the **Kumar and Yadav** prospective study, were 49 people in the high-risk group and 51 in the low-risk group. Anemia (20.41%), hypertensive disorders of pregnancy (20.41%), and seizure disorders (20.41%) were the most prevalent conditions. Of the patients in the current study, 40 (33%) were pathological and 80 (67%) were suspicious. While 50 (59%) of the patients in the high-risk group were suspicious and 35 (41%), respectively, were pathological on admission CTG, 30 (85.8%) of the cases in the low-risk group were suspicious and 5 (14.2%) were pathological. In the high-risk group, meconium-stained fluid was present in 84.7% of individuals with suspicious and pathological tracing CTG, compared to 30% in the low-risk group with suspicious and pathological tracing on admission CTG**[6]**.

In the current study, while the majority of patients in both groups with questionable CTG underwent LSCS (88.7%), all participants with abnormal CTG tracing received an emergency cesarean delivery (100%).

Fetal PH sampling is not available in hospitals, which contributes to the low rate of vaginal deliveries. Any intervention is warranted if the test confirms the abnormal pattern of CTG. The quickest way to deliver the baby is safe without fetal blood sampling.

This is why the rate of cesarean sections was so high. In the Bogdanovic et al. investigation, a low CS rate was noted [7]. Other CTG adjuncts, such as ST wave analysis (STAN), Numerous studies are now being conducted to increase the sensitivity of CTG and decrease the false positive rate using vibroacoustic stimulation and fetal scalp stimulation [7].

Our result disagreement with the difference between the C/S rate of 43.6% and the actual delivery rate of 34.6% in the Bouiller JP trial may have resulted from the use of scalp sample for PH based on the abnormal pattern in CTG. **[8]**.

Results showed that when cardiotocography deteriorated from normal to pathological, the number of surgical births rose. In contrast to earlier research, such as that conducted by Ibrahim Kale [9], they discovered that 97% of neonates born via cesarean surgery because of fetal distress had an APGAR score of 7 or higher at the 5th minute, and 86.5% of those born by cesarean section had a score of 7 or higher at the 1st minute. This indicates that many needless cesarean sections are caused by the clinical identification of fetal distress based solely on fetal heart rate readings.

If there is no secondary confirmatory test to identify fetal compromise, the rate of operative delivery may increase from admission cardiotocography: Pathological CTG justifies operative delivery unless the pregnancy is in the second stage of labor and about to deliver. Additionally, ongoing cardiotocography monitoring during labor is a result of suspicious CTG **[10].**

Shrestha and Shrestha confirmed similar findings of higher risk of surgical delivery in mothers with abnormal CTG **[11]**.

Results showed that when cardiotocography deteriorated from normal to pathological, the number of surgical births rose. In contrast to earlier research, such as that conducted by Ibrahim Kale [9], they discovered that 97% of neonates born via cesarean surgery because of fetal distress had an APGAR score of 7 or higher at the 5th minute, and 86.5% of those born by cesarean section had a score of 7 or higher at the 1st minute. This indicates that many needless cesarean sections are caused by the clinical identification of fetal distress based solely on fetal heart rate readings.

If there is no secondary confirmatory test to identify fetal compromise, the rate of operative delivery may increase from admission cardiotocography: Unless the pregnancy is in the second stage of labor and about to give birth, pathological CTG warrants an operation. Additionally, ongoing cardiotocography monitoring during labor is a result of suspicious CTG**[10].**

Shrestha and Shrestha confirmed similar findings of higher risk of surgical delivery in mothers with abnormal CTG **[11]**.

According to a different study, certain aberrant results on fetal heart rate electronic monitoring were linked to a higher incidence of cerebral palsy. But the rate of false positives was very high. Given that cesarean sections are commonly performed when such abnormalities are observed and are associated with maternal risk, their findings raise worries that many would be performed without benefit if these criteria were widely employed [9].

Neonatal Apgar scores, the requirement for resuscitation, and NICU hospitalization were found to be significantly correlated in other studies by **Imaralu et al. [12]** and **Kumar and Yadav [6]** in neonates born to mothers with suspicious or worrisome admission CTG results.

The sensitivity, specificity, negative, positive predictive value, and accuracy of the admission CTG in predicting the Apgar score at one minute between low-risk pregnancies were 51%, 96%, 52%, 98%, and 87.9%, respectively, according to the current study; sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in predicting the Apgar score at 5 minutes between low-risk pregnancies were 54%, 97%, 54%, 98%, and 89%, respectively; and sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in predicting NICU admission were 30%, 95%, 54%, 94%, 94%, and 90%, respectively.

When predicting the Apgar score at one minute between high-risk pregnancies, the sensitivity, specificity, negative predictive value, and accuracy of admission CTG were 70%, 75%, 60%, and 76%, respectively and 80% respectively; sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of Apgar score at 5-min between high-risk pregnancies were 73%, 76%, 65%, 77%, and 82% respectively; and sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of NICU admission were 75%, 83%,77%, 80%, and 85% respectively. This suggests that the entrance test predicts fetal distress in high-risk patients with excellent specificity and NPV.

When predicting the Apgar score at one minute between high-risk pregnancies, the sensitivity, specificity, negative predictive value, positive

predictive value, and accuracy of admission CTG were 70%, 75%, 60%, 76%, and 80%, respectively; Sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of Apgar score at 5-min between high-risk pregnancies were 73%, 76%, 65%, 77%, and 82% respectively; and the NICU admission CTG's sensitivity, specificity, negative, positive predictive value, and accuracy were 75%, 83%, 77%, 80%, and 85%, respectively. This suggests that the entrance test predicts fetal distress in high-risk patients with excellent specificity and NPV.

The sensitivity, specificity, and positive predictive value of aberrant admission cardiotocography in detecting fetal distress and likelihood ratio are fairly equivalent to those found in previous research. A study conducted by **Turner et al. [13]** on 405 women to assess the usefulness of fetal heart rate tracing during the latent period of labor revealed that screening fetal heart rate tracing had a positive predictive value of 75%, a sensitivity of 57%, and a specificity of 98%.

In contrast to Apgar score, meconium, resuscitation, NICU hospitalization, and seizures, the primary endpoint was determined to be an emergency caesarian section because of fetal distress.

In previous studies, the predicted effectiveness of the screening test was assessed using the study's end point, a cesarean section for fetal distress. However, perinatal hypoxia would not always be indicated by a cesarean delivery done for fetal discomfort. Nonetheless, our data indicate that the fetal admission test is useful in predicting the absence of intrapartum fetal distress due to its high specificity and negative predictive value.

The research has demonstrated that the interpretation of cardiotocography is subject to considerable intra-observer and inter-observer error. Although cardiotocographs were read and classified for this study by postgraduate trainees, the possibility of a mistake resulting from misinterpretation still exists. Studies comparing obstetricians' and midwives' evaluations of labor admission examinations came to this conclusion. Computerized cardiotocography can reduce erroneous interpretation, increasing sensitivity and specificity **[14].**

It's critical to utilize an effective early prediction test to identify fetuses that may be at risk during labor. Additional developments, such computer analysis of CTG, could reduce CTG faults like intra-observer and inter-observer interpretation variance. Future intrapartum surveillance may be revolutionized by an understanding of CTG pattern recognition based on fetal physiology and more recent CTG categorization. It will also be helpful to get fetal scalp sampling to identify acidity in the fetus in order to resolve any confusion during labor treatment **[14] .**

In order to provide appropriate fetal surveillance and reduce emergency caesarean sections for suspected fetal distress, supplementary fetal wellness tests were necessary, such as computerized CTG analysis or fetal blood sample for pH. Educating and training caregivers in the evaluation and interpretation of cardiotocography may help improve the standard of obstetric treatment **[6]**

CONCLUSIONS

Fetal distress that is already present at the time of admission can be detected with the help of admission CTG, a quick, straightforward, affordable, non-invasive screening technique that can also be very important in predicting the health of the fetus throughout labor. It aids in the planning of early intervention to avoid unfavorable prenatal outcomes, particularly in hospitals with heavy patient loads and limited resources. The sensitivity, specificity, negative and positive predictive values, and accuracy of the admission CTG in predicting the Apgar score at one minute between low-risk pregnancies showed that the test had high NPV and specificity in predicting fetal distress in low-risk participants: 51%, 96%, 52%, 98%, and 87.9%, respectively; 54%, 97%, 54%, 98%, and 89% for sensitivity, specificity, negative, and positive predictive value and accuracy of admission CTG in the prediction of NICU The corresponding admission rates were 30%, 95%, 54%, 94%, and 90%. The sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of Apgar score at 1-min between high-risk pregnancies were 70%, 75%, 60%, 76%, and 80% respectively; sensitivity, specificity, negative, positive predictive value, and accuracy of admission CTG in the prediction of Apgar score at 5-min between high-risk pregnancies were 73%, 76%, 65%, 77%, and 82% respectively; and sensitivity, the admission CTG's specificity, negative predictive value, positive predictive value, and accuracy in predicting NICU admission were 75%, 83%, 77%, 80%, and 85%, respectively. This suggests that the entrance test predicts fetal distress in high-risk patients with excellent specificity and NPV. The major drawback of admission CTG is that it increases the rate of cesarean sections when fetal blood is not taken to confirm fetal hypoxia during labor. Adjunctive

methods are required to improve the fetal CTG's sensitivity and specificity.

Conflicts of Interest

The authors report no conflicts of interest.

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