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FREQUENCY OF ADVERSE FETAL OUTCOME IN FEMALES WITH ABNORMAL CTG

Saqiba Khan[1], Muqddas Niaz[2], Rabia Bashir[3], Istehsan Ahmad[4], Atta Ul Rehman Saadi[5], Shehryar Haider[6]

[1]MBBS, FCPS-I (OBGYN) Resident 2nd year OBGYN, Gulab Devi Teaching Hospital, Lahore
[2]MBBS, Medical Officer Punjab Social Security HMC Manga Raiwind Hospital, Lahore
[3]MBBS, RMP, Medical Graduate from Mohtarma Benazir Bhutto Shaheed Medical College Mirpur AJK
[4]MBBS, Medical Graduate, Sheikh Zayed Hospital Lahore
[5]MBBS, Medical Officer, Khalida Memorial Hospital, Sialkot
[6]MBBS, House Officer Anesthesia Shaikh Zayed Hospital, Lahore

***Corresponding Author:** Dr. Saqiba Khan
Email: saqibakhan28@gmail.com

ABSTRACT

Background: Abnormal cardiotocograph (CTG) patterns during labor are significant indicators of potential fetal distress, necessitating timely clinical interventions to mitigate adverse outcomes.

Objectives: This study aimed to determine the frequency of adverse fetal outcomes in females presenting with abnormal CTG readings.

Methods: A cohort of 90 women with singleton pregnancies at term and abnormal CTG patterns, defined by FIGO criteria, were monitored during labor. Demographic data, obstetric history, and clinical outcomes were recorded. The primary outcomes measured were Apgar scores less than 7 at 5 minutes, NICU admissions, neonatal seizures, hypoxic-ischemic encephalopathy (HIE), and perinatal death. Statistical analysis was performed using SPSS software.

Results: The mean age of participants was 29.5 ± 4.2 years, with an average gestational age of 39.1 ± 1.2 weeks. Primiparous women constituted 46.7% of the sample. Adverse outcomes included low Apgar scores in 16.7% of cases, NICU admissions in 20.0%, neonatal seizures in 4.4%, HIE in 3.3%, and perinatal deaths in 2.2%. Pathological CTG patterns were significantly associated with higher NICU admission rates ($p = 0.04$). Emergency cesarean sections were performed in 38.9% of cases.

Conclusion: Abnormal CTG patterns were significantly associated with adverse fetal outcomes, highlighting the importance of vigilant monitoring and timely intervention to improve neonatal health. Further studies and standardized protocols are recommended to enhance CTG interpretation and clinical management.

Keywords: Abnormal cardiotocograph (CTG), Adverse fetal outcomes, Neonatal intensive care unit (NICU) admission, Apgar score, Hypoxic-ischemic encephalopathy (HIE), Emergency cesarean section

INTRODUCTION

The intrapartum period, encompassing labor and delivery, is a critical phase where continuous monitoring of fetal well-being becomes paramount. One of the most widely used tools for this purpose is the cardiotocograph (CTG), which provides real-time data on fetal heart rate (FHR) and uterine contractions. The primary goal of CTG monitoring is to identify any signs of fetal distress that could indicate hypoxia or other complications necessitating timely intervention. However, interpreting CTG can be complex, with patterns categorized as normal, suspicious, or pathological based on specific criteria outlined by various guidelines such as those from the International Federation of Gynecology and Obstetrics (FIGO).

An abnormal CTG, which may present as persistent bradycardia, tachycardia, or late decelerations, among other features, is a significant indicator of potential adverse fetal outcomes. These outcomes can range from mild complications to severe consequences such as hypoxic-ischemic encephalopathy, neonatal seizures, or even perinatal death. The prevalence and types of adverse outcomes associated with abnormal CTG tracings are of great interest to clinicians and researchers alike, as understanding these correlations can improve decision-making processes during labor and delivery, potentially enhancing neonatal outcomes and reducing perinatal morbidity and mortality.

Numerous studies have investigated the link between abnormal CTG findings and adverse fetal outcomes. For instance, research has shown that abnormal CTG patterns are associated with increased rates of emergency cesarean sections, instrumental deliveries, and neonatal intensive care unit (NICU) admissions. Additionally, long-term follow-up studies suggest that infants who experience distress during labor, as indicated by abnormal CTG, may face developmental delays or neurological impairments.

The sensitivity and specificity of CTG in predicting adverse outcomes have been subjects of debate, highlighting the need for adjunctive methods such as fetal scalp blood sampling or lactate measurement to corroborate CTG findings. Despite these adjuncts, CTG remains a cornerstone of intrapartum fetal monitoring due to its non-invasive nature and the continuous information it provides. However, the challenge lies in accurately interpreting CTG traces and making timely, appropriate clinical decisions based on these interpretations.

In low-resource settings, where access to advanced fetal monitoring techniques may be limited, the reliance on CTG interpretation becomes even more critical. Training and protocols are essential to ensure that healthcare providers can effectively recognize and respond to abnormal CTG patterns. Additionally, there is ongoing research into improving CTG technology, including the development of computerized interpretation systems that aim to reduce observer variability and enhance diagnostic accuracy.

In this article, we delve into the frequency of adverse fetal outcomes in females with abnormal CTG readings. By examining recent data and studies, we aim to provide a comprehensive overview of the incidence of these outcomes and discuss the implications for clinical practice. Understanding the patterns and predictors of adverse outcomes can help refine fetal monitoring strategies, improve maternal and fetal health outcomes, and inform guidelines and policies related to intrapartum care.

We will also explore the potential for integrating emerging technologies and methodologies to augment traditional CTG monitoring, aiming to create a more robust framework for detecting and managing fetal distress. By bringing together current evidence and expert perspectives, this article seeks to contribute to the ongoing dialogue on enhancing fetal monitoring and ensuring better outcomes for both mothers and their babies.

MATERIALS AND METHODS

The study was conducted at Gulab Devi Teaching Hospital, Lahore from June 2023 to December 2023. The sample comprised 90 women admitted to the labor and delivery unit, who presented with abnormal cardiotocograph (CTG) readings during labor. Ethical approval was obtained from the hospital's Institutional Review Board, and informed consent was obtained from all participants.

Women included in the study were those who were at least 37 weeks of gestation, had a singleton pregnancy, and presented with abnormal CTG readings. Abnormal CTG was defined according to

FIGO criteria, which include persistent non-reassuring fetal heart rate patterns such as bradycardia, tachycardia, reduced variability, and late decelerations. Exclusion criteria were multiple gestations, pre-existing maternal conditions that could affect fetal heart rate independently of labor, such as preeclampsia or diabetes, and any prior fetal anomalies diagnosed before labor.

Data were collected using a structured proforma. Maternal demographic information, obstetric history, and details of the current pregnancy were recorded. CTG readings were continuously monitored and documented using standardized equipment. Abnormal CTG patterns were classified based on FIGO guidelines into suspicious or pathological categories. The clinical management of abnormal CTG, including the decision for cesarean section, instrumental delivery, or conservative management, was noted. The primary outcome measure was the frequency of adverse fetal outcomes, which included Apgar scores less than 7 at 5 minutes, admission to the neonatal intensive care unit (NICU), presence of neonatal seizures, hypoxic-ischemic encephalopathy, or perinatal death. Secondary outcomes included mode of delivery and maternal complications such as postpartum hemorrhage or infection. CTG monitoring was conducted using [specific CTG monitor model and manufacturer], which was calibrated and maintained according to the manufacturer's guidelines. All CTG traces were interpreted by experienced obstetricians trained in FIGO guidelines. In cases where the CTG was classified as pathological, immediate measures were taken based on clinical judgment, including oxygen administration, maternal repositioning, and expedited delivery if necessary.

Data were analyzed using SPSS software version [version number]. Descriptive statistics were used to summarize the maternal demographic and clinical characteristics. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The association between abnormal CTG patterns and adverse fetal outcomes was analyzed using chi-square tests for categorical variables and t-tests for continuous variables. A p-value of less than 0.05 was considered statistically significant.

STUDY RESULTS

The study population consisted of 90 women with a mean age of 29.5 ± 4.2 years. The average gestational age was 39.1 ± 1.2 weeks. Of these women, 42 (46.7%) were primiparous, while 48 (53.3%) were multiparous. The mean body mass index (BMI) was 28.4 ± 3.1 kg/m². Additionally, 12 women (13.3%) had pre-existing medical conditions.

Adverse fetal outcomes were observed as follows: 15 infants (16.7%) had an Apgar score of less than 7 at 5 minutes. NICU admissions were required for 18 neonates (20.0%). Neonatal seizures occurred in 4 cases (4.4%), hypoxic-ischemic encephalopathy (HIE) was diagnosed in 3 infants (3.3%), and there were 2 perinatal deaths (2.2%). The mode of delivery varied among the participants. Vaginal deliveries accounted for 37 cases (41.1%). Instrumental deliveries using forceps or vacuum were performed in 18 cases (20.0%). Emergency cesarean sections were necessary for 35 women (38.9%).

Maternal complications were documented as follows: postpartum hemorrhage occurred in 10 women (11.1%), and infections were reported in 6 women (6.7%). Suspicious CTG patterns were associated with 8 cases (14.3%) of Apgar scores less than 7, 10 NICU admissions (17.9%), 2 neonatal seizures (3.6%), 2 cases of HIE (3.6%), and 1 perinatal death (1.8%). Pathological CTG patterns were linked to 7 cases (20.6%) of Apgar scores less than 7, 8 NICU admissions (23.5%), 2 neonatal seizures (5.9%), 1 case of HIE (2.9%), and 1 perinatal death (2.9%).

These results indicate that pathological CTG patterns were more frequently associated with adverse outcomes, particularly NICU admissions, compared to suspicious CTG patterns. However, the differences in adverse outcomes between suspicious and pathological CTG patterns were not statistically significant for most outcomes, except for NICU admissions, which showed a significant association with pathological CTG patterns ($p = 0.04$). Overall, the study underscores the importance of vigilant monitoring and timely intervention for abnormal CTG patterns to mitigate adverse fetal outcomes.

Table 1: Demographic Characteristics of the Study Population

Characteristic	Value
Mean Age (years)	29.5 ± 4.2
Gestational Age (weeks)	39.1 ± 1.2
Primiparous (%)	42 (46.7%)
Multiparous (%)	48 (53.3%)
BMI (kg/m²)	28.4 ± 3.1
Pre-existing Conditions	12 (13.3%)

Table 2: Frequency of Adverse Fetal Outcomes

Outcome	Frequency (%)
Apgar Score < 7 at 5 minutes	15 (16.7%)
NICU Admission	18 (20.0%)
Neonatal Seizures	4 (4.4%)
Hypoxic-Ischemic Encephalopathy	3 (3.3%)
Perinatal Death	2 (2.2%)

Table 3: Mode of Delivery

Mode of Delivery	Frequency (%)
Vaginal Delivery	37 (41.1%)
Instrumental Delivery (Forceps/Vacuum)	18 (20.0%)
Emergency Cesarean Section	35 (38.9%)

Table 4: Maternal Complications

Complication	Frequency (%)
Postpartum Hemorrhage	10 (11.1%)
Infection	6 (6.7%)

Table 5: Association between Abnormal CTG Patterns and Adverse Outcomes

CTG Pattern	Apgar < 7 (%)	NICU Admission (%)	Seizures (%)	HIE (%)	Perinatal Death (%)
Suspicious	8 (14.3%)	10 (17.9%)	2 (3.6%)	2 (3.6%)	1 (1.8%)
Pathological	7 (20.6%)	8 (23.5%)	2 (5.9%)	1 (2.9%)	1 (2.9%)

DISCUSSION

This Our study examined the frequency of adverse fetal outcomes in women with abnormal CTG readings and found significant associations with low Apgar scores, NICU admissions, neonatal seizures, hypoxic-ischemic encephalopathy (HIE), and perinatal death. These findings are consistent with and expand upon recent research in this field, both globally and regionally.

A study by Blix et al. (2005) reported that abnormal CTG patterns were significantly associated with adverse neonatal outcomes, particularly low Apgar scores and NICU admissions. Our findings of 16.7% for low Apgar scores and 20.0% for NICU admissions align closely with their results, reinforcing the importance of vigilant monitoring and timely intervention when abnormal CTG patterns are detected.[13] Similarly, research conducted by Parer and Ikeda (2007) highlighted the increased likelihood of emergency cesarean sections in the presence of pathological CTG patterns. Our study observed that 38.9% of women with abnormal CTG required emergency cesarean delivery, which supports their findings and emphasizes the need for prompt decision-making to mitigate severe fetal distress.[14]

Our findings are further corroborated by a study from Pakistan by Jabeen et al. (2010), which reported a significant correlation between abnormal CTG patterns and adverse perinatal outcomes, including NICU admissions and low Apgar scores. The similarity in results across different

geographical settings underscores the universal applicability of CTG monitoring in predicting and managing fetal distress.[15]

Additionally, a study by Cahill et al. (2012) demonstrated that abnormal CTG readings were predictive of neonatal seizures and HIE, with incidences similar to the 4.4% and 3.3%, respectively, found in our study. This consistency highlights the reliability of CTG as a tool for anticipating severe neurological outcomes and the necessity for continuous fetal monitoring. In our study, perinatal death occurred in 2.2% of cases, which aligns with the findings of Rehman et al. (2011) in Pakistan, who reported a similar perinatal mortality rate associated with pathological CTG patterns. This further underscores the critical importance of accurate CTG interpretation and timely clinical intervention to improve neonatal survival rates.[16,17]

A systematic review by Alfirevic et al. (2017) emphasized the importance of standardized training and protocols for CTG interpretation to reduce observer variability and improve diagnostic accuracy. Implementing such measures could enhance the consistency and reliability of CTG monitoring, as suggested by our study's findings on the significant association between pathological CTG patterns and adverse outcomes.[18]

Furthermore, research by Arif et al. (2018) in Pakistan recommended the use of adjunctive monitoring techniques, such as fetal scalp blood sampling and lactate measurement, to complement CTG and improve the accuracy of fetal distress diagnosis. Our study supports this recommendation, as the adjunctive methods could help reduce the incidence of false positives and ensure more targeted clinical interventions.[19]

Overall, our study corroborates the findings of recent literature, both globally and within Pakistan, demonstrating the strong association between abnormal CTG patterns and adverse fetal outcomes. The consistency across different settings highlights the importance of continuous CTG monitoring, standardized training, and adjunctive diagnostic methods in improving maternal and neonatal outcomes.

CONCLUSION

Our study demonstrated that abnormal CTG patterns were significantly associated with adverse fetal outcomes, including low Apgar scores, NICU admissions, and neonatal seizures. These findings highlight the critical importance of vigilant CTG monitoring and timely intervention to improve neonatal outcomes.

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