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Relation Between Abnormal Cardiotocography and Fetal Outcome

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Abstract

Background & objective: Monitoring of fetal heart rate during labour is important for earlier detection of adverse pregnancy outcomes. This study aimed to evaluate the role of cardiotocography during labour.

Methods: This study was a cross sectional study implemented in Labour ward of Erbil Maternity Teaching Hospital in Erbil City-Kurdistan Region/Iraq through the period of one year from 1st of May 2022 to 30th of April 2023on convenient sample of one hundred and fifty pregnant women. General characteristics of pregnant women, obstetrical characteristics of pregnant women, CTG findings and fetal outcomes of pregnant women were analyzed

Results: The cardiotocography was reactive in 33.3% of pregnant women, while abnormal in 66.7% of them. A significant association was observed between cesarean section delivery (72%) and abnormal cardiotocography finding ($p<0.05$). Low fetal Apgar scores (43%) after one minute and 5 minutes (9%) were significantly related to abnormal cardiotocography finding ($p<0.05$). Obesity of pregnant (42%) women was seen to be related to abnormal cardiotocography findings ($p<0.05$).

Conclusions: The cardiotocography is an appropriate intrapartum predictor of fetal outcomes.

Keywords: Cardiotocography, Fetal outcomes, Labour, Obesity.

Introduction

Earlier and accurate detection of fetuses at risk represented a great challenge for obstetricians. The fetal heart rate monitoring is essential in recognition of fetal hypoxia or acidemia that might lead to fetal co-morbidities and death.[1]Antepartum and intrapartum ischemia is the main etiology of stillbirth, encephalopathy and death, in addition to long term complication all over the world. The

hypoxia is regarded as public health problem that needs preventive strategies.[2] Good obstetrical care services have the ability to reduce about two thirds of term stillbirths.[3] Selecting cardiotocograph (CTG) for screening and risk stratification of fetuses helps in lowering morbidity and mortality rates.[4] The labour adverse outcomes lead to poor perinatal outcomes which may also lead to mortality of both mothers and fetuses. Consequently, prediction of these fetal disorders could assist in reduction of worldwide rates of fetal morbidity and mortality. At same time, prediction of some labour interventions is also required like the cesarean section.[5] The cardiotocography is a continuous electronic measure of fetal heart rate acquired through an ultrasound transducer placed on pregnant woman abdomen. The CTG is still the common tool in screening fetal status at prenatal period from the 20th week of gestation to birth by recording variations of fetal heart rate.[6] The CTG is the main tool applied in assessment of fetal wellbeing and it was the main method of fetal monitoring in last decade's.[7] In spite of CTG publicity, its interpretation is subjective and dependable on guidelines taken from inaccurate and rigid patterns of fetal heart rate. Nowadays, the CTG classification is based on fetal heart rate characteristics acquired by computer programs to confirm a reliable diagnosis and check the fetal wellbeing during pregnancy.[8] Clinically, poor labour outcomes risk measurement is basing on the risk of adverse assessment of antenatal factors like intrauterine growth restriction, prolonged rupture of membranes, antepartum hemorrhage, meconium staining of the amniotic fluid and/or abnormal CTG interpretation in period around labor onset.[9] For that, use of cardiotocography during labour is helpful in prediction of poor obstetrical outcomes and preventing and/or managing them. The aim of this study was to investigate the correlation between irregular patterns observed in cardiotocography (CTG) readings and the subsequent health outcomes of the fetus. The study seeks to determine how abnormalities in CTG, which monitors fetal heart rate and uterine contractions, correlate with adverse fetal conditions, helping to improve prenatal care and interventions.

Patients & methods

The design of present study was a cross sectional study implemented in Labour ward of Erbil Maternity Teaching Hospital in Erbil City-Kurdistan Region/Iraq through the period of one year from 1st of May 2022 to 30th of April 2023. Inclusion criteria were women with term pregnancy, single healthy pregnancy with longitudinal lie, cephalic presentation and complete follow up of fetuses. Exclusion criteria were women with preterm labour, multiple gestation, congenital anomaly, intrauterine growth restriction, abnormal presentation and lost follow up for fetuses. The proposal of the research was approved by research protocol committee of Kurdistan Higher Council of Medical

Specialties as well as documented informed consent was signed by the patients prior to their participation after thorough explanation of the aim and scope of the study. A convenient sample of one hundred and fifty pregnant women was enrolled in present study. Information of women was collected directly by researcher through interviewing selected women in the Labour ward and filling in a prepared questionnaire designed by the researchers. The questionnaire included general characteristics of pregnant women, obstetrical characteristics of pregnant women, CTG findings and fetal outcomes of pregnant women. The cardiotocography was implemented and interpreted in Labour ward by Senior Obstetrician. The cardiotocography used was (Philips-Avalon FM30). The pregnant women were followed up by researcher for one week following delivery to assess the fetal outcomes. The fetal outcomes were measured by Senior Pediatrician. The collected data were entered and interpreted statistically by SPSS program26. Suitable statistical tests (Chi square and Fishers exact tests) for data were implemented accordingly and p value of ≤ 0.05 was regarded as significant.

Results

In this study, one hundred and fifty pregnant women were enrolled with mean age (26.7 years); 53.3% of them were in age of 20-29 years. Mean BMI of pregnant women was (28.5 Kg/m^2); 34.7% of them were obese Table (1).

Table (1): General characteristics of pregnant women.

Variable	No.	%
Age mean±SD (26.7±6.4 years)		
<20 years	16	10.7
20-29 years	80	53.3
30-39 years	47	31.3
≥40 years	7	4.7
Body mass indexmean±SD (28.5±3.4 Kg/m^2)		
Normal	18	12.0
Overweight	80	53.3
Obese	52	34.7
Total	150	100.0

The primigravidity was prevalent (48.7%) nulliparity was also prevalent (49.3%) while miscarriage history was shown in 18% of them. Ruptured membrane was shown in 78% of women; 70.9% of them with clear fluid. Mean labour duration was (4.2 hours); 62.4% of women had labour in less than

5 hours. The augmentation was done for 42% of pregnant women, while labour induction was done for 15.3% of them Table (2).

Table (2): Obstetrical characteristics of pregnant women.

Variable	No.	%
Gravidity		
Primigravida	73	48.7
2-4 gravida	54	36.0
≥5 gravida	23	15.3
Parity		
Nulliparous	74	49.3
1-3 para	66	44.0
≥4 para	10	6.7
Miscarriage		
Yes	27	18.0
No	123	82.0
Membrane state		
Intact	33	22.0
Rupture	117	78.0
Colour of liquor		
Clear	83	70.9
Meconium	32	27.4
Bloody stained	2	1.7
Duration of labor mean±SD (4.2±1.7 hours)		
<5 hours	93	62.4
≥5 hours	56	37.6
Augmentation		
Yes	63	42.0
No	87	58.0
Induction		
Yes	23	15.3
No	127	84.7
Total	150	100.0

The CTG was reactive in 33.3% of pregnant women, while abnormal in 66.7% of them; common CTG abnormal findings were variable declaration (27%), early declaration (24%), late declaration (15%), reduced variability (11%), tachycardia (12%) and prolonged bradycardia (11%). Vaginal

delivery was done for 36% of pregnant women, while cesarean section was done for 64% of them. Male gender was the predominant (56.7%) and the apgar score after one minute was low in 30% of neonates, while the apgar score after five minutes was low in 6% of neonates. Mean birth weight was (3.4 Kg); only one neonate had low birth weight. NICU admission was recorded for 6.7% of neonates Table (3).

Table (3): CTG findings and fetal outcomes of pregnant women.

Variable	No.	%
CTG		
Reactive	50	33.3
Abnormal	100	66.7
CTG abnormalities		
Variable deceleration	27	27.0
Early deceleration	24	24.0
Late deceleration	15	15.0
Reduced variability	11	11.0
Tachycardia	12	12.0
Prolonged bradycardia	11	11.0
Mode of delivery		
Vaginal delivery	54	36.0
Cesarean section	96	64.0
Fetal gender		
Male	85	56.7
Female	65	43.3
Apgar score after 1 minute mean±SD (6.8±2.1)		
Normal	105	70.0
Low	45	30.0
Apgar score after 5 minutes mean±SD (8.7±1.2)		
Normal	141	94.0
Low	9	6.0
Birth weight mean±SD (3.4±0.4 Kg)		
Normal	149	99.3
Low	1	0.7
NICU admission		
Yes	10	6.7
No	140	93.3
Total	150	100.0

No significant differences were observed between pregnant women with reactive CTG and pregnant women with abnormal CTG regarding age. There was a significant association between pregnant women obesity and abnormal CTG finding (p=0.02) Table (4).

Table (4): Distribution of pregnant women's general characteristics according to CTG finding.

Variable	CTG				P
	Reactive		Abnormal		
	No.	%	No.	%	
Age					0.7
<20 years	5	10.0	11	11.0	
20-29 years	30	60.0	50	50.0	
30-39 years	13	26.0	34	34.0	
≥40 years	2	4.0	5	5.0	
Body mass index					0.02
Normal	8	16.0	10	10.0	
Overweight	32	64.0	48	48.0	
Obese	10	20.0	42	42.0	

No significant differences were observed between pregnant women with reactive CTG and pregnant women with abnormal CTG regarding gravidity, parity, miscarriage, membrane state, colour of liquor, duration of labour and induction. There was a significant association between labour augmentation and abnormal CTG finding (p=0.005) Table (5).

Table (5): Distribution of pregnant women's obstetrical characteristics according to CTG finding.

Variable	CTG				p-value
	Reactive		Abnormal		
	No.	%	No.	%	
Gravidity					0.39
Primigravida	25	50.0	48	48.0	
2-4 gravida	15	30.0	39	39.0	
≥5 gravida	10	20.0	13	13.0	
Parity					0.64
Nulliparous	25	50.0	49	49.0	
1-3 para	23	46.0	43	43.0	
≥4 para	2	4.0	8	8.0	
Miscarriage					0.36
Yes	11	22.0	16	16.0	
No	39	78.0	84	84.0	
Membrane state					

Intact	8	16.0	25	25.0	0.2
Rupture	42	84.0	75	75.0	
Colour of liquor					0.21
Clear	34	81.0	49	67.1	
Meconium	8	19.0	22	30.1	
Bloody stained	0	-	2	2.7	
Duration of labour					0.35
<5 hours	28	57.1	65	65.0	
≥5 hours	21	42.9	35	35.0	
Augmentation					0.005
Yes	29	58.0	34	34.0	
No	21	42.0	66	66.0	
Induction					0.07
Yes	4	8.0	19	19.0	
No	46	92.0	81	81.0	

A significant association was observed between cesarean section delivery and abnormal CTG finding (p=0.004). Male gender neonates were significantly related to reactive CTG finding (p=0.02). There was a highly significant association between low apgar score after one minute and abnormal CTG finding (p<0.001). There was a significant association between low apgar score after five minutes and abnormal CTG finding (p=0.02). No significant differences were observed between pregnant women with reactive CTG and pregnant women with abnormal CTG regarding birth weight and NICU admission Table (6).

Table (6): Distribution of fetal outcomes according to CTG finding.

Variable	CTG				p-value
	Reactive		Abnormal		
	No.	%	No.	%	
Mode of delivery					0.004
Vaginal delivery	26	52.0	28	28.0	
Cesarean section	24	48.0	72	72.0	
Fetal gender					0.02
Male	35	70.0	50	50.0	
Female	15	30.0	50	50.0	
Apgar score after 1 minute					<0.001
Normal	48	96.0	57	57.0	
Low	2	4.0	43	43.0	
Apgar score after 5 minutes					

Normal	50	100.0	91	91.0	0.02
Low	0	-	9	9.0	
Birth weight					0.47
Normal	50	100.0	99	99.0	
Low	0	-	1	1.0	
NICU admission					0.81
Yes	3	6.0	7	7.0	
No	47	94.0	93	93.0	

Discussion

Present study showed that CTG was reactive in 33.3% of pregnant women, while abnormal in 66.7% of them. This finding is close to results of Nazir et al.'s cross sectional study,[10] which showed that CTG findings were reactive in 39.63% of pregnant women. In our study, common CTG abnormal findings were variable decelaration (27%), early decelaration (24%), late decelaration (15%), reduced variability (11%), tachycardia (12%) and prolonged bradycardia (11%). These findings are better than results of Tarvonen et al [11]retrospective study which showed that common CTG findings of pregnant women were variable decelaration (9%), early decelaration (11.7%), late decelaration (41%), reduced variability (36.7%), tachycardia (13.9%) and prolonged bradycardia (4.6%). The current study found a significant association between pregnant women obesity and abnormal CTG finding. This finding coincides with results of Saadia clinical trial study,[12] in which it's reported that fetuses of obese women had abnormal FHR pattern compared with fetuses of non-obese women. Another study carried out by Frolova et al.,[13] showed higher proportion of obese pregnant women with CTG monitoring abnormalities; however, these internal monitors had no impact on maternal outcomes. Our study also showed a significant association between labour augmentation and abnormal CTG finding. This finding is inconsistent with results of Aye et al.,[14] retrospective nested case control study in United Kingdom which found that labour augmentation had no significant effect on fetal cardiotocogram. This inconsistency might be attributed to correlation of labour augmentation in present study with abnormal fetal outcomes. In present study, a significant association was observed between cesarean section delivery and abnormal CTG finding. This finding is consistent with results of Astruc et al [15]retrospective cohort study in France which revealed that abnormal CTG findings are related to higher emergency cesarean section rates. Chetandas et al.,[1]study in found that high false positive rates of CTG led to higher incidence rates of unnecessary cesarean sections. In our study,

male gender neonates were significantly related to reactive CTG finding. Inconsistently, Yohai et al [17]retrospective study found that male gender fetus is independently associated with abnormal CTG findings. However, Magro-Malosso et al.'s retrospective study,[18] reported that fetal gender had no effect on CTG parameters and interpretation. Our study showed a highly significant association between low apgar score after one minute and abnormal CTG finding. This finding is similar to results of Junior et al.'s retrospective case control study,[19] in Brazil which revealed a significant relationship between abnormal CTG findings and low fetal Apgar score after 1 minute. Our study also showed a significant association between low Apgar score after five minutes and abnormal CTG finding. This finding is parallel to results of Salustiano et al.'s retrospective cohort study,[20] which found that repeated late deceleration of CTG is a significant predictor of low fetal Apgar score after 5 minutes.

Conclusions

This study concluded that the cardiotocography is an appropriate intrapartum predictor of fetal outcomes. Abnormal cardiotocography findings are predicting for adverse fetal outcomes. The abnormal cardiotocography findings are indicators for higher caesarean section rates. Obesity of pregnant women is related to abnormal cardiotocography findings. The augmentation of labour might be related to abnormal cardiotocography findings. This study encourages Obstetricians for earlier fetal monitoring using cardiotocography to prevent complications.

Conflict of interest: Declared none.

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