Diagnostic Accuracy of Cardiotocography in Determining Good and Poor Apgar Score After Fetus Delivery

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Abstract

Objective: To determine the diagnostic accuracy of Cardiotocography in determination of good and poor Apgar score after delivery of fetus at term.

Methods: This was a cross sectional study done at Obstetrics & Gynecology department, Lady Atchison hospital, Lahore for 6 months, after ethical approval of study. 448 cases were included through non-probability consecutive sampling method. Initial CTG monitoring was done and normal and abnormal CTG was labeled. After delivery of baby, assessment for Apgar score was done. The good and poor Apgar score was labeled and the findings were co-related with the CTG findings. A proforma was specifically designed to record findings of this study. Data was analyzed by using SPSS 16. The sensitivity, specificity, Positive & Negative Predictive Values and diagnostic accuracy of abnormal CTG were calculated by taking Apgar score at birth as gold standard.

Results: The mean age of the patients was 30.42±5.73 years. The mean gestational age was 38.20±1.10 weeks. The mean Apgar score after 5 minutes of birth was 6.67±1.67. There were 183 (40.8%) females who had abnormal CTG while 265 (59.2%) females had normal CTG. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of CTG at birth were 65.9%, 51.4%, 67.9%, 49.2% and 60.3% respectively.

Conclusion: CTG is a good screening tool to assess mother & fetus wellbeing but it is not a diagnostic tool for fetal surveillance in females undergoing delivery at term.

Key words: Cardiotocography, Apgar score, Birth, Gestational Age, Diagnostic Accuracy, Third Trimester.

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Introduction

Cardiotocography (CTG) is a non-invasive tool to record fetal cardiac activity and uterine muscle contractions during the third trimester of pregnancy.[1,2] It is most commonly used technique to evaluate mother & child wellbeing during pregnancy.[3]

The technique of CTG monitoring assesses fetal cardiac abnormalities during intrauterine life & while birth & this early diagnosis of fetal hypoxia results in early handling of the labor & hence better mother & child health.[4] One very important use of this tool is to give extra care to such short of oxygen babies during cesarean section or assisted labor.[5] This fetal monitoring for hypoxia has saved many precious lives.[6]

In developed countries, majority of the mother & child hospitals are using this tool for the assessment of fetal wellbeing.[7] In a study of 217 patients of cesarean section, out of all patients with fetal distress, APGAR score was <7 in only 33 (15.2%) babies after 5 minutes of delivery.8In another study reported that sensitivity of CTG was higher i.e. 96.2% but specificity was only 8.3% for 5-min Apgar score.[9]

The CTG performance, monitoring & interpretation are observer dependent. A normal test shows a healthy non-hypoxic fetus while an abnormal test shows a

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possible fetal distress & hypoxia at or before term. Therefore careful handling of the device is very important.[10]

The Apgar score is an instant method to assess fetus wellbeing just after birth and to see response of resuscitation if required. It includes fetus respiratory effort, reflexes, muscle tone, heart rate & color. It is used to assess hemodynamic status of fetus. It is done at 1 and 5 minutes after birth & can be done at 5 minutes intervals if baby scores <7 at 5 minutes or who need resuscitation. A score of 7 or above is taken as good.[11-13]

The rationale of project was to find out the diagnostic accuracy of Cardiotocography in determination of good and poor Apgar score after delivery of fetus at term. This technique is used in routine to determine fetal wellbeing and to decide the route of delivery because of its non-invasive and cost effective properties. But CTG often indicates the abnormal fetal condition which results in excessive numbers of cesarean section, however, fetus is found normal and healthy after birth. In this study we wanted to confirm that either we can rely on this technique or not in future taking a larger sample size.

Methods

This was a Cross sectional study done at Obstetrics & Gynecology department, Lady Aitchison hospital, Lahore forSix months from date of ethical approval of study. 448 booked laboring females of age 20-40 years with singleton pregnancy, cephalic presentation and term pregnancy (37 completed week diagnosed by LMP) having parity<6 were included in the study by non-probability consecutive sampling. Sample size was estimated by using 95% confidence level, with expected sensitivity 96.2% with 3% margin of error, 8.3% specificity with 3% margin of error taking expected prevalence of poor Apgar score as 15.2%. Patients with history of previous cesarean section, multiple pregnancies, gestational diabetes, pregnancy induced hypertension, antepartum hemorrhage, intrauterine growth restriction &prolong pregnancy were excluded. Informed written consent was taken from each patient. A detailed demographic history (name, age, gestational age, parity) was taken. Initial CTG monitoring was done for 20 minutes. It was labeled as normal if basal heart rate 110–160 beats/min, beat to beat variability 5–25 beats/min with at least two accelerations and abnormal if fetal heart rate was beyond 110-160 beats/min, reduced or absent beat to beat variability with variable decelerations. In case of poor progress of labour with abnormal CTG findings, cesarean section was performed otherwise normal labor was followed. After delivery of baby, assessment for Apgar score was done i.e. birth score at 5 minute after delivery. Score of >6 (out of 10) was considered as good and score of <6 was considered as poor and the findings were co-related with the CTG findings. It was labeled as true positive if CTG was normal and also baby had good Apgar score after 5min, true negative if CTG was abnormal and also baby had poor Apgar score after 5min, false positive if CTG was normal but baby had poor Apgar score after 5min &false negative if CTG was abnormal but baby had good Apgar score after 5min.A proforma was specifically designed to record findings of this study. Data was analyzed by using SPSS 16. Quantitative variables like gestational age, apgar score & age were presented as Mean±SD. Qualitative variables like parity were presented as frequency and percentage. The sensitivity, specificity, Positive & Negative predictive values and diagnostic accuracy of CTG was calculated by generating 2/2 table.

Results

The mean age of the patients in our study was 30.42 ± 5.73 years. The mean gestational age was observed as 38.20 ± 1.10 weeks. There were 97 (21.7%) female who were nulliparous, 102 (22.8%) had para 1, 156 (34.8%) had para 2, 75 (16.7%) had para 3 and 18 (4.0%) had para 4. There were 183 (40.8%) female who had abnormal CTG while 265 (59.2%) females had normal CTG. The mean Apgar score of neonates after 5 minutes of birth was observed as 6.67±1.67 with minimum Apgar score of 4 and maximum Apgar score of 9. There were 66 (14.7%) neonates with score 4, 74 (16.5%) had score 5, 35 (7.8%) had score 6, 113 (25.2%) had score 7, 88 (19.6%) had score 8 and 72 (16.1%) neonates had Apgar score of 9. **Table 1**

There were 273 (60.9%) neonates who had good Apgar score while 175 (39.1%) had poor Apgar score. **Fig 1**

Among 273 neonates who had good Apgar score, 180 (65.9%) had normal CTG while 93 (34.1%) had abnormal CTG. Among 175 neonates who had poor Apgar score, 85 (48.6%) had normal CTG while 90 (51.4%) had abnormal CTG. The sensitivity, specificity, Positive & Negative Predictive Values and diagnostic accuracy of C TG was65.9%, 51.4%, 67.9%, 49.2% and 60.3%

respectively. **Table 2**

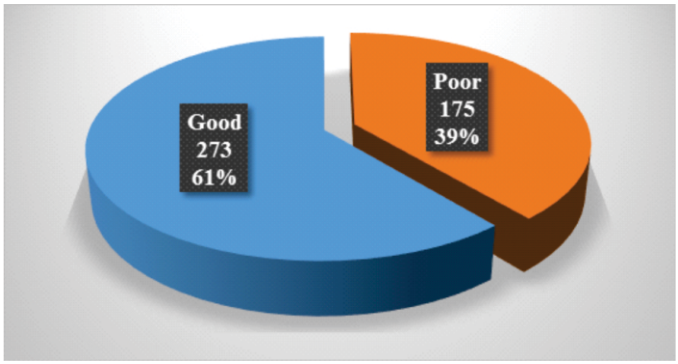

Figure-1: *Distribution of Neonates According to Apgar Score*

Table 1: *Baseline Characteristics of Pregnant Females*

n	448
Age (Years)	30.42 ± 5.73
Gestational Age	38.20 ± 1.10
Primigravida	97 (21.7%)
Parity 1	102 (22.8%)
Parity 2	156 (34.8%)
Parity 3	75 (16.7%)
Parity 4	18 (4.0%)
CTG	
Normal	265 (59.2%)
Abnormal	183 (40.8%)
Apgar score	6.67 ± 1.67
Apgar score	
4	66 (14.7%)
5	74 (16.5%)
6	35 (7.8%)
7	113 (25.2%)
8	88 (19.6%)
9	72 (16.1%)

Table 2: *Comparison of Predictive Values (Bishop Score vs. Cervical Length)*

		Apgar score		Total
		Good	Poor	
CTG	**Normal**	180 (65.9%)	85 (48.6%)	265 (59.2%)
	Abnormal	93 (34.1%)	90 (51.4%)	183 (40.8%)
	Total	273 (100%)	175 (100%)	448 (100%)

Sensitivity65.9%, Specificity 51.4%, PPV 67.9%, NPV49.2%, Diagnostic accuracy 60.3%

Discussion

In this study we found abnormal CTG in 183 (40.8%) females while 265 (59.2%) females had normal CTG. After delivery of baby, in our study, 273 (60.9%) neonates had good Apgar score (>6) while 175 (39.1%) had poor Apgar score (<6) at 5 minutes of birth. The sensitivity, specificity, PPV & NPV were 65.9%, 51.4%, 67.9% and 49.2% respectively with an overall diagnostic accuracy of CTG of 60.3%. The CTG performance, monitoring & interpretation are observer dependent. A normal test shows a healthy non-hypoxic fetus while an abnormal test shows a possible fetal distress & hypoxia at or before term. Therefore careful handling of the device is very important.[14]

Sultana and her colleagues did a similar study on CTG & found that the sensitivity, specificity, PPV & NPV was 87%,66%,54% & 92% respectively. Hence normal CTG is more conclusive of normal fetus & labour than that of abnormal CTG for abnormal fetus & labour.[15] CTG basically monitors fetal wellbeing. It records fetal heart beat & uterine contractions & produces a paper recording of both. Hence it's an easy & affordable measure of both fetal & mother health.[16]

Aboulghar et al., conducted a study and found the sensitivity of CTG was very much higher i.e. 96.2% but specificity was only 8.3% for 5min Apgar score which was far low and similar as found in our study as well as reported by other previous studies.[9]

In a local study, Khursheed, Das and Jatoi found that the sensitivity and specificity of CTG for poor Apgar score was 53.22% and 69.02%. They concluded that CTG is a good tool to monitor fetal wellbeing. However, it need to be standardized to reduce the incidence of false positive results that result in increased number of caesarean section.[17]

Conclusion

CTG is a good screening tool to assess mother & fetus wellbeing but it is not a diagnostic tool for fetal surveillance in future in females undergoing delivery at term without any pregnancy related complication. It is further suggested that more diagnostic tools and approaches should be evaluated in future to assess health of mother and neonates.

Conflict of interest: None

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Authors Contribution

S.I: Manuscript writing & approval
M.K.A: Study Design
T.K, M.F.S, I.W: data collection
S.Ul.M: data interpretation
S.K: Study design, Data collection
M.H.H: Study design, data analysis