

## ORIGINAL ARTICLE

# Positive Predictive Value of Abnormal Cardiotocography Trace During Labour for Poor Fetal Outcome

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## ABSTRACT

**Objective:** To determine the positive predictive value of abnormal cardiotocography (CTG) trace during labour for poor fetal outcome.

**Study design:** Cross sectional

**Duration of Study:** Six months from 24 -05-2011 till 24-12-2011

**Setting:** Study was carried out in the department of Obstetrics & Gynaecology, Sir Ganga Ram Hospital, Lahore.

**Results:** Majority of the patients i.e. 43.46%(n=113) were between 20-25 years of age, mean & sd was calculated as 24.25+ 5.21 years, frequency of poor fetal outcome was recorded in 31.92%(n=83), positive predictive value of abnormal cardiotocography (CTG) trace during labour for poor fetal outcome was recorded which shows 29.23%(n=76) true positive, 7.31%(n=19) false positive, 2.69%(n=7) had false negative while true negative was recorded in 60.77%(n=158), sensitivity, specificity, positive predictive value, negative predictive value & diagnostic accuracy was recorded as 91.57%, 89.27%, 80%, 95.67% and 90% respectively.

**Conclusion:** Abnormal cardiotocography trace during labour is an effective & reliable tool for prediction of poor fetal outcome.

**Key words:** Abnormal CTG trace, during labour, diagnostic accuracy, poor fetal outcome

## INTRODUCTION

Cardiotocography (also known as electronic fetal monitoring) records changes in the fetal heart rate and its temporal relationship to uterine contractions.<sup>1</sup> CTG is a screening tool to identify the possibility of asphyxia which may lead to neurological damage and intrapartum death.<sup>2</sup> Widespread use of electronic fetal monitoring is associated with fall in perinatal mortality 0.7/1000 compared with 1.8/8000 in auscultation group.<sup>3-4</sup> Cardiotocography is used for antepartum and intrapartum fetal surveillance because it gives information via the cerebrocardiac response of fetal cerebral activity which is modified by hypoxia.<sup>5</sup> The available methods range from intermittent auscultation, continuous fetal heart monitoring to invasive technique of fetal blood gas analysis which is complicated and time consuming technique.<sup>6</sup> Abnormal CTG trace shows fetal distress, it means absence of fetal well-being and it may be because of many different pathologies affecting the fetus as a chronic hypoxia leading to metabolic acidosis, mechanical trauma (excessive head compression), hyperthermia, meconium aspiration & sepsis.<sup>4</sup> There was higher cesarean delivery, lower APGAR score & higher perinatal

death among abnormal CTG group.<sup>5,7</sup> Neonatal admission was required in 33% of patients with abnormal CTG trace.<sup>6</sup> It is a dynamic screening test for state of oxygenation of fetus on admission of mother during labour. It assesses the ability of fetus to withstand the process of labour.<sup>5</sup> Normal CTG trace reassure fetal health. Problem is with abnormal CTG trace which can predict hypoxia in 73% of cases<sup>5</sup> so, accurate interpretation of CTG is essential & it is important to recognize a fetus that shows abnormal CTG in labour that may imply hypoxia & birth asphyxia.<sup>2</sup> Sensitivity of abnormal CTG trace is 42.3% and specificity is 95.6% according to one study the positive predictive value of abnormal CTG trace for predicting poor fetal outcome is 53.3%, another study shows it of only 27.4%.<sup>2</sup> The importance of my study was to determine that CTG is an important screening tool for fetal wellbeing during labour. Fetal hypoxia and fetal outcome at birth can be predicted by an abnormal CTG trace. Fetal mortality and morbidity can be reduced by early interventions in case of abnormal CTG.

## MATERIAL AND METHODS

The study was carried out in the department of Obstetrics and Gynecology, Sir Ganga Ram

Hospita, Lahore. Sample size of 260 cases was calculated with 95% confidence interval, 5.5% margin of error and taking positive predictive value of abnormal CTG trace that is 27.4% in the prediction of poor fetal outcome (in terms of APGAR score < 5) after 5 minutes of birth.

**Data Collection:**

All pregnant women presenting in obstetrics and gynecology Unit-IV, Sir Ganga Ram Hospital, through emergency department, fulfilling the inclusion and exclusion criteria were selected for this study, informed consent was taken, regarding usage of personal information for purpose of study.

**Inclusion Criteria:**

Age: 20-35 years

- Primary gravida to gravida four
- Term pregnancy > 37 weeks (on ultrasound)
- Single pregnancy
- Cephalic presentation
- In active phase of 1st stage of labor

**Exclusion Criteria:**

- Malformed fetus
- Intra uterine growth restriction fetus
- Postdated pregnancy: 42 weeks
- High risk pregnancies, e.g, PIH, GDM.

**RESULT**

A total of 260 subjects were recruited fulfilling the inclusion / exclusion criteria to determine the positive predictive value of abnormal cardiotocography (CTG) trace during labor for poor fetal outcome. Age of the patients was recorded and most of the patients were recorded between 20-25 years of age, i.e., 43.46% (n=113), 33.85% (n=88) were between 26-30 years and only 22.69% (n=59) were between 31-35 years of age, mean and SD were calculated as 24.25 + 5.21 years. (Table No.1) Gestational age (in weeks) of the patients was recorded, it shows 57.31% (n=149) between 37 to 40 weeks of gestation, 42.69%(n=111) were between 41-42 weeks. (Table No. 2) Distribution of parity of the patients was done and presented in Table No. 3, where 55% (n=143) were between 1-2 paras and 45%(n=117) were between 3-4 paras. (Table No. 3) Frequency of poor fetal outcome was recorded in 31.92%(n=83) while 68.08% (n=177) had no findings of poor fetal outcome. (Table No. 4) Positive predictive value of abnormal CTG trace during labour for poor fetal outcome was recorded

which shows 29.23% (n=76) true positive, 7.31% (n=19), false positive, 2.69% (n=7) had false negative while true negative was recorded in 60.77% (n=158), sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy was recorded as 91.57% ,89.27% , 80% , 95.67% and 90% respectively. (Table No.4).

**Table 1: Age Distribution of Patients (n = 260)**

Age (in years)	No. of patients	%
20-25	113	43.46
26-30	88	33.85
31-35	59	22.69
Total	260	100
Mean and sd	24.25 ± 5.21	

**Table 2: Gestational Age of the Patients (n=260)**

Gestational age (in weeks)	No. of Patients	%
37-40	149	57.31
41-42	111	42.69
Total	260	100

**Table 3: Distribution of Parity of the Patients (n=260)**

Para	No. of patients	%
1-2	143	55
3-4	117	45
Total	260	100

**Table 4: Frequency of Poor Fetal Outcome (n=260)**

Poor fetal outcome	No. of patients	%
Yes	83	31.92
No	177	68.08
Total	260	100

**Table 5: Positive Predictive Value of Abnormal Cardiotocography (CTG) Trace During Labour for Poor Fetal Outcomes (n=260)**

Cardiotocography trace	Poor Fetal Outcome (n=23)		Total
	Positive	Negative	
Positive	True positive (a) 76 (29.23%)	False positive (b) 19 (7.31%)	a + b 95(13.75%)
Negative	False negative (c) 7 (2.69%)	True negative (d) 158(60.77%)	c + d 165(86.25%)
Total	A + c 83 (31.92%)	b + d 177 (68.08%)	260 (100%)

## Positive Predictive Value of Abnormal Cardiotocography Trace During Labour for Poor Fetal Outcome

Sensitivity =  $a / (a + c) \times 100 = 91.57\%$

Specificity =  $d / (d + b) \times 100 = 89.27\%$

Positive predictive value =  $a / (a + b) \times 100 = 80\%$

Negative predictive value =  $d / (d + c) \times 100 = 95.76\%$

Accuracy rate =  $a + d / (a + d + b + c) \times 100 = 90\%$

### DISCUSSION

Evaluation of fetal health is the main concern of obstetricians. It requires the recognition and treatment of disease in utero. Whereas the prevention and treatment of diseases of the mother were once the focus of obstetricians, the same importance is now given to the fetus. The fetal health is evaluated, in part, by assessment of the fetal heart rate (FHR). This assessment involves identification of two general types of FHR patterns; those that may be associated with adverse fetal or neonatal outcomes (i.e., nonreassuring patterns) and those that are indicative of fetal well-being.<sup>72</sup> Despite the shortcomings of CTG, most clinicians use this technique to determine intrapartum fetal distress and the need for obstetric intervention during labour.<sup>73</sup> The results of some studies<sup>6,7</sup> show discrepancies to authenticate the diagnostic accuracy of CTG for determining the poor fetal outcome, however, we intended to determine that CTG is an important screening tool for fetal wellbeing during labour and an abnormal CTG trace can predict fetal hypoxia and fetal outcomes at birth, so, in case of abnormal CTG early interventions can be done and fetal morbidity and mortality can be reduced. Further, there is a lot of work done on this subject but there are still discrepancies in the results of different studies and my study will help to sort out these discrepancies. The results of the study revealed that frequency of poor fetal outcome was recorded in 31.92% (n=83) and when we determine positive predictive value of abnormal CTG trace during labour for poor fetal outcomes, it shows 29.23% (n=76) true positive, 7.31% (n=19) false positive, 2.69% (n=7) had false negative while true negative was recorded 60.77% (n=158), sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy was recorded as 91.57%, 89.27%, 95.67% and 90% respectively.

The authenticity of the findings are evident from Visser et al<sup>74</sup> identified normal and abnormal patterns of reactive CTG determining fetal distress after birth by examining the umbilical artery gas parameters, and found a sensitivity, specificity, and positive and negative predictive values of 79%, 85%, 68%, and 91%, respectively. In that study,

the positive and negative predictive values were 81% and 89%, respectively, for decelerations and 88% and 76%, respectively for variability loss<sup>75</sup>.

Niamh Daly and workers<sup>76</sup> examined the obstetric and perinatal outcomes of women presenting with reduced fetal movement (RFM) during the third trimester, specifically in relation to the diagnostic capacity of non-stress cardiotocography (CTG) used as the primary investigation in this clinical scenario and concluded that normal non-stress CTG is a reliable screening indicator of fetal wellbeing in women presenting with perception of RFM in the third trimester; abnormal pregnancy outcomes were more common when initial CTG was abnormal or persistently non-reassuring.

However, the results of the study determined that CTG is an important screening tool for fetal well being during labour and an abnormal CTG trace can predict fetal hypoxia and fetal outcomes at birth.

### CONCLUSION

Abnormal cardiotocography (CTG) trace during labour is an effective and reliable tool for prediction of poor fetal outcome.

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