Original Research Article

Comparative efficacy of admission cardiotocography in high risk and low risk pregnancies in predicting neonatal outcome

Gurpreet Kaur Nandmer*, Shivangi Jaiswal, Pooja Namdeo

Department of Obstetrics and Gynecology, Peoples College of Medical Science and Research Centre, Bhopal, Madhya Pradesh, India

*Correspondence:
Dr. Gurpreet Kaur Nandmer,
E-mail: kaurgauri2@yahoo.com

ABSTRACT

Background: Admission cardiotocography (CTG) is a test of fetal wellbeing performed during labor. A normal CTG is for 20-30 minutes and ranges from 110-160 bpm with beat to beat variability, two accelerations and no decelerations with two contractions (as per NICE 2018 guidelines). To study comparative efficacy of admission CTG in predicting neonatal out in high risk, low risk and universally in all pregnancy.
Methods: All high risk as well as low risk patients coming to labor room in labor were included in the study. CTG print was taken, and neonatal outcome as NICU admission were noted after taking written consent.
Results: 189 cases were taken.138 were high risk cases, CTG was taken: 91were reassuring, 47were abnormal (non-reassuring +abnormal). In terms of NICU admission, 21 and 26 neonates were admitted. Out of 51 low risk cases, 33 had reassuring CTG, and18 had abnormal; 7and 6 was the number of NICU admission, respectively. When compared, highest sensitivity, specificity and positive predictive value of 55.31%, 77% and 55.3% was seen in high risk pregnancy, whereas negative predictive value (78.8%) was slightly higher in low risk cases.
Conclusions: Admission CTG is a good predictor of neonatal outcome. Its predictive efficacy is more in high risk cases. It's practicality in revealing poor neonatal outcome is more.

Keywords: Admission CTG, High risk pregnancy, Neonatal outcome

INTRODUCTION

Admission cardiotocography (CTG) or admission test (AT) or labor admission test (LAT) is a test of fetal health that is performed when a lady is admitted in labour. It comprises a cardiotocographic tracing of 20-30 minutes done on admission.[1] A normal trace shows a within range fetal heart rate with beat to beat variability, two accelerations and no decelerations with two contractions in 20 minutes (the criteria are predefined and established; as per NICE 2017 guidelines). It was introduced as a screening test in early labour to detect compromised fetuses i.e. fetuses that may be hypoxic already, or may not withstand the stress of uterine contractions. Compromised fetuses may then be delivered or subjected to additional tests of fetal surveillance like continuous CTG

(cardiotocography) throughout labor in order to prevent adverse outcomes. Even a foetus which is apparently normal in the antenatal period may develop distress during labour, hence the importance of this test. Several studies including RCT support its role in high risk pregnancy. Neilson et al have recommended that electronic fetal monitoring should be used in uncomplicated labour.[2] The aim of our study was to determine comparative efficacy of admission CTG in predicting neonatal out in high risk, low risk and universally in all pregnancy.

METHODS

A prospective observational study conducted in People's Hospital and Research Centre, Bhopal, India. Study period was between December 2018 and September 2019, after

institutional ethical approval. Study population being all pregnant women (high risk as well as low risk)- at term getting admitted in the labour ward in early or established labour. Informed and written consent was obtained from the mothers enrolled in the study.

Clinical details (history and examination findings) were noted on study proforma and the admission CTG (as defined in introduction) was done for 20 minutes.[3]

Table 1: CTG findings.

	Baseline (bpm)	Variability (bpm)	Decelerations	Accelerations
Reassuring	110-160	≥5	None	Present
Non-reassuring	100-109	<5 for 40-90 minutes	Typical variable decelerations over 90 min. or single prolonged deceleration for up to 3 minutes	The absence of accelerations with otherwise normal trace is of uncertain significance.
	161-180			
Abnormal	<100	<5 for >90 minutes	Persistent atypical variable decelerations or late decelerations or single prolonged deceleration for >3 minutes	
	>180			
	Sinusoidal pattern >10 minutes			

Based on the CTG finding, further management of the woman in labour was done as per the standard departmental protocols.

The neonatal outcomes were noted in terms of admission to NICU.

Inclusion criteria

All term patients (37 weeks-42 weeks) and singleton pregnancy.

Exclusion criteria

 Anomalous baby, preterm labor, IUFD, multifoetal pregnancy, malpresentations.

Statistical analysis

Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Continuous variables were presented as mean (SD) or median if the data was unevenly distributed. Categorical variables were expressed as frequencies and percentages. Nominal categorical data between the groups was compared using Chi-squared test or Fisher's exact test as appropriate. Non-normal distribution continuous variables were compared using Wilcoxon signed rank test. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

RESULTS

The present study included a total of 189 women who presented in labor room of Department of Obstetrics and Gynaecology, PCMS and RC, Bhopal during study period. Out of all 189 cases, 138 (73%) were high risk cases and 51 (27%) were low risk cases. Admission CTG was done (Table 2).

Table 2: Cases enrolled.

Cases	Total (n=189)
High risk	138 (73%)
Low risk	51 (27%)

Of all 138 high risk cases, 91 CTG were reassuring comprising 79.8% of all reassuring CTGs, and CTGs were abnormal (non-reassuring + abnormal) comprising 72.3% of all. Out of 51 low risk cases, 33 (20.2%) had reassuring CTG and 18 (37.7%) had abnormal CTG (Table 3).

Table 3: Correlation of high risk/low risk and CTG.

CTG		
	Reassuring	**Abnormal**
High risk	91 (79.8%)	47 (72.3%)
Low risk	33 (20.2%)	18 (37.7%)
Total	124 (100 %)	65 (100%)

Table 4: Correlation between CTG and admission to NICU in high risk cases.

CTG	Admission to NICU		Total (n=189)	P value
	No	**Yes**		
Reassuring	70 (79.7%)	21 (23%)	91 (100%)	<0.001
Abnormal	21 (45.7%)	26 (55.3%)	47 (100%)	
Total	91	47	138	

When we see correlate results obtained on CTG with NICU admission rate in newborns, it was seen that out of 91 reassuring CTGs, 21 (23%) neonates were admitted in NICU. Out of 47 abnormal CTGs, 26 (55.3%) neonates were admitted in NICU. In high risk cases, p value of <0.001 (CI=95%, n=138) was calculated, showing a significant role of CTG in predicting neonatal outcome in high risk cases (Table 4).
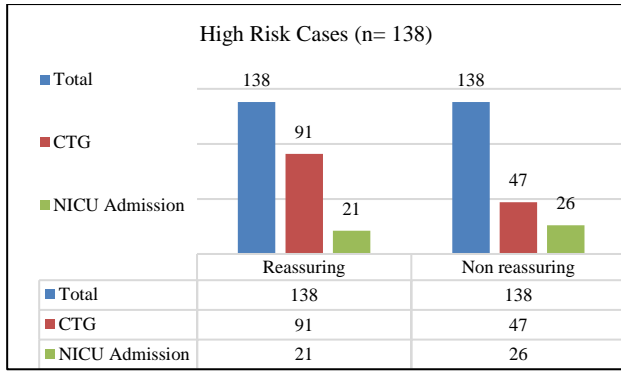
Figure 1: Relation between CTG finding in high risk cases and NICU admission.

Table 5: Correlation of admission CTG and admission to NICU in low risk cases.

CTG	Admission to NICU		Total (n=81)	P value
	No	**Yes**		
Reassuring	26 (79%)	7 (21%)	33 (100%)	
Abnormal	12 (67%)	6 (33%)	18 (100.0%)	0.772
Total	38	13	51	

On comparing CTG results with NICU admission in low risk cases, following observations were made: out of 33 reassuring CTGs, 7 (21%) neonates were admitted in NICU. Out of 18 abnormal CTGs, 6 (33%) neonates were admitted in NICU. P value of >0.05 was found in low risk cases, and thus there was no significance and usefulness. (Table 5). Figure 2 shows the same.
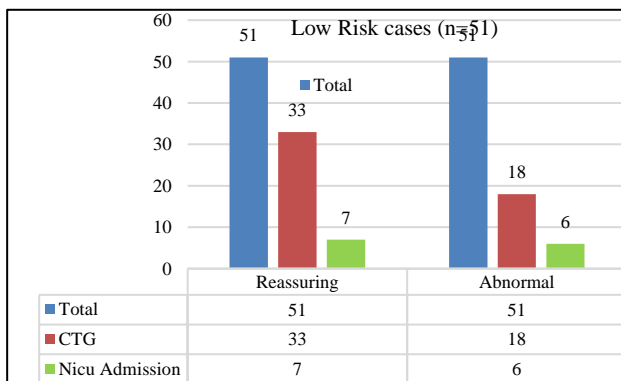

Figure 2: Relation between CTG finding in low risk cases and NICU admission.

Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of CTG in predicting neonatal outcome were calculated (Table 6). On comparing efficacy of admission CTG in high risk cases and low risk cases the sensitivity (55.3% versus 46.15%), specificity (77 % versus 68.4%), PPV (55.3% versus 33.3%) and NPV (77% versus 78%) all being highest in

high risk cases as compared to low risk and universal, respectively (Table 6).

Table 6: Comparative efficacy of CTG in high risk cases and low risk cases.

	High risk cases (n=138)	**Low risk cases (n=51)**
Sensitivity	55.3%	46.15%
Specificity	77%	68.4%
Positive predictive value (PPV)	55.3%	33.3%
Negative predictive value (NPV)	77%	78.8%

DISCUSSION

Admission CTG is a good predictor of neonatal outcome. In the recent years, CTG has emerged as the most reliable, trustable, and non-invasive method of intrapartum foetal monitoring among different modalities available for foetal surveillance. It has become a routine in developed as well as developing countries to perform Admission CTG in all women presenting in labor including both high risk and low group.

CTG traces were divided into reassuring, and abnormal as per NICE Criteria 2017. In present study, 124 (65.6%) women had reassuring CTG, 65 (34.4%) had abnormal pattern.

In a study conducted on mixed population Mires et al reported 21.8% of the admission traces to be normal, while 3.6% were considered as abnormal.[4] Rajalekshmi et al studied on 400 women, out of which 267 (66.75 %) had reactive tracing, 133 (33.25 %) had abnormal tracings, respectively.[5] In study by Dhanalakshmi et al out of 481/800 (60.1%) of women had reassuring CTG, 33.4% belonged to non-reactive group and 6.5% belonged to ominous.[6] In a study conducted in Kandan Karibu Hospital, Singapore (1998) on 1000 antenatal women, tracings were reactive in 982 (4.3%), suspicious in 49 (4.7%), and ominous 10 (1%).

In present study we included both high risk and low group. Majority i.e., 138 out of 189 (73%) women belong to high risk group. Out of these, 91 (65.9%) had reassuring CTG, and 47 (34%) had abnormal trace. In our study, 72.3% of total abnormal CTG were present in high risk group.

 In study by Bhartiya et al, 72 (36%) were low-risk and 128 (64 %) were high-risk women.[7] Rajalekshmi et al in their study had 267/400 (66.755) low risk cases whereas 133 (33.25%) high risk case.[5] In a study conducted on 201 high risk cases by Gupta et al, similar results as ours was found 63.2% had reactive CTG pattern and 36.8% had non-reactive CTG pattern.[8] In study by Dhakre et al, reassuring, non-reassuring and abnormal CTG pattern was observed in 62.9%, 13.3% and 23.8% of high risk pregnancies

respectively.[9] Manning et al, in their study done on 150 high risk cases found 83% reactive CTGs, and 17% non-reactive CTG.[10]

AT was a useful screening tool in patients with high risk factors and was able to predict neonatal outcomes in terms of NICU admission and the need for caesarean birth in study by Akhavan et al.[11]

In the present study, 44.6% neonates with abnormal trace had NICU admission. In the high risk versus low risk group, NICU admission was present in 55.3% versus 46.15%, and 44.6% versus 53.8% of neonates with in abnormal and reassuring, respectively.

Rahman et al had 57.1% NICU admission in cases with abnormal CTG. Thus, CTG prove to be a good predictor of neonatal outcome in terms of NICU admission in high risk group.[12]

In present study, sensitivity of admission CTG was 55.3%, specificity was 77%, PPV was 55.3% and NPV was found to be 77% in high risk cases whereas it's 46.1%, 68.4%, 33.3%, and 78.8%, respectively in low risk cases. All criteria except NPV, were higher in high risk cases implicating CTG being a better predictor in high risk cases. High specificity and NPV in our study means that it high predictability in cases who had adverse outcome, and rules out who did not have adverse outcome.

Kushtagi et al also found low sensitivity and PPV of 53% and 61%, and high specificity and NPV of 93% and 91%, respectively.[13] Ducey et al got best PPV (75%) in their results, sensitivity and specificity was 57% and 98%, respectively.[14]

Ingemarsson et al showed got best specificity (99%) in their results, sensitivity was 23.5%, and PPV was 40.[15] In most of the studies including ours, sensitivity was low indicating low number of adverse results predicted correctly by admission CTG and also, PPV was low suggestive of only few of those predicted positive were actually positive.

The few limitations of our study are that sample size taken was small. Also, no further test of foetal well-being like fetal blood sampling or fetal scalp blood pH was done.

CONCLUSION

CTG is a good predictor of newborn outcome. P value of >0.05 was found in low risk cases, and thus there was no significant usefulness of CTG in low risk cases.

P value of <0.001 was seen in high risk cases, showing a highly significant role of CTG in predicting neonatal outcome in high risk cases. Therefore, it's practicality in revealing poor neonatal outcome is more in high risk cases with sensitivity, specificity, and positive predictive value (PPV) being greater, and p value of <0.001. Thus, it should be used in high risk cases rather than using universally in all patients presenting in a labor ward.

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