Admission Cardiotocography as a screening test to predict foetal outcome and mode of delivery

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Abstract

Background: A screening test is ideally needed at the time of onset of labour which can detect the already existing compromise on the foetus and which can also predict its well-being for following hours in labour, which will pave way for timely intervention that will curtail the neurological damage and death. Assessment of foetal wellbeing in labour ward through admission cardiotocography (CTG) helps us to look for already prevailing high risk factors vigilantly and also new factors that have recently appeared.

Aim: To ascertain admission CTG as an effective tool in predicting the foetal outcome and mode of delivery.

Materials and Methods: In this study 400 women's Admission CTG's will be compared for pregnancy and neonatal outcomes such as mode of delivery, APGAR score, admission into neonatal intensive care unit (NICU) and duration of stay in NICU. Statistical analysis is done using Chi square test and $p<0.05$ is considered as statistically significant. Sensitivity, specificity, positive and negative predictive values, diagnostic accuracy of the admission CTG is also measured.

Results: There is a statistically significant co-relation between the admission CTG and the mode of delivery, APGAR score and NICU stay of the neonates.

Conclusion: We conclude that the admission test can be used as a useful tool to analyse CTG tracings of women in early labour to give quality care and to predict the mode of delivery and foetal outcome.

Keywords: Admission CTG, mode of delivery, foetal outcome, APGAR score, NICU, diagnostic accuracy

Introduction

A larger part of the current preventive obstetric practice consists of methods to detect, avoid and treat foetal asphyxia. In the last few decades, technological advances have undoubtedly contributed significantly to improved maternal and perinatal outcome. The impact on assessment of the foetus in utero has been particularly striking. It is now possible to assess the foetus not only for structural malformations, but also for its physiological status and well-being[1]. It is estimated that 20-40% stillbirths in the non-anomalous category occur as result of intrauterine hypoxia and are therefore potentially preventable.

In this context, a screening test is ideally needed at the time of onset of labour which can detect the already existing compromise on the foetus and which can also predict its well-being for following hours in labour, which will pave way for timely intervention that will curtail the neurological damage and death[2,3].

Assessment of foetal wellbeing in labour ward by admission cardiotocography (CTG) helps us to look for already prevailing high risk factors vigilantly and also new factors that have recently appeared[4,5,6].

Two problems can be solved even after following antenatal risk classification, so called low risk group can have foetal morbidity and mortality which leaves us with the task of determining who is at low risk. A new system must be developed to identify those who are at risk in labour by means of the "Admission test"[7]. Second problem we face is the difficulty in providing one to one care to offer optimal standards of intermittent auscultation with inadequate trained man power[8,9]. For good results with auscultation, one has to listen to foetal heart rate for one minute every 30 minutes perfectly after a contraction in the first stage of labour and after each and every other contraction during the second stage of labour[10,11]. This may not be feasible in many centres.

Routine electronic foetal monitoring in labour has become an established practice in almost all the labour wards but routine continuous electronic foetal monitoring is not feasible for all the cases. In order to overcome this hurdle admission CTG is a very useful

tool which gives an early, easy and quick assessment of foetal well-being, at the same time it helps us to pick up cases for whom we need continuous monitoring[12,13,14,15, 16,17].

Admission test is a 'Natural contraction stress test' that can assess the ability of foetus to withstand the functional stress of uterine contractions and helps to identify those cases at risk. It is a 20 minute recording of FHR and uterine contractions using a CTG machine at the time of admission to labour ward, so it is very simple, rapid and patient friendly procedure.

Aim of the Study

To ascertain admission CTG as an effective tool in predicting the foetal outcome and mode of delivery.

Materials and Methods

After obtaining the institutional ethics committee approval, 400 pregnant women in the early labour admitted in the labour ward of Sree Balaji Medical College Hospital, Chennai with gestational age of 37 to 41 completed weeks with no maternal complications were chosen for the study. Antenatal women with multiple gestation, antepartum haemorrhage, pregnancy induced hypertension, eclampsia, oligohydramnios, intra-uterine growth retardation, gestational diabetes mellitus were excluded from the study.

After included in the study, the patients were explained about the procedure and informed consent was obtained. The pregnant mother was asked to empty her bladder and all the procedure, what to expect during the procedure and what is expected of her were explained to her. She is placed in the semi fowler's position. The ultrasound transducer is applied to the maternal abdomen with a gel interface and the foetal heart rate is observed for 20 min. The patient is asked to press the event marker every time she perceives foetal movement. Presence of spontaneous foetal heart rate accelerations with foetal movement is an indicator of foetal well-being.

Non stress test (NST) Variables to be evaluated are
- Baseline foetal heart rate
- Variability of foetal heart rate
- Presence or absence of accelerations
- Presence or absence of decelerations

The admission test tracings were typed into (i) Reactive (ii) Suspicious (iii) Ominous. Depending on the type of tracings, the mode of management varies.

Patient can be divided into low and high observational status depending upon the tracings[18].

Low observational status – Reactive tracing

High observational status - Suspicious + Ominous Tracings

If the admission test tracings are reactive and not in immediate labour, she is transferred to antenatal ward. If the tracings are ominous, she is transferred to labour ward and further management is decided based on individual condition. The admission CTG will be used in comparison of pregnancy and neonatal outcomes such as mode of delivery, APGAR score, admission into neonatal intensive care unit (NICU) and duration of stay in NICU.

Results

Table 1: Admission Test Trace Pattern

Tracings	No. of Patients	Percentage
Reassuring	267	66.75%
Suspicious	114	28.5%
Ominous	19	4.75%
Total	400	100%

Out of 400, 267 (66.75%) women had reactive tracings, 114 (28.5%) had suspicious and 19 (4.75%) had ominous tracings. (Figure 1)
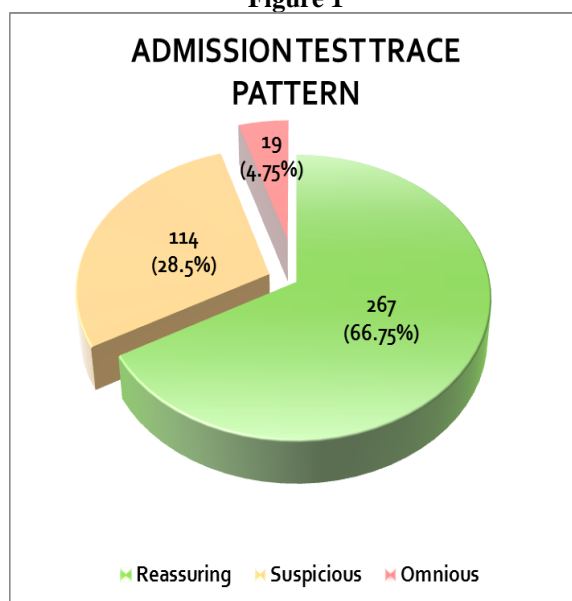
Figure 1

66.75% women were classified as low observational status and 33.25% as high observational status according to CTG. (Figure 2)

Table 2: Observational Status of CTG

Observational status of CTG	Frequency	Percentage
LOW	267	66.75%
HIGH	133	33.25%

66.75% women were classified as low observational status and 33.25% as high observational status according to CTG. (Figure 2)
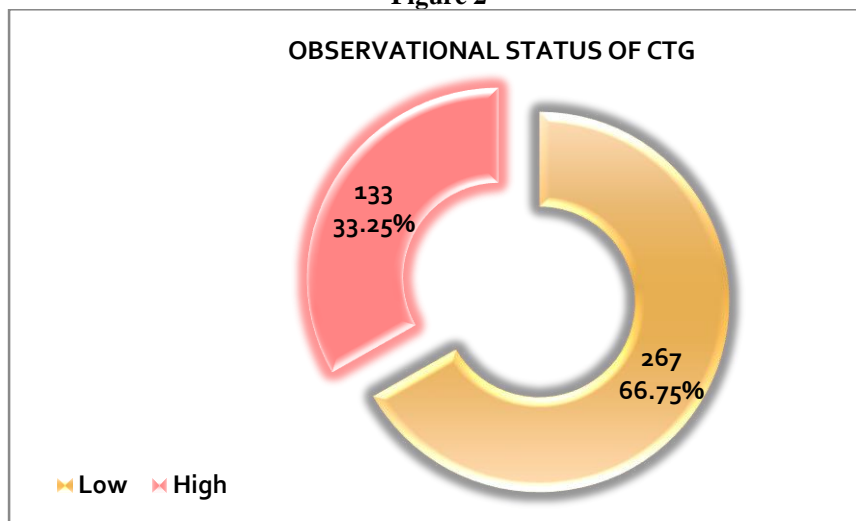
Figure 2

Table 3: CTG vs Mode of Delivery

CTG	Mode of Delivery			Total
	Vaginal	**Forceps**	**LSCS**	
Reassuring	179 (44.75%)	8 (2%)	80 (20%)	267
Suspicious	2 (0.5%)	7 (1.75%)	105 (26.25%)	114
Ominous	0	0	19 (4.75%)	19
Total	181	15	204	400

As per Chi-square test **P value < 0.0001**. Since P value is less than 0.05 there is significant correlation between type of tracings and mode of delivery. (Figure 3)
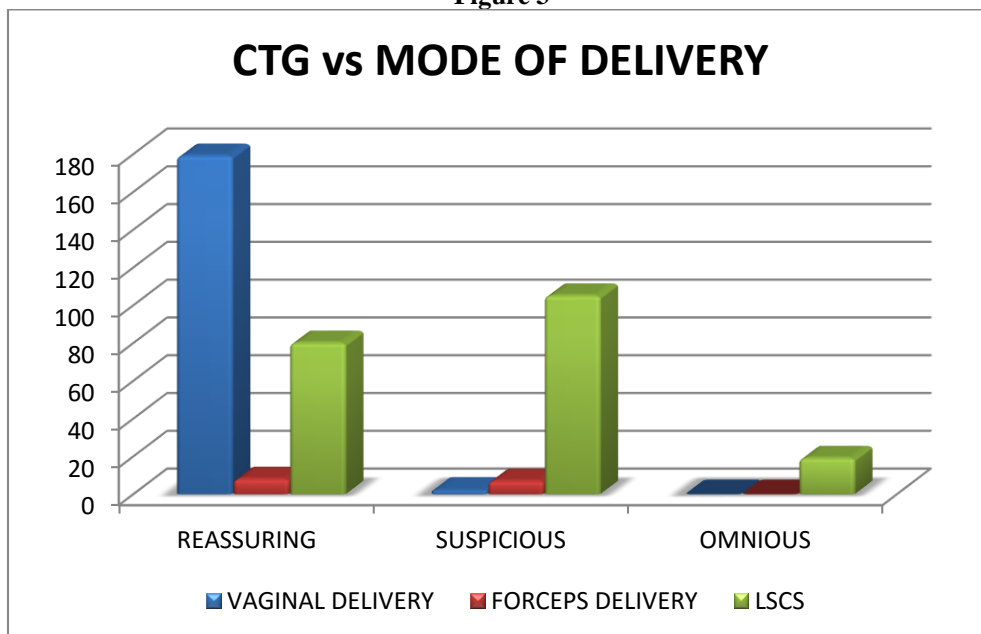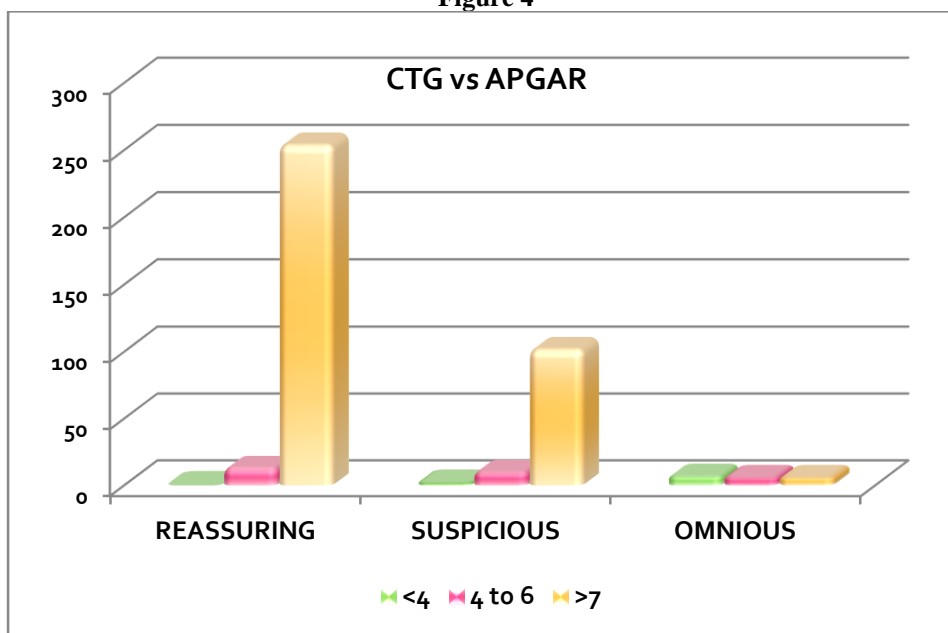
Figure 3

Table 4: CTG vs APGAR

CTG Status	APGAR			TOTAL
	<4	**4 to 6**	**>7**	
Reassuring	0	13 (3.25%)	254 (63.5%)	267 (66.75%)
Suspicious	2 (0.5%)	10 (2.5%)	102 (25.5%)	114 (28.5%)
Omnious	7 (1.75%)	6 (1.5%)	6 (1.5%)	19 (4.75%)
Total	9 (2.25%)	29 (7.25%)	362 (90.5%)	400 (100%)

P value < 0.0001. Since P value < 0.05, there is significant correlation between admission test tracing and apgar. (Figure 4)

Figure 4

Table 5: CTG vs NICU Stay

CTG	< 5 days	5 - 10 days	TOTAL
Reassuring (n=267)	2	1	3 (1.1%)
Suspicious (n=114)	12	2	14 (12.3%)
Ominous (n=19)	3	6	9 (47.4%)
Total	17	9	26

P value = 0.03. Since P value is < 0.05, statistical significance exists. (Figure 5)

Figure 5
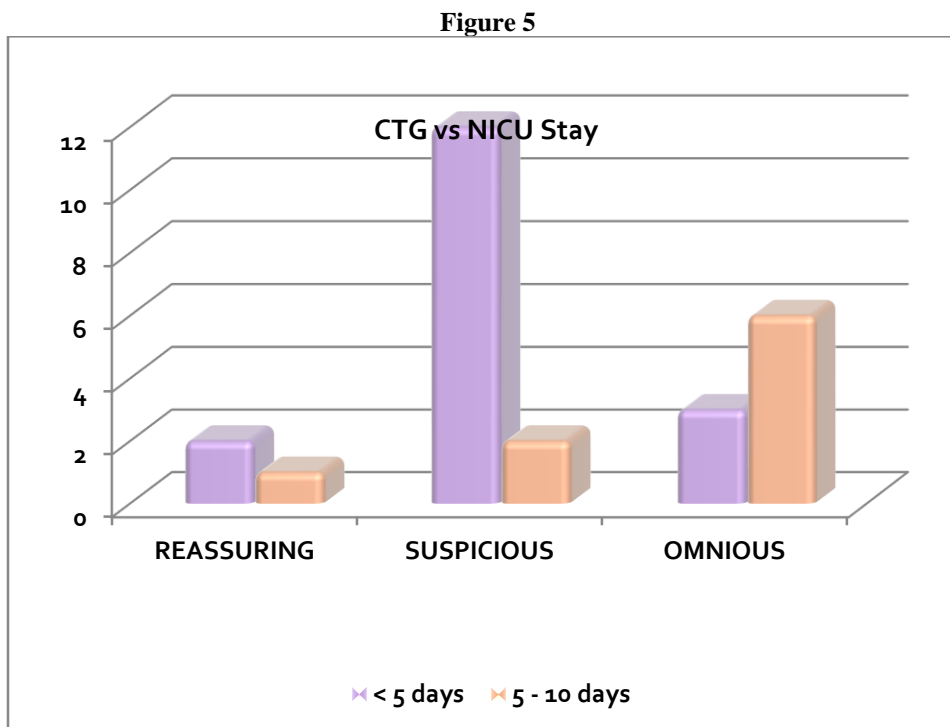
Analysis of Admission Test as a Screening Test

To evaluate the outcome, foetal distress was considered to be present when abnormal FHR tracing led to cesarean section or forceps delivery or if the newborn had an Apgar Score < 7. Here positive test result means non-reassuring and abnormal pattern of CTG and negative test result means reassuring CTG pattern.

Table 6

Screening Test	Foetal Distress	No Foetal Distress	Total
Postive (Abnormal CTG Pattern)	**(True +ve)** 117 (a)	**(False +ve)** 16 (b)	133 (a+b)
Negative (Normal CTG Pattern)	**(False -ve)** 9 (c)	**(True -ve)** 258 (d)	267 (c+d)
Total	126 (a+c)	274 (b+d)	400 (a+b+c+d)

a) **True Positive**: Those individuals found positive on the test developed foetal distress during the course of labour (abnormal CTG pattern with foetal distress) a=117.

b) **False Positive**: denotes who have the positive test result but who did not develop foetal distress (abnormal CTG with good outcome) b=16.

c) **False Negative**: denotes those with negative (normal CTG) result but later developed foetal distress. c = 9.

d) **True Negative**: denotes those with negative results (normal CTG) who did not develop foetal distress d = 258.

e) **Sensitivity**: Ability of the test to identify correctly all those who developed foetal distress.

f) **Specificity**: Ability of the test to identify correctly those who did not have the disease

g) **Positive predictive value** = this reflects the diagnostic power of the test. Predictive value of the positive test indicates the probability of getting foetal distress with a positive test result.

h) **Negative predictive value**: is probability of good outcome that is no foetal distress in negative results (normal CTG)

Table 7

FACTOR	FORMULA	PERCENTAGE
Sensitivity	a/(a+c)*100	92.85%
Specificity	d/(b+d)*100	94.16%
Positive predictive value	a/(a+b)*100	87.96%
Negative predictive value	d/(c+d)*100	96.62%
Diagnostic accuracy	(a+d)/(a+b+c+d)*100	93.75%

Discussion

In our study 400 antenatal women were included according to the inclusion criteria. More than half of the antenatal women were multi gravida. Out of 400 women, 267 (66.75%) of patients had reactive tracing, 114 (28.5%) had suspicious tracing and 19 (4.75%) had ominous tracing.

Kushtagi P, Narogoni. S. conducted a study on Admission test with 500 patients where tracings were: 86.6% (n-433) reactive, 7.4% (n-37) belonged to suspicious group and 0.6% (n-30) belonged to ominous[19].

In our study, 267 patients were classified to low observational status and 133 belong to high observational status. 343 (85.75%) had spontaneous onset of labour. Only 57 (14.25%) had induced labour.

In our study, mode of delivery among 400 Antenatal women; 181 delivered vaginally, 15 by forceps and 204 had LSCS. On comparing admission test tracings with mode of delivery, Only 39.2% (n-80) of the reactive group had caesarean delivery, but 51.4% (n-105) of suspicious and 9.4% (n-19) of the ominous group had caesarean delivery. This showed that abnormal tracings were associated with increased incidence of caesarean delivery than reactive tracings (p<0.05).

Similarly Macdonald et al, Ingemarsson et al and Vinitha Das et al in their study found that most of the caesarean deliveries occurred in abnormal CTG group. They found a statistically significant relation between non – reactive tests & increased incidence of induced vaginal delivery (IVD) and caesarean section (C.S)[20,21,22]. But Kidd LC et al found that caesearan delivery rates were almost same in both reactive and non-reactive tracings hence they concluded that availability of non-stress cardiotocography was not associated with increased labour induction (or) caesarean section[23].

In our study, 13 babies of ominous tracings group and 12 babies of suspicious group had apgar score <7. But 13 babies of the reactive tracings group had low apgar score (<7). So abnormal tracings had 2 fold increased risk of having low apgar score then reactive tracings. (p value < 0.0001) showing statistical significance.

Atul K.Sood in his study found that there was significant co-relation between apgar score < 7, neonatal admission were more commonly associated with non reactive tracings (p < 0.005)[4]. Similarly Sandal J. et al concluded in their study that abnormal (suspicious & ominous) admission test tracings were associated with increased risk of instrumental vaginal delivery and caesarean section and low 5 min apgar score[24]. Fawole AO, Sotiloye OS, in their study on antenatal cardiotocography analysed that low apgar <7 occurred most commonly in non reactive tracings (p = 0.04) and the Reactive test was associated with 3 fold reduction in the incidence of low apgars compared with Non reactive. They concluded that antenatal cardiotocography can be used in low resource settings for improving perinatal care[25]. Manterola Alvarez D, Angeles Weintraub also found a statistical significant correlation between suspicious and ominous tracings and foetal condition at birth (Apgar < 7) (p = 0.01)[26]. But Kidd LC, Smith R observed that frequency of intrapartum foetal distress and low apgar score were similar in both reactive and abnormal tracings group[23]. 59.3% antenatal women had foetal distress and 40.7% women had other indications for LSCS.

In our study, when admission test tracings and neonatal outcome were analysed and the results showed that abnormal tracings were associated with poor foetal outcome, than reactive tracings (p < 0.0001). Neonatal outcome was based on requirement of ventilatory support and referral to higher centres.

In our study about 26(6.5%) neonates were admitted in NICU among 400 deliveries. Among 267 patients who had reassuring CTG, 3 babies were admitted in NICU. 12.3% of the babies of suspicious group were admitted in NICU whereas 47.4% of the babies of the ominous CTG group were admitted in NICU. So, NICU admission is more in the suspicious and ominous CTG group.

P Value = 0.036, which is < 0.05.
Hence, there is correlation between abnormal CTG & NICU admission.

This study when compared with other studies for the diagnostic ability of the CTG as a screening test gave some interesting data.

Table 8

Authors	Sensitivity	Specificity	Positive Predictive value	Negative Predictive Value
Vinitha Das[40]	38%	79%	48%	72%
Kushtagi P[23]	53%	93%	61%	91%
This study	92.85%	94.16%	87.96%	96.62%

The diagnostic accuracy of this study was 93.75%. The values obtained in the present study shows it has a very high diagnostic accuracy, indicating that reactive admission test correlates well with foetal well-being.

Conclusion

This study concludes that admission CTG helps in identifying early foetal compromise, so that early intervention can be made thereby reducing foetal mortality and morbidity. The study shows that there is a good correlation between reactive tracings and good foetal outcome even with less frequent monitoring. Hence the admission test can be used as a useful tool to analyse CTG tracings of women in early labour to give quality care and to predict the mode of delivery and foetal outcome.

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Source of Support: Nil

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