Original Research Article

Admission test cardiotocography in labour as a predictor of foetal outcome in high risk pregnancies

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ABSTRACT

Background: Continuous fetal heart monitoring in all pregnant women in labour has gained prominence in obstetric practice in the recent years. The aim of this study was to emphasize on the role of admission cardiotocography (CTG) in labour as a predictor of foetal outcome in high risk pregnancies.

Methods: This was a prospective observational study done on 340 high risk patients admitted in labour with a period of gestation of ≥37 weeks. An admission CTG which consists of a 20-minute recording of FHR and uterine contractions was taken and the foetal outcome was correlated with it. The non-parametric Chi-square test was used for statistical calculations and a p valve of <0.05 was considered to designate statistical significance.

Results: The admission CTG was reactive in 69.4% of all patients, equivocal in 22.2% and pathological in 8.4% of the 340 recruited patients. A total of 37.5% of the patients were post-dated followed by 20.6% of pregnancy incuded hypertensive patients. The neonatal outcomes in terms of fetal distress, meconium stained liquor, NICU admission were considerably higher in pathological test. The specificity of the test was 53.3%, and the negative predictive was 86.49%.

Conclusions: Admission CTG is a simple, useful screening test and serves as a non-invasive tool in forecasting the adverse foetal outcomes in high risk pregnancies.

Keywords: Cardiotocography (CTG), Foetal outcome, High risk pregnancy

INTRODUCTION

Foetal surveillance during labour is necessary to ensure safe passage of the foetus from an intrauterine to an extra uterine environment with minimum intervention.[1] The mechanism of labour itself presents as a physiological stress to the fetus. Thus, continuous foetal heart rate (FHR) monitoring in all pregnant women in labour has gained prominence in obstetric practice in the recent years .Intermittent auscultations can measure the baseline FHR but other features such as baseline variability, accelerations, decelerations in response to the uterine contraction remains unappreciated.[2] Foetal monitoring is essential to identify foetuses at risk for hypoxic injury due to uteroplacental insuffiency .It can prevent neurological injuries such as cerebral palsy.[3] Thus, electronic fetal monitoring has been widely adopted.[4]

A number of technical breakthroughs occurred in the 20th century that led to development and commercialisation of cardiotocography (CTG) in the 1960's to monitor fetal heart rate and uterine contractions.[5] The use of CTG as a first line of investigation for both antepartum and intrapartum monitoring has been widely advocated by some authors to decrease the perinatal mortality.[6] In developing countries economic constraints limit routine

and continuous monitoring of electronic fetal heart monitoring .In busy labour wards with a few monitors , selection of the patients for continuous monitoring is necessary.[7]

Ingemarsson et al described an alternative method of monitoring FHR during labour to pick the women apparently at risk whose foetuses were compromised on admission or were likely to be compromised in labour-Admission test (AT).[8] The admission CTG is a short, usually a 20 minute, recording of the FHR immediately after admission to the labour ward.[9]

The main justification for admission CTG is that the uterine contractions during labour decreases the placental circulation; an abnormal tracing indicates a deficiency and hence identifies foetal compromise at an early stage to allow intervention.[10] The NICE guidelines of 2017 do not recommend admission CTG in low risk women but offers continuous CTG in patients with risk factors.[11] The aim of this study was evaluate the predictive value of admission CTG at the time of admission in labour and to correlate the results of the admission CTG with perinatal outcome in high risk obstetric cases.

METHODS

This was a prospective observational study conducted on 340 high risk patients admitted in labour for a period of one year (April 2017 to March 2018) at Shri B. M. Patil Medical College Hospital and Research Centre, Vijaypura, Karnataka, India. The women eligible to join the study had ≥37 weeks of gestation, were in the 1st stage of labour (spontaneous in onset), singleton fetus with a cephalic presentation and classified as high risk during the time of admission (Table 1).

Table 1: High risk factor groups.

Risk factors
Postdated
PIH (Pregnancy induced hypertension)
PIH with IUGR (intrauterine growth restriction)
IUGR (Intrauterine growth restriction)
PROM (premature rupture of the membranes)
BOH (Bad obstetric history)
Oligohydramanios
Diabetes

Exclusion criteria

- Women with a period of gestation ≤37 weeks.
- Congential anomaly confirmed by ultrasonography (USG).
- Multiple pregnancies
- Acute hypoxic states (placental abruption, cord prolapse, abnormal lie and needing emergency

caesarean section or elective LSCS (lower segment ceaserean section).

On admission, the women's details, age, parity, antenatal care, menstrual and obstetric, medical history were documented followed by a general and physical examination.

A per abdomen and bimanual examination was done to determine the stage of labour, after which an Admission test CTG was taken by a BPL FM 9856 machine. A 20-minute tracing of the FHR with uterine contractions was taken with the patient lying in the left lateral position in a room adjacent to the labour room.

The FHR tracing was classified as normal, suspicious or pathological as according to the classification proposed by NICE (National institute of clinical excellence) guidelines 2017.[11] Patients with a normal reactive test were monitored by intermittent auscultation for 1 minute, every 30 minutes in the 1st stage of labour and every 5 minutes in the second stage of labour. (Table 2) (Table 3).

Table 2: Definition of CTG tracings (NICE guidelines 2017).

Category	Definition
Normal	An FHR trace in which features are classified as reassuring.
Suspicious	An FHR trace with 1 no reassuring feature AND 2 reassuring features.
Pathological	An FHR trace with 1 abnormal feature OR 2 no reassuring features.

Those with suspicious tracings were placed on continuous CTG monitoring.

In patients with a pathological tracing delivery was hastened by operative, instrumental intervention depending upon the stage of labour. Perinatal outcome was assessed in terms of the colour of the liquor, APGAR score, NICU admission and perinatal mortality.

Statistical analysis

All characteristics were summarized descriptively. For categorical data, the number and percentage were used in the data summaries and diagrammatic presentation. Chi-square (χ2) test was used for association between two categorical variables.

If the p-value was <0.05, then the results were considered to be statistically significant otherwise it was considered as statistically non-significant. Data were analyzed using SPSS software Version .23.0. and Microsoft office 2007.

Table 3: Pathological classification proposed by NICE.

Description	Feature		
	Baseline (beats/minute)	Baseline variability (beats/minute)	Declarations
Reassuring	110 to 160	5 to 25	None or early Variable decelerations with no concerning characteristics* for less than 90 minutes
Non-reassuring	100 to 109 or 161 to 180	Less than 5 for 30 to 50 minutes or More than 25 for 15 to 25 minutes	Variable decelerations with no concerning characteristics* for 90 minutes or more OR Variable decelerations with any concerning characteristics* in up to 50% of contractions for 30 minutes or more or Variable decelerations with any concerning characteristics* in over 50% of contractions for less than 30 minutes or Late decelerations in over 50% of contractions for less than 30 minutes, with no maternal or fetal clinical risk factors such as vaginal bleeding or significant meconium
Abnormal	Below 100 or Above 180	Less than 5 for more than 50 minutes or More than 25 for more than 25 minutes or Sinusoidal	Variable decelerations with any concerning characteristics* in over 50% of contractions for 30 minutes (or less if any maternal or fetal clinical risk factors) or Late decelerations for 30 minutes (or less if any maternal or fetal clinical risk factors) or Acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more

RESULTS

Out of the 320 cases majority of the patients were primigravida in the age group of 21 to 25 years. Pathological AT was higher in the age group of 36 to 40 years and patients with a gestational age of 37 to 40 weeks (Table 4). Around 37.5% of the patients were post-dated followed by PIH (20.6%), PIH with IUGR PROM (10.6%), BOH (bad obstetric history patient) were 6.9%. A few patients had multiple risk factors (Table 5) like CPD (cephalopelvic disproportion), anemia and previous LSCS. About 69.4% of the patients had a "normal "admission test CTG out of which 13.5% was associated with fetal distress. A higher percentage of fetal distress was observed in the suspicious AT (26.8%) and the pathological AT showed an alarming fetal distress of 55.6% (Table 6).

Table 4: Demographic and clinical characteristics.

Age (years)	Normal (N=222)		Suspicious (N=71)		Pathological (N=27)		Total (N=320)	
	N	%	N	%	N	%	N	%
17-20	38	66.7	15	26.3	4	7.0	57	17.8
21-25	101	75.9	22	16.5	10	7.5	133	41.6
26-30	40	60.6	20	30.3	6	9.1	66	20.6
31-35	28	66.7	10	23.8	4	9.5	42	13.1
36-40	15	68.2	4	18.2	3	13.6	22	6.9
Total	222	69.4	71	22.2	27	8.4	320	100.0
Parity								
Primi	130	65.7	50	25.3	18	9.1	198	61.9
Multi	92	75.4	21	17.2	9	7.4	122	38.1
Total	222	69.4	71	22.2	27	8.4	320	100.0
Gestational age								
37-40 weeks	122	69.3	40	22.7	14	8.0	176	55.0
>40 weeks	100	69.4	31	21.5	13	9.0	144	45.0
Total	222	69.4	71	22.2	27	8.4	320	100.0

It is evident from Table 7 that incidence of fetal distress and pathological AT was found in all patients with IUGR, oligohydraminos, diabetes and PIH with IUGR.

Table 5: Risk factors in the study population.

Risk factors	N	%
Postdated	120	37.5
PIH	66	20.6
PIH with IUGR	21	6.6
IUGR	18	5.6
PROM	34	10.6
BOH	22	6.9
Oligohydramanio	14	4.4
Diabetes	11	3.4
Rh-ve pregnancy	8	2.5
Others	6	1.9
Total	320	100.0

Table 6: Admission test result and incidence of foetal distress.

Results	At results		Foetal distress	
	N	%	N	%
Normal	222	69.4	30	13.5
Suspicious	71	22.2	19	26.8
Pathological	27	8.4	15	55.6

P <0.05*

Moderate thick meconium stained liquor (mod –thick MSL) was seen 48.1% of the patients with pathological AT as compared to 15.5% of the suspicious AT and 9% of the normal AT group ($p<0.05\%$). The incidence of birth asphyxia in neonates with a pathological AT as evidenced by the AGPAR score 7 at 5 minute and cord blood pH<7.2 was high, 44.4 % and 29.6% respectively.

Table 7: Incidence of foetal distress (FD) in specific risk factor groups. Data are expressed as number (N) and %.

Risk factors	Normal (N=222)			Suspicious (N=71)			Pathological (N=27)		
	Total	FD (N)	%	Total	FD (N)	%	Total	FD (N)	%
Postdated	80	11	13.8	31	8	25.8	9	4	44.4
PIH	41	4	9.8	19	3	15.8	6	3	50.0
PIH with IUGR	12	3	25.0	6	2	33.3	3	2	66.7
IUGR	11	3	27.3	5	2	40.0	2	2	100.0
PROM	28	2	7.1	4	1	25.0	2	0	0.0
BOH	18	2	11.1	2	2	100.0	2	1	50.0
Oligohydramanios	11	2	18.2	2	1	50.0	1	1	100.0
Diabetes	10	1	10.0	0	0	0.0	1	1	100.0
Rh -ve pregnancy	6	2	33.3	2	0	0.0	0	0	0.0
Others	5	0	0.0	0	0	0.0	1	1	100.0

Table 8: Correlation of foetal/neonatal outcomes with AT.

	Normal (N=222)		Suspicious (N=71)		Pathological (N=27)	
	N	%	N	%	N	%
Mod-thick MSL	20	9.0	11	15.5	13	48.1
Apgar score 5 min <7	16	7.2	8	11.3	12	44.4
NICU admission	14	6.3	8	11.3	9	33.3
Cord blood Ph<7.2	10	4.5	5	7.0	8	29.6
Neonatal death	1	0.5	3	4.2	2	7.4

P <0.05% *

There were five neonatal deaths in mothers with suspicious and pathological AT's, and the NICU admission was the highest in the pathological AT group (Table 8).

In comparison to pathological AT group where incidence of LSCS was 66.7%, the normal AT group patients had 30.2% of LSCS while the suspicious AT group had 39.4%. Instrumental delivery, forceps/vacuum application was higher in the normal AT i.e.,13.1 % while the pathological AT patients had 11.1 %.

The results indicate that operative/ instrumental delivery techniques with fetal distress were higher in the pathological group and considerably lower in the normal group (Table 9).

Table 9: Mode of delivery with the results of the admission test and occurrence of foetal distress (FD).

Mode of delivery	Normal (N=222)		Suspicious (N=71)		Pathological (N=27)	
	N	%	N	%	N	%
Spontaneous vaginal delivery	126	56.8	38	53.5	6	22.2
With FD	25	11.3	12	16.9	1	3.7
Without FD	101	45.5	26	36.6	5	18.5
Forceps/Ventouse	29	13.1	5	7.0	3	11.1
With FD	8	3.6	3	4.2	2	7.4
Without FD	21	9.5	2	2.8	1	3.7
LSCS	67	30.2	28	39.4	18	66.7
With FD	9	4.1	13	18.3	17	63.0
Without FD	58	26.1	15	21.1	1	3.7

P <0.05

The above table shows that AT CTG has high sensitivity and specificity for predicting fetal distress (53 % and 75% respectively). The proportion of the false negatives were low. A high NPV (86.49%) enables a clinician to accurately exclude fetal distress in an individual patient.

Table 10: Diagnostic parameters of admission test.

	Present study
Sensitivity	53.13
Specificity	75.00
Positive predictive value	34.69
Negative predictive value	86.49
False negatives	9.4
False positives	20.00

DISCUSSION

The admission CTG is a simple noninvasive tool. It can be used as a screening test in early labor to detect compromised fetuses on admission and thereby select the women in the need of continuous EFM during labour .A Cochrane based review recommended the use of continuous EFM be limited to high risk pregnancies where antenatal care is inadequate with a large number of high risk pregnancies being delivered in crowded settings and inadequate low health care provider to patient ratio.[12] In developing countries like India where this study was conducted this is applicable because of the high patient input in the labour rooms and the paucity of CTG monitors. The use of EFM is controversial in intrapartum monitoring. In an RCT conducted by Impey et al found no role of admission CTG in improving the neonatal outcome. Similarly, Blix et al, in a systemic review of three randomized controlled trial found that labour admission CTG has no prognostic value.[13] In contrast Akhavan et al showed that the 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.[14,15] Hafizur et al, had a 57.1 % of NICU and cesarean birth rate as high as 100% with an ominous AT and with fetal distress. Blessy D17

et al conducted a study on 400 women and the incidence of caesarean delivery with non-reactive AT was 93.25% and the same group had 43.7% babies in the NICU.[16,17] This is consistent with the present study where pathological AT group births had 33.3% of NICU admission as compared 6.3 % of the normal AT group births. The rate of caesarean section in the current study is 66.7% in the pathological AT group. The present study has 55.6 % of the pathological AT in high risk patients as in the studies of Behuria et al and Sandhu et al and Das et al. Behuria S, study shows fetal distress in high risk patients was found in 64% of the nonreactive cases whereas Ingemarsson et al 8 study in low risk patients had fetal distress in 40% of the reactive group.[8,18] Sandhu et al found a 73% fetal distress in high risk patients with a non-reactive AT. Das V et al , found fetal distress in 31.5% of high-risk patients of the reactive category and in 18.8% in the low risk category.[19,20] Incidence of fetal distress in this study is high in this study due to the recruitment of only high-risk cases and exclusion of low risk cases. Gourounti et al, have done a meta -analysis of different RCT's (randomized controlled trial) and have found increase rate of caesarean section and instrumental delivery in low risk patients with an AT. However, in the present study where only high-risk patients were included also showed an increase rate of caesarean section and instrumental delivery in patients with both suspicious and pathological AT 's.[21] In Libirian et al study ,50% risk of fetal asphyxia was reported in the ominous group babies when measured by APGAR score and /umbilical cord blood pH. In this study, the cord blood pH <7.2 in the neonates was higher 29.6% in the pathological AT group as compared to 4.5% in the normal AT group .Both the present and Libirian et al study were in agreement.[22] Panda et al study on the efficacy of admission CTG to predict obstetric outcome obtained a sensitivity of 57.89 %, specificity of 96.30%, a PPV of 78.5% , NPV of 90.70% but in present study had a sensitivity of 53.13%, specificity 75%, PPV of 34.69% and an NPV of 86.49%. The difference in specificity may be due to the selection of only high-risk cases. Amena Kaur et al got a statistically non-significant data in the abnormal NST and meconium stained liquor. The study of Santosh et al

evaluated 200 patients with the AT and reported that the incidence of meconium stained liquor, need for NICU admission was was significant statistically and is in agreement with present study (p < 0.05).[23,24,25]

CONCLUSION

The admission test cardiotocography is a simple, non-invasive, inexpensive test for both antepartum and intrapartum fetal wellbeing assessment. It should be used as a screening test modality to differentiate high risk patients from low risk patients. This study emphasis on the role of AT in planning early intervention as majority of the patients with a pathological tracing landed up in caesarean delivery .It also prevents neonatal morbidity and mortality as the high NPV (98.7%)of the study reflects on the importance of AT in identifying a compromised fetus .The load of continuous monitoring in high risk patients can be decreased thus proving to be a time saving method in intervention required especially in institutes with a high patient load.

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