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Role of admission test by Cardiotocography (CTG) as a predictor of perinatal outcome: A prospective study

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Abstract
Background: Routine and continuous electronic monitoring of foetal heart rate (FHR) in labour has become an established obstetric practice. In this study we aim to evaluate if the admission Cardiotocography (CTG) can be used as a predictor in detecting foetal hypoxia at the time of admission in labour and to correlate the results of the admission CTG with the perinatal outcome.
Material & Method: Total of 100 patients admitted in the labour room with singleton live pregnancy after 37 weeks of gestation were included in this prospective observational study. Foetal heart tracing was recorded at the time of admission to labor room, for a period of 20 minutes and evaluated using standard procedure.
Result: One hundred patients were recruited. The admission CTG were 'reactive' in 67, equivocal in 21, and 'ominous' in 12 women. Occurrence of foetal distress, meconium stained liquor and neonatal intensive care unit (NICU) admission was significantly more frequent among patients with ominous test results compared with equivocal or reactive test results on admission. Incidence of vaginal delivery was more common when the test was reactive.
Conclusion: It is simple and easy test and an effective screening test to identify group of women with greater risk of Intrapartum foetal hypoxia and prevents unnecessary delay in intervention.

Keywords: Cardiotocography, admission test, foetal distress, foetal hypoxia, perinatal outcome

Introduction
The most yearned by and the sweetest sound for a mother is the cry of her newborn baby. For the obstetrician, it is the fruit of watchful labor. Watchful labor comprises of maternal and fetal surveillance. Fetal surveillance is extremely important for the delivery of a healthy baby. Journey of the fetus through the birth canal is a stressful process which can be manifested by the fetus as a 'stress response' in the form of fetal heart rate (FHR) abnormalities. Some foetuses may be in stress prior to the onset of labor [1]. Fetal distress, a common occurrence and cause of concern for both patient and the treating obstetrician, can be the harbinger of perinatal morbidity and mortality. To minimize these untoward outcomes it is essential to determine the intrauterine fetal condition which can be achieved by intrapartum fetal monitoring. Intrapartum fetal monitoring not only gives the idea about fetal condition but also identifies fetuses at risk of hypoxic damage so that perinatal outcome can be optimised by appropriate and timely intervention. Admission test by Cardiotocography (CTG) is used to indicate not only the state of oxygenation of the fetus on admission of the mother non- invasively but also checks the fetal reserve by recording FHR during the phase of temporary occlusion of the utero-placental blood supply under physiological stress of repeated uterine contractions. Thus, taking a short recording of fetal heart rate on admission helps us to determine the ability of the fetus to withstand the stress of labor [2] For these reasons electronic fetal monitoring by cardiotocography is widely established obstetric practice .However critics of this method of fetal surveillance claim that it has led to rise in the rate of caesarean section due to false positive results (the false-positive rate for a reactive CTG is 2-5%, versus 50-80% for non-reactive CTG.) [3-5]. Economic constraints especially in developing countries like ours, is also a limiting factor for the use of cardiotocographic or electronic fetal monitoring (EFM) for all antenatal patients admitted to the labor room. This continuous EFM was recommended for high risk patients but FHR changes, fetal hypoxia and acidosis may occur with same frequency in low risk patients as in high risk ones. Busy labor rooms with limited CTG monitors make it difficult to select patients for continuous EFM.

So, an alternative way of short recording of FHR at admission for labor, called as the 'Admission Test'(AT) is used to select patients for continuous EFM and also to detect compromised foetuses on admission.

Based on the postulation that the early uterine contractions of labour may put stress on the placental circulation; an AT might detect pre-existing intrauterine fetal hypoxia and also that hypoxia which develops in active labor thereby allowing early detection of such compromised foetuses and prompt intervention [6]. So we carried out this study to evaluate the predictive value of the admission CTG in detecting foetal hypoxia at the time of admission in labour and to correlate the results of the admission CTG with the perinatal outcome.

Material & Methods

Study design and setting: This study was conducted during the period 2017 to 2018 &was a prospective, single centre observational study at the labour room, Department of Obstetrics and Gynaecology at Dr. D. Y. Patil Hospital, Kolhapur. Approval of the ethical committee was obtained. Written informed consent was taken from the women who participated in the study.

Sampling Size: 100 cases were taken into this prospective study. The admission test was done i.e. a short cardiotocographic recording of FHR for 20 mins, & the result was evaluated after delivery as Reactive (Normal), Equivocal (Suspicious) and Ominous (Pathological).

Inclusion & Exclusion Criteria: Women included were who consented to participate in the study with singleton live pregnancies, with 37 completed weeks, cephalic presentation in active labour.

Multiple pregnancy, malpresentation, congenital anomalies and women who delivered more than 6 hours after the admission test were excluded.

On admission, the demographic details of the patients were noted. Detailed history including obstetric, menstrual, medical and family history was documented. General physical and systemic examination was done. Bimanual examination was performed to determine the stage of labor following which patients were subjected to Admission Test (CTG). A tracing of fetal heart rate (FHR) for 20 minutes with the patient in a semilateral position was recorded by the BPL Foetal Monitor FM9853. External abdominal transducers were used for CTG; the one for the FHR tracing was placed on the maternal abdomen where the FHS were best heard and the one for the noting the uterine pressure was positioned on the fundus of the uterus after applying aquasonic gel.

The FHR tracings obtained were then categorised as Reactive (Normal), Equivocal (supicious), & Ominous (Pathological) as per National Institute of Clinical Excellence (NICE) Clinical guideline 2017.

Table 1: CTG Description According to NICE Guidelines 2017

Description	Feature		
	Baseline (Beats/min)	**Baseline Variability (Beats/min)**	**Decelerations**
Reassuring	110 to 160	5 to 25	None or Early Variable with no concerning characteristics for < 90 min
Non-Reassuring	100 to 109 or 161 to 180	< 5 for30 to 50 min Or >25 for 15 to 25 min	Variable with no concerning characteristics for ≥90 min or Variable with any concerning characteristics in upto 50% of contractions for ≥30 min or Variable with any concerning characteristics in > 50% of contractions for <30 min or Late Decelerations in over 50% of contractions for <30 min or with maternal or fetal clinical risk factors
Abnormal	Below 100 Or Above 180	<5 for >50 min Or >25 for >25 min Or Sinusoidal	Variable with any concerning characteristics in > 50% of contractions for >30 min or Late Decelerations for over 30 min. or Acute Bradycardia or Single Prolonged Deceleration for >3 min.

Table 2: Categories of CTG Tracing according to NICU Guidelines 2017

Category	Definition
Reactive/ Normal	All Features are reassuring
Equivocal/ Suspicious	1 Non Reassuring feature And 2 Reassuring features
Ominous/ Pathological	1 Abnormal feature And 2 Non Reassuring features

Following the AT, patients with reactive trace were monitored intermittently by auscultation of FHR, for one minute every 30 min in first stage of labor & every 5 minutes in second stage. Cases with equivocal trace were put on continuous CTG monitoring. In patients with ominous tracings, (appearance of late, significant variable or prolonged decelerations), delivery was hastened by instrumental or operative intervention depending upon stage of labour. Various outcome variables were studied like Operative Delivery, APGAR Score less than 7 at 5 minutes, presence of meconium stained liquor and NICU admission.

Results & Observations

In our tertiary level teaching hospital in Western Maharashtra, majority of the cases were in the age group of 21 to 25 years (55%) followed by 26 to 30 years (29%). 67% of the patients were nulliparous while 23% were multiparous.

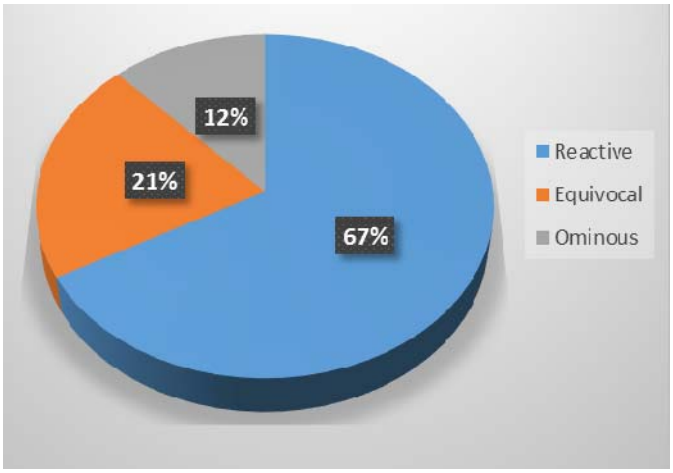

Chart 1: Types of CTG

According to the 20 min admission CTG tracing done in our subjects, 67% had reactive CTG, 21% had equivocal and 12% had ominous CTG (Chart No 1).

Table 3: Mode of Delivery

Type Of Ctg	Mode Of Delivery		
	Vaginal	Instrumental	LSCS
Reactive (67)	39 (58%)	6 (9%)	22 (33%)
Equivocal (21)	9 (43%)	1 (5%)	11 (52%)
Ominous (12)	1 (8%)	1 (8%)	10 (84%)

Mode of delivery was studied in each of the groups. In patients having Reactive CTG (67), 58% had vaginal delivery, 9% had instrumental delivery and 33% patients underwent lower segment caesarean section (LSCS). Out of the total 21 patients with equivocal CTG, 43% had normal vaginal delivery, 5% had instrumental delivery and 52% had LSCS. In patients with ominous CTG (12), majority (84%) delivered by LSCS, 8% had normal vaginal and 8% had instrumental delivery (Table 3). Thus vaginal delivery was more common in patients with reactive AD than in ominous & suspicious group, while caesarean sections were more when the AD was ominous. Statistically significant difference between the mode of delivery depending upon the results of admission CTG was observed. (p< 0.05**).

Table 4: Perinatal Outcome

Type Of Ctg		Reactive	Suspicious	Ominous	p Value
MSL		7 (10.4%)	7 (33.3%)	9 (75%)	p<0.0001
Non MSL		60 (89.6%)	14 (66.7%)	3 (25%)	
APGAR <7 at 5 min		5 (7.42%)	6 (28.6%)	8 (66.7%)	p<0.0001
APGAR >7 at 5 min		62 (92.58%)	15 (71.4%)	4 (33.3%)	
NICU admission	YES	5 (7.5%)	6 (28.6%)	8 (66.7%)	p<0.0001
	NO	62 (92.58%)	15 (71.4%)	4 (33.3%)	

Neonatal outcome was also studied in terms of intra operative meconium stained liqor (MSL), APGAR score at 5 min (<7) and NICU admission. In reactive CTG group, 10.4% had MSL, 7.4% had both APGAR Score <7 at 5 min and NICU admission. In patients with equivocal CTG, 33.3% had intra operative MSL, 28.6% had both APGAR Score <7 at 5 min and NICU admission.. In ominous CTG group, 75% had MSL, 66.7% had both APGAR Score <7 at 5 min and NICU admission (Table 4).Thus the occurrence of meconium stained liquor, APGAR < 7 at 5mins. & NICU admissions was found be more in the suspicious & ominous Admission CTG group as compared to the reactive group. This difference was found to be statistically significant (p<0.0001**).

Discussion

In our study, out of 100 enrolled subjects, majority belonged to the age group of 21-25 yrs (55%), followed by 26-30 yrs age group (29%). This correlated with the study by Hafizur Rahman *et al*. in which 42.5% of the patients were in 21-25 yrs age group. While in the study by Kansal *et al*, majority of patients belonged to the age group 26-30 yrs (44%) [1, 6]

67% of the patients were nulliparous while 23% were multiparous which were comparable with the results of the study by Kumari VR *et al*, where 56% were nulliparous and 44% were multiparous [7].

According to the 20 min admission CTG tracing done in our subjects, 67% had reactive CTG, 21% had equivocal and 12% had ominous CTG which was comparable to the study by Hafizur R *et al*. [1] These results were also comparable to the study by Xavier AA *et al*. [8]

All these patients were followed till the delivery. Out of the 67 patients with reactive CTG, 39 patients (58%) delivered vaginally, 6 (9%) patients underwent instrumental delivery while 22 (32%) were delivered by caesarean section. (CS) Of the 21 patients with equivocal CTG, 9 (43%) delivered vaginally, 5% (1 patient) had instrumental delivery and 11 (52%) underwent caesarean section. Among the 9 patients who had ominous CTG, 10 (84%) delivered by caesarean section, while 8% delivered vaginally & 8% had instrumental delivery. So the incidence of vaginal deliveries was more common when there was reactive CTG as compared to operative delivery. On the other hand operative deliveries (caesarean sections) were more in the ominous CTG group.

This result was comparable to those of Hafizur R. *et al*. In the study by Ram Bharat Meena, Lila Vyas *et al*, 92% patients with reactive CTG delivered vaginally & 6.67% delivered by CS while 88% patients with ominous or non reactive CTG underwent CS & 12% delivered vaginally [9]. Hegde *et al* in their study on 200 low risk patients found that as the admission test became suspicious or ominous, fetal distress increased and the incidence of operative delivery also increased [10].

When the neonatal outcome was studied by us in the patients who had reactive admission CTG, we found that of the67 patients with reactive CTG 10.4% had meconium stained liquor, 7.4% had APGAR at 5 mins less than 7, & 7.4% of these babies needed NICU (neonatal intensive care unit) admission. In the group with ominous CTG (12 patients), 75% patients had meconium stained liquor, 6.7% of the neonates had APGAR less than 7 at 5 mins. & 6.7% needed NICU admission. Of the 21 patients with equivocal CTG, 33.3%% had meconium stained liquor, 28.6% had APGAR less than 7 & the same percentage of babies were admitted to the NICU. Thus the incidence fetal distress & poor neonatal outcome (as seen from the presence of meconium stained liquor, APGAR score & NICU admissions) was more in the patients with ominous CTG in our study.

Das *et al.* conducted a prospective randomised study to prove the efficacy of admission test in predicting fetal jeopardy during labour. They reported that incidence of fetal distress and chances of caesarean delivery were higher in the abnormal admission test group [11] Study done by Hafizur R *et al*. had similar results to our study. Out of the total patients with reactive CTG, 8.9% had MSL, 6.5% had APGAR <7 at 5 min and 6.5% had NICU admission. In Equivocal group, 39.1% had MSL, 26.1% had APGAR<7 and 26.1% had NICU admission. In patients with Ominous CTG, 71.4% had MSL, 64.3% had APGAR< 7 and 57.1% had NICU admission [1]. On the contray, Gupta *et al* had 34.6% MSL, 33.1% APGAR <7 & 22.8% NICU admission in Reassuring CTG group and 66.2% MSL, 58.1% APGAR <7 & 75.7% NICU admission in non reassuring CTG group [12]. In a prospective study by Panda *et al*, Reassuring CTG group had 4.65% MSL, 3.48% APGAR <7 and 9.3% NICU admission. Non reassuring CTG group had 85.71% MSL, 28.57% APGAR < 7 and 78.57% NICU admission [13].

Conclusion

Thus, from our findings we conclude that Admission CTG is an effective, non-invasive and the best screening test to identify patients at a greater risk of intrapartum foetal hypoxia. It is also an effective tool to evaluate the fetal condition and to predict the perinatal outcome thereby prompting early intervention to improve perinatal outcome.

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