Admission Cardiotocography: A Predictor of Neonatal Outcome

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Abstract

Background Screening for fetal distress is a big challenge for obstetricians. Labor admission test by cardiotocography (CTG) can be utilized to differentiate between mothers, in whom continuous fetal monitoring is needed and those who can be managed by intermittent auscultation. Admission CTG is commonly used screening test which aims to identify on admission to the delivery unit the fetus at increased risk of intrapartum hypoxia. We conducted a study to evaluate the efficacy of CTG in low- and high-risk women.

Methods A prospective longitudinal study was conducted on 200 low-risk and high-risk antenatal women, beyond 32-week gestation with live pregnancy in labor and admitted in labor ward.

Results Correlation of labor admission test with meconium in low risk and high risk was found statistically significant ($p = 0.0010$ and $p = 0.000046$, respectively). Correlation of labor admission test with low Apgar score, NICU admission and mortality was found statistically insignificant in low-risk and high-risk groups.

Conclusion Admission CTG does not benefit the neonatal outcome in normal- or low-risk women and rather results in increased obstetric intervention. Thus, it is not beneficial as a screening test to detect intrapartum fetal distress in normal- or low-risk women.

Keywords Admission cardiotocography · Screening test · Perinatal outcome

Introduction

The development and perfection of specific and accurate diagnostic tests for identification of the fetus at risk in uterus have long been a major challenge for perinatologists. Since more than 75 % of the fetal deaths occur during antepartum period, focus has shifted from limiting fetal surveillance to the intrapartum period to also the antepartum period.

Fetal heart rate monitoring initially was started for the detection of fetal hypoxia or fetal acidemia, which can cause multi-organ complication in the newborn. The extreme consequences of this damage can be intrapartum or early neonatal death. The less severity of hypoxia may result in transient or possibly permanent morbidity.

Screening for fetal distress is a big challenge for obstetricians. Labor admission test (LAT) by cardiotocography (CTG) can be utilized to differentiate between mothers, in whom continuous fetal monitoring is needed and those who can be managed by intermittent auscultation.

A recording of fetal heart rate and uterine activity using the cardiotocograph for about 20 min on admission to the labor ward is called as labor admission test.

Admission test is used to indicate the fetal well-being noninvasively. 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. It is a dynamic screening test for the state of oxygenation of the fetus on admission of the mother into labor room. It checks the fetal reserve by recording fetal heart rate during the phase of temporary occlusion of the utero-placental blood supply under physiological stress of repeated uterine contractions. The admission CTG, therefore, has two potential roles. It can be used as a screening test in early labor to detect compromised fetuses on admission and to select the women in need of continuous fetal electronic monitoring

during labor. Barring acute events like cord prolapsed, uterine hyperstimulation, placental abruption and meconium aspiration, the admission test is a good predictor of fetal condition at the time of admission and during the next few hours of labor in term fetuses. Electronic fetal heart rate monitoring (EFM) is used for evaluation of fetal well-being and to detect early fetal distress resulting from fetal hypoxia and metabolic acidosis. Another benefit includes closer intrapartum assessment of fetuses to high-risk mothers.

The aim of the intrapartum monitoring is to detect fetal hypoxia at the earliest in order to prevent subsequent acidemia and subsequent neurological damage. Intrapartum fetal asphyxia is an important cause of stillbirths and neonatal deaths. Acute hypoxia results in decrease in fetal heart rate produced initially by chemoreceptor-mediated stimulation, but eventually by myocardial ischemia.

Cardiotocography (CTG) is one form of fetal assessment that simultaneously records fetal heart rate (FHR), fetal movements and uterine contraction patterns to investigate hypoxia. Successive Confidential Enquiry into Stillbirths and Deaths in Infancy has highlighted failure in the interpretation of CTGs.

Electronic fetal heart rate monitoring has gained popularity because of easy application of the fetal heart rate (FHR) tracings, accuracy of picking up the fetal heart rate signals and additional information obtained about fetal heart rate, which is not possible to get by intermittent auscultation of fetal heart.

CTG is especially valuable in high-risk cases where the appearance of abnormal fetal heart rate patterns had great impact on perinatal outcome, in the mode of delivery and NICU admission.

We conducted a prospective study to evaluate the efficacy of CTG in low- and high-risk women.

Aims and Objectives

1. Sensitivity and specificity of cardiotocography (CTG) as admission test for intrapartum fetal distress.
2. Predictive value of normal and abnormal CTG pattern to correlate perinatal outcome.

Materials and Methods

A prospective longitudinal study was conducted on 200 low-risk and high-risk antenatal women, beyond 32-week gestation with live pregnancy in labor and admitted in labor ward of our institution.

Exclusion criteria were intrauterine death of fetus (diagnosed by ultrasound), congenital abnormality, <32 week of gestational age and elective LSCS.

Criteria for Low-Risk Antenatal Cases

Pregnant women or more than 32 weeks without any maternal and fetal complication(s) were considered as normal- or low-risk antenatal cases.

Criteria for High-Risk Cases

Antenatal women beyond 32 weeks with any of the following maternal or fetal complications were considered as high-risk antenatal cases:

History of diminished fetal movements, bad obstetric history, fetal distress, pregnancy-induced hypertension, polyhydramnios or oligohydramnios, preterm labor, premature rupture of membrane, Rh-negative pregnancy, pregnancy with diabetes mellitus, previous cesarean section, pregnancy with jaundice and postmaturity.

At the time of admission, cardiotocography was performed using Biosys fetal monitor (BFM-800) in semi-Fowler's position (30°) by using the external ultrasound fetal heart rate transducers for both the fetal heart rate and uterine pressure, external abdominal transducers were used, and the one for the former was positioned at the site where the FHS was best heard and the one for the latter over the fundus of the uterus, after applying aquasonic gel on the transducer.

Biosys fetal monitor (BFM-800) records continuous and simultaneous FHR tracings and uterine pressure on a moving strip of paper. Scaling factors were 40 bpm (range 30–240 bpm) and 3 cm/min chart recorder paper speed. This test was carried out for a period of 20 min.

The test was labeled as reassuring, non-reassuring and abnormal pattern.

All women were followed up till delivery. Monitoring during labor was dependent on the results of LAT. Those women in whom LAT indicated fetal distress were subjected to usual obstetric intervention as per the stage of labor. Those in whom LAT showed no fetal distress were allowed to progress in labor with usual monitoring. Babies born were grouped as non-asphyxiated and asphyxiated. This was done on the basis of Apgar scoring done at 1 and 5 min of birth, as is the standard procedure. Scores > 8 were labeled as non-asphyxiated.

Score less than 8 was labeled as asphyxiated, while score <3 was considered as severe, interpretation of fetal heart rate pattern as severe; 3–5 as moderate and 5–8 as mildly asphyxiated.

Interpretation of Fetal Heart Rate Patterns

Baseline fetal heart rate: Derived from a line passing through the saw-toothed fluctuations of the trace and determined over a time period of 5–10 min, expressed as beats per minute. Normally, it is 110–160 bpm.

Tachycardia—sustained rise in FHR > 160 bpm for >10 min

Bradycardia—sustained fall in FHR < 110 bpm for >10 min

Baseline variability: Measured by the differences between two lines drawn through the highest and lowest point of the trace in any 1-min segment. Normally, it is >5 bpm between contractions. Non-reactive trace (flat trace)—loss of normal long-term baseline variability for >35 min.

Accelerations: Transient increase in FHR > 15 bpm above baseline for >15 s.

Decelerations: Transient episodes of slowing of FHR > 15 bpm below the baseline, lasting >15 s.

Early decelerations—deceleration where the FHR dropping to no more than 15 beats below the baseline and lowest point of fetal heart rate occurs within 20 s of contraction.

Late deceleration—Deceleration where the lowest part of fetal heart rate occurs more than 20 s after the peak of contraction and there must be 3 or more such decelerations following consecutive contractions.

Variable deceleration—All deceleration not fitting in the definition of early/late deceleration.

Prolonged deceleration—An abrupt decrease in FHR to levels below the baseline that lasts at least 2 min, but not >10 min.

Sinusoidal patterns: Regular oscillation of the baseline, long-term variability is absent.

Fetal heart rate traces [1] are categorized according to NICE guidelines 2001.

Various patterns and their correlation were documented with the presence or the absence of meconium at delivery, perinatal deaths, mode of delivery, indications for intervention, Apgar score at 5 min and NICU admission

Technique

By this instrument, fetal heart rate was heard for 20 min particularly before and after the contraction. It is heard 1/2 hourly when the fetal heart rate is within the normal range. In those cases where fetal heart rate showed bradycardia or tachycardia, we heard it in every 15 min.

Monitoring for progress of labor was done and partogram was plotted.

Table 1 Type of FHR pattern in non-reassuring and abnormal traces in low-risk cases and high-risk cases

Type of FHR pattern	Non-reassuring		Abnormal	
	Group A	Group B	Group A	Group B
Early deceleration	4 (2 %)	16 (8 %)	–	
Late deceleration	18 (9 %)	24 (12 %)	–	
Variable deceleration	4 (2 %)	10 (5 %)	–	
Reduced variability	10 (5 %)	16 (8 %)	–	
Absent variability	–	8 (4 %)	–	
No accelerations	4 (2 %)	4 (2 %)	–	
Tachycardia	–	–	2 (1 %)	
Bradycardia (<100)	–	–	2 (1 %)	–
Sinusoidal pattern	–	–	2 (1 %)	–

Any complication during normal delivery or cesarean section, any maternal morbidity and mortality, mode of delivery (vaginal/abdomen), Apgar score at 1 and 5 min, meconium-stained liquor (meconium aspiration), neonatal morbidity, NICU admissions and neonatal mortality was documented.

Results

Total 207 pregnant women were enrolled for the study: 7 women were lost to follow-up and 200 women were considered for the study after fulfilling the inclusion criteria. Seventy-two were low-risk antenatal women (group A) and 128 (64 %) were high-risk women (group B). Majority of expectant mothers were between 20 and 30 years (76 %), followed by age band between 30 and 40 years (17 %) and <20 years group made just 2 % (4 cases) of the total. Sixty-six percent women were multigravida and 34 % were primigravida.

Among high-risk women (128), anemia (22 %) was the most prevalent problem followed by PIH 18 %, previous LSCS 10 %, premature rupture of membranes (4 %) and post dated pregnancy (2 %). Sixty-two percent were pre-term pregnancies and 34 % were term pregnancies. Mean gestational age was found to be 36.18 weeks and standard deviation was 2.27.

Reassuring pattern was found in 37 %, non-reassuring pattern was found in 60 %, and abnormal patterns were found in 3 %.

In low-risk women, late deceleration pattern was most striking finding in CTG traces. In group A, late deceleration pattern (9 %) was followed by reduced variability (5 %). Early deceleration, variable deceleration and absent acceleration were observed in (2 %). Tachycardia was found in 2 % only. In high-risk patients, late deceleration pattern was found in 12 %, reduced variability and early deceleration pattern were found in 8 % each, and variable

deceleration and absent variability were 5 and 4 %, respectively. No accelerations were found in 2 %. Bradycardia and sinusoidal pattern in abnormal traces were found 1 % each (Table 1).

Cesarean section was performed in 124 cases (62 %) and vaginal delivery was found in 76 (38 %).

In 72 low-risk women, cesarean section was performed in 40 (56 %). Among non-reassuring cases and reassuring cases, LSCS rate was 16 % and 4 %, respectively, which is statistically significant. In high-risk cases, cesarean section was found in 86 women (43 %). In reassuring cases, LSCS rates were 10 %, and in non-reassuring cases, LSCS rates were 31 %. Four abnormal cases underwent LSCS. Correlation of labor admission test with mode of delivery was found to be statistically significant ($p = 0.005$) (Table 2).

Prevalence of low birth weight was 53 % and normal weight babies (>2500 g) were 47 %. In reassuring cases, prevalence of LBW and normal weight babies was 50 % in each group. In non-reassuring cases, low birth weight was found in 55 % of cases, and in abnormal cases, LBW was found in 50 %. Among LBW babies, non-reassuring cases were (55 %). Correlation of labor admission test with birth weight of babies was found to be 0.7838 which was statistically nonsignificant (Table 3).

Clear liquor was found in 168 (84 %) and meconium-stained liquor was 32 (16 %). Meconium staining in low risk and high risk was 2 and 14 %, respectively. Out of 32 (16 %), meconium-stained cases 28 (14 %) were from high-risk group. Correlation of labor admission test was found statistically significant ($p = 0.0217$).

In low-risk women, clear fluid was found in 68 (34 %) and meconium staining was found in 4 (2 %). In reassuring cases, meconium staining was found in one case only, while in 29 (14.5 %) had clear liquor. In non-reassuring cases, meconium staining was found in 1 %. In abnormal traces, 0.5 % had MSL. Correlation of labor admission test with MSL was found statistically significant ($p = 0.0010$).

Table 2 Correlation of admission test with mode of delivery in normal- and high-risk cases

Mode of delivery	Reassuring cases		Non-reassuring case		Abnormal case	
	No.	%	No.	%	No.	%
<i>Normal cases</i>						
Vaginal (32) (16 %)	22	11	8	4	2	1
Cesarean Sect. (40) (20 %)	8	4	32	16	–	–
n = 72	30	15	40	20	2	1
χ^2	22.32					
<i>High-risk cases</i>						
Vaginal	24	12	18	9	–	–
Cesarean	20	10	62	31	4	2
χ^2	15.24					
p value	0.005					

Table 3 Association of admission test with birth weight

Birth weight (g)	Reassuring cases		Non-reassuring case		Abnormal case	
	No.	%	No.	%	No.	%
<2500	40	20	62	31	4	2
2500–3000	28	14	32	16	4	2
3000–3500	10	5	16	8	–	–
>3500	2	1	2	1	–	–
N	80	40	112	56	8	4
χ^2	3.197					
p value	0.7838					

Table 4 Correlation of admission test with MSL in normal- and high-risk cases

Color of liquor	Reassuring cases		Non-reassuring case		Abnormal case	
	No.	%	No.	%	No.	%
<i>Normal cases (group A)</i>						
Clear	29	14.5	38	19	1	0.5
MSL	1	0.5	2	1	1	0.5
N	30	15	40	20	2	1
χ^2	13.75					
p value	0.0010					
<i>High-risk cases (group B)</i>						
Clear	42	21	56	28	2	1
MSL	2	1	24	12	2	1
N	44	22	80	40	4	2
χ^2	19.979					
p value	0.000046					

Among 128 high-risk women, 100 (72 %) had clear fluid and 28 (14 %) had meconium staining. Among reassuring cases, meconium staining was found in 1 % only, and in non-reassuring cases, meconium staining was found in 12 % cases. Of the four abnormal cases,

1 % had meconium staining. Correlation of labor admission test with MSL was found statistically significant ($p = 0.000046$) (Table 4).

Apgar < 4 at 5 min was found in 7 %, between 4 and 6 in 14 % and between 7 and 10 in 79 %. Correlation of

Table 5 Association of admission test with Apgar score in normal- and high-risk cases (group A)

Apgar score	Reassuring cases		Non-reassuring case		Abnormal case	
	No.	%	No.	%	No.	%
<i>Normal cases</i>						
<4	–	–	2	1	–	–
4–6	1	0.5	2	1	1	0.5
7–10	39	19.5	24	12	3	1.5
<i>N</i>	40	20	28	14	4	2
χ^2	14.991					
<i>p</i> value	0.0721					
<i>High-risk cases</i>						
<4	4	2	8	4	–	–
4–6	8	4	14	7	2	1
7–10	20	10	68	34	4	2
<i>N</i>	32	16	90	45	6	3
χ^2	3.339					
<i>p</i> value	0.5028					

labor admission test was found statistically insignificant ($p = 0.1904$).

In low risk, Apgar score less than 4 was found in 2 (1 %), 4–6 Apgar score was found in 2 %, and Apgar score >7 was found in 33 %. 19.5 % cases of reassuring category had Apgar score more than 7. In non-reassuring cases, 12 % had Apgar score above 7, and in abnormal traces, 1.5 % had Apgar score >7. Correlation of labor admission test with Apgar score was found statistically insignificant ($p = 0.0721$). In high-risk women, Apgar score <4 was found in 12 (7 %) and 9 % cases. Ninety-two women had Apgar > 7. Correlation of labor admission test was found statistically insignificant ($p = 0.5028$) (Table 5).

Among 200 neonates, 38 (19 %) had NICU admission. In low-risk and high-risk group, NICU admission rate was 3.5 and 15.5 %, respectively. Mortality rate was 5 % in low risk and 3.5 % in high risk. Correlation of labor admission test with NICU admission and mortality was found statistically insignificant ($p = 0.8057$).

Out of the 72 normal cases, 7 neonates were admitted in NICU and one baby died. Thus, death rate in normal cases was found to be 1 %. Correlation of labor admission test with NICU admission and mortality was found statistically insignificant ($p = 0.6242$). Among 128 high-risk cases, 31 neonates were admitted in NICU and 7 neonates died. Thus, death rate in high-risk cases was found to be 5 %. Among the reassuring cases, 5 % mortality was found. In non-reassuring group, 25 (12.5 %) neonates were admitted in NICU and five neonates died. Thus, mortality rate was 2.5 %. In abnormal cases, 2 neonates were admitted and one died. Correlation of labor admission test with NICU

admission and mortality was found statistically insignificant ($p = 0.2119$) (Table 6).

Discussion

Intrapartum fetal surveillance using electronic fetal monitoring has gained popularity in recent years in our quest to reduce perinatal mortality and morbidity [2]. According to the Schiffrin et al. [3], it is presumed to be superior method for fetal hypoxia as it detects the subtle changes in fetal heart rate which can be missed on intermittent auscultation by stethoscope.

In present prospective study, the various fetal heart rate patterns (reassuring, non-reassuring and abnormal) in normal- and high-risk antenatal women are found. Chi-square test of significance was performed.

Chaudhari et al. [4] reported majority of cases belonged to PIH 12 %, and in our study, majority 22 % belonged to anemia

According to NICE guidelines 2001 [1], CTG traces were divided into reassuring, non-reassuring and abnormal. In our study, 60 % of the traces belonged to non-reassuring pattern, 37 % belonged to reassuring, and 3 % were abnormal. Chaudhari et al. [4] reported 74 % reactive, 10 % ominous and 16 % equivocal. Mires et al. [5] reported 21.8 % of the admission traces in the intervention group were considered normal, while 3.6 % were considered as abnormal.

Impey et al. [6] found 32 % traces as abnormal at admission. In Scottish study, abnormal traces were found in

Table 6 Correlation of admission test with perinatal morbidity and mortality for normal- and high-risk cases

Perinatal outcome	Reassuring cases		Non-reassuring case		Abnormal case	
	No.	%	No.	%	No.	%
<i>Normal cases (group A)</i>						
NICU admission	2	1	4	2	1	0.5
Perinatal mortality	–	–	1	0.5	0	0
<i>N</i>	2	1	5	2.5	1	0.5
χ^2	0.240					
<i>p</i> value	0.6242					
<i>High-risk cases (group B)</i>						
NICU admission	4	2	25	12.5	2	1
Perinatal mortality	1	0.5	5	2.5	1	0.5
<i>N</i>	5	2.5	30	15	3	1.5
χ^2	3.103					
<i>p</i> value	0.2119					

Table 7 Comparative results of admission CTG as a screening test for fetal distress

S. no.	Author's name	Sensitivity (%)	Specificity (%)	PPV
1.	Cruzen et al. [9]	23.34	93.78	27
2.	Ingemarsson et al. [10]	79	99	54
3.	Ducey et al. [11]	57	98	75
4.	Capt et al. [12]	66.7	93.3	53.3
5.	Chaudhari and Pai [4]	31.3	95.3	31.9
6.	Our Study	25	75.38	39.68

14 % cases, and in our study, 63 % mothers had abnormal fetal heart rate.

Among low-risk cases, 13 % had reduced variability and 87 % had normal variability.

Among high-risk cases, 12.5 % had reduced variability, 6.25 % had absent variability, and 1.56 % had salutatory pattern.

Mahomed et al. [7] reported that the late deceleration was the commonest type of pattern in 21 % cases. Haverkamp et al. [8] documented acceleration and early deceleration as the most common type of pattern in 3 % cases and late deceleration only in 7 % cases, and in our study, commonest pattern observed was late deceleration (12 %).

Our study observed that MSL was more common in high-risk group, and most common pattern with meconium-stained liquor was variable deceleration. Meconium-stained liquor was more common in the cases which had non-reassuring pattern. The fetal heart rate pattern is greatly affected by meconium-stained liquor and is poor prognostic factor for perinatal outcome. In the study of Chua et al., MSL was found in 16 % cases.

In the study by Mahomed et al. [7], meconium staining was 40 % in electronically monitored group.

Though the perinatal outcome was slightly better in normal group, the data were statistically analyzed and difference was found to be insignificant.

In group A, there was one neonatal death because of hypoxia which was due to unavoidable conditions.

In our study, CTG identified nearly twice as many fetuses with an abnormal pattern which increases the need for cesarean section, so chances of cesarean section are slightly more in high-risk cases. This may be due to the absence of fetal blood sampling, pulse oxymetry, to make a definitive diagnosis of fetal hypoxia to confirm diagnosis and to avoid unnecessary interventions. Despite significant number of neonatal admissions with non-reassuring CTG pattern, there was no significant rise in perinatal mortality. And the sensitivity of admission CTG to detect intrapartum fetal distress is 25 %, specificity is 75.38 %, and positive predictive value is 39.68 % (Table 7).

Further studies with a larger number of patients and modalities of fetal monitoring are suggested. Except for a few single study outcomes, the predictive value of the labor admission test was poor. Sensitivity varied between 5 and 83 % in the 28 single-outcome studies and was above 50 % in four outcomes. This means that more than 50 % of

adverse outcomes were predicted by the labor admission test. Positive predictive values were between 1 and 28 %. The consequence of this is that the majority of those testing positives are true positive. Specificity was between 78 and 98 %, indicating that test could point out majority of those having adverse outcome(s). Negative predictive value was between 89 and 99 %, indicating that among the women testing negative, very few had adverse outcome.

In the randomized controlled trials, the labor admission test led to more and more surgical interventions without any significant improvement in neonatal outcome. Ducey et al. [11] had best results—highest positive predictive values.

Sandhu et al. [13] performed admission cardiotocography (CTG) testing in 150 high-risk obstetric cases to predict neonatal outcome and reported that fetal distress during labor developed in 15 % of patients with a normal test and in 73 % of patients with an abnormal test. The admission test had a sensitivity of 66.7 %, specificity of 93.3 % and a positive predictive value of 53.3 % for predicting an Apgar score <5 at birth. Neonatal admission to neonatal intensive care unit was required in 1 % of patients with a normal test and 33 % of patients with an abnormal test ($p < 0.01$).

Kansal et al. [14] conducted a study on 276 women and reported fetal distress in 139 patients. Only 64 (16.0 %) cases developed fetal distress in the normal admission test group, whereas the percentage increased to 39 (62.9 %) and 36 (97.3 %) in the suspicious and pathological groups, respectively. Fifty-nine neonates had NICU admission. Fifty-seven neonates developed fetal heart variation during labor, 54 showed the presence of meconium-stained liquor, and 28 neonates had low Apgar score (less than 7 at 1 and 5 min). Among the patients with a normal admission test, 2.7 % neonates had low Apgar score. In a suspicious admission test, 8.1 % neonates had low Apgar score, while with a pathological admission test, 32.4 % neonates had low Apgar score. Although the majority of the patients in all the trace pattern groups showed Apgar score of >7, it was clear that as the admission test changes from normal to pathological, the number of neonates with Apgar score of <7 increased. Thus, the inference is that the suspicious and pathological admission test is significantly associated with low Apgar score ($p < 0.001$).

Bhangdiya [15] interpreted 200 tracings of LAT and found that 115 (57.5 %) were delivered normally, in 15.5 % ventouse was applied, and 54 (27 %) cases underwent LSCS. In the reactive group, 89 (70.60 %) cases had normal vaginal delivery, 14 (11.10 %) had ventouse application, and 23 (18.30 %) underwent LSCS. In the equivocal group, 25 (38.50 %) delivered normally, 16 (24.60 %) had ventouse application, and 24 (36.90 %) underwent LSCS. In the ominous group, 1 (11.10 %) case

delivered normally, in 1 (11.10 %) case ventouse was applied, and remaining 7 (77.80 %) cases underwent LSCS. This was statistically significant.

In the present study, after birth, at 1 min, the Apgar score was <7 in 57 (28.5 %) cases which improved at 5 min and at 5 min the resulting Apgar score of <7 was found only in 15 (Apgar score at 1 min was less than 7 in 22 (17.50 %), 27 (41.50 %) and 8 (88.90 %) neonates, respectively, in R, E and O groups, while it was more than 7 in 104 (82.50 %) neonates in R, 38 (58.50 %) in E and 1 (11.10 %) neonate in O group. There was correlation between LAT and Apgar score of <7 at 1 min, which was statistically significant. Among the reactive group, out of 126 neonates delivered, 12 (9.5 %) required resuscitation. In the equivocal group, out of 65 neonates delivered, 17 (26.2 %) required resuscitation. In the ominous group, out of 9 neonates delivered, 7 (77.8 %) required resuscitation. The above correlation was found to be significant statistically. Apgar score at 5 min was less than 7 in 15 (7.50 %) neonates and thus 8 (6.30 %), 4 (6.20 %) and 3 (33.30 %) in the R, E and O groups, respectively.

Overall, 30 (15 %) neonates were admitted to NICU, out of whom 26 (13 % of 200) were for FD (respiratory distress, neonatal depression, meconium aspiration, observation) and 4 (2 % of 200) were for other cause (i.e., PROM). In the reactive group, out of 14 (11.1 %) NICU admissions, 11 were done for FD and 3 for other cause. The correlation on LAT and fetal distress was found to be statistically significant. Sensitivity of LAT was 70 %, specificity was 76 %, PPV was 54 %, and NPV was 86 %. The accuracy was found to be 0.75; thus, seeing its diagnostic value, LAT was found to be a “fair test” for predicting fetal outcome.

Rajalekshmi et al. [16] documented that out of 400, 267 (66.75 %) women had reactive tracings, 114 (28.5 %) had suspicious and 19 (4.75 %) had ominous tracings. In reassuring group, 179 (44.75 %) had vaginal deliveries. In suspicious trace, 2 (0.5 %) had vaginal deliveries, 7 (1.75 %) had instrumental delivery, and 105 (26.25 %) underwent LSCS. All women with ominous trace underwent LSCS. There was significant correlation between admission test tracing and Apgar, p value <0.0001. Out of 66.75 % in reassuring trace, none had Apgar < 4 and 63.5 % and 3.25 % had Apgar > 7 and between 4 and 6, respectively. 28.5 % belonged to suspicious trace, out of which 0.5 % had Apgar < 4 and 2.5 % and 25.5 % had Apgar > 7. 4.75 % had ominous trace, whereas 1.75 % had Apgar < 4 and 1.5 % in each Apgar > 7 and between 4 and 6 groups. Out of 26 NICU admissions, 1.1 % were in reassuring group, 12.3 % in suspicious trace and 47.4 % in ominous trace.

The present study showed that there were more obstetrical interventions in the labor test group than in control

group. Most likely cause for this could be high proportions of abnormal tests. An abnormal test is usually followed by continuous electronic fetal monitoring, which can again lead to unnecessary and excessive surgical interventions.

Conclusion

The admission CTG could identify nearly twice as many fetuses with an abnormal pattern that increases the need for cesarean section. So, chances of cesarean section are slightly more in high-risk cases. Hence, admission CTG does not benefit the neonatal outcome in normal- or low-risk women and rather results in increased obstetric intervention. Thus, it is not beneficial as a screening test to detect intrapartum fetal distress in normal- or low-risk women, and we recommend further studies with a large number of patients based on randomized control trial a better study design for assessing efficacy of labor admission test.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest related to this manuscript.

Ethical Approval The study was approved from institutional ethical committee, and an informed written consent was obtained from the patient.

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