Original Article

Use of Cardiotocogram (CTG) as an Admission Test as Predictor of Fetal Outcome in Labour in Low Risk Group

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ABSTRACT

Introduction: Intrapartum fetal morbidity and mortality is not uncommon in a low risk population. If for some reason continuous monitoring cannot be applied, alternative ways of using monitors might be of interest. Such an alternative is the admission test. Objective of the study was to evaluate the role of cardiotocogram (CTG) and to study fetal outcome in low risk group.

Materials and Methods: The study population consisted of 200 low risk patients in labor admitted at Chalmeda Anand Rao institute of medical sciences, Karimnagar during the period of 2013-2015. Patients were subjected to admission test using Philips Avalon FM20 fetal monitor at speed of 1cm/min for 20 minutes. The trace thus obtained will be classified as normal, suspicious and pathological AT. Admission test results were compared with various labor outcome variables i.e., Incidence of fetal distress, mode of delivery, neonatal outcome in relation to AT result.

Results: In this study, there were 168 patients (84%) with normal AT, 14 patients (7%) with suspicious AT, 18 patients (9%) with pathological AT and therefore, a total of 16% patients had abnormal AT. The incidence of fetal distress (88.88% vs. 7.73), caesarean section rate (94.44% vs. 7.73%), low Apgar score at 5' (50% vs. 4.87%), NICU admission (55.55% vs. 4.76%) was higher in pathological AT group than in normal AT. The sensitivity of the admission test in predicting fetal distress was 57.89%, specificity was 93.82%, and the positive & negative predictive values were 68.75% & 90.47% respectively.

Conclusion: The admission cardiotocography is a simple noninvasive test that can serve as screening tool to detect fetal distress already present or likely to develop and prevent unnecessary delay in intervention. The test has high specificity and can help in 'triaging' fetuses in obstetric wards of developing countries with a heavy workload and limited resources. Admission test in this study was helpful in reducing the neonatal morbidity by early intervention in pathological admission test group even when its sensitivity is low in detecting distressed fetus

Keywords: CTG, fetal distress, low risk pregnancy, apgar score, perinatal outcome

INTRODUCTION

Labor poses physiological stress to all fetuses during the transition from intrauterine to extrauterine environment, as the fetus it self embarks on the most delicate journey it will undertake in its lifetime. Although the introduction of intrapartum fetal surveillance has not been able to make this journey any easier, it has certainly helped in making it much safer than it has ever been.

Routine electronic fetal heart rate monitoring in labor has become an established obstetric practice in the developed world. Economic constraints in many developing parts of the world limit routine and continuous monitoring. In busy labor wards with few monitors, selection of the patients for continuous monitoring is necessary. The labor admission test comprises a cardiotocography (CTG) of 20–30 minutes duration carried out on admission to the

labour ward. The labor admission test was introduced 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 labour.

Fetal heart rate monitoring is a predictive rather than a diagnostic modality. Changes in the fetal heart rate may not be due to fetal hypoxia alone, but also due to maternal factors such as uterine contractions, sound vibrations, maternal medication, emotional changes and fetal sleep.

Routine electronic fetal monitoring is accepted in high risk women but low risk women too require some reliable objective assessment to optimize the outcome. This holds true especially in low resource, peripheral settings where referral to higher centres might be better for the neonatal outcome.

This study was to evaluates the role of CTG as an admission test (AT) in intrapartum period and correlates the results of the admission CTG with the fetal outcome in low-risk obstetric cases.

MATERIALS AND METHODS

The study conducted during the period 2013-2015, was a prospective, cross-sectional, single centered study at the Labor ward, Department of Obstetrics and Gynecology at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. Written informed consent was obtained from the women who participated in the study.

The study included a total of 200 low risk patients admitted in labor to the labor ward with period of gestation of > 37 weeks, with a singleton pregnancy in cephalic presentation, with intact membranes in the first stage of labor. Women who were excluded from the study were USG confirmed lethal congenital anomaly of fetus, high risk groups (previous caesarean section, Rh negative pregnancy, post dated pregnancy, oligohydramnios, APH, malpresentations, preeclampsia, gestational diabetes mellitus etc), multiple pregnancies, abnormal lie and presentation needing immediate caesarean section, and patients those who were identified for elective LSCS.

On admission, women's detail history including age, parity, antenatal care, menstrual, obstetric and medical history was documented. General physical examination was done. Per abdominal and bimanual examination were performed to determine the stages of labor, following which they were subjected to AT. Philips Avalon FM20 CTG machine was used. A tracing was taken for 20 min at the speed of 1cm/min with patient in a semilateral position. The FHR traces thus obtained were categorized as normal, suspicious or pathological as according to the classification proposed by National Institute of Clinical Excellence (NICE) - Clinical guideline September 2007. [1]

Table 1: Categorization of FHR Traces: NICE 2007 Guidelines

Category	Definition
Normal	An FHR trace in which all four features are classified as reassuring
Suspicious	An FHR trace with one feature classified as non-reassuring and the remaining features classified as reassuring
Pathological	An FHR trace with two or more features classified as non- reassuring or one or more classified as abnormal

Following the AT, patients with reactive trace were monitored intermittently by auscultation for one minute every 30 min in first stage of labor and every 15 min in second stage of labor postcontraction. Cases with persistently suspicious trace were placed on continuous CTG monitoring. In those with pathological tracings, appearance of late, significant variable or prolonged decelerations, delivery was hastened by operative or instrumental intervention depending upon stage of labor. Admission test was repeated at 5 hrs, if labor progressed for >5 hrs in normal admission test group and suspicious admission test group.

After delivery, the liqor color, and Apgar score of each neonate were determined.

Fetus/neonate was considered to be distress if any one of the following were present.

1. Pathological FHR changes led to caesarean section (LSCS) or forceps/ventouse delivery
2. Presence of moderate–thick meconium stained liqor (MSL)
3. Apgar score at 5 min < 7
4. Admission into neonatal intensive care unit (NICU) for birth asphyxia
5. Incidence of intrapartum/neonatal mortality.

Ethics approval

The study protocol was reviewed and approved by the Institutional Ethics committee, at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar, 2015, and written informed consent form was obtained from all participants.

STATISTICAL ANALYSIS

In the present study, the data was analyzed, statistically, by computing the sample statistic viz, mean, standard deviation, percentages wherever applicable. The inference is obtained by computing the statistical test viz., Chi-square test. The statistical inference is considered significant if p value < 0.01.

RESULTS

Majority of the women were between 20 and 25 years (73.5%). Maximum 168 (84%) patients had normal trace, 14 (7%) had suspicious trace, and where as 18 of 200 patients (9%) had pathological trace on Admission test. Approximately 88.88% cases (16 of 18) with pathological trace on admission had fetal distress, where as nearly 42.8% (6 of 14) of those with suspicious AT and only 7.73% (16 of 168) with normal AT had fetal distress. It is evident that incidence of fetal distress increase significantly with worsening of AT (P<0.001).

Table 1: Incidence of Fetal Distress In Relation to the Admission Test

Admission Test	Total No of Patients	No of Patients with Fetal Distress	Percentage
Normal	168	16	7.73%
Suspicious	14	6	42.8%
Pathological	18	16	88.88%

In the normal AT group, 8 babies (4.76%) had Apgar score <7 at 5 min, 8 cases had mod-thick MSL amniotic fluid, and 6 of these babies were admitted to NICU. In the suspicious group, 4 (28.57%) babies had 5 min Apgar <7 of which, 2 cases had mod-thick MSL, where as in pathological group out of 13 cases who had mod-thick MSL, 10 babies had Apgar score < 7 at 5 min, and all the (100%) babies in this group were admitted to NICU.

Table 2: Apgar Score in relation to admission test

Admission Test	≥7 At 5 Min (%)	<7 At 5 Min (%)	NICU Admission (%)
Normal	160(95.23)	8(4.76)	6(3.57)
Suspicious	10(71.42)	4(28.57)	3(21.42)
Pathological	8(44.44)	10(55.55)	10(55.55)

Table 3: Indication for LSCS and Instrumental delivery in relation to the admission test

Admission Test	LSCS		Instrumental Delivery	
	Fetal Distress (%)	Other Indication (%)	Fetal Distress (%)	Other Indication (%)
Normal	7(4.16)	6(3.57)	7(4.16)	8(4.76)
Suspicious	4(28.57)	2(14.28)	2(14.28)	1(7.14)
Pathological	17(94.44)	---	1(5.55)	---

Incidence of birth asphyxia was lower (7.73%) in patients of normal AT group than those with pathological AT trace (88.88%), when measured by the presence of moderate–thick meconium stained liquor (MSL) and Apgar score <7 at 5 min.

Nearly 83.3% cases with normal AT had spontaneous vaginal delivery. Only 8.3% (14 out of 168) patients underwent instrumental or operative delivery in this group for fetal distress, while in the rest of the instrumental or operative deliveries indication was other than fetal distress. 35.7% of the patients with suspicious AT had spontaneous vaginal delivery and other 64.3% had instrumental or operative delivery. 6 of 14 (42.8%) patients in this group had operative delivery for fetal distress. In the pathological group 1 (5.55%) had instrumental delivery while 17(94.44%) had operative delivery in view of fetal distress.

The AT had high specificity (93.82%) and negative predictive value (90.47%), however, sensitivity and positive predictive value were low (57.89% and 68.75%, respectively).

DISCUSSION

Surveillance of the fetus during labor is preventive care; the aim of fetal surveillance and other forms of labor management is to ensure the delivery of a healthy baby in good condition with minimum intervention. In 1989, American Congress of Obstetricians and Gynecologist (ACOG) indicated that "fetuses of laboring women could be assessed by electronic fetal monitoring or by intermittent auscultation of fetal heart tones".[5] Auscultation, however, is necessarily intermittent, subjective and difficult to verify and document. Also in the developing countries, with busy labor wards and a minimum staff, sole reliance on auscultation is often ineffective.

EFM can detect hypoxia early and unnecessary delay in intervention can be avoided. It is a noninvasive recordable method of fetal monitoring.

Uterine contraction serves as a functional stress to the fetus; a short tracing of FHR on admission in labor ward may thus detect fetal intrauterine hypoxia already present on admission and may have some predictive value for hypoxia that may develop during labor. Based on this assumption 20 minute EFM on admission has been used as labor admission test.[2]

In the present study 7.73% babies from mother with normal AT group, 42.8% babies from suspicious group, and 88.8% babies from pathological group showed evidence of fetal distress. Similar observation was made by Kusthagi et al[3], Ingemarsson et al[2], reported lowest 0.9% fetal distress in reactive group, and 50% in the ominous group. In the present study incidence of NICU

admission was highest in patients with pathological AT (55.55%), compared to those with normal (3.57%) and suspicious AT (21.4%). Similar rates of NICU admission were reported by Perveen et al[4], i.e., 66.67% NICU admission in ominous group and 6.6% in reactive group.

In the present study, we observed women with the reactive AT had low risk (7.73%) of developing intrapartum fetal hypoxia and significantly high risk in the pathological group (88.88%) when assessed by the presence of moderate–thick meconium stained liquor (MSL) and Apgar score <7 at 5 min. Libiran MJ et al[6], also concluded that a reassuring trace is associated with low risk, (6.5%) for asphyxia when measured by Apgar score and/umbilical cord blood pH, while ominous trace is associated with high (50%) risk, for asphyxia.

In our study we noted high specificity (93.82%) for the admission test. Ingemarsson et al[2], also reported a very high 99.4% specificity in their studies. The high specificity of the AT means that a normal test accurately excludes adverse fetal status at the time of testing.

Rahman et al[7] and the Swedish guidelines[8] published in the year 2001, recommend the admission test as the predictor of fetal outcome irrespective of the risk factors, especially in the low resource settings owing to the high specificity (93.8% in the present study) of the admission test.

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[9]. Detractors of electronic fetal monitoring like Impey et al[10], believe that neonatal outcome is not significantly improved by the use of admission testing as compared to intermittent fetal heart rate auscultation during labor. Thacker et al[11], also feel that the use of electronic fetal monitoring is of limited effectiveness and carries an increased risk of interventions. According to them increased information at admission will not necessarily lead to better clinical outcomes. This may be true in developed countries with a population provided comprehensive antenatal care and receiving personal attention during labor. But in developing countries with inadequate antenatal care, an AT has a role in obstetric units with a heavy workload (>10 000 deliveries/year) with limited resources in 'triaging' fetuses by providing a 'snapshot' view of fetal wellbeing at the time of admission in labor.[12]

While Thacker et al[11] felt that the usage of cardiotocography as an admission test might lead to an increased operative interventions, Cheyne et al[13] challenged this hypothesis by testing 312 healthy low risk pregnant women the use of admission cardiotocography and comparing them to the women who have had no admission CTG, if admission test actually resulted in an increase in continuous monitoring during labour or in obstetric interventions when compared to women who have had no admission CTG. This trial found no statistically significant differences between the groups for use of continuous monitoring or any of the obstetric interventions studied. The authors concluded that the use of admission cardiotocography did not in itself lead to a cascade of intervention.

The AT cannot be expected to predict the development of any acute asphyxial insult during the course of labor. In the absence of such acute events, an adverse fetal outcome is unlikely if the AT is normal. The result of admission CTG testing can be used to identify patients likely to develop adverse fetal outcomes and help in optimal utilization of limited labor room resources. This is particularly relevant in situations where the antenatal attendance and follow-up has been inadequate.

In the present study, 14 patients with reactive AT had fetal distress in labor. It was found that in all of them admission test-delivery interval was prolonged (varied from 5 to 9 hours). It can be explained from the fact that an AT cannot be expected to predict fetal distress after several hours of labor with other influential factors like problems of the cord, prolonged labor, etc., which may become operational as labor progress. So in cases where admission test delivery interval is expected to be more than 5 hours, it is good to repeat CTG to detect fetal distress.

Further studies are required to define specific time interval to repeat CTG to detect fetal distress and to minimize the false negatives. Future research should emphasize on defining the role of AT in patients with specific pregnancy complications. Studies are also required to determine the convenient supplemental diagnostic modalities, which can enhance the positive predictive value of an equivocal/abnormal AT.[7]

Updated National Institute of Clinical Excellence guidelines (National Collaborating Center for Women's and Children's Health) published in December 2014[14], has revised and reclassified the cardiotocographic trace features with a view that the current practice assumed CTG had greater accuracy than the evidence demonstrated and that the individual parameters are probably being interpreted with an impression of precision that is not supported by the evidence.

The classification presented in the original version of the guideline in 2007[1], took no account of the stage or progress of labour, the presence or absence of meconium or signs of infection, and little account of the contractions or the woman's condition. This could have adverse effects

on the care delivered.

The NICE 2014 guideline development group noted several factors that limit the usefulness of the research findings.

First, the outcomes of importance were rare so that a large number of cases would be needed to show a difference, if one were to exist, especially in terms of long term neurodevelopment. Second, there is likely to be a 'treatment effect'. Third, the fetal heart rate is only a surrogate for fetal hypoxia and is in turn influenced by many factors. Fourth, this guideline recommends the use of CTG only in high risk labours.

They have concluded that the cardiotocograph is to be analysed clinically taking into account multiple factors. It is not just the fetal heart rate which is considered but the underlying risk factors and any other relevant information, such as the progress of labour and/or maternal complications. This means that the performance of individual parameters may not reflect the risks and benefits of using CTG in a clinical setting. Complex tasks of 'pattern recognition' together with clinical evaluation may not be captured in simple algorithms and not reflected in the research reviewed.[14]

CONCLUSION

The present study showed the admission cardiotocography to have high specificity (93.82%) and a high negative predictive value (90.47%), positive predictive value of 68.75% and a sensitivity of 57.89%. Although the sensitivity is low, its high specificity, low cost and the ease of doing supports its role as admission test. It helps in preventing fetal morbidity and mortality. As the test has high specificity, it has role in obstetric wards of developing countries with a heavy workload and limited resources to help in 'triaging' fetuses.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. *National Institute for Health and Clinical Excellence.* 2007. Intrapartum care. NICE Clinical guideline No. 55. London: National Institute for health and clinical excellence: 44–5.
2. Ingemarsson I, Arulkumaran S, Ingemarsson E, Tambyraja RL, Ratnam SS. Admission test: A screening test for fetal distress in labor. *Obstet Gynecol.* 1986; 68: 800–6.
3. Kushtagi P, Shashibala N. Labor Admission test an effective risk screening tool. *J Indian Med Assoc.* 2002; 100: 234–6.
4. Shakira P, Haleema H. Effectiveness of Admission test. *J Dow Univ Health Sci.* 2007; 1: 205.
5. *American College of Obstetricians and Gynecologists.* Intrapartum fetal heart monitoring. Technical bulletin No. 132. Washington, DC: American College of Obstetricians and Gynecologist; 1989.
6. Libiran MJ, Solis MS, Santos RR, Baga EB. Admission test as predictor of intrauterine fetal asphyxia. *Philipp J Obstet Gynecol.* 1999; 3: 143–9.
7. Rahman H, Renjhen P, Dutta S. Reliability of admission cardiotocography for intrapartum monitoring in low resource setting. *Niger Med J.* 2012; 53: 145–149.
8. Nordström L, Waldenström U. Handläggning av normal födsel (Management of normal labour) Stockholm: *Socialstyrelsen;* 2001.
9. Blix E, Reinar L M, Klovning A, Oian P. Prognostic value of the labor admission test and its effectiveness compared with auscultation only: A systematic review. *Br J Obstet Gynaecol.* 2005; 112: 1595–604.
10. Impey L, Reynolds M, MacQuillan K, Gates S, Murphy J, Shell O. Admission cardiotocography: A randomized controlled trial. *Lancet.* 2003; 361: 465–70.
11. Thacker SB, Stroup DF. Revisiting the use of the electronic fetal monitor. *Lancet.* 2003; 361: 445–6.
12. Chandraharan E, Sabaratnam A. Electronic fetal heart rate monitoring in current and future practice. *J Obstet Gynecol India.* 2008; 58: 121–30.
13. Cheyne H, Dunlop A, Shields N, Mathers AM. A randomized controlled trial of admission electronic fetal monitoring in normal labor. *Midwifery.* 2003; 19: 221-29.
14. National Institute for Health and Clinical Excellence (NICE). *Intrapartum care:* Care of healthy women and their babies during childbirth. NICE, 2014.