

Role of admission test in pregnancy

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Abstract: *Introduction:* Cardiotocogram is a non-invasive admission test, easily performed, interpreted and readily accepted by the patients. It was found that it could be used as screening procedure to detect pre-existing fetal hypoxia and plan early intervention to prevent adverse perinatal outcome. The present study was thus conducted to evaluate the efficacy of cardiotocogram as admission test in predicting fetal outcomes at birth. *Materials & Methods:* A prospective observational study was conducted in a tertiary care hospital including 400 pregnant mothers fulfilling the eligibility criteria. The admission test was conducted and interpreted for all patients. On the basis of admission test results, type of delivery and neonatal outcome at birth was assessed. Data was analyzed using SPSS ver 23.0. *Results:* In this study, there were 328 patients (82%) with normal AT, 37 patients (9.3%) with suspicious AT, 35 patients (8.8%) with pathological AT and a total of 18% patients had abnormal AT. The incidence of fetal distress (100% vs. 31.6%), caesarean section rate (100% vs. 6.1%), low Apgar score at 5' (50% vs. 26.1%), NICU admission (50% vs. 26.1%) was higher in pathological AT group than in normal AT. The sensitivity and specificity of NST in predicting fetal distress was 61.6% and 94.5% respectively, while the overall diagnostic accuracy was 86.4%. *Conclusion:* Our study supports the idea that admission test plays an important role in prediction of adverse fetal outcomes. Cardiotocogram as an admission test can be used to identify patients likely to develop adverse fetal outcomes and help in optimal utilization of limited labor room resources available.

Keywords: Admission Test, Fetal hypoxia, Neonatal outcome, Cardiotocogram.

Introduction

The most crucial time for the fetus during the whole pregnancy period is the labour. Labour poses physiological stress to all fetuses during the transition from intrauterine to extrauterine environment. A normal fetus throughout pregnancy, too, may sustain hypoxia during labour. In labour, fetal distress is quite common and is the main cause of concern for the obstetrician. This gave birth to the concept of intrapartum fetal monitoring, which is the easiest way to listen to fetal heart rate [1].

In the twentieth century, fetal growth was monitored by measuring symphysio-fundal height, quickening (fetal movements perceived by mother) and hearing fetal heart beats. With time, these methods were found to be unreliable because mothers do not perceive all the fetal movements and fetal heart rate could be normal if not taken properly during and after contractions [1]. During 1940 to 1950, it was proved that intermittent FHR monitoring was not a satisfactory method to detect the likely of fetal

compromise. Prof E. H. Hon and Prof. Caldeyro Barcia invented cardiotocogram (CTG) for fetal monitoring [1]. In the 1970s, with the invention of cardiotocogram, continuous fetal monitoring was introduced and it became the standard practice in all pregnant women. In the western countries, continuous fetal monitoring is being used extensively but due to economic constraints, it is not feasible in most of the developing countries like ours for practicing it.

Ingemarsson et al. [2] has described an alternative, in the form of Admission Test (AT) or Non stress test (NST) which is a short recording of FHR by cardiotocogram and uterine contractions of 15-20 minutes, at the time of admission in labour ward. Admission test has been categorized as reactive or normal, suspicious or equivocal and ominous or Non-Reactive [3]. Reactive or normal NST is characterized by a normal baseline FHR of 110-160bpm and 2 or more fetal heart rate accelerations of about 15 bpm and lasting at

least 15 seconds from the baseline within a 20 minute period [3]. Equivocal /suspicious tracings are those with normal baseline rate with no accelerations in 20 minutes and reduced baseline variability (5-10 beats/min) or tracings showing abnormal baseline rate with no accelerations and variable decelerations without ominous signs [3]. Non-reactive or Ominous NST is characterized by lack of acceleration for a period of 40 minutes [4].

Cardiotocogram as an admission test is a non-invasive, easily performed, interpreted and readily accepted by the patients. The test looks for presence of temporary acceleration of the FHR associated with fetal movements that involves the cerebral cortex and is affected by physiological and pathological influences on foetal brain. It was found that admission test could be used as screening procedure to detect pre-existing fetal hypoxia and plan early intervention to prevent adverse perinatal outcome. The present study was thus conducted to predict the perinatal outcome by doing cardiotocogram as an admission test, for decrease the fetal morbidity and mortality by appropriate intervention and treatment.

Material and Methods

The study was conducted at the department of obstetrics & gynaecology, Al-Ameen medical college and hospital, Vijayapur during the period from Nov. 2015 to Sep. 2017. Pregnant females of any age group with gestational age > 37 weeks presented in early/first stage of labour were included in the study. Cases with pre-term labor, congenital anomalies and those presented in second stage of labour were excluded.

Sample Size: With 95% confidence level, margin of error of ±5%, a sample size of 384 (≈400) subjects was taken for the study. Sample size was calculated using the formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

where;

z - z statistic at 5% level of significance is 1.96

d - margin of error

p- anticipated prevalence rate

Methodology: Patients were first given a description of the procedure they have to undergo after history taking, thorough general examination & Obstetric examination. Informed consent was taken from all mothers.

Later patients were subjected to admission test using BPL FM 9853 fetal monitor at speed of 1cm/min for 20 minutes. The patient was placed in left lateral position to prevent aortocaval compression. The Doppler transducer was secured to the patient's abdomen with an elastic, adjustable, retaining strap that encircles the abdomen after applying an adequate amount of ultrasound coupling gel over the transducer, at a site where the fetal heart sounds were maximally heard. The tocodynamometer was secured at the level of the uterine fundus, in the same way. The patient was provided with an event marker, which she presses, each time she perceives a fetal movement. The graph was recorded for 20 minutes and the trace is analyzed. The trace thus obtained was classified as normal, suspicious, pathological.

Table-1: Nice (2007) Classification of FHR trace feature [4]

Feature	Baseline	Variability	Deceleration	Acceleration
Reassuring	110-160	≥5	None	Present
Non – reassuring	100-109 161-180	<5 for 40-90min	Typical variable deceleration with over 50% of contraction, occurring for over 90min Single prolonged deceleration for up to 3min	The absence of acceleration with otherwise normal trace is of uncertain significance
Abnormal	<100 >180	<5 for 90min	Either atypical variable decelerations with over 50% of contractions or late decelerations, both for over 30 minutes Single prolonged deceleration for more than 3 minutes	

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 more classified as abnormal

- In patients with suspicious admission test, a 20 minutes extended strip was taken after the following actions:
 - Repositioning of patients.
 - Discontinuation of uterine stimulants.
 - Vaginal examination.
 - Administration of oxygen to the mother.
 - Correction of maternal dehydration.

The trace obtained is again classified as normal, suspicious or pathological.

- Patients with normal admission test were followed by intermittent auscultation for 1 minute every 30 minutes in first stage and every 15 minutes once in second stage of labor.
- Patients with persistently suspicious admission test were monitored by continuous electronic monitoring.
- In patients with pathological admission test, appropriate intervention was taken immediately. Admission test was repeated at 5 hrs, if labor progressed for >5 hrs in normal admission test group and suspicious admission test group.

Fetal distress was considered to be present when pathological FHR changes were seen and led to LSCS or instrumental vaginal delivery on that indication or Apgar score of less than 7 at 5 minutes. Labour outcome was assessed with respect to incidence of fetal distress during labour, operative deliveries, Apgar score at 1 minute and 5 minutes & neonatal intensive care admissions. Admission test results were compared with various labor outcome variables i.e. Incidence of fetal distress, mode of delivery and neonatal outcome.

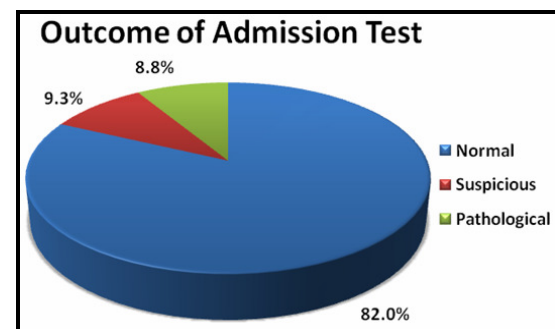
Statistical Analysis: All characteristics were summarized descriptively. For continuous

variables, the summary statistics of mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square (χ^2)/ Fisher exact test was employed to determine the significance of differences between groups for categorical data. If the p-value was < 0.05, then the results were considered to be statistically significant. Data was analysed using SPSS software v.23.0.

Results

Most of the study subjects were between 20-30 years of age (85%) while only 3% were above 30 years of age. A total of 42.5% females were primi-gravida while 57.5% were multi-gravida. Non-Reassuring Admission Test was observed in 18% mothers of which 9.3% showed suspicious admission test & 8.8% had pathological admission test (Fig-1).

Fig-1: Distribution of cases according to Outcome of Admission Test



Caesarean delivery was conducted in 55.5% of females with suspicious/ pathological admission test as compared to 6.1% females with normal admission test. The association of abnormal pattern in admission test and caesarean section was found to be statistically significant (p<0.01) (Table 3).

Table-3: Association between Admission Test results and mode of delivery

Mode of Delivery	Admission Test		Total
	Abnormal (Suspicious/ Pathological)	Normal	
LSCS	40	20	60
	55.56%	6.10%	15.00%
Vaginal	32	308	340
	44.44%	93.90%	85.00%
Total	72	328	400
	100.00%	100.00%	100.00%

p- value < 0.01

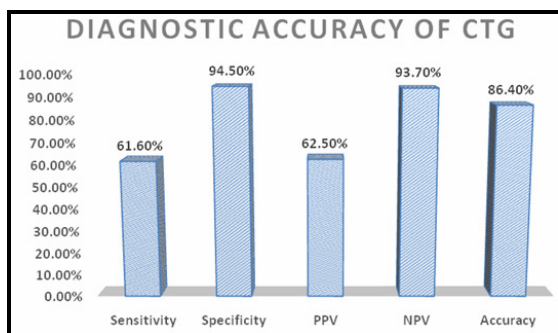
In our study 25 (31.6%) babies among normal admission went into distress. While in suspicious group 20 (25.3%) babies were and in pathological group 34 (43.0%) babies were in fetal distress. Overall association of abnormal pattern in admission test and fetal distress was found to be statistically significant (p<0.01). Only in minority of cases i.e. 26.1%, in normal admission test group, the admission test did not predict poor perinatal outcome (APGAR<7at5’). In suspicious group 30.4% of the neonates had APGAR <7 at

5’. Among the patients with pathological trace false positive rate was 43.5%. Similar significant association was also observed with NICU admission and Meconium stained liquor (MSL) with 47.22% and 44.44% babies with abnormal admission test required NICU admission and had MSL as compared to 3.66% and 3.35% babies with normal admission test (p<0.01) 2 babies died after 2 days in pathological group which had meconium aspiration (Table 4).

Table-4: Association between Admission test with neonatal outcome

Variables	Admission Test		Total	p- value
	Abnormal (Suspicious/ Pathological) (n-72)	Normal (n-328)		
Fetal Distress	54	25	79	<0.01
	75.00%	7.62%	19.75%	
APGAR <7 (at 5 min.)	34	12	46	<0.01
	47.22%	3.66%	11.50%	
NICU Admission	34	12	46	<0.01
	47.22%	3.66%	11.50%	
Meconium stained liquor	32	11	43	<0.01
	44.44%	3.35%	10.75%	

Fig-2: Overall Diagnostic Efficacy of Admission Test



The sensitivity and specificity of NST in predicting fetal distress was 61.6% and 94.5% respectively, while the positive and negative

predictive values were 62.5% and 93.7% respectively. The overall diagnostic accuracy was 86.4% (Figure 2).

Discussion

There are various antenatal surveillance modalities used for high risk pregnancies such as CTG, CST, BPP, modified BPP, Doppler velocimetry etc. CTG is one of the easiest test to perform and cost effective. There are considerable number of clinical literatures that support the use of CTG as an admission screening test [5-8]. In present study abnormal admission test was observed in 18% subjects.

In a similar study by Shrestha et al. [7] among the 125 pregnant mothers who were included in the study, 10% had abnormal admission test. In a study by Pada et al. [6], out of 100 cases, 86% had normal admission test and 14% had abnormal admission test. In other studies by Faheem et al. [8], Gurung G et al. [9] and Phelan J et al. [10], 11.6%, 4% and 14% females had abnormal admission test respectively.

Caesarean delivery was conducted in 55.5% of females with abnormal admission test as compared to 6.1% females with normal admission test in present study ($p < 0.01$). Phelan J et al. [10] studied NST of 1452 high risk patients and observed that 14% tests were abnormal and in these women, they also observed a significant increase in LSCS rate in females with non-reassuring NST. In a similar study to assess the value of antenatal NST, Brown V et al. observed significantly increased incidence of caesarean deliveries in females with abnormal NST pattern [11]. Amena Khatun et al. [12] reports 82% caesarean rate from abnormal NST group which was statistically significant from normal NST group. Rahman H et al [13] in a similar study found LSCS rate of 35.8% from normal group and 78.6% from abnormal group ($p < 0.001$).

In present study meconium stained liquor was observed in 44.4% of babies with abnormal admission test as compared to 3.35% babies with normal admission test ($p < 0.01$). APGAR score at 5 minutes was significantly lower in babies with abnormal admission test ($p < 0.01$). Fetal distress and NICU admission rate was observed in 75% and 47.2% of babies with abnormal admission test as compared to 7.62% and 3.35% babies with normal admission test ($p < 0.01$). Visser G et al. evaluated in CTG of 428 patients in whom labour was induced. All patients with non-reactive NST showed signs of fetal distress during labour and patients with a normal NST rarely showed signs of fetal distress during labour [14]. Rahimi et al. enrolled 818 intrapartum singleton pregnancies with gestational age of > 34 weeks. Thick meconium staining, fetal distress and NICU admission was significantly more frequent in abnormal NST subjects ($P < 0.001$) [15].

Khandelwal et al found that patients with non-reactive traces had higher incidence of meconium staining, clinically detected fetal distress,

operative delivery or cesarean section and NICU admission [16]. Chua et al. reported that operative delivery ($P < 0.001$), 5-min Apgar score < 7 ($P < 0.005$), assisted ventilation ($P < 0.001$) and admission to NICU ($P < 0.001$) were significantly associated with non-reactive NST at admission [17].

Sultana J et al. compared the pregnancy outcome and early neonatal outcome among the normal and abnormal NST groups. Early neonatal outcomes included APGAR score, birth weight, admission into neonatal intensive care unit (NICU), duration of stay in NICU and perinatal mortality. There were significant differences between the two groups regarding pregnancy outcomes and early neonatal outcomes [18].

Elimian et al. stated that patients in the abnormal admission test were six times as likely to have fetal distress, and that fetuses with distress were more likely to have a non-reactive NST [19]. Sudip Dutta et al. [13] found the incidence of meconium staining as 71.4%, NICU admission as 57.1%, APGAR < 7 at 5 minutes 64.3% in abnormal admission test group ($p < 0.01$). In a study by Panda et al. [6], Meconium Staining is 85.71%, NICU admission 21.42% and APGAR < 7 at 5 minutes is 28.57% from abnormal NST group [1]. In a study conducted by Bano et al [20] the APGAR score < 7 at 5 minutes was 3.4% in the reactive NST group whereas 42.8% in the non-reactive group.

In present study, the sensitivity and specificity of admission test in predicting fetal distress was 61.6% and 94.5% respectively, while the positive and negative predictive values were 62.5% and 93.7% respectively. The overall diagnostic accuracy was 86.4%. Sultana J et al. observed that sensitivity of CTG was 87%, specificity was 66%, positive predictive value was 54% and negative predictive value was 92% in the prediction of abnormal outcomes [18].

Brown et al. observed the sensitivity and specificity of admission test as 50% and 99% [11]. Dwarakanath L et al. [21] studied the efficacy of admission CTG to predict obstetrics outcome. While discussing the

efficacy of admission test they got sensitivity of 75.8%, specificity of 76.9% PPV of 95.6%, NPV of 32.25%. Panda et al. [6] found sensitivity of 57.89%, specificity of 96.30% PPV of 78.57%, NPV of 90.70%. Jophy et al. [22] observed the predictive value of non-reactive test as 55.26% with sensitivity of 63% for predicting poor outcome.

Conclusion

Our study supports the idea that admission test plays an important role in prediction of adverse fetal outcomes. Cardiotocogram as an admission test can be used to identify patients likely to develop adverse fetal outcomes and help in optimal utilization of limited labor room resources available.

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