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## Perinatal Outcome by Admission Cardiotocography in Low-Risk Obstetric Population

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### ABSTRACT

*Abstract: The labor admission test is a very useful screening test in early labor to detect compromised fetus on admission. It is used to select the woman in need of continuous fetal electronic monitoring during labor. It is a dynamic screening test to study fetal oxygenation at the time of admission of the mother in labor room.*

**KEYWORDS: Labour Admission Test, Mode of delivery, Fetal Outcome, APGAR Score, NICU Admission, Diagnostic Accuracy.**

### INTRODUCTION

The reduction of family size a felt need of the current era, desire and necessity were inevitable in a viable and healthy fetus more now than ever in the history of homo sapiens. Care given to a mother during her pregnancy and childbirth is an index of civilization. There is a sea change in the antenatal and intranasal care since the inception of the concept of antenatal care by Bellantyne in 1901.<sup>1</sup> While nutritional supplements, vaccinations and investigations as part of antenatal care have increased and improved for better maternal and fetal wellbeing, the ten centimetre journey from brim to the outlet of pelvis has remained the most dangerous journey in one's life since the evolution of the species.

Hence the necessity of monitoring of the fetus, in the antenatal and the intranatal period and hence an insight and research into the modern biomedical engineering and its application to fetal activity.

**ADMISSION CARDIOTOCOGRAPHY** - A short recording of fetal heart rate over 20-30 minutes is done immediately after admission in the labour room. In this application of electronic fetal monitoring, women with low-risk pregnancies are monitored for a short time on admission for labour, and continuous monitoring is used only if abnormalities of the fetal heart rate patterns are subsequently identified.

This test identifies a fetus with risk for hypoxia in the next 5-6 hours of labour. Ingermarsson I et al (1986)<sup>2</sup> observed that a reactive or normal CTG tracing guaranteed a progress of labour without fetal distress, provided delivery occurred in about next 6 hours.

A normal admission fetal Cardiotocography reassures and thus allows the patient to be mobile by eliminating continuous monitoring. It reduces the burden on CTG machine, which is an important necessity for the majority of the nations including ours.

Thus: -

- The labour admission test is a screening test in early labour to detect compromised fetus on admission.
- It is used to select the woman in need of continuous fetal electronic monitoring during labour.
- It is a dynamic screening test to study fetal oxygenation at the time of admission of the mother in labour room.

## AIMS & OBJECTIVES

- To assess the reliability of the admission cardio-tomogram in detecting fetal hypoxia.
- Correlate the result of the admission test with the perinatal outcome in low-risk obstetric population.

## MATERIAL & METHODS

The present study, a hospital based descriptive observational study was conducted in Department of Obstetrics & Gynaecology, S.M.S. Medical College & attached a group of Hospitals, Jaipur from February 2015 to 2017.

After obtaining the institutional ethical committee approval, 130 pregnant women were admitted to the labour room in the first stage of labour after applying inclusion (gestational age of  $\geq 36$  weeks, Singleton pregnancy, Cephalic presentation, Primi or multigravida) & exclusion (Bad obstetric history, Multifetal pregnancy, Congenital fetal anomalies, Mal-presentation, False labour pain, Elective LSCS or previous LSCS, Use of sedative drug, Admission interval  $> 24$  hrs, IUGR, Medical disorders: Hypertension, anaemia, asthma, thyroid disorder etc.) criteria.

After included in the study, the patients were explained about the procedure and informed consent was obtained. The pregnant mother was asked to empty her bladder and all the procedure, what to expect during the procedure and what is expected of her were explained to her. She is placed in the semi fowler's position. The ultrasound transducer is applied to the maternal abdomen with a gel interface and the fetal heart rate is observed for 20 min. The patient is asked to press the event marker every time she perceives fetal movement. The presence of spontaneous foetal heart rate accelerations with foetal movement is an indicator of foetal well-being.

In the present study the observations for an admission CTG were done on following lines - According to NICE guideline [2014], Intrapartum care for healthy women and babies (CG190)<sup>3</sup>.

1. Baseline fetal heart rate
2. Baseline variability
3. Decelerations
4. Accelerations

The admission test tracings were typed into (i) Reactive & (ii) Non- Reactive. If the tracings are non-reactive, further management is decided based on individual condition. The admission test was used in the comparison of neonatal outcomes such as mode of delivery, APGAR score, admission into neonatal intensive care unit (NICU) and duration of stay in NICU.

## RESULTS

**The result of Labour Admission Test:** Out of 130, 105 (80.77%) women had reactive and 25 (19.23%) had non-reactive CTG tracings.

**Table-1**

### Mode of Delivery

Mode of Delivery	Reactive		Non-reactive	
	Number	%	Number	%
Vaginal	97	92.38	3	12.00
Ventouse (Instrumental Vaginal)	1	0.95	0	0.00
Caesarean section	7	6.67	22	88.00
<b>Total</b>	<b>105</b>	<b>100.00</b>	<b>25</b>	<b>100.00</b>

$$\chi^2 = 77.077$$

$$d.f. = 2$$

$$p < 0.001$$

Sig

Application of Chi-square test showed that this difference was statistically significant at  $p < 0.001$  and non reactive CTG is significantly associated with requirement of C section.

**Table-2**  
**Indication for LSCS**

Indication		LSCS			
		Reactive (n = 105)		Non-Reactive (n = 25)	
		Number	%	Number	%
More than One Loop CAN		0	0.00	3	12.00
Severe Oligo		0	0.00	2	8.00
MSL	Regular FHS	2	1.90	12	48.00
	Irregular FHS	1	0.95	5	20.00
NPOL		3	2.85	0	0.00
CPD		1	0.95	0	0.00
Total		7	6.67	22	88.00

**Table-3**  
**Intra Delivery Findings in Vaginal v/s LSCS**

Intradelivary Findings	Reactive (n = 105)				Non-reactive (n = 25)				Total	%
	Vaginal	%	LSCS	%	Vaginal	%	LSCS	%		
One Loop CAN	7	6.67	0	0.00	0	0.00	0	0.00	7	5.38
More than One Loop CAN	1	0.95	0	0.00	0	0.00	3	12.00	4	3.07
Severe Oligo	1	0.95	0	0.00	0	0.00	2	8.00	3	2.30
MSL	7	6.67	3	2.85	2	8.00	17	68.00	29	22.30

Application of Chi-square test showed that this difference was statistically significant and nonreactive CTG is significantly associated with the presence of CAN & severe oligo hydramnios (p<0.005).

**Table-4**  
**APGAR Score at 1 & 5 Minute Interval**

APGAR Score	Reactive (n = 105)				Non-reactive (n = 25)			
	At 1 minute	%	At 5 minute	%	At 1 minute	%	At 5 minute	%
<4	0	0.00	0	0.00	5	20.00	0	0.00
5-6	6	5.71	0	0.00	9	36.00	3	12.00
7-10	99	94.29	105	100.00	11	44.00	22	88.00
Total	105	100.00	105	100.00	25	100.00	25	100.00

At 1 min :  $\chi^2 = 43.086$       d.f. = 2      p < 0.001      Sig

At 5 min :  $\chi^2 = 7.706$       d.f. = 1      p = 0.006      Sig

**Table-5**  
**Correlation of Fetal / Neonatal Outcome with Admission Test**

	Reactive (n = 105)		Non-Reactive (n = 25)		p-value
	No.	%	No.	%	
APGAR Score at 5 min < 7	0	0.00	3	12.00	0.004
Observation Under Paediatrician	8	7.62	13	52.00	<0.001

<b>NICU Admission</b>	<b>0</b>	<b>0.00</b>	<b>11</b>	<b>44.00</b>	<b>&lt;0.001</b>
<b>Neonatal Seizures</b>	<b>0</b>	<b>0.00</b>	<b>1</b>	<b>4.00</b>	<b>0.433</b>
<b>Neonatal death</b>	<b>0</b>	<b>0.00</b>	<b>0</b>	<b>0.00</b>	<b>-</b>

Application of Chi-square test revealed that CTG result is significantly associated with the fetal outcome as shown in the table.

**Table-6**

**Diagnostic Parameters of Admission Test**

<b>Diagnostic Parameter</b>	<b>% (95% CI)</b>
<b>Sensitivity</b>	<b>70% (45.72 – 88.11%)</b>
<b>Specificity</b>	<b>90% (82.81 – 94.90%)</b>
<b>Positive Predictive Value</b>	<b>56% (40.40 – 70.49%)</b>
<b>Negative Predictive Value</b>	<b>94.29% (89.39 – 97%)</b>
<b>False Negative</b>	<b>5.70%</b>
<b>False Positive</b>	<b>44%</b>

Above table shows that CTG at admission has high sensitivity and specificity for predicting fetal distress (70 % and 90% respectively). The proportion of false negative results is very low. A high NPV (94.29%) allows a clinician to accurately exclude fetal distress in an individual patient.

**DISCUSSION**

In our study 130, antenatal women were included according to the inclusion criteria 104 out of 130 belonged to 21-30 years age group (this is a most fertile period) group 104 (80%). Only 10.77% of subjects were above 30 years of age & adolescent pregnancy was contribute only 12 (9.2%) subjects. The study showed that 58 (44.62%) study subjects comprise of urban population and 72 (55.38%) were rural, but among these rural residents were migrants to the city for their jobs (at the time of hospital admission address has been noted from Aadhar card or voter IDs). Most of the study subjects were primigravida (44.61%) and 43.08% were 2<sup>nd</sup> gravida. Only 16 (12.31%) of women had gravida 3 or more. Most of the study subjects delivered at 38 weeks of gestation (30.77%) followed by 37-week gestation (20%), as assessed by 1<sup>st</sup> trimester USG. Only 15 subjects (11.54%) delivered before the ≥36 week (late pre-term) of gestation. Out of 130 women, 105 (80.77%) had reactive and 25 (19.23%) had non-reactive CTG.

In our study, All these patients were subjected to admission test or admission CTG. Out of 130 tests performed, 105 (80.77%) were reactive and 25 (19.23%) were non-reactive. In certain non-reactive tests, the test was repeated for another 30 minutes to confirm the previous abnormal finding. If again the test was non-reactive, a decision of termination of pregnancy was taken accordingly.

Similarly Rahman H et al (2012)<sup>8</sup> conducted a study on 192 pregnant women and showed that CTG was Reactive in 88.40% and Nonreactive in 12.0% woman.

Dwarakanath L et al (2013)<sup>9</sup> conducted a study on 200 pregnant women and showed that Incidence of the reactive trace was 69% & Non-Reactive 31%.

In our study subjects with reactive CTG, 97 (92.38%) delivered by normal vaginal delivery, 1 (0.95%) had ventouse application (due to prolonged 2<sup>nd</sup> stage of labour) and C-section was required (for NPOL in 3 subjects, MSL in 3 subjects & 1 was due to CPD) in only 7 (6.67%) cases, whereas in subjects with non-reactive CTG, 88% required C-section (indication of LSCS in the non-reactive group out of 25 subjects was mainly meconium-stained liquor in 17 subject and severe oligo & CAN in 5 subjects) and normal vaginal delivery was seen only in 12% subjects. (p<0.001).

Blessy D et al (2014)<sup>10</sup> conducted a study on 400 patients. On comparing admission test tracings with the mode of delivery, 80 out of 267 women of the reactive group had caesarean delivery (29.96%), and in the Non-Reactive group, 124 (93.25%) had a caesarean delivery.

Hafizur Rahman et al (2012)<sup>8</sup> conducted a study on 192 patients, Operative delivery for fetal distress was required in only 2.3% (4 of 169) women of the reactive group, in 36.3% (4 of 11) women of the equivocal group and in 83.3% (10 of 12) women of the ominous group.

Similarly Blessy D et al (2014)<sup>10</sup> conducted a study on 400 patients. About 72% patients with an ominous test had moderate-thick MSL, compared to 39% and 9% in the equivocal and reactive AT group respectively ( $p < 0.001$ ).

While in a study Khursheed F et al (2009)<sup>6</sup> conducted a study on 210 women, meconium stained liquor was present in 23 (15.97%) babies of reactive group & 18 (27.27%) babies of the non-reactive group.

Similarly, in a study conducted by Chuang J et al (2004),<sup>4</sup> on 169 patients with fetal heart-rate deceleration was determined that uterine compression resulting from oligohydramnios may be fundamental to the etiology of spontaneous fetal-heart-rate deceleration.

In our study APGAR score at 1 ( $p < 0.001$ ) and 5 ( $p$ -value = 0.006) minute was comparable to standard studies. Application of chi-square test revealed that CTG result is significantly associated with APGAR score at 1 and 5 minutes. APGAR score at 5-minute interval  $< 4$  was not reported with all three modes of delivery. APGAR score 5 to 6 were reported in 1 (4%) vaginal delivery and 2 (8%) LSCS in Non-Reactive group and APGAR score  $> 7$  was seen with most of the cases, 97 (92.38%) in reactive & 2 (8%) out of three vaginal delivery respectively reactive & non-reactive group. 27 (93.10%) out of 29 LSCS in the Reactive & Non-Reactive group were reported with APGAR score  $> 7$  at 5-minute interval. This APGAR score  $> 7$  in most cases was seen due to early intervention took in cases of Non-Reactive CTG group.

Similarly in a study conducted by Talaulikar VS et al (2011)<sup>7</sup> on 1041 low-risk women. The test was reactive in 94.3% and in this group, APGAR scores less than 7 at 5 minutes occurred in 1.3%.

Blessy D et al (2014)<sup>10</sup> was conducted a study on 400 patients. In this study, 25 (18.79%) in the non-reactive group had APGAR score  $< 7$  compared to only 13 out of 267 (4.87%) babies in the reactive group. So abnormal tracings had a statistically significant increase in the risk of having low APGAR score than reactive tracings.

In our study NICU admission was also predicted in all 11 cases (44%) that required NICU admission, in which 1 (4% of all CTG Non-Reactive cases) out of 11 had a neonatal seizure within 24 hours of delivery in CTG Non-Reactive Group. No, any neonatal death reported in all cases of NICU admission.

Similarly Hafizur Rahman et al (2012)<sup>8</sup> conducted a study on 192 pregnant women, incidence of neonatal intensive care unit (NICU) admission was also significantly high (about 42%) in babies delivered from mother in ominous test group as compared to those with equivocal (27%) and reactive (1.2%) test groups.

Blessy David et al (2014)<sup>10</sup> was conducted a study on 400 patients, among 267 patients with reactive CTG only 3 babies (1.12%) were admitted to the NICU. 14 out of 114 babies (12.28%) in the equivocal group and 9 out of 19 (47.37%) babies in the ominous group required NICU admission.

Khatun A et al (2009)<sup>5</sup> conduct a study on hundred consecutive normal and hundred consecutive abnormal CTC tracings, there was significantly higher perinatal death among the abnormal CTG group.

Our study shows that CTG at admission has high sensitivity and specificity for predicting fetal distress (70% and 90% respectively). The proportion of false negative results is very low. A high NPV (94.29%) allows a clinician to accurately exclude fetal distress in an individual patient.

Hafizur Rahman et al (2012)<sup>8</sup> conducted a study on 192 patients, has a sensitivity of 73.7%, specificity of 94.8%, positive predictive value of 60.9%, and negative predictive value of 97.0%.

Blessy David et al (2014)<sup>10</sup> was conducted a study on 400 patients. The study concluded that admission CTG has 92.85% sensitivity and 94.16% specificity. The positive predictive value was 87.96% and negative predictive value was 96.62% with a diagnostic accuracy of 93.75% indicating that reactive admission CTG correlates well with the fetal wellbeing.

## CONCLUSION

The cardiotocography test is a simple, non-invasive, inexpensive test for antepartum fetal surveillance. It is easy to perform and causing no inconvenience or complications to the patient. CTG test should be performed for diagnostic performance in light of clinical circumstances.

Our study has shown that Non-Reactive CTG is an alarming sign for active intervention as early as at the time of admission because those who have Non-Reactive CTG (approximately 20% [25 cases] in our study) majority of them landed in caesarean delivery for fetal distress. Hence early intervention decreased the neonatal morbidity.

Now we have automated machine available for recording of cardiotocography, more of training is not required to interpret the CTG results, hence we recommend availability in every labor room both in public sector (i.e. District Hospitals, Sub District Hospitals, Community Health Centre and even in Primary Health Centre) and private sectors.

A study showing high Negative predictive value (94.29%) so this admission test very useful in detecting a compromised fetus, in very early in first stage labour.

Finally, conclude that admission test is a very useful prognostic tool in early labour for triaging of the fetus and helpful in predicting the fetal outcome and mother's well-being.

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