

## A Retrospective Study on Correlation of Labour Admission Test with Perinatal outcome and Mode of Delivery

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### Abstract

**Background:** Labour Admission test (LAT) is a non invasive Cardiotocographic (CTG) recording of foetal heart rate and uterine contractions simultaneously for twenty minutes. This is commonly used to evaluate the foetal well being at the time of admission in labour ward. In a low resource setting where continuous CTG monitoring for all patients in labour is not possible, an abnormal tracing in LAT will help the treating Obstetrician to identify antenatal women who require continuous monitoring and appropriate timely intervention prevent perinatal mortality. **Material and Methods:** This is a retrospective study done on 300 antenatal women who met the inclusion criteria. The CTG tracing was categorised based on FIGO 2015 guidelines into Normal, Suspicious and pathological. Mode of delivery and specific foetal and neonatal outcome measures were studied and correlated with admission CTG testing. **Results:** The incidence of operative delivery was phenomenally high in Pathological group (70%) and low in Normal group (5.5%). Foetal distress during labour developed in 8.5% of patients with Normal tracing and 70% of patients with pathological tracing. LAT has a sensitivity of 64.7% and specificity of 94.37% and Positive predictive value (PPV) of 40.4% in predicting an Apgar score of <7 at 5 minutes of birth. NICU admission

was required in 1.03% of patients with Normal tracing and 50% of patients with Pathological tracing (Pvalue < 0.001). **Conclusion:** The result of the study showed high specificity indicating that normal tracing appears to be predictive of foetal well being in low risk and high risk cases. However, Suspicious and Pathological pattern required intense monitoring and if possible early intervention in the absence of diagnostic modalities like foetal blood gas evaluation.

**Keywords:** Labour Admission Test (LAT); Cardiotocogram (CTG); Normal; Suspicious; Pathological.

### Introduction

Foetal surveillance during both ante partum and intra partum periods is increasing in our quest to improve perinatal morbidity and mortality. Obstetricians are concerned with the early recognition of foetal distress during labour in order to avoid an adverse outcome. Foetal heart rate (FHR) monitoring was introduced four decades ago into clinical use for foetal surveillance and It continues to be the predominant method for intrapartum foetal surveillance. The available methods for intrapartum fetal surveillance range from intermittent auscultation, continuous electronic foetal heart rate monitoring to invasive techniques of foetal blood gas analysis.

Currently, in western countries continuous electronic foetal heart monitoring is being widely used for foetal surveillance during intra partum period which requires capital expenditure, educational programs and increased patient surveillance. In developing countries like India, where

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continuous foetal monitoring for every Intrapartum patient is not possible. Labour Admission Test (LAT) can be done in early labour, as this test identifies foetus with risk for hypoxia in next 5-6 hours of labour.

The aims of intrapartum foetal monitoring by Labour admission test are the early recognition of foetal distress during labour in order to avoid an adverse outcome i.e to detect earliest stage of hypoxia or hypoxic acidemia, so therapy can be directed to prevent asphyxia and asphyxial damage and to improve perinatal morbidity and mortality.

The Labour Admission Cardiotocography test is a short continuous electronic FHR recording for duration of 20 minutes along with simultaneous recording of uterine activity done immediately on admission to labour room. First described by Ingermarsson et al (1986) [1]. It is dynamic screening test to assess the state of oxygenation of foetus at the time of admission of mother in Labour room. It assesses the placental reserve by checking the response of foetal heart during the phase of temporary occlusion of uteroplacental blood supply under physiological stress of repeated uterine contractions. It there by assesses the ability of foetus to withstand the process of labour.

The admission CTG therefore has two potential roles. It can be used as a screening test for labour to detect compromised fetuses on admission and to select the women in need of continuous electronic monitoring during labour [2].

The objective of this study is to evaluate the predictive value of Admission Test in detecting compromised foetus or foetal distress at the time of admission in Labour and to correlate the results of Admission test with different parameters like perinatal outcome and mode of delivery.

## Material & Methods

After obtaining the approval from the institutional ethics committee, a retrospective analytical study of Labour Admission test was done in a sample size of 300 women in a tertiary care hospital of GSL Medical College, Rajamahendravaram for a period of 06 months from Jul 2016 to Dec 2016.

### *Inclusion Criteria for the Study*

Pregnancies with gestational age between 36 weeks to 41 weeks both high and low risk irrespective of parity admitted in early labour, Singleton pregnancy with longitudinal lie and cephalic

presentation. Also all patients who were admitted in spontaneous labour as well as patients who went into labour after induction of labour by Misoprostol/Oxytocin were included in the study.

### *Exclusion Criteria for the Study*

Pregnancies with gestational age less than 36 weeks and more than 41 weeks, Multiple pregnancies, malpresentations, Pregnancies with congenital foetal anomalies, Use of sedative drugs before admission test, women admitted in 2<sup>nd</sup> stage of labour and those who underwent Elective LSCS.

All the pregnant women of the study underwent admission test where foetal heart rate (FHR) was recorded with uterine activity for a period of 20 minutes and then categorised into normal, suspicious or pathological groups as per the FIGO 2015 guidelines [3] for the interpretation of CTG tracings.

As per standard protocol, patients with normal CTG were monitored by intermittent auscultation for one minute after uterine contraction, every 30 minutes in the first stage of labour and every five minutes in the second stage of labour. Those with suspicious trace and pathological trace were placed on continuous CTG monitoring. In those with pathological foetal heart rate tracings, appearance of recurrent late, variable or prolonged decelerations was taken as foetal distress.

The foetal/ neonatal outcome measures assessed were development of foetal distress during labour (meconium staining of liquor in labour), FHR variations in labour, Apgar score at 5 minutes after birth, NICU admissions, development of neonatal seizures, stillbirth / neonatal deaths.

## Results

Table 1 shows that (90.7%) majority of women in the study were below 25 years who came for delivery. The study highlighted the fact that almost 41% were teenage pregnancies in this rural area.

Table 2 shows the gravida wise distribution of 300 cases of which majority were primigravida.

Table 3 shows the patterns that were identified in the LAT which were Normal, suspicious and Pathological. The CTG observational status was low in 273 (91%) patients and it was high in 27 patients (9%).

P value < 0.001 indicating that the incidence of operative and instrumental delivery is increased as CTG becomes abnormal. Since P value is less than

0.001 there is significant correlation between type of tracings and mode of delivery.

Table 5 the incidence of meconium stained (fetal distress during labour) is high in pathological group and is statistically significant.

Table 6 showed the Apgar score the results of the study indicated that Suspicious and Pathological admission test is significantly associated with Low Apgar score with  $p < 0.001$ .

Table 7 shows that as the incidence of NICU admissions increased as CTG tracing shifted from normal to pathological which is statistically significant.

Table 9 Sensitivity, Specificity, Positive Predictive Value & Negative Predictive Value of Labour Admission test for various foetal/neonatal outcomes.

Table 1: Age wise distribution

Sr. No.	Age group	No	Percentage
1	≤ 20 years	125	41.7%
2	21 - 25 years	147	49.0%
3	26 - 30 years	23	7.7%
4	≥ 30 years	5	1.7%
	Total	300	100%

Table 2: Gravidity wise distribution

Sr. No.	Gravidity	No	Percentage
1	Primigravida	145	48.3%
2	Second Gravida	122	40.7%
3	Third Gravida	27	9%
4	Fourth Gravida	6	2%
	Total	300	100%

Table 3: Results of labour admission test

Sr. No.	Result of LAT	No	Percentage
1	Normal	273	91%
2	Suspicious	17	5.7%
3	Pathological	10	3.3%
	Total	300	100%

Table 4: Results of labour admission test to mode of delivery

Sr. No.	Mode of Delivery	Number (n=300)	Spontaneous Vaginal Delivery	Instrumental Delivery	Emergency LSCS
1	Normal	273	235(86%)	23 (8.5%)	15 (5.5%)
2	Suspicious	17	4 (23.52%)	1(5.88%)	12 (70.5%)
3	Pathological	10	1(10%)	2 (20%)	7 (70%)
	Total	300	240 (80%)	26 (8.66%)	34 (11.33%)

Table 5: Labour admission test and meconium stained liquor

Sr. No.	Admission Test	Meconium Stained		Total	P value
		Yes	NO		
1	Normal	23 (8.5%)	250 (91.5%)	273	0.000
2	Suspicious	10 (59%)	7 (41%)	17	
3	Pathological	7 (70%)	3 (30%)	10	
	Total	40	260	300	

Table 6: Labour admission test and APGAR score

Sr. No	Admission Test	APGAR Score		Total	P value
		<7	≥ 7		
1	Normal	6 (2.19%)	267 (97.81%)	273	0.000
2	Suspicious	5 (29.41%)	12 (70.58%)	17	
3	Pathological	5 (50%)	5 (50%)	10	
	Total	18	282	300	

**Table 7:** Correlation between labour admission test and NICU admissions

Sr. No	Admission Test	NICU Admission		Total	P value
		Yes	NO		
1	Normal	3 (1.09%)	267 (98.91%)	273	0.000
2	Suspicious	5 (29.41%)	12 (70.58%)	17	
3	Pathological	5 (50%)	5 (50%)	10	
	Total	13	284	300	

**Table 8:** Correlation of the admission test with foetal/neonatal variables

Outcome	Normal (n=273)	Suspicious (n=17)	Pathological (n=10)
Development of foetal distress	23 (8.4%)	10 (58%)	7 (70%)
Apgar score $\leq 7$ at 5 minutes after birth	6 (2.19%)	5 (29.4%)	6 (60%)
Admission to NICU	3 (1.09%)	5 (29.4%)	5 (50%)
Neonatal Seizures	Nil	Nil	Nil
Intrapartum/Neonatal Mortality	Nil	Nil	Nil

**Table 9:** Sensitivity, specificity, positive predictive value & negative predictive value of labour admission test for various foetal / neonatal outcomes

Outcome	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Development of foetal Distress during labour	42.5%	96.15%	63%	91.57%
Apgar Score $\leq 7$ at 5 minutes after birth	64.7%	94.37%	40.4%	97%
Admission to NICU	78.57%	94.07%	37.03%	98.9%

Diagnostic accuracy 92%

## Discussion

Admission CTG is continuous recording of foetal heart rate for duration of 20 minutes, immediately after admission to the labour room which helps to triage the antenatal women in labour into normal, suspicious and pathological CTG group, where the suspicious and pathological group is more vulnerable to adverse foetal outcome so they fall into high observational status. In present study of 300 patients both high risk as well as low risk group were included, 75 were high risk cases and 225 were low risk cases.

In our retrospective study we found that the incidence of operative delivery was significantly higher in pathological and suspicious group (70%) in comparison to normal group (5.5%), as delivery of the fetus was significantly hastened due to meconium staining of liquor in suspicious and pathological CTG group. The incidence of instrumental delivery in pathological group (20%) was higher than other groups. However the incidence of instrumental delivery in normal group (8.5%) was slightly higher than suspicious group (5.8%). The reason for this was to cut short the 2<sup>nd</sup> stage in view of maternal conditions like pre-eclampsia, maternal heart disease, VBAC, maternal exhaustion, and meconium staining

of liquor. Our study findings correlate with previous RCTs and various studies that have shown that there is an increase rate of LSCS and instrumental delivery in the abnormal CTG women.

It has been recognized that meconium passage is a manifestation of normally maturing gastrointestinal tract or is the result of vagal stimulation from umbilical cord compression. But in general sense, meconium passage is still considered as a sign of foetal distress occurring due to foetal hypoxia and is considered a marker of adverse perinatal outcome.

In our study foetal distress (meconium staining of liquor) in was found in 70% of pathological group, 58% in suspicious group and 8.5% in normal group as compared to study done by Behuria S et al [4]. Where foetal distress was found in 64% of nonreactive cases 28.5% in suspicious cases and 29% of reactive cases. Ingemarsson et al<sup>1</sup> has done admission CTG in low risk patients where they had foetal distress in 40% of non-reactive group and 1.4% in reactive group. In study done by Kansal et al. [5], only 16.0% cases developed foetal distress in the normal admission test group whereas, the percentage increased to 62.9% and 97.3% in the suspicious and pathological group respectively. Sandhu. et al [5] have done admission CTG in high risk patients where they found that foetal distress occurred in 15% of reactive group and 73%

**Table 10:** Comparative incidence of fetal distress in relation to admission test in various studies

Study	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Behuria et al <sup>4</sup>	22.5	93.5	63.5	91
Hegde et al <sup>8</sup>	66.7	90	38.7	96
Ingemarsson et al <sup>1</sup>	23.5	99.4	40	98.7
Kushtagi et al <sup>7</sup>	53	93	61	91
Sandhu et al <sup>6</sup>	42.3	95.6	73.3	84
Kansal et al <sup>5</sup>	53.96	93.35	75.76	84.04
Present Study	42.5	96.15	65	91.57

PPV-Positive predictive value; NPV-Negative predictive value

**Table 11:** Comparative incidence of foetal distress in relation to admission test in various studies

Study LAT	Behuria et al (n=200)			Sandhu et al (n=150)			Kansal et al			Present Study		
	R	S	O	N	S	P	N	S	P	N	S	P
No.	164	14	22	101	34	15	401	62	37	273	17	10
FD No.	48	4	14	15	19	11	64	39	36	23	10	7
FD%	29	28.5	64	15	55	73	16	62.9	97.3	8.5	58	70

( LAT- Labour admission test; R- Reactive; S- Suspicious; O-Ominous; N-Normal; P-Pathological; FD-Foetal Distress)

**Table 12:** Comparison of LAT Parameters with other studies

	Sensitivity			Specificity			Positive Predictive Value		
	Behuria et. al	Sandhu et.al	Present Study	Behuria et. al	Sandhu et.al	Present Study	Behuria et. al	Sandhu et.al	Present Study
Foetal distress	22.5%	42.3%	42.5%	93.5%	95.6%	96.15%	63.6%	73.3%	63%
5 min APGAR Score	44.4%	66.7%	64.7%	95%	93.3%	94.37%	50%	53.3%	40.4%
NICU Admission	17.24%	83.3%	78.57%	95%	90.9%	94.07%	62.5%	33.3%	37.03%

in non-reactive group. In study done by Hegde et al [8] the fetal distress was seen in 3.6% in reactive group, 15% in suspicious group and 75% in ominous group.

The sensitivity, specificity, positive and negative predictive values for foetal distress are comparable with that of Sandhu et. al [6], Kushtagi. et. al [7], Kansal et.al [5], The values of the above comparison shows that admission test which has got such high specificity and high negative predictive value can be used with great reliability to detect foetuses who are not hypoxic which means that a normal test accurately excludes adverse foetal status at the time of testing.

We found that positive predictive value for Apgar score after 5 minutes and neonatal outcome was low indicating that there was fast intervention to deliver the foetus by operative method without confirming the foetal acidosis by more diagnostic method like scalp PH. In such scenario the false positives tend to be more thereby impacting the positive predictive value. We found that the admission test has a low positive predictive value for adverse foetal outcome. This is expected in situations where an adverse event is relatively rare as stated by sandhu et.al [5]. The sensitivity and specificity of the admission test were good when development of foetal distress during labour were excluded in favour of more ominous foetal

outcomes like severe asphyxia at birth and neonatal ICU admissions. NICU admission was required in 1% of pts with normal test and 50% of pts with pathological CTG (P <.001) which is statistically significant.

Recent Cochrane review [9] states that CTG during labour is associated with reduced rates of neonatal seizures, but no clear differences in cerebral palsy, infant mortality or other standard measures of neonatal wellbeing. However, continuous CTG was associated with an increase in caesarean sections and instrumental vaginal births. The challenge is how best to convey these results to women to enable them to make an informed decision without compromising the normality of labour.

In our study, the observation was that birth asphyxia was phenomenally higher in pathological (60%) and suspicious (29%) groups in comparison to normal group (2.19%) which can be compared to study done by Ingemarsson et al [1], where the birth asphyxia was 40% in ominous group and 1% in reactive group. Das et al [10] observed that there was a marked difference in the number of asphyxiated neonates (Apgar score <7 at 5 min) in abnormal admission test group (8.7%) versus reactive admission test group (1.6%). Neonatal admissions

were 3.93 times higher with abnormal admission test and neonatal mortality was also higher with abnormal admission test as compared to reactive admission test group irrespective of high or low risk factors. In our study also the NICU admissions were 50 times higher in pathological group compared to normal CTG ones irrespective of risk factors to mother.

To conclude, It is evident from the results of the present study that the Labour admission test can be used as an important non-invasive method to screen for foetal compromise present at the time of admission in high as well as low risk patients in early labour. The advantages of the admission test is that it is non invasive test of short duration and well accepted by patient and high specificity and high negative predictive value of the test indicates that if the test turns out to be reactive, it rules out fetal hypoxia for next 5-6 hrs of labour and has low incidences of false negative. However, the admission test cannot be expected to predict the development of any acute asphyxial insult during the course of labour such as cord prolapse, abruptio placenta. In the absence of such acute events, an adverse fetal outcome is unlikely if the admission test is normal. Even though LAT has a diagnostic accuracy of 92%, the low specificity points out to the fact that it is only a screening test but not a confirmatory test. So there is likelihood that the foetus may develop birth asphyxia if it is abnormal and should be under continuous monitoring or should undergo confirmatory test like scalp PH to diagnose foetal hypoxia. The result of admission CTG testing can be used to identify patients likely to develop adverse foetal outcomes and help in optimal utilization of limited labour room resources.

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