# A cross-sectional study on role of labor admission test by CTG as a predictor of perinatal outcome

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**Abstract:**

**Background**: Perinatal hypoxia is a major contributor to neonatal mortality and morbidity worldwide. Intrapartum assessment of fetal well-being has become an integral part of labour management. Labor admission test (LAT), a test of fetal well-being, can be utilized as a screening tool in early labor to detect compromised fetuses on admission. **Objectives:** This study was undertaken to evaluate the efficacy of LAT in assessing fetal well-being at the onset of labor and comparing the test results with neonatal outcomes. **Material and methods:** This was a cross-sectional study conducted among women admitted in labor room of a tertiary care teaching hospital. LAT was performed following which, the patients were classified according to FHR tracings obtained as 'Reactive', 'Equivocal' and 'Non-reactive. Perinatal outcomes of these patients were also assessed. **Results:** Out of 165 patients that participated in the study, 106 (64.2%) had reactive, 6 (3.6%) had equivocal and 53 (32.1%) had non-reactive FHR trace on LAT. Out of the patients with a non-reactive trace, 8 (15.1%) had an APGAR score at 5 minutes of less than 7, 8 (15.1%) patients had meconium stained liquor and 45 (84.9%) were delivered through LSCS. About 27 (50.9%) newborns required admission into the NICU in this group. **Conclusions:** LAT can be used as a simple, non-invasive, inexpensive screening tool to identify fetuses who are unlikely to cope with the stress of labor and become hypoxic especially when continuous electronic fetal monitoring is not possible for every patient due to economic constraints.

**Keywords:** Labour admission, reactive, nonreactive, perinatal outcome.

Labour is a time of both happiness and stress for the patients. The fetus faces maximum threat during this shortest phase of pregnancy. It is estimated that 23% of the neonatal deaths per year in the world occur because of intrapartum complications [1, 2]. Physiology of labour states that the contractions that occur during labour can reduce utero-placental perfusion by around 60% [3]. The incidence of severe fetal hypoxia resulting from acute events such as placental abruption, uterine rupture or cord prolapse is rare and most of the fetal hypoxia occurs gradually due to uterine contractions [4]. Placental function is generally sufficient to deal with the hypoxic stresses of labor, but, in some women intrapartum fetal compromise may develop leading to perinatal hypoxia. Perinatal hypoxia is a major factor involved in stillbirth, cerebral palsy and hypoxic ischemic encephalopathy (HIE). Many newborns who develop HIE do not survive the first month of life and survivors have long-term issues such as cerebral palsy [5].

Medical technology has now made it possible to identify the fetuses that are not able to withstand periods of intermittent hypoxia. Such fetuses show this compromise in many ways, such as heart rate abnormalities, passage of meconium in utero etc. [6] These abnormalities can be easily identified and patients can be managed accordingly.

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Therefore, intrapartum assessment of fetal well-being has become an integral part of labour management. Labor admission test (LAT) is a test of fetal well-being, performed when a woman is admitted in labor to assess fetal well-being [7]. With the help of this test, fetuses that may be hypoxic or that are unlikely to withstand the stresses of labor can be identified and delivered or assessed with additional tests of fetal hypoxia. LAT has the ability to assess all parameters of fetal heart rate including baseline variability. Auscultation can also provide the baseline heart rate and indicate presence of accelerations/deceleration but it cannot help identify baseline variability or describe the type of decelerations [7]. On the other hand, LAT is a visual test can help reassure patients that the fetus is not at risk of hypoxia at the time of admission and is not likely to develop hypoxia in the next few hours [7].

Thus, LAT can be utilized as a screening tool in early labor to detect compromised fetuses at the time of admission in the hospital. Therefore, this study was undertaken to evaluate the efficacy of LAT in assessing fetal well-being at the onset of labor and comparing the test results with neonatal outcomes.

**Materials and methods**

Institutional ethics committee approval was obtained before starting the study. This was a cross-sectional study conducted among women admitted in labor room of a tertiary care teaching hospital from August 2019 to July 2020.

Registered and unregistered antenatal patients admitted in labor were included in the study. However, patients in labor who were not full term (gestational age of less than 36 weeks), patients progressed beyond 1$^{st}$stage of labor at the time of admission, patients delivering by elective caesarian section and patients not willing to participate were excluded from the study. All patients fulfilling the inclusion and exclusion criteria during the study period were enrolled for the study. Written informed consent was taken from the study participants after explaining the methodology of the study. The patients were free to refuse participation or withdraw from the study anytime they wanted to. Their refusal to participate in the study did not affect the treatment they received at the hospital.

A structured proforma was used for data collection. Patient history details including obstetric and medical history were noted. Antenatal women with any of these conditions were considered as high-risk antenatal cases: previous abortions, previous LSCS, patients with cardiac disease, hypothyroidism, severe anaemia (Hb < 7 gm %), any other medical condition and pregnancy induced hypertension. Bimanual examination was done to determine the stage of labor following which LAT was performed.

Fetal heart rate (FHR) tracing was recorded using cardiotocography (CTG) machine for 20 minutes with the patient in semi-lateral position in labour room. The external abdominal transducers were used for CTG; with one for FHR tracing placed on the maternal abdomen where FHS were best heard and the other for noting uterine pressure positioned on the fundus of the uterus after applying aquasonic gel. The patients were then classified according to FHR tracings obtained as 'reactive', 'equivocal' and 'non-reactive' defined by the National Institute of Clinical Excellence (NICE) clinical guidelines 2017 [8].

Following the admission test, patients with 'reactive' trace were monitored intermittently by auscultation for 1 minute every 30 minutes in the 1$^{st}$ stage of labour and every 5 minutes in the 2$^{nd}$ stage of labour post contraction. Cases with 'equivocal' trace were put on continuous CTG monitoring. In those with 'non-reactive' tracings, appearance of late, significant variable or prolonged decelerations, delivery was hastened by operative or instrumental intervention depending on stage of labour. Data on delivery outcomes such as mode of delivery, colour of liquor, APGAR score at 1 and 5 minutes, admission to NICU and neonatal death were noted.

Statistical analysis: Data was analyzed using SPSS statistics version 21 software. Variables measured on nominal scale were described using frequency and proportion. Pearson's chi square test was used to check association between LAT CTG tracings and outcome variables.

**Results**

A total of 165 patients underwent the LAT. Out of 165 patients, 63 (38.2%) were primigravida and 102 (61.8%) were multigravida. High-risk pregnancy was present in 86 (52.1%) and 79 (47.9%) patients had a low-risk pregnancy. The risk factors of the study patients are given in table 1.

| **Table 1: Risk factors present in study patients (n=165)** | |
|---|---|
| **Factors** | **Number of patients** |
| Previous abortions | 32 (19.4%) |
| Previous LSCS | 14 (8.5%) |
| Severe anemia (Hb < 7gm%) | 4 (2.4%) |
| Cardiac disease | 14 (8.5%) |
| Hypothyroidism | 22 (13.3%) |
| Other medical conditions | 17 (10.3%) |
| Pregnancy induced hypertension (PIH) | 14 (8.5%) |

Based on LAT, 106 (64.2%) had reactive, 6 (3.6%) had equivocal and 53 (32.1%) had non-reactive FHR trace (figure 1). The number of patients with reactive, equivocal and non-reactive FHR tracings were similar in patients with high-risk and low-risk pregnancies (p=0.730) (table 2).

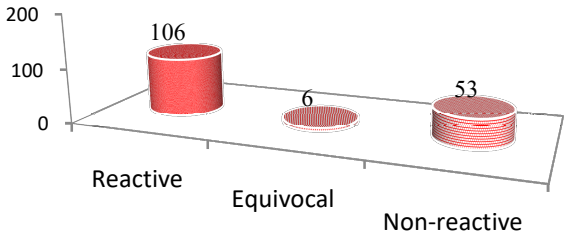


Figure 1 : Distribution of patients according to FHR tracings

| **Table 2: Comparison of pregnancy risk with CTG trace on LAT** | | | | |
|---|---|---|---|---|
| **Pregnancy risk** | **CTG trace on LAT** | | | **Total** |
| | **Reactive** | **Equivocal** | **Non-reactive** | |
| High risk | 53 (50.0%) | 3 (50.0%) | 30 (56.6%) | 86 (52.1%) |
| Low risk | 53 (50.0%) | 3 (50.0%) | 23 (43.4%) | 79 (47.9%) |
| Total | 106 (64.2%) | 6 (3.6%) | 53 (32.1%) | 165 (100%) |
| $\chi^2 = 0.629$, p = 0.730 | | | | |

Normal accelerations were auscultated in 78 (73.6%) patients with reactive trace, 4 (66.7%) patients with equivocal trace and 14 (26.4%) patients with non-reactive trace and the difference was statistically significant.

The pregnancy outcomes according to results of admission test are given in table 3. Of the patients with reactive FHR tracings, 78 (73.6%) had vaginal delivery and 45 (84.9%) patients with non-reactive FHR tracings underwent LSCS. This difference was statistically significant. APGAR score at 5 minutes was less than 7 in 8 (15.1%) patients with non-reactive FHR tracing, whereas in none with reactive or equivocal FHR tracing. NICU admission was required for 3 (2.8%) infants delivered to patients with reactive and 27(50.9%) infants with non-reactive FHR tracings. The difference in both these outcome variables was statistically significant. No neonatal deaths occurred in any of the groups.

| **Table 3: Comparison of CTG trace on LAT with perinatal outcomes** | | | | |
|---|---|---|---|---|
| **Perinatal outcomes** | **CTG Trace on LAT** | | | **P value** |
| | **Reactive (106)** | **Equivocal (6)** | **Non-reactive (53)** | |
| Mode of delivery | | | | |
| • Vaginal delivery | 78 (73.6%) | 0 (0.0%) | 8 (15.1%) | <0.001 |
| • Instrumental delivery | 2 (1.9%) | 3 (50.0%) | 0 (0.0%) | |
| • LSCS | 26 (24.5%) | 3 (50.0%) | 45 (84.9%) | |
| Meconium stained liquor | 0 (0.0%) | 3 (50.0%) | 8 (15.1%) | <0.001 |
| APGAR <7@1m | 101 (95.3%) | 6 (100%) | 50 (94.3%) | 0.825 |
| APGAR <7@5m | 0 (0.0%) | 0 (0.0%) | 8 (15.1%) | <0.001 |
| NICU admission | 3 (2.8%) | 1 (16.7%) | 27 (50.9%) | <0.001 |

**Discussion**

LAT was originally designed as a screening tool for women with low-risk pregnancies at the onset of labor but has now found use in both low as well as high risk pregnancies. In this study, 106 (64.2%) had reactive, 6 (3.6%) had equivocal and 53 (32.1%) had non-reactive CTG trace on LAT. We compared our study findings with similar studies conducted elsewhere. A study by Joshi H et al has reported similar number of patients (67%) with reactive CTG tracing. They also reported that 21% had equivocal and 12% had ominous CTG tracing [9]. Similar studies by Mohd R et al and Bhartiya V et al have reported patients with abnormal tracings around 3-8% [10, 11].

Current guidelines recommend the use of CTG for patients with high-risk pregnancy. Fetal morbidity and mortality are greater in high-risk women, but at full term, morbidity and mortality due to intrapartum events occur with similar frequency in low-risk and high-risk pregnancies [7]. Intrapartum complications can occur quickly and unexpectedly in patients with both high and low risk pregnancy[12]. Our study showed that the number of patients with reactive, equivocal and non-reactive FHR tracings were similar in patients with high-risk and low-risk pregnancy. A study by Rekha B et al showed that admission test was reactive in 70% cases in the high-risk group and 84% in low risk group, whereas it was non-reactive in 30% cases in high-risk group and 16% in low-risk group[13].

As a part of pregnancy outcome when the mode of delivery was compared, the rate of instrumental delivery and LSCS were higher among those with a non-reactive CTG trace in our study. According to Joshi H et al vaginal delivery was more common in patients with reactive trace than in ominous and suspicious group, while caesarean sections were more when the AD was ominous. They reported that normal vaginal, instrumental and LSCS rates among patients having reactive CTG were 58%, 9% and 33% respectively and in those ominous CTG 84% were delivered by LSCS and 8% had normal vaginal delivery [9].

We found that, perinatal outcomes such as meconium-stained liquor, APGAR score of less than 7 at 5 minutes, infant admission to the NICU were all poor in patients with non-reactive CTG trace on LAT. Our findings are supported by similar studies that have stated that the APGAR scores at minutes 1 and 5in the abnormal admission test group were lower than those in the normal admission test group [10, 14]. Joshi et al reported that among patients with reactive CTG trace, 10.4% had meconium-stained liquor and 7.4% infants had both APGAR score <7 at 5 min and NICU admission. Whereas in ominous CTG group, 75% had meconium-stained liquor and 66.7% infants had both APGAR Score <7 at 5 min and NICU admission [9].

A systematic review assessed the effectiveness of the LAT in preventing adverse outcomes, compared with auscultation only. They concluded that there were more operative deliveries and LSCS among the women randomized to the LAT, but these differences were not statistically significant. Also, there were no significant differences in augmentation of labor between the two groups, or in any of the neonatal outcomes [15].

**Conclusion**

Most of the patients with an equivocal and non-reactive LAT had meconium stained liquor, newborns had APGAR score of less than 7 at 5 minutes and required NICU admission. Thus, LAT can be used as a simple, non-invasive, inexpensive screening tool to identify fetuses who are unlikely to cope with the stress of labor and become hypoxic

especially when continuous electronic fetal monitoring is not possible for every patient due to economic constraints. However, absence of robust evidence does not equate lack of effectiveness. More studies are required to explore the utility of this test in accurately detecting fetal hypoxia whilst not increasing operative intervention in labour.

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