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Original Research Article

## The role of cardiotocography in predicting perinatal outcomes in women presenting with reduced perception of fetal movements at term: an observational study

Bhuvaneshwari K. M.\*, Rekha N.

Department of Obstetrics and Gynecology, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka, India

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**\*Correspondence:**

Dr. Bhuvaneshwari K. M.,

E-mail: [bhuvaneshwarikm@gmail.com](mailto:bhuvaneshwarikm@gmail.com)

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### ABSTRACT

**Background:** Reduced perception of fetal movement by mother is a common reason for self referral for assessment by healthcare providers affecting 5-15% of pregnancy. It allows early identification of fetuses at risk of adverse outcome. Non stress test (NST) or Cardiotocography (CTG) is the most commonly used test for antepartum and intrapartum fetal surveillance. Hence, this study was conducted to evaluate the role of NST/CTG in predicting perinatal outcomes in women presenting with reduced perception of fetal movements.

**Methods:** A prospective observational study was conducted on 110 term pregnant women presenting with reduced perception of fetal movements. NST/CTG was done as a preliminary test in them and the results were analyzed statistically.

**Results:** Total 60% women had reactive CTG, 17.3% had suspicious CTG and 22.7% had pathological CTG at the time of presentation. Out of 66 women who had reactive NST, 34 women were discharged after observation for 24 hours to follow up. About 58.15% women had one or more risk factors associated with pregnancy in our study. Pathological/suspicious CTG was more commonly associated with adverse perinatal outcomes like presence of MSAF, low APGAR score at 1 minute and 5 minutes, neonatal distress, need for neonatal resuscitation and NICU admission with statistical significance. However, all babies had good outcome in our study.

**Conclusions:** Early approach, timely intervention could reduce associated complications and improve perinatal outcome in all these cases.

**Keywords:** CTG, NST, Perinatal outcome, Reduced fetal movements

### INTRODUCTION

Pregnancy in a developing country like India is often the first time a woman is evaluated medically. The motto of modern obstetrics is "To deliver a healthy baby from a healthy mother". The primary objective of the antenatal fetal assessment is to avoid fetal death. According to American College of Obstetricians and Gynecologists (ACOG) and American college of Pediatrics (2007) the goals of antepartum fetal surveillance include prevention of fetal death and avoidance of unnecessary interventions.<sup>1</sup>

The antepartum assessment of fetal wellbeing is an essential component of management of both low risk and high risk pregnancy. Maternal perception of fetal movements is one of the first signs of fetal life. It serves as an indirect measure of central nervous system integrity and function of the fetus. Maternal perception of decreased fetal movements prior to fetal demise was first observed in 1970s, following which fetal movement monitoring was proposed as a method of fetal surveillance to prevent stillbirth.<sup>2</sup> Passive unstimulated fetal activity commences as early as 7 weeks of gestation age, and becomes more

sophisticated and co-ordinated by the end of pregnancy.<sup>1</sup> It remains as an important early indicator of status of life and fetal wellbeing throughout pregnancy as fetal motor activity reflects the fetal condition in utero.

In persistent hypoxic condition, the fetus conserves energy by reducing movements as an adaptive mechanism to reduce oxygen consumption.<sup>3</sup> Reduced perception of fetal movement by mother is a common complaint affecting 5-15% of pregnancy and is associated with poor perinatal outcomes.<sup>4</sup>

Froen et al have reported that those presenting with reduced fetal movements (RFM) in pregnancy had an increased perinatal mortality, increased need for emergency delivery and low neonatal APGAR scores at delivery.<sup>5,6</sup> Both the Royal College of Obstetricians and Gynecologists (RCOG) and ACOG recommend that any woman perceiving RFM should be offered further testing in the form of NST or CTG and an ultrasound fetal wellbeing assessment.<sup>7</sup>

Freeman (1975) and Lee colleague introduced the CTG to describe FHR acceleration in response to fetal movement as a sign of fetal health.<sup>8</sup> It looks for the presence of Doppler detected temporary acceleration of fetal heart rate (FHR) associated with fetal movements which reflects oxygenation to brain. Fetal movements during performing the test are identified by mother and recorded by a hand held probe.

Thus in our study, we incorporated these two simpler methods for assessment of fetal wellbeing and we studied the role of CTG/NST in predicting perinatal outcomes in women presenting with reduced fetal movements after 37 weeks of gestation.

Study objective was to determine the diagnostic value of NST/CTG in predicting perinatal outcomes in women presenting with reduced fetal movements.

## **METHODS**

A prospective observational study was conducted on 110 term pregnant women presenting with reduced perception of fetal movements to BGS Global Institute of Medical Sciences and hospital during the study period of March 2021-September 2022. Ethical committee clearance was obtained from the Institutional Ethical committee.

### ***Inclusion criteria***

Gestational age of >37 weeks, singleton pregnancy, and pregnant women presenting with reduced fetal movements were included.

### ***Exclusion criteria***

Patients with congenital anomalies were excluded from this study.

The study was conducted as follows:

All women in third trimester were educated to keep a note on daily perception of fetal movements. Three counts, each of one hour duration (post breakfast, lunch, dinner) are recommended. If there is diminution of the number of kicks to less than 10 movements in 12 hours or 3 movements in each hour indicates reduced movements.

Pregnant women with >37 weeks of gestation age complaining of reduced perception of fetal movements and fulfilling inclusion criteria were admitted and enrolled for study. Informed consent was obtained. Detailed history was taken and examination was done. They were subjected to NST/CTG. BPL company machine was used in our hospital. Paper speed was kept at 1cm/min, and it was interpreted as per NICE (national institute for health and clinical excellence) guidelines.

Women were categorized as normal, suspicious, and pathological. Trace was continued upto 40 mins if initial trace was non reassuring.

If CTG was normal, observation was done for 24 hours, she was counseled regarding the importance and maintenance of daily fetal movement count chart. Repeat CTG was done and if found reactive, she was discharged and was asked to review after 1 week. If the complaint persists or if signs of labour occurs like increased pain abdomen, bleeding p/v or leaking p/v to review immediately.

If the CTG was suspicious, conservative measures were taken and it was repeated and if still found non reassuring, they were considered for delivery by induction of labour. If found assuring it was managed as normal CTG.

If the CTG was pathological even after resuscitative measures, they were considered for immediate delivery.

If women was in early labour, and CTG was found to be normal, she was allowed for spontaneous progress of labour. If CTG was suspicious, depending on the bishops score patient was considered for augmentation of labour. If CTG was pathological, operative delivery was conducted.

Perinatal outcomes with reference to mode of delivery, presence of neonatal distress, presence of meconium stained amniotic fluid, APGAR at 1 min and 5 min, requirement of neonatal resuscitation, requirement of NICU admission, duration of NICU stay in hospital and final outcome or condition at discharge-presence of any complications was noted. All data was analysed.

### ***Data analysis***

All the statistical data was analyzed using Statistical Package for Social Sciences version 20 (SPSS Inc., Chicago, IL, USA) and Microsoft word and Excel were

used to generate graphs, tables etc. Descriptive statistics like mean, median, Standard deviation (SD), Inter-quartile range (IQR), percentages were calculated. Suitable test of significance was used as required, p value <0.05 considered as significant.

## RESULTS

In this study we have recruited 110 pregnant women who presented with complaints of reduced perception of fetal movements after 37 weeks of gestation.

Table 1 shows distribution of NST/CTG at presentation. Out of 110 cases, 66 (60%) cases had reactive CTG, 19 (17.3%) had suspicious and 25 (22.7%) had pathological CTG at the time of presentation of complaints.

**Table 1: Distribution of NST/CTG at presentation.**

CTG at presentation	Number of cases	Valid percent
<b>Reactive</b>	66	60
<b>Suspicious</b>	19	17.3
<b>Pathological</b>	25	22.7
<b>Total</b>	110	100

Table 2 shows diagnostic value of NST/CTG in predicting MSAF. Out of 22 cases (20%) where MSAF was present, 10 cases (45.45%) had pathological CTG. Out of 88 cases (80%) where MSAF was absent, 60 cases (68.18%) had reactive CTG. The p value was 0.002 which was statistically significant.

**Table 2: Diagnostic value of NST/CTG in predicting MSAF.**

MSAF	Reactive NST/CTG (%)	Suspicious NST/CTG (%)	Pathological NST/CTG (%)	Total (%)
<b>Absent</b>	60 (90.9)	13 (68.4)	15 (60)	88 (80)
<b>Present</b>	6 (9.1)	6 (31.6)	10 (40)	22 (20)
<b>Total</b>	66 (100)	19 (100)	25 (100)	110 (100)

**Table 3: Diagnostic value of NST/CTG in predicting APGAR score categories at 1 min.**

APGAR categories at 1 min	Reactive NST/CTG (%)	Suspicious NST/CTG (%)	Pathological NST/CTG (%)	Total (%)
<b>4-6= moderate depression</b>	10 (15.2)	10 (52.6)	19 (76)	39 (35.5)
<b>7-9 =depression</b>	56 (84.8)	9 (47.4)	6 (24)	71 (64.5)
<b>Total</b>	66 (100)	19 (100)	25 (100)	110 (100)

**Table 4: Diagnostic value of NST/CTG in predicting APGAR score categories at 5 minutes.**

APGAR categories at 5 min	Reactive NST/CTG (%)	Suspicious NST/CTG (%)	Pathological NST/CTG (%)	Total (%)
<b>4-6= moderate depression</b>	1 (1.5)	1 (5.3)	2 (8)	4 (3.6)
<b>7-9 =depression</b>	65 (98.5)	18 (94.7)	23 (92)	106 (96.4)
<b>Total</b>	66 (100)	19 (100)	25 (100)	110 (100)

**Table 5: Diagnostic value of NST/CTG in predicting neonatal distress.**

Neonatal distress	Reactive NST/CTG (%)	Suspicious NST/CTG (%)	Pathological NST/CTG (%)	Total (%)
<b>No</b>	45 (68.2)	3 (15.8)	2 (8)	50 (45.5)
<b>Yes</b>	21 (31.8)	16 (84.2)	23 (92)	60 (54.5)
<b>Total</b>	66 (100)	19 (100)	25 (100)	110 (100)

Table 3 shows diagnostic value of NST/CTG in predicting APGAR score categories at 1 min. Out of 39 moderately depressed neonates, 19 (48.17%) neonates belonged to pathological CTG group. Out of 71 neonates who did not have any depression, 56 (78.87%) neonates belonged to reactive CTG group. The P value was <0.001 which was statistically strongly significant.

Table 4 shows diagnostic value of NST/CTG in predicting APGAR score categories at 5 minutes. Out of 4 moderately

depressed neonates, 2 (50%) neonates belonged to pathological CTG group. Out of 106 neonates who did not have any depression, 65 (61.32%) neonates belonged to reactive CTG. The P value was 0.309 which was statistically not significant.

Table 5 shows diagnostic value of NST/CTG in predicting neonatal distress. Among 110 cases, more than half of neonates i.e. 60 neonates had neonatal distress, of which, 23 neonates (38.33%) belonged to pathological CTG

group. Out of 50 neonates who didn't had neonatal distress, majority i.e. about 45 (90%) neonates belonged to reactive CTG. The p value was <0.001 which was statistically strongly significant.

Table 6 shows diagnostic value of NST/CTG in predicting neonatal resuscitation. In our study, among 21 neonates who had neonatal resuscitation, 13 (62%) neonates belonged to pathological CTG group. Out of 89 neonates who didn't had any resuscitation, majority of them i.e. 63

(70.7%) neonates belonged to reactive CTG. The P value was <0.001 which was statistically strongly significant.

Table 7 shows diagnostic value of NST/CTG in predicting neonatal ICU admission. In our study, among 44 neonates who had NICU admission, 20 (45.45%) neonates belonged to pathological CTG. Out of 66 neonates who didn't require NICU admission, 53 (80.3%) neonates belonged to reactive CTG. The p value was <0.001 which was statistically strongly significant.

**Table 6: Diagnostic value of NST/CTG in predicting neonatal resuscitation.**

Resuscitation	Reactive NST/CTG (%)	Suspicious NST/CTG (%)	Pathological NST/CTG (%)	Total (%)
No	63 (95.5)	14 (73.7)	12 (48)	89 (80.9)
Yes	3 (4.5)	5 (26.3)	13 (52)	21 (19.1)
<b>Total</b>	66 (100)	19 (100)	25 (100)	110 (100)

**Table 7: Diagnostic value of NST/CTG in predicting neonatal ICU admission.**

NICU admission	Reactive NST/CTG (%)	Suspicious NST/CTG (%)	Pathological NST/CTG (%)	Total (%)
No	53 (80.3)	8 (42.1)	5 (20)	66 (60)
Yes	13 (19.7)	11 (57.9)	20 (80)	44 (40)
<b>Total</b>	66 (100)	19 (100)	25 (100)	110 (100)

Table 8 shows distribution of cases based on duration of hospital stay. In our study, among 110 cases, 44 neonates got admitted to NICU. Maximum number of neonates i.e. 12 (10.9%) neonates had stay for 4 days. Mean duration of stay in NICU was, mean $\pm$ SD = 5.2 $\pm$  2.27 days. Range was between 1-10 days.

**Table 8: Distribution of cases based on duration of hospital stay.**

Duration of stay in NICU in days	Number of neonates	Valid percent
1	1	0.9
2	3	2.7
3	4	3.6
4	12	10.9
5	5	4.5
6	4	3.6
7	6	5.4
8	2	1.8
9	1	0.9
10	3	2.7
<b>Number of neonates who were shifted to mother side</b>	69	62.7
<b>Total</b>	110	100

Table 9 shows distribution of neonatal complications among cases.

In our study, out of 110 neonates, all neonates had good outcome. There were no perinatal deaths in our study.

**Table 9: Distribution of neonatal complications among cases.**

Complications	Number of neonates	Valid percent
MAS	11	10
Early ONST sepsis (EOS)	10	9.09
TTNB	8	8.18
Perinatal asphyxia	6	5.45
Congenital pneumonia	3	2.72
Congenital pneumonia with EOS	2	1.81
Secondary apnea with EOS	1	0.90
Perinatal asphyxia with EOS	1	0.90
Perinatal asphyxia with MAS	2	1.81
Hypoglycemia	1	0.90
Hypoglycemia with EOS	1	0.90
Hypoglycemia with TTNB	1	0.90
SGA	1	0.90
RDS	1	0.90
No complications	60	54.54
<b>Total</b>	110	100

## DISCUSSION

In a developing country like India, screening test offered to patients should be simple, non invasive, less time consuming so that large number of patients can be

screened in short time and cost effective for it to be acceptable by the patients.

Fetal movement monitoring by the mother provides a subjective assessment of fetal wellbeing in contrast to the cardiotocogram, which provides an objective assessment of intrauterine fetal condition. Decreased perception of fetal movements provides us a group of high risk patients who can be readily assessed by cardiotocogram for immediate identification of fetus in distress and to plan further intervention accordingly. Thus we conducted this prospective observation study. The mean gestational age at the time of admission was 38 weeks 1 day in our study.

In our study, out of 110 cases, 66 (60%) cases had reactive CTG, 19 (17.3%) had suspicious and 25 (22.7%) had pathological CTG at the time of presentation of complaints. Similar results were found in study done by Neogi et al, where normal, suspicious and abnormal CTG were 70%, 16% and 14% respectively.<sup>9</sup>

In our study, out of 110 cases, 22 cases (20%) had meconium stained amniotic fluid (MSAF). In study done by Syeda et al, 14/50 (28%) had meconium stained liquor (MSL).<sup>10</sup> Another study by Neogi et al had 32% incidence of MSL of which 43.75% had pathological CTG. In our study, 45.45% had pathological CTG. It also showed that in normal CTG group, 92.9% had clear liquor. However in our study, 90.9% cases of reactive CTG had clear amniotic fluid. The p value was 0.002 which was statistically significant.

Out of 110 neonates, 35.45% neonates had moderate depression and 64.55% neonates had no depression at 1 minute. However, in similar study done by Neogi et al, 72% neonates had no depression, 15% neonates had moderate depression and 7% neonates had severe depression.<sup>9</sup> In our study we did not have any severely depressed baby. Out of 39 moderately depressed neonates, nearly half of them, 19 (48.7%) neonates belonged to pathological CTG group. Out of 71 neonates who did not have any depression, 56 (78.8%) neonates belonged to reactive CTG group, and only 6 (8.5%) neonates belonged to pathological CTG. The P value was <0.001 which was statistically strongly significant.

Out of 110 neonates, only 4 (3.63%) neonates had moderate depression and 106 (96.36%) neonates had no depression at 5 minute. There was significant improvement in neonates by 5 mins of life. In similar study done by Neogi et al, 86% neonates had no depression, 7% neonates had moderate depression and 1 baby had severe depression at end of 5 mins.<sup>9</sup> Out of 4 moderately depressed neonates in our study, 2 belonged to pathological CTG. Out of 106 neonates who did not have any depression, 23 neonates belonged to pathological CTG. The P value was 0.309 which was statistically not significant. However, similar study done by Mamta et al showed the association between CTG and APGAR score

at 5 mins which was statistically significant with p value of 0.001.<sup>11</sup>

In our study, among 21 neonates (19.1%) who had neonatal resuscitation, 13 (62%) neonates belonged to pathological CTG. Out of 25 neonates who belonged to pathological CTG, 13 neonates (52.0%) had resuscitation compared to only 3 neonates (4.5%) who belonged to reactive CTG. The P value was <0.001 which was statistically strongly significant. Similar study done by Salma et al had 49% of neonates who required neonatal resuscitation which was high compared to our study may be due to increased preterm delivery as they have included women after 34 weeks of gestation.<sup>12</sup>

In our study, among 44 neonates who had NICU admission, 20 (45.5%) neonates belonged to pathological CTG. Out of 66 neonates who didn't require NICU admission, only 5 (7.5%) neonates belonged to pathological CTG. The p value was <0.001 which was statistically strongly significant. Similar results were found in study by Mamta et al.<sup>11</sup>

In our study, 44 neonates got admitted to NICU. Maximum number of neonates i.e. 12 (27.3%) neonates had stay for 4 days. Maximum duration of stay in the hospital was 10 days which was due to perinatal asphyxia with MSAF-1 baby, congenital pneumonia with early onset sepsis (EOS) -1 baby, and culture proven EOS -1 baby. Three neonates were shifted to mother side within 24 hrs of birth, all of them were admitted i/v/o TTNB. Mean duration of stay in NICU was, mean±SD - 5.2±2.27 days. Range was between 1-10 days

In our study, due to early identification of neonates at risk and timely intervention, final outcome of all neonates were good. Similar study done by Neogi et al showed 6 % incidence of still birth in their study.<sup>9</sup> Similar study done by Mamta et al also found that out of 14 women who persistently complained of RFM despite explaining DFMC, 6 had poor fetal outcome and the association between DFMC and fetal outcome was statistically significant.<sup>11</sup> Study done by Salma et al also showed 8 early neonatal deaths, which was more in non-reassuring CTG group. However their study included preterm after 34 weeks.<sup>12</sup>

## CONCLUSION

From our study we suggest that NST/CTG is a useful screening test in women presenting with reduced perception fetal movements at term gestation. It is of greatest value to note that the need for early intervention can be reduced in those patients with normal CTG/NST. Early approach to healthcare facility and timely intervention by the health care providers can reduce associated complications and improve perinatal outcomes in all these cases.

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