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RESEARCH ARTICLE

Role of admission cardiotocography in predicting pregnancy outcome in postdated pregnancies

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ABSTRACT

Background: Admission cardiotocography (CTG) comprises recording of foetal heart rate and uterine contractions for 20 minutes done at the time of admission to labour room. This test can identify foetuses who are compromised during early labour and are in need for continuous foetal monitoring. **Aim:** To evaluate the role of admission cardiotocography in predicting the pregnancy outcome in post-dated pregnancies. **Methodology:** This study was a hospital based cross-sectional study conducted in the department of obstetrics and gynaecology, Jorhat Medical College and Hospital from July 2021 to June 2022. Admission cardiotocography was done in 90 post-dated pregnant women with singleton pregnancies admitted in labour room. **Results:** The admission CTG was normal in 70 % of all patients, suspicious in 10% and pathological in 20 %. The neonatal outcomes in term of foetal distress, meconium stained liquor and NICU admissions were considerably higher in patients with pathological result. The sensitivity of test was 81.4% and specificity was 92%.**Conclusion:** Admission CTG is a simple, useful screening test and serves as a non-invasive tool in forecasting the adverse foetal outcomes in high risk pregnancies.

Keywords: Admission test, post-dated pregnancy, perinatal outcome.

Delivery of a healthy baby is one of the most important concern for an obstetrician. The passage of the foetus from an intrauterine to extrauterine environment needs surveillance as the mechanism of labour itself presents as a physiological stress to the foetus. A healthy foetus can well tolerate this stress, but an already compromised one can't sustain this. So, the potential risk of intra-partum hypoxia and subsequent hypoxic ischemic encephalopathy is common in high-risk pregnancies like post-dated pregnancy. The duration of pregnancy is 40 weeks (280 days) and is calculated from the Last Menstrual Period (LMP), according to Naegele's rule. Only 4% (1 in 20) of women deliver on the expected date of delivery (EDD).The management of pregnancy beyond expected date relies on an accurate assessment of the gestational age, calculated from the last menstrual period (LMP) assuming normal 28 days cycle (Naegele's formula).

Dating gestational age on the basis of first date of last menstrual period (LMP) alone assumes both accurate recall by the patient and ovulation on the 14th day of menstrual cycle, therefore, dating scan is a more accurate assessment of gestational age than last menstrual period with fewer pregnancies past 40 weeks of gestation. Although, term pregnancy is between 37-42 weeks of gestation, there is increased risk of maternal and foetal jeopardy after the expected date of delivery, thereby causing considerable anxiety to the mother and the treating obstetrician[1]. In a pregnancy which has crossed the expected date of delivery, the risk of intrapartum foetal distress increases mostly due to placental ageing, oligohydramnios, meconium-stained liquor, macrosomia, foetal post maturity syndrome[2].

In busy labour room wards with heavy workload and less trained manpower providing one to one care of intermittent auscultation is difficult. For good results with auscultation,

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one must listen to the foetal heart rate for one minute every 15 minutes perfectly after a contraction in the first stage of labour and after every 5 minutes in the second stage of labour [3]. This may not be feasible in many centres.

Also, other aspects of the foetal heart, such as baseline variability, accelerations, and decelerations cannot be assessed by auscultation. Therefore, there should be an ideal technology for monitoring labour which is non-invasive, reliable, accessible, easily interpretable, and capable of detecting irregularities in the course of labour. Cardiotocography can monitor baby's heart rate and the mother's uterine contractions and record them electronically on a paper. This is done by using a Doppler ultrasound transducer to monitor the baby's heart rate and a pressure transducer to monitor the uterine contractions. So, emphasis was laid on using cardiotocography as an admission test for early predictivity of labour outcome.

Admission cardiotocography (CTG) comprises a CTG of 20 minutes done at admission to labour room. The main justification for admission CTG is that the uterine contractions of labour decrease the placental circulation; an abnormal tracing indicates a deficiency and hence identifies foetal compromise at an early stage to allow intervention. Cardiotocography (CTG) has high sensitivity but only a limited specificity in predicting foetal hypoxia/acidosis [4]. This study was done to evaluate the role of admission CTG in predicting intrapartum foetal distress mostly due to oligohydramnios or meconium-stained liquor, the appearance of abnormal foetal heart patterns had great impact on mode of delivery, perinatal outcome and NICU admissions.

Methods and materials

This was a hospital based cross-sectional study conducted in the department of obstetrics and gynaecology, Jorhat Medical College and Hospital from July 2021 to June 2022. Approval of the institutional ethics committee was taken prior to commencement of the study.

From hospital indoor records, average number of postdated pregnancy cases admitted per month in the Obstetrics and Gynaecology Department of Jorhat Medical College and Hospital who meet the inclusion and exclusion criteria of the proposed study was 30. Data collection was done for 6 months. Therefore, the total population was 180. By probability proportional to size 50% of the population was taken according to convenience. So, the estimated sample size was 90.

Patients were selected by consecutive sampling.

Selection criteria -

Inclusion criteria

- Pregnant women who had crossed 40 weeks of gestation with a dating scan.
- Singleton pregnancies.

Exclusion criteria

- Patients who refused to be a part of the study
- Post caesarean section patients
- Multifoetal pregnancy
- Intrauterine foetal death
- Congenital anomalies
- Antepartum haemorrhage
- Hypertensive disorders of pregnancy
- Gestational diabetes mellitus

On admission, patients were first given a description of the procedure they had to undergo after a preliminary history taking, thorough general examination and obstetric examination. Informed consent was taken. Data were collected using a standard proforma.

Later patients were subjected to admission test using - Mediveron CTG Machine, Model: MV-CT in semi-fowler position. Recording of foetal heart rate and uterine contractions for a period of 20 minutes was done. The FHR tracings were classified as normal, suspicious or pathological according to the classification proposed by NICE (National institute of clinical excellence) guidelines 2017 [5]. Patients with a normal reactive test were monitored by intermittent auscultation for 1 minute, every 30 minutes in the 1st stage of labour and every 5 minutes in the second stage of labour.

Table 1: Definition of CTG tracings (NICE guidelines 2017)

Categories	Definition
Normal	An FHR trace in which features are classified as reassuring.
Suspicious	An FHR trace with 1 no reassuring feature and 2 reassuring features.
Pathological	An FHR trace with 1 abnormal feature or 2 no reassuring features

Those with suspicious tracings were placed on continuous CTG monitoring. In patients with a pathological tracing delivery was hastened by operative, instrumental intervention depending upon the stage of labour. Perinatal outcome was assessed in terms of the colour of the liquor, APGAR score, NICU admission and perinatal mortality. Statistical analysis: All characteristics were summarized descriptively. Data were analysed using SPSS software and Microsoft excel. Chi-square ($\chi 2$) test was used for association between two categorical variables. If the p-value was <0.05 then the results were considered to be statistically

Table 2: Pathological classification proposed by NICE

Description	Features Baseline (beats/minute)	Baseline variability (beats/minute)	Declarations
Reassuring	110 to 160	5 to 25	None or early variable decelerations with no concerning characteristics for less than 90 minutes
Non-reassuring	100 to 109 or 161 to 180	Less than 5 for 30 to 50 minutes or more than 25 for 15 to 25 minutes	Variable decelerations with no concerning characteristics for 90 minutes or more OR Variable decelerations with any concerning characteristics in up to 50% of contractions for 30 minutes or more or Variable decelerations with any concerning characteristics in over 50% of contractions for less than 30 minutes or Late decelerations in over 50% of contractions for less than 30 minutes, with no maternal or foetal clinical risk factors such as vaginal bleeding or significant meconium.
Abnormal	Below 100 or Above 180	Less than 5 for more than 50 minutes or more than 25 for more than 25 minutes or Sinusoidal	Variable decelerations with any concerning characteristics in over 50% of contractions for 30 minutes (or less if any maternal or foetal clinical risk factors) or Late decelerations for 30 minutes (or less if any maternal or foetal clinical risk factors) or Acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more.

significant otherwise it was considered as statistically non-significant.

Results

Out of the 90 patients, majority (61%) were primigravida and 35% were multigravida. According to the age distribution it was seen that majority (64%) were in the age group 20-25 years. The socioeconomic status of all the participating women were studied according to the modified Kuppuswamy scale 2019 and it was found that majority (53.33%) belonged to class IV (upper lower). Out of the total 90 patients, 63.3 % were booked and 36.7 % were unbooked. Majority (70%) patients belonged to gestational age between >40 – 41 weeks, followed by 26.7% between >41 – 42 weeks and 3.3% >42 weeks and it was seen that the percentage of abnormal admission test results increased as gestational age increased beyond EDD.

Table 3: Gestational age with admission CTG results

Gestational age	Admission test result (%)		
	Normal	Suspicious	Pathological
>40- 41 weeks	74.6	9.5	15.9
>41-42 weeks	66.67	12.5	20.83
>42 weeks	0	0	100
P value = 0.0116			

About 70% of the patients had normal admission test, 10% suspicious and 20% pathological. Out of patients with normal test 7% were associated with foetal distress.

Higher percentage of foetal distress was observed in suspicious admission test (44%) and pathological admission test (100%).

Meconium- stained liquor was seen in 11% patients with pathological result, as compared to 44.4% with suspicious and 77.8% with normal results (table 4).

All the patients with normal CTG result were allowed to progress into labour and intermittent auscultation of FHR was done. 53.97%had normal vaginal delivery, 12.7% had ventouse delivery due to meconium-stained liquor or foetal distress in second stage of labour or prolonged second stage of labour. 33.33% of patients underwent caesarean section due to non-progress of labour, cephalopelvic disproportion, gross oligohydramnios, foetal distress. The patients with suspicious result were under continuous CTG monitoring

Table 4: Association of foetal outcomes with admission CTG result

Outcome	Normal (%)	Suspicious (%)	Pathological (%)
Meconium-stained liquor	11	44.4	77.8
Foetal distress	7	44	100
APGAR score <7 at 5 minutes	3.17	33.33	61.11
NICU admission	3.17	33.33	61.11
P value <0.0001			

Table 5: Association of admission CTG with mode of delivery

CTG result	Vaginal delivery (%)	Ventouse delivery (%)	Caesarean section (%)
Normal	53.97	12.7	33.3
Suspicious	22.2	33.3	44.4
Pathological	0	0	100
P value <0.0001			

Table 6: Sensitivity and specificity for predicting foetal distress

Factor	Percentage
Sensitivity	81.4%
Specificity	92%
Positive predictive value	81.4%
Negative predictive value	92%
Diagnostic accuracy	88.9%

22.22% had normal vaginal delivery, 33.33% had ventouse delivery, and 44.44% had caesarean section. The incidence of LSCS was 100% with pathological result as compared to 44.4% with suspicious and 33.33% with normal results. Instrumental delivery was higher with suspicious results i.e. 33.33% while it was 12.7 % with normal results (table 5).

Table 6, shows that cardiotocography as an admission test in post-dated pregnancies has high sensitivity (81.4%) and specificity (92%) for predicting foetal distress. As the study shows that CTG has a high negative predictive value

(92%) foetal distress can be excluded in an individual with normal result.

Discussion

Admission CTG can be used as a screening test in early labour to detect compromised foetuses on admission and thereby select the women in the need of continuous electronic foetal monitoring during labour. The use of CTG as a first line investigation for both antepartum and intrapartum monitoring has been widely advocated by some authors to decrease perinatal mortality.

A Cochrane based review recommended the use of continuous EFM be limited to high-risk pregnancies where antenatal care is inadequate with a large number of high-risk pregnancies being delivered in crowded settings and inadequate low health care provider to patient ratio [6].

In the present study, out of the 90 postdated pregnant women majority were primigravida and 64% belonged to the age group 20-25 years followed by 26-30 years. In a study conducted by Rahman H et al[7], it was seen that majority of the postdated women were primigravida and belonged to the age group 21 – 25 years (42.1%) followed by 26-28 years (31.3%). This shows that the incidence of postdatism is more in primigravidas and in the age group 20-25 years.

In this study, after a 20 minutes of admission cardiotocography in all the 90 cases it was found that 70% had normal, 10% had suspicious and 20% had pathological results. In another study conducted on postdated women by Bashir et al[8], it was found that 60% had normal result, 20 % had suspicious and another 20% had pathological result. In a study conducted by Sugandhi R[9], it was found that 76%, 16% and 8% had normal, suspicious and pathological results respectively.

When the association of CTG result with mode of delivery was analysed it was found that out of the 70% patients with normal result, 53.9% had normal vaginal delivery, 12.6% had ventouse delivery and 33.3% had caesarean section and these findings were similar to the findings of Bashir A et al[8] where in the study group out of the 60% patients with normal result 66.6% had normal delivery and 33.3% had caesarean section. There was no instrumental delivery. In the study conducted by Suganthi R[9], 92.1% had normal delivery and 7.9% had caesarean delivery. This showed that the incidence of normal vaginal delivery was more with normal CTG. Out of the 9 patients with suspicious CTG result study, 22% had normal vaginal delivery, 33.3% had ventouse delivery and 44.4% had caesarean section. In the study conducted by Bashir A et al[8] 40% had normal vaginal delivery and 60% had caesarean section. All the 18 patients with pathological result underwent caesarean section. This was similar to the study of Suganthi R[9] where all the 4 cases with pathological result underwent caesarean section. In the study conducted by Bashir A et al[8] out of the 10 patients 10% had normal delivery and 90% had caesarean section. This shows that the incidence of caesarean section was more in the abnormal CTG groups. They found a statistically significant association between non – reactive tests and increased incidence of caesarean section.

Also, significant association between abnormal CTG results and foetal distress was seen. 7% with normal result, 44% with abnormal result and 100% with pathological result developed foetal distress. These findings were similar to the study conducted by Rahman et al[7]where 11.5% with normal result, 36.4% with suspicious and 75% with pathological result developed foetal distress. In another study conducted by Sandhu et al[10] 15% with normal result, 55% with suspicious and 73% with pathological result developed foetal distress. Thus, the incidence of foetal distress was more with suspicious and pathological CTG results.3% with normal result, 33% with suspicious and 61% with pathological result had APGAR score <7 at 5 minutes and were admitted in NICU. Similarly, Joshi et al[11] found that 7.42% with normal result, 28.6% with suspicious and 66.7% with pathological result had APGAR score <7 at 5 minutes and were admitted in NICU. Rahman H et al[7] found that 6.5%, 26.1% and 64.3% had APGAR score <7 at 5 minutes and were admitted to NICU. So, these studies showed that when admission test tracings and neonatal outcome were analysed, the results showed that abnormal tracings were associated with poor foetal outcome (low APGAR scores and high NICU admissions) than reactive tracings.

When the diagnostic ability of CTG was calculated it was found that its sensitivity was 81.4%, specificity was 92%, positive predictive value was 81.4% and negative predictive value was 92% and the diagnostic accuracy was 88.9%. These findings were similar to the results of a study conducted by Mahmood et al[12] where sensitivity was 91.5%, specificity was 89.27%, positive predictive value was 80% and negative predictive value was 95.76%. In another study conducted by Rajaleksmi M et al[13] they also found similar results with sensitivity of 92.85%, specificity of 94%, positive predictive value of 87.96% and negative predictive value of 96.62%. The values obtained in the studies shows

CTG has a very high diagnostic accuracy, indicating that reactive admission test correlates well with foetal well-being.

Conclusion

Cardiotocography is useful as an admission test for screening foetuses in distress when admitted to labour room. Abnormal admission CTG predicts the increased risk of foetal distress and immediate intervention is needed. As it has high specificity and negative predictive value it can be concluded that with normal CTG result the chances of developing foetal distress is unlikely. However, in low-risk cases it may lead to unnecessary obstetric intervention and the incidence of caesarean section increases. Therefore, the routine use of cardiotocography as admission test is not recommended as it is associated with an increase in caesarean delivery rates and no improvement in perinatal outcome. The test has high specificity which makes it useful for "triaging" in-utero fetuses in developing nations where there is a huge workload, a large number of high-risk cases, and extreme lack of resources.

Conflict of interest: None. **Disclaimer:** Nil.

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