Admission Cardiotocography - A Screening Test to Predict Perinatal Outcome in High Risk and Low Risk Pregnancies

P. Sree Sailaja[1], S. Silpahasa[2], R.V. Manasa[3], Chaduvula Suresh Babu[4]

[1]Assistant Professor, Department of Obstetrics and Gynaecology, Gitam Institute of Medical Sciences and Research, Visakhapatnam, Andhra Pradesh, India. [2]Assistant Professor, Department of Obstetrics and Gynaecology, Gitam Institute of Medical Sciences and Research, Visakhapatnam, Andhra Pradesh, India. [3]Lecturer in Statistics, Department of Community Medicine, Gitam Institute of Medical Sciences and Research, Visakhapatnam, Andhra Pradesh, India. [4]Professor, Department of Obstetrics and Gynaecology, Gitam Institute of Medical Sciences and Research, Visakhapatnam, Andhra Pradesh, India.

ABSTRACT

BACKGROUND

Routine electronic foetal monitoring has become an established obstetric practice. It is the most common utilized method for the assessment of foetal wellbeing during labour. The aim of this study is to evaluate the role of admission cardiotocography (CTG) in predicting perinatal outcome in low risk and high-risk antenatal women.

METHODS

This is a prospective study conducted in the department of Ob / Gyn, GIMSR, and Teaching Hospital. A total of 282 women in labour were selected for the study. All of them were subjected to admission test which is a 20-minute recording of foetal heart rate on a cardiotocograph machine at the time of admission in labour. Foetal and perinatal outcome were correlated with Admission CTG.

RESULTS

Out of 282 women, 68 % had a normal admission test, 21 % had a suspicious test and 11 % had pathological admission test. Foetal distress developed in 51.6 % in pathological group and 14 % in normal admission test group. The specificity of Admission CTG in predicting foetal distress was 91.62 % and the negative predictive value was 85.86 %.

CONCLUSIONS

Admission test is a simple, non-invasive screening tool to identify foetal distress already present at the time of admission in both high risk and low risk women and can thereby assist in avoiding unnecessary delay in obstetric intervention.

KEYWORDS

Admission Test, Cardiotocography, Foetal Distress, Perinatal Outcome.

Corresponding Author:
Dr. P. Sree Sailaja,
Assistant Professor,
Department of OBG,
Gitam Institute of Medical Sciences & Research, Visakhapatnam - 530045,
Andhra Pradesh, India.
E-mail: sailaja.pidugu@gmail.com

DOI: 10.18410/jebmh/2020/416

How to Cite This Article:
Sailaja PS, Silpahasa S, Manasa RV, et al. Admission cardiotocography- a screening test to predict perinatal outcome in high risk and low risk pregnancies. J Evid Based Med Healthc 2020; 7(37), 2000-2004. DOI: 10.18410/jebmh/2020/416

Submission 17-06-2020,
Peer Review 22-06-2020,
Acceptance 22-07-2020,
Published 14-09-2020.

BACKGROUND

Monitoring foetal heart rate (FHR) during pregnancy and labour has a key role in assessing foetal wellbeing to optimize foetal and neonatal outcomes. Intrapartum foetal monitoring can identify early signs of developing hypoxia, so that timely intervention can prevent irreversible brain damage and death. Continuous Electronic Foetal Monitoring (EFM) was introduced into clinical practice in the late 1960s.[1] The premise of EFM rests on the assumption that, FHR is a reflection of foetal oxygenation status.[2] EFM provides a continuous record of FHR pattern over a desired length of time, usually on a two channel chart, with FHR on the upper channel and frequency, amplitude and duration of uterine contractions on the lower channel constituting Cardiotocograph (CTG).[3] It has been well established that reassuring foetal heart rate patterns is an excellent predictor of the absence of foetal academia, and abnormal CTG patterns as a predictor of current or impending foetal asphyxia.[4,5]

Ingemarrson et al described an alternative method of monitoring FHR during labour to pick the women apparently at risk, whose foetuses were compromised on admission were likely to be compromised in labour – Admission test.[6] Labour Admission test (LAT) is a 20 minute CTG on admission to the delivery suite, as a screening test to identify mothers in whom continuous EFM is needed and those who can be managed by intermittent auscultation.[7] The advantage of LAT is that it identifies foetuses that present with foetal heart rate abnormalities suggestive of chronic hypoxia or prelabour acidosis and require intensive foetal heart monitoring during labour or immediate delivery.

The objective of this study was to evaluate the predictive value of admission CTG in detecting foetal hypoxia at the time of admission in labour and to correlate the results with the perinatal outcome.

METHODS

A prospective study was conducted among 282 low risk and high-risk antenatal women, beyond 37 weeks' gestation admitted in labour ward. Informed consent was obtained from the mothers enrolled in the study. The study was approved by the Institutional Ethics Committee. Exclusive criteria were congenital abnormality, intrauterine death, gestational age < 37 weeks, multiple pregnancies, abnormal lie and presentation, Elective LSCS.

Low Risk: Antenatal women above 37 weeks gestation without any maternal or foetal complications.

High Risk: Pregnancies with medical disorders (diabetes, hypertension), PIH, post - dated pregnancy, BOH, PROM, Oligohydramnios, IUGR, Rh negative pregnancy, anaemia.

All women were subjected to Admission CTG for 20 minutes. CTG was performed using EDAN monitor F3 version in semi Fowler's position. Paper speed was set at 1 cm / min. The results of the test were categorized as Normal, Suspicious and Pathological as per NICE (National Institute of Clinical Excellence) 2017.[8]

Category	Definition
Normal	An FHR trace in which features are classified as reassuring
Suspicious	An FHR trace with 1 non-reassuring feature and two reassuring features.
Pathological	An FHR trace with 1 Abnormal feature or two non-reassuring features.

Definition of CTG Tracings (NICE Guidelines)

Patients with normal test were monitored by intermittent auscultation for 1 minute every 30 minutes in first stage and every 5 minutes in second stage. Those with suspicious tracing were subjected to continuous CTG monitoring. In patients with Pathological tracing, delivery was hastened by operative or instrumental intervention depending upon the stage of the labour. Perinatal outcome was assessed in terms of colour of liquor, five-minute APGAR score, NICU admission and perinatal mortality.

Statistical analysis of the variables was done using Chi square test. A 'p' value of < 0.05 was considered significant.

RESULTS

Variable	Frequency	Percent
Age		
≤ 20	25	8.9
21 - 25	145	51.4
26 - 30	85	30.1
31 - 35	26	9.2
36 - 40	1	0.4
Parity		
Primi	174	61.7
Multi	108	38.3
Gestational age		
37 - 40 weeks	269	95.4
> 40 weeks	13	4.6
Risk factors		
IUGR	7	5.42
PROM	28	21.7
BOH	6	4.65
Oligohydramnios	28	21.7
Post dated	13	10.1
HTN	19	14.7
Diabetes	13	10.1
Rh negative pregnancy	11	8.53
Others	4	3.1

Table 1. Distribution of Demographic Variables, Clinical Characteristics and Risk Factors in the Study Population

Out of the 282 cases, majority of the patients were in the age group of 21 to 25 years (51.4 %), followed by the age group of 26 to 30 years (30.1 %). 61.7 % were primigravida and 38.3 % were multigravida. 153 were low risk antenatal women and 129 were high risk antenatal women. Among high risk antenatal women, 21.7 % were oligohydramnios, 21.7 % were PROM followed by 14.7 % PIH and 10.1 % postdated and Diabetes (Table 1).

	Normal CTG (191)	Suspicious CTG (60)	Pathological CTG (31)	P-Value
Foetal distress	27	24	16	0.001*
Mod to thick MSL	20	20	15	0.001*
Low A/S	13	9	7	0.02*
NICU admissions	17	11	8	0.01*
Mode of Delivery				
NVD	135	18	4	0.001*
LSCS	47	38	27	
Instrumental delivery	9	4	0	

Table 2. Correlation of AT Results with Foetal Distress, Incidence of MSL, 5 min Apgar Score <7, NICU Admissions and Mode of Delivery in the Study Population

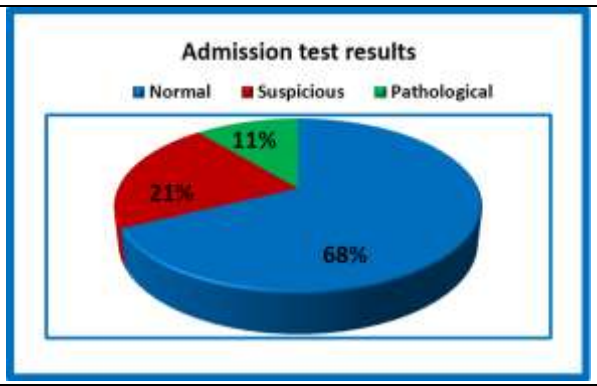

Figure 1. About 68 % Had a Normal Admission CTG. 21 % Had a Suspicious CTG and 11 % Had a Pathological CTG

As shown in Table (2), Foetal distress was more common in pathological group (51. 61 %) followed by 40 % in suspicious group. The reactive group had foetal distress in only 14 % of the cases. The correlation of LAT with foetal distress was statistically significant (p = 0.001).

Moderate to thick meconium stained liquor was seen in 48.38 % with pathological AT compared to 33.33 % with suspicious AT and 10.47% with normal AT. The correlation of LAT with Meconium stained liquor was found to be statistically significant. (p = 0.001).

5-minute APGAR score < 7 was seen in 29 cases out of 282 cases. The incidence of low APGAR score was more in pathological AT (22.6 %) followed by 15 % in suspicious AT and 6.8 % in Normal AT. 28 out of 29 cases had a 5-minute APGAR score of 4 to 6 and 1 case with suspicious CTG had an APGAR score of < 4.

The correlation of LAT with low APGAR score was found to be statistically significant. (p= 0.02). NICU admissions were the highest in Pathological AT (25. 8 %) followed by 18.33 % in suspicious AT and 8.9 % in normal AT group. The correlation of LAT with NICU admissions was found to be statistically significant (p=0.01).

There was only one neonatal death in mother with suspicious CTG due to birth asphyxia which had an APGAR score of < 4 at 5 minutes.

The incidence of vaginal delivery was more common in normal AT group (70.7 %) followed by 30 % in suspicious group and 13 % in pathological AT (Table 2). In comparison to pathological AT group, where the incidence of LSCS was 87 %, the normal AT group had 24.6 % of LSCS, while the suspicious AT had 63.3% of LSCS. Instrumental delivery was 4.7 % in normal AT and 6.7 % in suspicious AT. Statistically significant difference between mode of delivery depending upon the results of admission CTG was observed. (p=0.001).

CTG Results	High Risk Cases (129)		Low Risk Cases (153)	
	Count	%	Count	%
Normal	72	55.81	119	77.78
Suspicious	38	29.46	22	14.38
Pathological	19	14.73	12	7.84

Table 3. Distribution of AT Results in Low-Risk and High-Risk Groups

Chi-square value = 15.48 Df= 2 p-value = 0.01*

153 were low risk antenatal women and 129 were high risk antenatal women. Out of 129 high risk cases, 55.8 % had normal AT, 29.4 % had suspicious AT and 14. 73 % had pathological AT. Out of 153 low risk cases, 77.78 % had normal AT, 14.38 % had suspicious AT and 7.84 % had pathological AT. The incidence of pathological AT was more in High risk group when compared to low risk group and the difference in AT results between high risk and low risk groups was statistically significant. (p=0.01).

In 153 low risk women, foetal distress was seen in 28 cases (18.3 %). The incidence of foetal distress in normal AT and abnormal AT groups was 9.2 % and 41.6 % respectively. (Table 4). In 129 high risk women, foetal distress was seen in 39 cases (30.2 %). The incidence in normal AT and abnormal AT was 22.2 % and 57.89 % respectively. The incidence of meconium stained liquor is more in high risk group (15.2 % vs 52.63 % in normal AT vs pathological AT), when compared to low risk group (7.56 % vs 41.67 % in normal AT vs pathological AT).

The incidence of low APGAR score at 5 min is more in high risk group (12.5 % vs 31.58 % in normal AT vs pathological AT) when compared to low risk group (3.36 % vs 8.33 % in normal AT vs pathological AT). 15 cases of low risk group (9.8 %) and 21 cases of high-risk group (16.2 %) were admitted to NICU. The correlation of LAT with foetal distress, MSL, low APGAR score and NICU admissions in low risk cases were found to be statistically significant. In high risk group, the correlation of LAT with foetal distress and MSL was statistically significant (p=0.001). But the correlation of LAT with low APGAR score and NICU admissions was found to be statistically insignificant.

In 153 low risk women, caesarean section was performed in 38 women (24.8 %). Among normal AT and abnormal AT cases, the caesarean rates were 16.8 % and 75 % respectively. (Table 4). In 129 high risk women, caesarean section was performed in 74 women (57.3 %). Among normal AT and abnormal AT cases, the caesarean

	Low Risk Cases (153)				High Risk Cases (129)			
	Normal CTG (119)	Suspicious CTG (22)	Pathological CTG (12)	P-Value	Normal CTG (119)	Suspicious CTG (22)	Pathological CTG (12)	P-Value
Foetal Distress	11 (9.24)	12 (54.55)	5 (41.67)	0.001*	16 (22.22)	12 (31.58)	11 (57.89)	0.001*
MSL	9 (7.56)	9 (40.91)	5 (41.67)	0.001*	11 (15.28)	11 (28.95)	10 (52.63)	0.001*
5 min A/S <7	4 (3.36)	4 (18.18)	1 (8.33)	0.02*	9 (12.5)	5 (13.16)	6 (31.58)	0.11
NICU Admissions	7 (5.88)	6 (27.27)	2 (16.67)	0.001*	10 (13.89)	5 (13.16)	6 (31.58)	0.15
Mode of Delivery								
NVD	92 (77.31)	9 (40.91)	3 (25.00)	<0.01*	43 (59.72)	9 (23.68)	1 (5.26)	<0.01*
LSCS	20 (16.81)	9 (40.91)	9 (75.0)		27 (37.50)	29 (76.32)	18 (94.74)	
Instrumental Delivery	7 (5.88)	4 (18.18)	0 (0.0)		2 (2.78)	0 (0.0)	0 (0.0)	

Table 4. Correlation of AT Results with Foetal Distress, Incidence of MSL, 5 min. Apgar Score < 7, NICU Admissions and Mode of Delivery in High Risk and Low Risk Groups

rates were 37.5 % and 94.74 % respectively. Correlation of labour admission test with mode of delivery was found to be statistically significant in both high risk and low risk women ($p < 0.01$).

	Present Study
Sensitivity	37.20 %
Specificity	91.62%
Positive predictive value (PPV)	51.61%
Negative predictive value (NPV)	85.86%
Diagnostic accuracy	81.08%

Table 5. Diagnostic Performance of Admission Test in Predicting Foetal Distress

The above table shows that admission CTG has a high specificity in predicting foetal distress (91.62 %). High negative predictive value enables a clinician to accurately exclude foetal distress in an individual patient.

DISCUSSION

LAT could be utilized as a screening tool in early labour to detect compromised foetuses on admission, and select women who may benefit with continuous CTG monitoring.
According to the 20-minute Admission CTG tracing done in our subjects, 68 % had normal AT, 21 % had suspicious AT, and 11 % had pathological AT results. The results were comparable to the study by Hafizur R et al, Kumar A et al and Sandhu et al.[9,10,11]

The incidence of foetal distress was 51 % in pathological AT group and 14 % in normal AT group. Ingemarrson et al study in low risk patients had foetal distress of 40 % in pathological group and 1.4 % in reactive group.[6] Gurung et al study in low risk and high risk patients had foetal distress in 50 % of the pathological group.[12] Kumar A et al study in high risk patients had foetal distress in 55 % of pathological AT group compared to 13.5 % in reactive group.[10]

In the present study, increased rates of caesarean section were noted in pathological group (87 %) and suspicious group (63.3 %) compared to 24.6 % in normal AT group. This showed that abnormal tracings were associated with increased incidence of caesarean delivery than reactive tracings ($p=0.01$). In a study conducted by Hafizur R et al in 160 high risk women, caesarean section was done in 78.6 % of pathological group and 35.8 % in reactive group.[9] In a study conducted by Behuria S et al in 200 high risk women, 81 % underwent caesarean section in abnormal group.[13] Similarly, Vinita Das et al[14] study in high risk and low risk women and Ingemarrson et al[15] study found a statistically significant relation between abnormal test and increased incidence of caesarean deliveries. Mires et al and Impey et al reported that there is increased incidence of LSCS in the abnormal CTG group, but the difference was not statistically significant.[16,17]

In the present study 5-minute APGAR score < 7 was seen in babies of mothers in 6.8 % of the normal AT group, 15 % of suspicious AT and 22.5 % of pathological AT group while NICU admissions were seen in 8.9 % of the normal AT and 25.8 % of the pathological AT group. Similar rates of NICU admissions were obtained in the study by Kumar A et al[10] in high risk obstetric cases (6.3 % in the reactive group and 33.3 % in pathological AT group). Our study showed a significant association between suspicious and pathological AT with low APGAR score and NICU admissions ($p < 0.01$) similar to Kumar A et al study.[10] A study conducted by Shailesh B Patil involving high risk and low risk women also showed that abnormal AT is significantly associated with low APGAR score and NICU admissions.[18]

In a study by Das V et al[14] on 175 low risk and high-risk antenatal women, foetal distress was seen in 38 % of the high-risk group and 19. 5 % of the low risk group. The incidence of foetal distress was 31.5 % in high risk and 18.8 % in low risk of reactive category, whereas it was 54 % in high risk and 22.2 % in low risk of non-reactive category. Our study also showed a higher incidence of foetal distress in high risk group (30 %) compared to 18 % in low risk group, whereas foetal distress was seen in 57.8 % in high risk and 41.5 % in low risk of non-reactive category. Correlation of LAT with foetal distress was found to be statistically significant in both high risk and low risk groups.

Moorthy D K et al,[19] Ram Bharat Meena et al[20] did a study on low risk antenatal women. They found that 5 min APGAR score < 7 and NICU admissions were more commonly associated with non-reactive tracings than reactive tracings. ($p < 0.01$). Our study also showed a significant association between abnormal AT with 5 min APGAR score < 7 and NICU admissions in low risk women ($p=0.05$).

In the present study, the incidence of 5 min APGAR score <7 and NICU admissions were more in high risk group (15.55 and 5.88 % respectively) compared to low risk group (5.88 % and 9.8 % respectively). In high risk group the incidence of 5 min APGAR score< 7 and NICU admissions were more in pathological AT group (31.58 % and 31.58 % respectively) when compared to normal AT group. (12.5 % and 13.89 % respectively), but the difference was not statistically significant. This was seen due to early intervention taken in cases of suspicious and no- reactive group in high risk pregnancies. A study on 200 low risk and high-risk women by Bhartiya et al also found no significant association between admission CTG with low APGAR score and NICU admissions.[21]

Vinita Das study on efficacy of Admission test in predicting foetal distress obtained a sensitivity of 38 %, specificity of 79 %, PPV of 48 %, and NPV of 72 %.[14]
Kushtagi P study on Labour admission test showed a sensitivity of 53 %, specificity of 93 %, PPV of 61 % and NPV of 91 %.[22] Present study had a sensitivity of 37.2 %, specificity of 91.62 %, PPV of 51.61 % and NPV of 85.86 %.

CONCLUSIONS

Admission test is a simple, non-invasive test to detect intrapartum foetal distress already present at the time of admission and predicts foetal well-being for the next few hours of labour. It can be used as a screening test to detect foetal compromise in all pregnant women in labour

irrespective of risk status. This will decrease continuous electronic foetal monitoring in all high-risk cases and on the other hand alerts the obstetrician to be vigilant even in a low risk patient with abnormal admission test. This study has a high specificity and negative predictive value thereby supporting the role of admission test in identifying foetal compromise.

Financial or Other Competing Interests: None.

REFERENCES

[1] Cunningham, F. G., & Williams, J. W. (2010).Williams's obstetrics.

[2] Freeman RKGT, Nageotte MP, Miller LA. Foetal Heart Rate Monitorinng, 4th Edn.Philadelphia, USA: Lippincott, Williams and Wilkins, 2012.

[3] Text book on The Management of Labour, 3rd Edn. Sabaratnam Arulkumaran, Gita Arjun, Leonie K penna: chapter 5: pg 85.

[4] Parer JT, Ikeda T. A framework for standardized management of intrapartum foetal heart rate patterns. Am J Obstet Gynecol. 2007; 197(10:26.e1-e6.

[5] Macones GA, Hankins GD, Spong CY, Hauth J, Moore T. The 2008 National Institute of Child Health and Human Development workshop report on electronic foetal monitoring: update on definitions, interpretation and research guidelines. Obstet Gynecol. 2008; 112(3):661-666.

[6] Ingemarsson I, Arulkumaran S, Ingemarsson E, Tambyraja RL, Ratnam SS. Admission test: a screening test for foetal distress in labor. Obstet Gynecol. 1986; 68(6):800-6.

[7] Blix E, Reine L M, and Klovning A, Oian P: Prognostic value of the labour admission test and its effectiveness compared with auscultation only: A systematic review. BJOG, 2005; 112 (12): 1595 - 1604.

[8] National Institute for Health and Clinical Excellence, NICE Clinical Guideline 190.1 - Intrapartum Care. Feb, 2017. pp. 10-13.

[9] Hafizur R, Renjhen P. Dutta S. Kar S. Admission cardiotocography: Its role in predicting foetal outcome in high-risk obstetric patients. AMJ. 2012; 5(10):522-527.

[10] Kumar, Anvesha & Jaju, Purshottam. (2019). Admission test cardiotocography in labour as a predictor of foetal outcome in high risk pregnancies. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 10.18203/2320-1770.ijrcog20190981.

[11] Sandhu GS, Raju R. Admission cardiotocography Screening of High Risk Obstetric Patients. Medical J Armed Forces India. 2008; 64(1):43-5.

[12] Gurung, G., Rana, A., & Giri, K. (1). Detection of intrapartum foetal hypoxia using admission test (AT). Nepal Journal of Obstetrics and Gynaecology, 1(2), 10-13.

[13] Behuria S, Nayak R. Admission cardiotocography as a screening test in high risk pregnancies and its co-relation with perinatal outcome. Int J Reprod Contracept Obstet Gynecol. 2016; 5(10):3525-8.

[14] Das V, Katiyar N, Malik GK. Role of admission test. J Obstet Gynecol Ind. 2001; 51(1):48-50.

[15] Ingemarsson I and Arul kumaran S. The FHR Admission test. In foetal monitoring: Physiology and technique of antenatal and intrapartum foetal assessment, ed JAD spencer Turnbridge wells: 1989; castle house publications.

[16] Mires G, Williams F, Howie P. Randomised controlled trial of cardiotocography versus Doppler auscultation of foetal heart at admission in labour in low risk obstetric population. British Med J. 2001:322(7300):1457-60.

[17] Impey L, Reynolds M, Macquillan K, Gates S, Murphy S, Shell O. Admission cardiotocography: a randomized controlled trial. Lancet, 2003:361:465-70.

[18] Patil, Shailesh B. and Milind Balkrishna Patil."Role of Admission test in predicting foetal outcome in low and high risk pregnancies." (2018).

[19] Moorthy, Dhanalakshmi & Ramakrishnan, Vengadeswari. (2017). Validity of Admission test in differentiating high and low observational antenatal women- A Prospective study in a tertiary care hospital. Journal of Evolution of Medical and Dental Sciences. 6. 2109-2116. 10.14260/Jemds/2017/459.

[20] Meena RB, Vyas L, Meena BS, Khandelwal A. Perinatal Outcome by Admission Cardiotocography in Low-Risk Obstetric Population. International Journal of Advance Research & Development. 2017;2(3):13-18.

[21] Bhartiya V, Sharma R, Kumar A, Srivastava H. Admission Cardiotocography: A Predictor of Neonatal Outcome. The J of Obs and Gynec of India. 2016; 66(1):321-329.

[22] Kushtagi P, Narogoni S. Effectiveness of Labour admission test as a screening tool. J Indian Med Asso. 2002 April: 100(4):234-36.