Original Article

Frequency of Poor Apgar Score Among Neonates Delivered by Women with Normal Versus Abnormal Cardiotocography

Aqsa Mandvia[1], Pushpa Bai[1], Raveesha Kumari[2], Nazia Wagan[3], Afshan Sultana Zia[2] and Muhammad Nadeem Chohan[4]

ABSTRACT

Objective: To compare frequency of poor APGAR SCORE among neonates delivered by women with normal versus abnormal cardiotocography.

Study Design: Prospective cohort study

Place and Duration of Study: This study was conducted at the Study was conducted at Gynae / Obs Unit - I, Dow University of Health Sciences, Karachi from January to June 2019 for a period of 6 months.

Materials and Methods: All patients who fulfilled the inclusion criteria and visited OPD of Department of Gynae/Obs Unit - I, Dow University of Health Sciences, Karachi were included in the study. After ethical approval and informed and written consent patients were divided into two groups. Group A (exposed i.e. abnormal CTG) & B (non-exposed i.e normal CTG). Outcome was checked by comparing both the groups for APGAR score at 5 minutes.

Results: Total 120 low risk pregnant patients were included. The mean age of women was 27.90+4.527 years. The mean APGAR score in group A was 5.562+1.453, while in group B the mean APGAR score was 7.083+0.577.2.

Conclusion: In this study women having normal CTG has better APGAR score in their newborns as compared to abnormal CTG. CTG is a useful and indispensable adjunct to monitor the condition of endangered fetus. The number of patients having abnormal CTG in low risk pregnancies is not negligible. Abnormal CTG necessitates cesarean section. Therefore, adjunctive methods are required to improve the sensitivity and specificity of fetal monitoring if unnecessary interventions are to be avoided.

Key Words: Cardiotocography, Low risk pregnancy, APGAR score, Neonates

INTRODUCTION

The use of Cardiotocography (CTG) is increased in near past to reduce fetal and neonatal mortality. CTG is the graphic representation of fetal heart contractions and uterine contractions. An abnormal CTG suggests fetal distress, while normal CTG suggests normal fetal wellbeing [1].

CTG was developed in 1950 and its commercial use was initiated in 1960. Fetal monitoring can be done with various methods like fetal movement assessment, periodic fetal heart rate auscultation, continuous fetal heart rate monitoring, fetal biophysical profile, amniotic fluid analysis, fetal blood evaluation and Doppler velocimetry [2]

In 1952, Virginia Apgar MD, proposed "Apgar Score" which is predictive of poor neurological prognosis in neonates[3]. In a study by Alpaslan Kabar, et al, two groups of patients were compared based on cardiotocography, they found no significant difference was found in terms of APGAR score[4]. While a study by Bosnia Journal statistics found a significant difference (x2=3.841, p<0.05%), concluding that abnormal cardiotocography records very likely indicates presence of perinatal asphyxia[5]. Another study carried out in India institute of medical sciences also concluded that abnormal cardiotocography had no significant difference in immediate adverse neonatal outcome [6] In a study conducted in Bangladesh, the mean 5 minute APGAR score of patients with normal cardiotocography was 9.3 ± 1.2, while with abnormal cardiotocography, it was 8.6 ±1.6, p=0.014 [7].

In the current situation, almost all women are monitored Cardiotocographically, which in some cases leads to an unnecessary increase in number of caesarian sections being performed. Advantages of

1. Department of Gynae / Obs, Civil Hospital, Karachi.
2. Isra University Hospital, Hyderabad.
3. Department of Sindh Government Qatar Hospital Orangi Town, Karachi.
4. Department of Pediatrics, LUMHS, Jamshoro.

Correspondence: Muhammad Nadeem Chohan, Assistant Professor Pediatrics LUMHS Jamshoro.
Contact No: 0334-0397861
Email: nadeem.chohan@lumhs.edu.pk

cardiotocography are generally accepted and certainly the most widely used noninvasive technique of fetal monitoring comes out from the fact that for its implementation there are no contraindications and the cardiotocography findings can be written that is documented. The drawback of electronic fetal monitoring is its high sensitivity of 81% and low specificity 33%, leading to increase false positive result.

As the local data in this regard is sparse, this study is conducted to see frequency of poor APGAR SCORE among neonates delivered by women with normal versus abnormal cardiotocography. As the population data in this regard is controversial, so this study will clarify and reduce unnecessary caesarean section and thereby reducing maternal and neonatal morbidity.

MATERIALS AND METHODS

Operational definition:

Normal CTG: When all of the following features are present.

Fetal heart rate: 110-150 beats/min Variability: 5-25beats/min, Accelerations: upward deflection from baseline, fetal heart Rate of at least 15 bpm lasting for 15sec in 20 minutes time period. Abnormal CTG: CTG was considered "ABNORMAL" when any one of the following are present

Fetal heart rate: >150 beats/min for 15 sec. Accelerations: absence of upward deflection from baseline fetal heart rate of at least 15 bpm lasting for 15 sec. Variability: beat to beat variability< 7 at 5 minutes was taken by paedriatician at the time of birth having 2 or more years of experience.

Low risk pregnancy: Pregnancy without any known disease like hypertension, diabetes, anemia, cardiac, renal, fetal growth restriction, antepartum hemorrhage, previous caesarean section as assessed by history.

This Prospective cohort study was conducted by Non probability, consecutive sampling technique at Gynae/Obs Unit - I, Dow University of Health Sciences, Karachi from 1st January to 31st May 2019 (Total 6 months duration). All patients who fulfilled the inclusion criteria and visited OPD of Department of Gynae/Obs Unit - I, Dow University of Health Sciences, Karachi were included in the study. After ethical approval and informed and written consent patients were divided into two groups. Group A (exposed ie abnormal CTG) & B (non-exposed i.e normal CTG). Outcome was assessed by comparing both groups for APGAR score at 5 mins.

Sample size was calculated by taking Poor APGAR SCORE of abnormal CTG: 8.6 Poor APGAR SCORE of normal CTG: 9.3 by using WHO calculator, considering statistics for poor APGAR SCORE in normal as 84% and abnormal as 16%, power of test =90% the total sample size was 60 in each group. The total sample size was 120.

All women having age between 20-35 years, Parity 1-4. Gestational age 37+0 to 41+6 weeks based on 1st trimester ultrasound, Singleton pregnancy confirmed by ultrasound, Cephalic presentation confirmed by ultrasound and Latent phase of labor (cervical dilation) were included in the study. Women having any chronic disease like hypertension, diabetes, renal or cardiac disease were excluded from the study. Women having the Obstetrical complications like antepartum hemorrhage, intra uterine growth restriction (assessed by history and clinical examination), history of ruptured membranes, known fetal death and multiple gestations confirmed by Ultrasound were also excluded from the study

Patients were selected according to inclusion and exclusion criteria from labor room of Civil Hospital Karachi, and was followed till delivery and APGAR SCORE was assessed by paedriatician at the time of birth. Their case files were reviewed and patients were divided into two groups according to cardiotocography; patient with abnormal CTG was taken as exposed, while those with normal CTG will be taken as non-exposed. Pregnant women 'exposed' with abnormal cardiotocography were followed till delivery of baby. Pregnant women 'unexposed' with normal cardiotocography were also followed till delivery of baby. APGAR score of neonates at 5 minutes, and birth weight was also recorded.

Data was entered and analyzed by using SPSS version 20. Numerical variables like maternal age, parity, height, weight, gestational age, duration of labor (hours), birth weight, and APGAR score at 5 minutes was presented as mean and standard deviation. Categorical variables like mode of delivery, meconium staining and parity was presented as frequency and percentages.

The APGAR SCORE between two groups was compared using Chi square test. Level of significance was taken as <0.05. Effect modifiers such as maternal age, parity, body mass index (BMI), duration of labor (hours), meconium staining of liquor, mode of delivery, birth weight, was controlled through stratification. Post stratification Chi square test was also applied.

RESULTS

A total of 120 low risk pregnant patients were selected to conduct this study. Patients were divided into two groups, group A includes patients with abnormal CTG, while in group B patients with normal CTG were included. The mean age of 27.90+4.527 years. The descriptive statistics of age is presented in Table-1. In group A 23 patients (19.2%) were nulliparous and 37 (30.8%) were multiparous while in group B 18 patients (15%) were nulliparous and 42(35%) were multiparous. In group A gestational age was 38-39 weeks in 30 patients (25%) and was 40- 41 weeks in 30(25%), while in group B gestational age was 38-39 weeks in

19(15.2%) and was 40-41 weeks in 41(34.8%), as shown in Table-1

In group A the mean duration of labor was 2.550+1.049 hours, while in group B the mean duration of labor was 2.008+0.895 hours, as shown in Table-2 In group A the meconium staining of liquor was seen in 30(25%), while in group B the meconium staining of liquor was seen in 22(18.3%), as shown in Table-2 In our study the mean APGAR score in group A was 5.562+1.453, while in group B the mean APGAR score was 7.083+0.577, as shown in Table-3. Stratification of APGAR Score (at 5 minutes) between Exposed (abnormal CTG) & Non exposed (normal CTG) groups with respect to age is shown in table 4. Stratification of APGAR Score (at 5 minutes) between Exposed (abnormal CTG) & Non exposed (normal CTG) groups with respect to Gestational age is shown in table 5.

Table No.1: (Age, Parity, Gestational age and height Distribution with respect to groups)

Age Groups	Age (normal) CTG)	Age (Abnormal CTG)	Overall
20..28 year.1	42(35%)	19(15.2%)	61(50.2%)
29-35 years	18(15%)	4 1(34.8%)	59(49.8%)
Total	60(50%)	60(50%)	120(100%)
Mean ± SD	25.98±4. 119	29.84±4.11 1	27.90±4.527
Parity Groups	Parity (Normal CTG)	Parity {A bnom1a l CTG)	Overall
Multi parous	37(30.8%)	42(35%)	79(65.8%)
Nulli parous	23(19.2%)	18(15%)	41(34.2%)
Total	60(50%)	60(50%)	120(100%)
Gestational age (weeks) Groups	Gestational age (Normal CTG)	Gestational age {A bnom1a l CTG)	Overall
38-39	30(25%)	19(15.2%)	49(40.2°/e)
39.1-40	30(25%)	4 1(34.8%)	71(59.8%)
Total	60(50%)	60(50%)	120(100%)
Mean + SD	39.050+ (l.581	39.245+0.54 1	39.148+ (l.586
Height (meters) Groups	Height (Normal CTG)	Height (Normal CTG)	Overall
1-4-1.6	32(26.66%)	45(37.5%)	77(64. 16%)
1.7-1.8	28(23.34%)	15(12.5%)	43(35.84 0)
Total	60(50%)	60(50%)	120(100%)
Mean+, SD	1.602+0.143	1.652+0.13I	1.582+(l.138

Table No.2: (Weight, BMI, and Duration of labor and Meconium staining of liquor Distribution with respect to groups)

Weight (Kilograms) Groups	Weight (Norma l CTG)	Weight (Abnormal CTG)	Overall
55-78	52(43.34%)	48(40%)	100(83.34%)
79-100	8(6.66%)	12(10%)	20(16.66%)
Total	60(50%)	60(50%)	U0{100%)
Mean+5D	67.07 +9.359	69.47+13.291	68.27+ 11.509
BMI {Kg/m1) Groups	BMI {Norma l CTG)	BMI {Abnormal CTG)	Overall
18-26	36(30%)	44(36.66%)	80(66.66%)
27-33	24(20%)	16(13.36%)	40(33.36%)
Total	60(50")	60(50%)	120{100%)
Mean+5D	23.310+3.787	25.472+3.08S	24.39l+3.606
Duration of labor hours) Groups	Duration of labor {Normal CTG)	Du ration of labor {Abnormal CTG)	Overall
1-2	30(25%)	45(37.5%)	75(62.5%)
3-4	30(25%)	15(12.5%)	45(37.5%)
Total	60(50")	60(50%)	U0(100%)
Mean;t5D	2.55O+1.049	2.008+0.895	2.279;t1.008
Meconium staining of liquor Groups	Meconium staining of liquor {Normal CTG)	Meconium staining of liquor {Normal CTG)	Overall
No	30(25%)	38(31.7%)	68(56.7%)
Yes	30(25")	22(18.3")	52(43.3"1
Total	60(50")	60(50%)	UO(100%)

Table-3 (Mode of Delivery, Birth weight and APGAR score Distribution with respect to groups)

1ode of Delivery Groups	Mode of Delivery Normal CTG)	Mode of Delivery (Abnormal CTG)	Overall
Caesarean	20(16.7%)	1 1(9.2%)	31(25.9o/o)
Vaginal	40(33.3%)	49(40.8%)	89(74.1°/o)
Total	60(509o)	60(50°/o)	120(100%)
Birth weight (grams)Groups	Birth weight Normal CTG	Birth weight (Abnormal CTG)	Overall
2-3.5	22(18.33%)	7(5.83%)	29(24.1 6o/o)
3.6-5	38(3 1.67%)	53(44.17%)	91(75.77°/o)
Total	60(509o)	60(50%)	120(100°/o)
Mean ± SD	3.735± 1.00 1	4.255+- 0.745	3.995+- 0.916
APGAR score (at 5 minutes) Groups	APGAR score (Abnormal CTG)	APGAR score normal CTG)	Overall
2-5	20(16.66%)	0	20(16.66%)
5-1-8	40(33.34%)	60(50%)	100(83.34%)
Total	60(509o)	60(50%)	120(100°/o)
Mean+SD	5.562±1.453	7.083+- 0.577	6.323±1.340

Table No.4: (Stratification of APGAR Score (at 5 minutes) between Non Exposed (Normal CTG) & exposed (Abnormal CTG) groups with respect to age :(n=120)

Age Group30s	Groups	APGAR Score (at 5 minutes) Groups		Total	P value
		2-5	5.1-8		
20-28 years	Group A Exposed (Abnormal CTG)	12(10%)	30(25%)	42(35%)	0.450
	Group B. Non Exposed (Normal CTG)	0	21(17.5%)	21(17.5%)	
29-35 years	Group A exposed (Abnormal CTG)	7(5.84%)	11(9.16%)	18(15%)	
	Group B. non Exposed (Normal CTG)	0	39(32.5%)	39(32.5%)	
Total		19(15.84%)	101(84.16%)	120(100%)	

Table No.5: (Stratification of APGAR Score (at 5 minutes) between Exposed (abnormal CTG) & Non exposed (normal CTG) groups with respect to Gestational age :(n=120)

Gestational age (weeks) Groups	Groups	APGAR Score (at 5 minutes) Groups		Total	P-Value
		2-5	5.1-8		
38-39	Group A	6(5%)	24(20%)	30(25°/o)	0.279
	Group B	0	19(15.84%)	19(1S.84°/o)	
39.1-40	Group A	15(12.5%)	15(12.5%)	30(250/o)	
	Group B	0	41(34. 16%)	41(34.16°/o)	
Total		60(50°/o)	60(50%)	120(100%)	

DISCUSSION

CTG and ultrasonography are the essential tools for the obstetricians. The role of CTG is increasing for the detection of fetal distress and possible Caesarian section. In 20th century about 74% pregnancies were monitored by CTG. In high risk pregnancies abnormal CTG is higher as compared to low risk pregnancies ie about 7.8%. Mothers having abnormal CTG delivers 3 times higher asphyxiated newborn as compared to normal CTG women that has a higher chance to develop cerebral palsy. There is 7 times more chance of neonatal death in case of abnormal CTG. The wide use of CTG is resulting in higher rates of Cesarean Section. A higher Cesarean Section rate (72.72%) was observed in a study in the presence of pathological pattern of CTG.

An international study revealed that intrapartum fetal heart rate variability is very important in detecting fetal distress and it can be used as predictive element of APGAR score [8]. In our study the mean APGAR score in normal CTG group was 5.56, while it was 7.08 in neonates whose mothers CTG was abnormal. An unsimilar study concluded that the APGAR score was lower in neonates whose mothers CTG was abnormal as compared to mothers whose CTG was normal. They concluded that CTG is better screening tool for fetal distress. Abnormal CTG can predict poor APGAR score at five minutes. Women having the abnormal CTG had higher Caesarean section and their newborns needed the resuscitation at birth [9]. In another un-similar

study there were mixed results ie out of 249 newborns 117 had < 7 APGAR score at 5 minutes whose mother had abnormal CTG, while 128 neonates had normal APGAR score at 5 minutes [10].

In another study abnormal CTG was associated with higher neonatal admissions at NICU as compared to normal CTG i.e. (75.7% v/s 22.8%). Cesarean section rate was also higher in abnormal in non-reactive CTG group as compared to normal CTG group ie (87.8% versus 20.5%)[11]. Neonatal admission to neonatal intensive care (NICU) was required in 76.2% of patients with an abnormal CTG test result while only 36.5% of patients with the normal CTG test required NICU admission [12].

Another study had the similar results showing higher NICU admission in nonreactive group as compare to reactive group (75.7%v/s 22.8%). This study concluded that there is statistically significant role of reactivity of CTG and NICU admission. (P< 0.001)[13]. Another study concluded that CTG does not identify all infants at risk of Neonatal Encephalopathy, so further investment in new approaches to fetal surveillance in labor is needed[14].

In our study the mean age of mothers was 27.90+4.527 years. In group A gestational age was 38-39 weeks in 30 patients (25%) and was 40- 41 weeks in 30(25%), while in group B gestational age was 38-39 weeks in 19(15.2%) and was 40-41 weeks in 41(34.8%). In group A 23 patients (19.2%) were nulliparous and 37 (30.8%) were multiparous while in group B 18 patients (15%) were nulliparous and 42(35%) were multiparous.

In a similar study the mean age of mothers was 25.61±5.65 years varied from 19 to 38 years in normal CTG and 24.82±3.81 years varied from 19 to 38 years in abnormal CTG. Majority patients were prim parous in both groups (56.0% vs. 52.0%). At 1-minute APGAR score >7 was found 94.0% babies in normal CTG and 78.0% in abnormal CTG.

CONCLUSION

In this study women having normal CTG has better APGAR score in their newborns as compared to abnormal CTG. CTG is a useful and indispensable adjunct to monitor the condition of endangered fetus. The number of patients having abnormal CTG in low risk pregnancies is not negligible. Abnormal CTG necessitates cesarean section. Therefore, adjunctive methods are required to improve the sensitivity and specificity of fetal monitoring if unnecessary interventions are to be avoided.

Author's Contribution:

Concept & Design of Study:	Aqsa Mandvia
Drafting:	Pushpa Bai, Raveesha Kumari
Data Analysis:	Nazia Wagan, Afshan Sultana Zia, Muhammad Nadeem Chohan
Revisiting Critically:	Aqsa Mandvia, Pushpa Bai
Final Approval of version:	Aqsa Mandvia

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Nazir L, Lakhta G, Anees K, Khan FR, Safdar S, Nazir GR, et al. Admission Cardiotocography as a Predictor of Low Apgar Score: An Observational, Cross-Sectional Study. Cureus 2021;13(4).
2. Martis R, Emilia O, Nurdiati DS, Brown J. Intermittent auscultation (IA) of fetal heart rate in labour for fetal well- being. Cochrane Database of Systematic Reviews 2017(2).
3. Simon LV, Hashmi MF, Bragg BN. Apgar score. 2017.
4. Kaban A, CengizH, Karakas S, Ozcan A, Kaban A. The success of cardiotocography in predicting perinatal outcome. J Clin Experimental investigations 2012;3:168-71.
5. Bogdanovic G. Cardiotocography in the prognosis of perinatal outcome. Med Arch 2014; 68(2):102-5.
6. Khatun A. Role of elaborate cardiotocography in pregnancy management. Banga bandhu Sheikh Mujib Med Univ J 2009; 2(1):18-24.
7. Daly N, Brennan D, Foley M, O' Herlihy C. Cardiotocography as a predictor a. of fetal out come in women presenting with reduced fetal movement. Eur J Obstet Gynecol Reprod Biol 2011;159:157- 61.
8. Medeiros TK, Dobre M, da Silva DM, Brateanu A, Baltatu OC, Campos LA. Intrapartum fetal heart rate: A possible predictor of neonatal acidemia and APGAR score. Frontiers Physiol 2018;9:1489.
9. Waheed N, Ahmed S, Iqbal K. Fetal Outcome of Pathological Cardiotocography in Women Presenting at Term Pregnancy. J Society of Obstet Gynaecologists Pak 2019;9(1):14-8.
10. Sen, M., Samal, S., Datta, S. and George, M. Abnormal cardiotocographic findings and perinatal outcome: a prospective study 2019.
11. Gupta M, Gupta P. Role of cardiotocography in high risk pregnancy and its correlation with increase cesarean section rate. Int J Reproduction, Contraception, Obstet Gynecol 2016; 6(1):168-71.
12. Archana T, Sonal S. Study of admission cardiotocography screening of high risk obstetric cases and its correlation with perinatal outcome. Ind J Obstet Gynecol Res 2018; 5(2):209-14.
13. Gupta M, Nagar T, Gupta P. Role of cardiotocography to improve perinatal outcome in high risk pregnancy. Int J Contemporary Med Res 2017; 4(4):853-6.
14. Farquhar CM, Armstrong S, Masson V, Thompson JM, Sadler L. Clinician Identification of Birth Asphyxia Using Intrapartum Cardiotocography Among Neonates With and Without Encephalopathy in New Zealand. JAMA network open 2020;3(2):e1921363