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Original Research Article

Admission cardiotocography versus Doppler auscultation of fetal heart in high risk pregnancies in a tertiary health facility in Nigeria

Mkpe Abbey[1]*, Kinikanwo I. Green[2]

[1]Department of Obstetrics and Gynaecology, Rivers State University Teaching Hospital, Port Harcourt, Rivers State, Nigeria
[2]Department of Obstetrics and Gynaecology, University of Port Harcourt Teaching Hospital, Port Harcourt Rivers State, Nigeria

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***Correspondence:**
Dr. Mkpe Abbey,
E-mail: mkpeabbey@aol.com

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ABSTRACT

Background: Admission cardiotocography (CTG) and intermittent auscultation (IA) of the fetal heart might help to identify those foetuses that could not withstand the stress of labour and also predict neonatal outcome. The aim was to compare the associations of admission CTG findings and those of IA of the fetal heart with labour and neonatal outcome.
Methods: It was a prospective COHORT study. 30 minutes admission CTG for each of the 387 participants was interpreted, using the FIGO 2015 guideline and physiological interpretation. Admission IA was also performed on the same patients. Women whose CTG showed chronic hypoxia had caesarean section while those with either suspicious or pathological CTG, had intrapartum fetal resuscitation. Those that responded proceeded to labour during which fetal condition was monitored with IA. Data was analysed using a statistical package for social science (SPSS) software, version 19.
Results: 108 (28.57%) and 57 (15.08%) of the 378 participants had abnormal admission CTG and admission IA findings respectively. The sensitivity of abnormal admission CTG and IA to predict abnormal IA findings in labour were 70.59% and 41.18% respectively. Compared with admission IA, admission CTG was more likely to predict the following labour and neonatal outcomes: caesarean section rates 72 (70.59%) and 42 (41.18%) for admission CTG versus IA groups respectively; relative risk RR=1.714; 95% CI 1.317-2.231, 1 min Apgar score less than 7, 78 (89.66%) and 36 (41.38%); RR=2.167; 95% CI 1.670-2.810, 5 min Apgar score less than 7, 57 (90.48%) and 33 (52.38%); RR=1.727; 95% CI 1.347-2.215, admission to SCBU 51 (68%) and 30 (40%); RR=1.700; 95% CI 1.237-2.336, intrauterine fetal deaths and early neonatal death.
Conclusions: Admission CTG was a better predictor of labour and neonatal outcome than admission IA. CTG was therefore highly recommended as an integral tool in the management of labour.

Keywords: Admission cardiotocography, Doppler, Fetal heart, High risk, Tertiary health, Nigeria

INTRODUCTION

Admission CTG is a 20-30 minutes tracing of the fetal heart carried out immediately after admission to the labour ward.[1] Abnormal CTG might represent a foetus having chronic hypoxia and therefore with little reserve to withstand the stress of labour or it might be as a result of significant uterine contractions. The finding would permit timely intervention.[2-4]

Globally, approximately 140 million births occur every year.[5] The majority of these are vaginal births among pregnant women with no identified risk factors for complications, either for themselves or their babies, at the

onset of labour.[6,7] Approximately half of all stillbirths and a quarter of neonatal deaths result from complications during labour and childbirth.[8] The burden of maternal and perinatal deaths is disproportionately higher in low and middle-income countries (LMICs) compared to high-income countries (HICs). Therefore, improving the quality of care around the time of birth, especially in LMICs, has been identified as the most impactful strategy for reducing stillbirths, maternal and newborn deaths, compared with antenatal or postpartum care strategies.[9]

There is therefore good reason to monitor the foetus adequately in labour and of course on admission to the labour ward. The WHO however recommends that routine CTG is not recommended for the assessment of fetal well-being on labour admission in healthy pregnant women presenting in spontaneous labour; auscultation using a Doppler ultrasound device or Pinard fetal stethoscope is recommended for the assessment of fetal wellbeing on labour admission.[10]

When compared with intermittent auscultation, continuous CTG has been shown to decrease the occurrence of neonatal seizures, but no effect has been demonstrated on the incidence of overall perinatal mortality or cerebral palsy. However, these studies were carried out in the 1970s, 1980s and early 1990s where equipment, clinical experience and interpretation criteria were very different from current practice and they were clearly underpowered to evaluate differences in major outcomes.[11]

In spite of these limitations, most experts believed that continuous CTG monitoring should be considered in all situations where there was a high risk of fetal hypoxia/acidosis.[12] Specifically, admission CTG in high-risk obstetric population had been shown in recent studies to predict perinatal outcome.[13-15]

However in Nigeria which was a low-to-medium income country, admission and continuous CTG in labour was not a routine practice. The pinard stethoscope and sporadically the hand-held Doppler were normally used for intrapartum fetal monitoring.

Aim

The aim was to compare the associations of admission CTG and IA auscultation of the fetal heart with labour and perinatal outcome in a high risk obstetric population.

METHODS

Design

The study was of prospective COHORT design. Both CTG and IA were carried out on each patient since our ethical committee could not approve a randomisation to either an admission CTG or IA in a high risk patient. The endpoint analysis had elements of randomisation.

Place

It was carried out at Rivers state university of Port Harcourt teaching hospital (UPTH), Rivers state, Nigeria.

Study population

All patients that were recruited for the study from October 2019 to March 2020 certified the inclusion criteria which were as following: high risk obstetric population presenting in labour to the labour ward, patients must be either in the latent of active phase of the first stage of labour, gestational age at presentation must be from 32 weeks to term and post term.

Intervention

All patients who fulfilled the inclusion criteria, on admission to the labour ward, had a CTG for about 30 minutes and IA either with a pinard stethoscope or hand-help Doppler device. The CTG traces were interpreted immediately, using the FIGO 2015 guideline.[12] They were simultaneously interpreted using the guideline based on physiological interpretation of CTG.[16] That was necessary to determine the guideline that better predict or correlate with perinatal outcome. Women with normal CTG were reassured; fetal monitoring during the rest of labour was conducted by IA which (a routine practice in the hospital). Continuous electronic fetal heart rate monitoring was rarely used in the hospital.

Women whose CTG traces showed suspicious or pathological features as per FIGO classification or any of the abnormal features as per physiological interpretation were managed accordingly as per the unit guideline. Normal CTG was the same in both guidelines while suspicious CTG in the FIGO guideline corresponded to the spectrum of gradually evolving hypoxia, compensated which became pathological as the associated tachycardia, decelerations and baseline variability get worse.[12,16] In our opinion, the pathological CTG in FIGO classification correlated with worsening gradually evolving CTG compensated, gradually evolving hypoxia, compensated, gradually evolving hypoxia decompensated, acute hypoxia uncomplicated (not preceded by gradually evolving hypoxia), acute hypoxia, complicated (preceded by gradually evolving hypoxia), subacute hypoxia and chronic hypoxia.

Patients with pathological CTG were resuscitated-oxytocics stopped, tocolytics given for hyperstimulation, patients changed from recumbent to left-lateral position, iv fluids set up, pyrexia treated. Those whose CTG became normal were allowed to proceed with labour. Since CTG was not practised in the hospital, FHR monitoring was carried out by intermittent auscultation using a pinard stethoscope or a hand-held Doppler. Patients whose CTG showed chronic hypoxia had a very short period of resuscitation but to no avail and all of them ended up with caesarean section.

Main outcome measures

The primary outcome measures were suspicious or pathological CTG on admission and Apgar scores at 1 and 5 minutes. Cord blood sampling for metabolic acidosis was not practised in the tertiary centre. Secondary outcome measures included other measures of fetal condition at birth and obstetric intervention.

Sample size

Therefore the sample size for the study was calculated by applying the sample size formula for a prospective COHORT study as shown below,[17]

$$n=\frac{[Z_\alpha\sqrt{(1+1/m)P^*(1-P^*)}+Z_\beta\sqrt{P_1\left(1-P_1/m\right)+P_2(1-P_2)}]}{(P_1-P_2)^2},$$

where,

n is the minimum sample size per group,

Z_α is the standard normal deviate for α error=1.96 (at an α error 5%),

at 5% type I error ($p<0.05$), it is 1.96; if we decide to raise the degree of precision with less error, at 1% type 1 error ($p<0.01$), it will be 2.58; that will increase the power of the study. In many studies, p value is considered significant at $p<0.05$; therefore 1.96 was used in the present calculation of the sample size for the study; in a study in Nigeria, the prevalence of abnormal CTG was 130/436 (29.8%); 93/436 (21.3%) were suspicious while 37/436 (8.5%) were pathological;[18] therefore 29.8% as the prevalence of abnormal CTG was used in calculating the sample size for the present study,

Z_β is the standard normal deviate for power ($1-\beta_{error}$)=1.28 (at 90% power),

m is the ratio of control subjects to COHORT=270/108=2.5.

P_1 is the probability a normal CTG findings in the parturient which was unknown, usually taken as 50% for an unknown parameter=0.5,[19,20]

P_2 is the probability abnormal CTG findings in the parturient=29.8%=0.298.

P* is the average probability of the exposure=$\frac{P_2+mP_1}{m+1}=\frac{0.298+2.5\times0.5}{2.5+1}=0.442.$

$$n=\frac{[1.96\sqrt{(1+1/2.5)0.442\,(1-0.442)}+0.842\sqrt{0.5\,(1-0.5/2.5)+0.298\,(1-0.298)}]^2}{(0.5-0.298)^2}$$

$n=\frac{[1.96\times0.588+1.28\times0.556]^2}{0.202^2}=85.17\approx86$ parturient per group,

considering a drop-out rate of 10%=8.6≈9 minimum sample size per group=86+9=95,

minimum sample size in both group (N)=95×2=190 parturient.

Data analysis

Data was collected on a preformed proforma and then entered into SPSS 2019 for analysis. Simple proportions were used in the descriptive analysis. Quantitative data were summarized and presented as mean and standard deviation while qualitative data were presented as numbers and percentages. 9 tables that illustrated the association of admission CTG findings with the outcome of labour were created. (Risk ratio/9RR) with 95% CI was used to illustrate the differences in the associations. In Table 4, the column findings on admission CTG showed the number of foetus's that were affected in the numerator and those that were not affected in the denominator.

The interpretation of relative risk was as following: RR <1 less likelihood of developing the condition; RR=1 no difference in developing the condition; RR >1 more likelihood of developing the condition; 95% CI if its range contained 1, it was not statistically significant but if its range did not contains 1 it was statistically significant.

Ethical approval

Ethical approval for the study was granted by the university of Port Harcourt teaching hospital ethical committee.

RESULTS

Risk factors presented by the patients

The 378 participants in the study were classified as having high risk pregnancies because of the presence of the outlined risk factors in Table 1.

Socio-demographic obstetric and general characteristics of the patients

A total of 378 patients were recruited. Age distribution was computed using the WHO standard age groups which were modified.[21] The mean age of the patients was 32±0 years. The highest number of the patients was in the age bracket of less than 35 years which stood at 85.71% while those

more than 35 years of age constituted 14.29% of the study population (Table 1). Educational, employment, social, marital status and parity of the patients are as shown in Table 2.

Gestational age was stratified as WHO classification of 2012 into different degrees of preterm birth, term and post-term pregnancies.[22] This was done with a view of determining the impact of prematurity on the outcome of the pregnancy. Birth weight was classified into low, normal and high birth weights (Table 2). Stages of labour when CTG tracing was carried out was divided into latent phase of the first stage of labour (cervical dilatation up to 5 cm) and established labour (from 5 cm cervical dilatation.[10]

Admission CTG and IA findings

A total 270 (71.43%) and 321 (84.92%) of the total 378 participants had normal admission CTG and IA findings respectively while 108 (28.57%) and 57 (15.08%) of them had abnormal admission CTG and IA respectively (Table 3).

Table 1: Risk factors presented by the patients.

Pre-existing medical and gynaecological conditions	Previous poor obstetric history	Obstetric and medical conditions that develop during pregnancy	Complications in labour
Hyperthyroidism	PTL	SGA baby	CPD
Hypothyroidism	IUFD	Hydrocephalus	PTL in twins
Hepatitis B	Hydrocephalus	RFM	Chorioamnitis
Obesity	Previous c/s	Fetal growth restriction (FGR)	Breech at full dilatation
Chronic hypertension	Previous fetal weight of 4.5 kg	Hypertensive disease in pregnancy	Grand multipara in labour
Maternal anaemia		GDM	Pyrexia in labour
RVD		Malaria	
Hepatitis C		Oligohydramnious	
Hep B surface antigen positive		Polyhydramnious	
Jehovah witness		Vagina discharge and itching	
Previous mastectomy for CA breast		Placenta praevia,	
Type II diabetes mellitus		Post-term pregnancy	
Previous mastectomy for CA breast		Prolonged rupture of membranes at term	
Uterine fibroid		PPROM	
		PGP	

Table 2: Demographic, obstetric and general characteristics of the patients (N=378).

Demographic obstetric and general characteristics	Subgroup	Frequency	Percentage (%)
Age (in years)	35 and more	54	14.29
	less than 35	324	85.71
Education	Primary	6	1.59
	Secondary	75	19.84
	Tertiary	297	78.57
	Total	378	100.00
Employment	Employed	255	67.46
	Self-employed	69	18.25
	Student	6	1.59
	Unemployed	48	12.70
Social history	Drinking	12	3.17
	Smoking	12	3.17
	Nil	354	93.65

Continued.

Demographic obstetric and general characteristics	Subgroup	Frequency	Percentage (%)
Marital status	Divorced	6	1.59
	Married	360	95.24
	Unmarried	12	3.17
Parity	1 to 2	252	66.67
	3 and more	108	28.57
	Nulliparity	18	4.76
Gestational age at birth (in weeks)	Early preterm (28-30)	7	1.85
	Moderate preterm (31-33)	15	3.97
	Mild preterm (34-36)	51	13.49
	Term (37-42)	303	80.16
	Post-term (More than 42)	2	0.53
Stages of labour	Established	81	21.43
	latent	297	78.57
Neonatal weight at birth in kg	Low birth weight (1,500-2)	45	11.90
	Normal birth weight (2,500-3,99)	288	76.19
	High birth weight (4,000 and more)	45	11.91

Table 3: CTG and IA findings (N=378).

CTG			IA	
FIGO classification/physiological interpretation	**Frequency N (%)**	**Total N (%)**	**Categories**	**Frequency N (%)**
Normal/normal	270 (71.43)	270 (71.43)	Normal	321 (84.92)
Pathological/acute hypoxia (uncomplicated)	6 (1.59)	108 (28.57)		
Pathological/gradually evolving hypoxia, compensated	21 (5.56)		Abnormal	57 (15.08)
Pathological/gradually evolving hypoxia, decompensated	30 (7.94)			
Pathological/subacute hypoxia	21 (5.56)			
Pathological CTG/chronic hypoxia	12 (3.17)			
Pathological/acute hypoxia, complicated	6 (1.59)			
Suspicious/gradually evolving hypoxia, compensated	12 (3.17)			
Total	378 (100)	378 (100)	Total	378 (100)

Table 4: Relationships between admission CTG findings and those of intermittent auscultation (N=378).

Admission CTG findings	Findings on admission IA, N (%)				Total
	Abnormal	Total	Normal	Total	
Normal	0 (0.00)	0 (0.00)	270 (84.11)	270 (84.11)	270 (71.4)
Pathological/acute hypoxia uncomplicated	6 (10.53)	57 out of 108 (52.78)	0 (0.00)	51 of 108 (47.22%)	6 (1.59)
Pathological/gradually evolving hypoxia compensated)	9 (15.79)		12 (3.74)		21 (5.56)
Pathological/gradually evolving hypoxia, decompensated)	15 (26.32)		15 (4.67)		30 (7.94)
Pathological/subacute hypoxia)	21 (36.84)		0 (0.00)		21 (5.56)
Pathological/chronic hypoxia	0 (0.00)		12 (3.74)		12 (3.17)
Pathological/acute hypoxia, complicated	6 (10.53)		0 (0.00)		6 1.59
Suspicious/gradually evolving hypoxia, compensated	0 (0.00)		12 (3.74)		12 (3.17)
Total	57 (100)		321 (100)		378 (100)

Table 5: Admission CTG and IA findings as predictors of the mode of delivery; IA (N=378).

Admission IA findings	Outcome of labour				
	C/S for abnormal IA findings (%)	C/S for FTP (%)	SVD (%)	Ventous for abnormal IA findings (%)	Total (%)
Abnormal	39 (68.42)	6 (10.53)	9 (15.79)	3 (5.26)	57 (100.00)
Normal	54 (16.82)	66 (20.56)	195 (60.75)	6 (1.87)	321 (100.00)
Total	93 (24.60)	72 (19.05)	204 (53.97)	9 (2.38)	378 (100.00)

Table 6: Admission CTG and IA findings as predictors of the mode of delivery; CTG (N=378).

Admission CTG findings (FIGO classification / physiological interpretation)	Reasons for caesarean section		SVD N (%)	Ventous delivery For abnormal IA	Total
	Suspicion of fetal hypoxia N (%)	Failure to progress N (%)			
Normal/normal	27 (10.00)	63 (23.33)	177 (66.56)	3 (0.11)	270 (100.00)
Pathological/acute hypoxia, uncomplicated	3 (50.00)	0 (0.00)	3 (50.00)		6 (100.00)
Pathological/gradually evolving hypoxia, compensated	3 (14.29)	3 (14.29)	15 (71.43)		21 (100.00)
Pathological/gradually evolving hypoxia, decompensated	24 (80.00)	3 (10.00)	3 (10.00)		30 (100.00)
Pathological/subacute hypoxia	15 (71.43)	0 (0.00)	3 (14.29)	3 (14.29)	21 (100.00)
Pathological CTG/chronic hypoxia	12 (100.00)	0 (0.00)	0 (0.00)		12 (100.00)
Pathological/acute hypoxia, complicated	6 (100.00)	0 (0.00)	0 (0.00)		6 (100.00)
Suspicious/gradually evolving hypoxia, compensated	3 (25.00)	3 (25.00)	3 (25)	3 (25)	12 (100.00)
Total	93 (24.60)	72 (19.05)	204 (56.35)	9 (2.38)	378 (100)

Table 7: Predictive values of CTG and IA of the outcome of labour.

Outcomes	Number predicted (%)/total number affected		RR	95% CI	P value
	Admission CTG group	Admission IA group			
C/S and ventous for abnormal IA in labour	72 (70.59)/102	42 (41.08)/102	1.714	1.317-2.231	0.000
1 min Apgar score less than 7	78 (89.66)/87	36 (41.38)/87	2.167	1.670-2.810	0.000
1 min Apgar score 7 and more	261 (89.69)/291	270 (92.78)/291	0.967	0.838-2.435	0.187
5 Min Apgar score Less than 7	57 (90.48)/63	33 (52.38)/63	1.727	1.347-2.215	0.000
Admission to SCBU	51 (68)/75	30 (40)/75	1.700	1.237-2.336	0.001
IUFD in labour	3 (50)/6	0/6			
Neonatal death within 1 week of life	9 (100)/9	6 (66.67)/9	1.5	0.225-1.113	

Correlation of admission CTG findings with those of IA

All the 270 patients that had normal CTG confirmed by the 2015 FIGO CTG interpretation and the physiological guidelines also had normal findings on intermittent auscultation (Table 4).

57 (52.78%) of the 108 patients that had suspicious and pathological admission CTGs had abnormal admission IA findings while 51 of them (47.22%) had normal findings (Table 4).

Admission CTG findings as predictors of labour and neonatal outcomes

The outcomes that were considered were outlined in Table 5 and 6 and included the following: intrapartum fetal hypoxia, mode of delivery, 1 and 5 minutes Apgar score, intrapartum fetal deaths, neonatal admission to special care baby unit (SCBU) and early neonatal deaths.

DISCUSSION

The study investigated the predictive value of admission CTG versus admission IA in high risk obstetric population in the prediction of labour and neonatal outcome. There was no randomisation to admission CTG and IA but each patient had the two methods of fetal assessment. Interpretation of the admission CTG was carried out not on the basis of the NICE guideline of 2007, but it was based on the FIGO pattern recognition and the physiological interpretation guideline.[12,16,23] Furthermore, for patients who presented with abnormal CTG on admission, after resuscitation, continuous CTG was not used in labour; intermittent auscultation was used in monitoring fetal condition.

The pattern of both obstetric and medical conditions that characterised high risk pregnancies was the same, with very little differences, when compared with near similar studies that were carried out in the past [2,10,23] Each of the patients presented with one to 3 risk factors but the most frequent factors were hypertensive diseases in pregnancy 270 (71.43%) of the total 378 participants in the study had normal admission CTG while 108 (28.57%) had abnormal tracings. Unlike the findings on admission CTG, 57 (15.08%) of the participant patients had abnormal admission IA and 321 (84.92%) had normal findings.

Using the FIGO guideline for interpretation of the CTG, out of the 108 participants that had abnormal admission tracings, 12 (11.11%) of them had suspicious CTG while in 96 (88.90%) of the cases, the CTG was pathological. On application of the physiological interpretation, the same number of patients (108) had CTG that were not normal. The superiority of the physiological interpretation of CTG tracings lied in the stratification of the FIGO suspicious and pathological CTG into six subgroups which specifically defined the associated management plan for the patients. The subgroups were acute hypoxia (uncomplicated), gradually evolving hypoxia compensated, gradually evolving Hypoxia decompensated, subacute hypoxia, chronic hypoxia and acute hypoxia (complicated).[17] Their respective frequencies and percentages were as outlined in Table 3.

There was 100% association of normal admission CTG with normal admission IA while in 51 patients (47.22%) where admission CTG showed abnormal results, admission IA probably showed normal findings. 72 (66.67%) [(93-27)+3+3)] of the 108 patients that had abnormal admission CTG and 30 (11.11%) (27+3) of the 270 patients that had normal admission CTG ended up with abnormal IA in labour (Table 5 and 7). Therefore the incidence of abnormal IA findings in labour was 26.98% (72+30/378×100) while the sensitivity of abnormal admission CTG to predict abnormal IA findings in labour was 72/102×100=70.59%. In the same vein, 42 (73.68%) of the 57 patients that had abnormal admission IA and 60 of the 321 that had normal IA findings ended up with abnormal auscultations findings in labour (Tables 6 and 7). Therefore the sensitivity of abnormal admission IA to predict abnormal IA findings in labour was 42/42+60×100=42/102×100=41.18%. The incidence of abnormal IA findings in labour was 26.98%.

Compared with admission IA, admission CTG was statistically significantly more likely to predict the following labour and neonatal outcomes: caesarean section rates, 72 (70.59%) and 42 (41.18%) for admission CTG versus IA groups respectively; relative risk RR=1.714; 95% CI (1.317-2.231); p<0.000, 1 min Apgar score less than 7, 78 (89.66%) and 36 (41.38%); RR=2.167; 95% CI 1.670-2.810; p<0.000, 5 min Apgar score less than 7, 57 (90.48%) and 33 (52.38%); RR=1.727; 95% CI 1.347-2.215 and admission to SCBU, 51 (68%) and 30 (40%); RR=1.700; 95% CI 1.237-2.336, p<0.001. The differences were not statistically significant in the following circumstances: 1 min Apgar score 7 and more, 261 (89.69%) and 270 (92.78%); RR=0.967; 95% CI 0.838-2.435; p<0.178 and neonatal death within 1 week of life, 9 (100%) and 6 (66.67%); RR=1.5; 95% CI 0. 0.225-1.113. Regarding IUFD, there was none in the abnormal IA group but 3 (50%) out of the 6 cases occurred in the CTG group, also illustrating the superiority of admission CTG over admission IA in predicting neonatal outcome.

There were some limitations in the study. Firstly, continuous CTG was not use in labour and therefore both arms for comparison (women that had admission CTG and those that had admission IA) had the same intervention (IA) in labour. Secondly, foetal blood sampling is not normally done in labour; umbilical cord pH and base excess were not used as measures for comparison between women that had admission CTG and those that had admission IA.

CONCLUSION

The pattern of both obstetric and medical conditions that characterised high risk pregnancies was similar with those in other near similar studies that were carried out in other countries. 270 (71.43%) and 57 (15.08%) of the total 378 participants in the study had normal admission CTG and IA respectively while 108 (28.57%) and 321 (84.92%) respectively had abnormal findings. There was 100% association of normal admission CTG with normal admission IA while in 51 patients (47.22%) where admission CTG showed abnormal results, the findings on IA were normal. It was noted that physiological interpretation of the CTG redefined the findings obtained, using the 2015 FIGO interpretation, stratifying the FIGO

suspicious and pathological CTG into seven subgroups which specifically define hypoxia and the associated management plan. The incidence of abnormal IA findings in labour was 26.98% and while the sensitivity of abnormal admission CTG to predict abnormal IA findings in labour was 70.59%, that of admission IA was 41.18%.

Compared with admission IA, admission CTG was statistically significantly more likely to predict the following labour and neonatal outcomes: caesarean section rates, 1 min Apgar score less than 7.5 min Apgar score less than 7 and admission to SCBU. The differences were not statistically significant in the following circumstances, 1 min Apgar score 7 and more and neonatal death within 1 week of life. Regarding IUFD, there was none in the abnormal IA group but 3 (50%) out of the 6 cases occurred in the CTG group, also illustrating the superiority of admission CTG over admission IA in predicting neonatal outcome.

Recommendations

CTG was highly recommended as an integral tool in the management of labour in high risk pregnancies. In low and medium-income countries, at least admission CTG was highly recommended even if using it throughout labour was not affordable.

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