VOLUME - 11, ISSUE - 05, MAY - 2022 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Gynaecology

RELATIONSHIP OF CARDIOTOCOGRAPHY AND UMBILICAL ARTERY DOPPLER WITH PERINATAL OUTCOME IN PRE-ECLAMPSIA

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ABSTRACT

AIM: To find the relation of CTG and UAD with perinatal outcome in pre-eclampsia.

MATERIALS AND METHOD: The present study is a prospective longitudinal study conducted in a tertiary care centre, Assam. The study period is from 1st June 2020 to 31st May 2021. It is a study on pre-eclampsia patients of two groups: Group A and Group B, where CTG and UAD were the two investigative tools applied in the group A and compared the perinatal outcome using the various parameters of the two groups.

RESULTS: While comparing the two groups, need of induction was more in Group B (56.3%). APGAR score at 1 minute (60.4%) was found to be significantly better in Group A unlike APGAR score at 5 minutes (50.9%). Intrapartum meconium staining (64.2%) was found to be more consistent with the group B. Likewise, depressed baby with APGAR <7 at 1 minute was more in Group B and hence demanded significant need of resuscitation (60.4%).

CONCLUSION: Even though there was no remarkable difference in NICU admission and perinatal death, APGAR score at 1 minute, need of resuscitation and lastly meconium staining of liquor was found to be improved with the use of CTG and UAD together.

KEYWORDS :

INTRODUCTION

Hypertensive disorders of pregnancy, particularly pre-eclampsia, are important determinants of maternal and perinatal morbidity and mortality worldwide. Though broadly clinically characterized by hypertension, proteinuria and edema, pre-eclampsia is also characterized by disturbed placentation, diffused endothelial dysfunction/activation, hypertriglyceridemia and oxidative stress.[1,2]

In prior studies, singleton infants delivered by women with pre-eclampsia, as compared with infants delivered by normotensive mothers, were found to be SGA, or to be of LBW.[3,4] LBW babies are at greater risk of fetal distress.

To avoid untoward consequences, it is of vital importance to detect fetal distress early during labour. Currently, the available methods to monitor the distress are intermittent auscultation, continuous electronic FHR monitoring with CTG and invasive techniques such as fetal blood gas analysis. CTG has been used widely to monitor the fetal wellbeing during pregnancy. It was introduced in 1960s with the aim of reducing perinatal mortality and morbidity such as neonatal seizures, cerebral palsy and hypoxic related deaths. It is available in a hospital setting and is easy to operate making it possible to use in the absence of the obstetrician and is financially viable. However, visual interpretation of CTG is subjective, there is a high inter- and intra-observer variability in interpreting the FHR by the clinicians.[5]Continuous CTG monitoring may also lead to an increased numbers of cesarean sections and instrumental vaginal deliveries.[6]

Response of the fetus to stress or hypoxia in utero is known by doppler velocimetry of the umbilical circulation. Previously the only markers of an adverse perinatal outcome were a decrease in, or cessation of, end diastolic flow , and the presence of umbilical vein pulsations.[7] More recently, many authors have used UA flow patterns as markers of fetal well-being.[8] These flow patterns provide information about the fetoplacental circulation[9], and have become a valuable tool for detecting the hemodynamic alterations that occur in response to fetal hypoxia.[10] Use of UA Doppler velocimetry in clinical practice has reduced perinatal mortality in high-risk patients and has improved perinatal management and outcome.[11,12]

Not many studies could be found for cardiotocography and umbilical artery doppler combination, hence taking both the special investigative tools together for fetal wellbeing in utero, this study was undertaken.

Keeping in mind the burden of pre-eclampsia on perinatal outcome, this study was conducted among patients in the department of Obstetrics and Gynaecology, Gauhati Medical College and Hospital. The purpose of the study was to determine the impact of combined application of CTG and UAD on perinatal outcome in pre-eclampsia.

OBJECTIVES

To evaluate CTG findings in pre-eclampsia cases

To evaluate UAD in pre-eclampsia cases

To compare the test results with different modes of delivery and perinatal outcome

MATERIALS AND METHOD

It is a tertiary care hospital based prospective longitudinal study during the period of 1 year from 1st June 2020 to 31st May 2021. The study protocol was approved by the Ethical Committee of Srimanta Sankardeva University of Health Sciences, Guwahati, Assam.

2 groups of 100 pre-eclamptic women attending ANOPD and ELR are selected randomly for the study.

Inclusion Criteria:

All women who have pre-eclampsia at gestational age >34 weeks with single cephalic pregnancy without any other obstetrical complications.

Exclusion Criteria:

- All women with obstetrical conditions namely PROM, BOH, APH, multiple pregnancy, malpresentation, GDM, anemia, post caesarean, post term pregnancy
- All women with chronic hypertension.

METHODOLOGY:

Methodologies applied at admission of pre-eclampsia patients were:

Detailed history collection, examination including general, obstetrics abdominal, vaginal and investigations including spot urinary protein, serum uric acid, LFT, RFT, serum electrolytes and ECG.

Considering two sample situations with 5% and 19% pre-eclamptic pregnant women undergoing LSCS for fetal distress with normal and increased umbilical artery S/D ratio respectively[13], taking 95% confidence interval and a power of 80% and a drop-out rate of 20% dropouts, the sample size was calculated and rounded off to total number of 100 in each group.

The study participants (pre-eclamptic women) attending ANOPD and ELR were selected randomly for the study and were assigned to the study group and control group alternatively till the sample size of 100 was achieved in each group.

100 patients were allotted in the group A and umbilical artery doppler and cardiotocography were exclusively done in this group, apart from routine examination and investigations. Other 100 patients were controls allotted in group B, wherein routine examination and investigations were done.

Interventions were taken accordingly based on the indications and rest patients were planned for IOL. Induction of labour (IOL) commenced after assessing the bishop score, obstetrical ultrasonography.

In GROUP A, before starting the induction, umbilical artery doppler and cardiotocography findings were evaluated. Umbilical artery doppler was done using the 2-dimensional ultrasound machine available in our setting labelled as MOBILE TROLLEY, SN=PTA2C002123, manufacturer: Mindray, model number: UMT – 150. It was done in the free loop of umbilical cord floating in the amniotic fluid. Cardiotocography was done using the CTG machine available in our hospital labelled as FETAL MONITOR, SN= EATB8L1732, manufacturer: BPL, model number: FM 9854. Paper speed was 1cm/min and was done as admission test for 20 minutes during antepartum or intrapartum depending on the patient status at admission. Abnormal UAD and non-reactive CTG were invariably prepared for LSCS.

GROUP B underwent routine workup and induction or LSCS were planned accordingly.

Various fetal outcomes were taken into consideration namely, APGAR score, meconium staining of liquor, need of resuscitation, NICU admission, perinatal and neonatal death. Data was collected, checked for sanity and revised/repaired for statistical analysis using Microsoft Excel 2019. Qualitative/categorical data was presented as proportions and percentages, while quantitative data was presented as mean, standard deviations or ranges, as applicable. The comparison between two categories or groups was done using Chi-square test or Fisher's exact test. Fisher's exact was preferred over Chi-square when the count of expected values <5 was >=25% of the total count of expected values. The confidence level was set to 95% and the margin of error accepted was set to 5%.

RESULTS

This study was conducted among antenatal patients who attended the antenatal OPD and emergency labor room in Gauhati Medical College, Guwahati from 1/6/2020 to 31/5/2021. Two groups of one hundred patients were selected and were followed up throughout intrapartum and immediate postpartum period.

In Group A, 73 patients needed induction (43.7% of total patients who needed induction) and 94 patients from Group B needed induction (56.3%).

Similarly, 27 patients in Group A were not given induction (81.8% of patients who were not given induction) and 6 patients of Group B were not given induction (18.2%).

GROUPS	INDUCTION				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	73	43.7%	27	81.8%	100	CHI-SQUARE	0.000
B	94	56.3%	6	18.2%	100		
Total	167	100.0 %	33	100.0 %	200		

In Group A, 98 patients had given birth to live babies (98%), 2 babies were stillborn, but no IUFD was reported.

In Group B, 97 live babies were born (97%), 1 was stillborn (1%) and 2 IUFD were reported (2%).

BABY OUTCOME	GROUPS				Total	TEST USED	P VALUE
	A		B				
	Number	%	Number	%			
LIVE BABY	98	98.0%	97	97.0%	195	FISHER'S EXACT	0.527
STILL BORN	2	2.0%	1	1.0%	3		
IUFD	0	0.0%	2	2.0%	2		
Total	100	100.0 %	100	100.0 %	200		

In Group A, 39 babies showed APGAR score <7 at 1 minute (39.4% of total babies showing <7 APGAR score) and 60 babies of Group B (60.6%) showed APGAR score <7 at 1 minute.

Whereas, 61 babies from Group A did not show APGAR score <7 (60.4% of the total babies not showing <7 APGAR score) and 40 babies from Group B (39.6%) did not show APGAR score <7 at 1 minute.

GROUPS	APGAR SCORE < 7 AT 1 MIN				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	39	39.4%	61	60.4%	100	CHI-SQUARE	0.003
B	60	60.6%	40	39.6%	100		
Total	99	100.0%	101	100.0%	200		

Out of 100 babies in Group A, 12 babies showed APGAR score <7 at 5 minutes (44.4% of total babies showing APGAR score <7 at 5 minutes) and 15 babies of Group B (55.6%) showed APGAR score <7 at 5 minutes.

On the other hand, 88 babies from Group A did not show APGAR score <7 at 5 minutes (50.9% of total babies not showing APGAR score <7 at 5 minutes) and 85 babies from Group B (49.1%).

GROUPS	APGAR SCORE < 7 AT 5 MIN				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	12	44.4%	88	50.9%	100	CHI-SQUARE	0.535
B	15	55.6%	85	49.1%	100		
Total	27	100.0%	173	100.0%	200		

Among 100 patients in Group A, 32 babies were admitted in NICU (45.7% of total NICU admission) and 38 babies from Group B were admitted (54.3%).

In Group A, 68 babies were not admitted in NICU (52.3% of total non-NICU admission) and 62 babies from Group B were not admitted in NICU (47.7%).

GROUPS	NICU ADMISSION				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	32	45.7%	68	52.3%	100	CHI-SQUARE	0.374
B	38	54.3%	62	47.7%	100		
Total	70	100.0%	130	100.0%	200		

In Group A, 5 babies died (41.7% of total perinatal death) and 7 babies died from Group B (58.3% of total perinatal death).

GROUPS	PERINATAL DEATH				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	5	41.7%	95	50.5%	100	CHI-SQUARE	0.552
B	7	58.3%	93	49.5%	100		
Total	12	100.0%	188	100.0%	200		

In Group A, 24 patients showed meconium staining of liquor (35.8% of total patients showing meconium-stained liquor) and 43 patients from Group B (64.2%) showed meconium staining of liquor.

In Group A, 76 patients did not have meconium-stained liquor (57.1% of total patients who did not have meconium-stained liquor) and 57 patients from Group B did not have meconium-stained liquor.

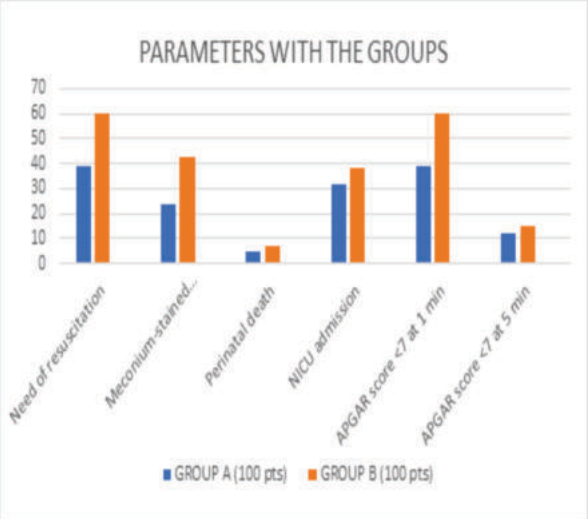
GROUPS	MECONIUM-STAINED LIQUOR				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	24	35.8%	76	57.1%	100	CHI-SQUARE	0.004
B	43	64.2%	57	42.9%	100		
Total	67	100.0%	133	100.0%	200		

In Group A, 39 babies needed resuscitation (39.4% of total babies who needed resuscitation) and 60 babies of Group B (60.6%) needed resuscitation.

In Group A, 61 babies did not need resuscitation (60.4% of the total babies who did not need resuscitation) and 40 babies from Group B (39.6%) did not need resuscitation.

GROUPS	NEED OF RESUSCITATION				Total	TEST USED	P VALUE
	YES		NO				
	Number	%	Number	%			
A	39	39.4%	61	60.4%	100	CHI-SQUARE	0.003
B	60	60.6%	40	39.6%	100		
Total	99	100.0%	101	100.0%	200		

TABLE SHOWING PERINATAL OUTCOME IN THE GROUPS



PERINATAL PARAMETERS	GROUP A (100 pts)	GROUP B (100 pts)	P VALUE
Need of resuscitation	39	60	0.003 (chi square)
Meconium-stained liquor	24	43	0.004 (chi square)
Perinatal death	5	7	0.552 (chi square)
NICU admission	32	38	0.374 (chi square)
APGAR score <7 at 1 min	39	60	0.003 (chi square)
APGAR score <7 at 5 min	12	15	0.535 (chi square)

DISCUSSION

The study was conducted to find out the relationship of cardiotocography and umbilical artery doppler with perinatal outcome in pre-eclampsia.

During the study period, the total number of pre-eclampsia patients followed up was 200. It was a prospective longitudinal hospital based comparative study where patients were allotted in Group A and B and two special investigative tools were used in Group A.

AUTHOR	YEAR	% OF ABNORMAL UAD	MECONIUM STAINING	APGAR SCORE <7 AT 5 MIN
S Gudmundsson *et al*[14]	1988	36%	76%	-
BH Yoon *et al*[15]	1994	51%	-	57%
Present study	2021	29%	1%	58.3%

Present test result for abnormality of umbilical artery doppler is similar to the study of S Gudmundsson *et al*.

Out of 29 abnormal UAD, 16 showed reduced UAD, 8 showed absent UAD and 5 showed reversed UAD in the study.

An abnormal Doppler umbilical artery waveform is associated with poor perinatal outcome and is a strong predictor of perinatal mortality.[16]

In the study by YS Seyam *et al* in 2002[17], they showed that out of 84 abnormal doppler patients, only 22 babies (26%) were admitted in NICU unlike the present study where 40% NICU admission is observed.

S Ivanov *et al* in 2006 conducted a study and found 17.20% of pre-eclampsia patients showed pathological findings in CTG.[18]

53.3% of the pre-eclampsia patients were shown to have non-reactive CTG in the study conducted by J Milošević-Stevanović *et al*. in 2015.[19]

In present study, cardiotocography is found to be non-reactive in 18% of the pre-eclampsia patients.

AUTHOR	YEAR	% OF NON-REACTIVE	APGAR SCORE <7
S Ivanov *et al*	2006	17.2	-
J Milošević-Stevanović *et al*	2015	53.3	53.3
Present study	2021	18	41.7

There is no clear evidence that antenatal CTG improves perinatal outcome, but further studies focusing on the use of computerized CTG in specific populations of women with increased risk of complications are warranted.[20]

Comparing non-reactive CTG vs NICU admission

AUTHOR	YEAR	% NICU ADMISSION
Khursheed et al[21]	2009	30.64%
H Rahman et al[22]	2012	37.8%
Present study	2021	34.4%

Patients with non-reactive CTG who needed NICU admission was 34.4% (in our study) and is comparable to the study by Khursheed *et al* (30.64%) and H Rahman (37.8%).

Comparing non-reactive CTG vs perinatal death

AUTHOR	YEAR	PERINATAL DEATH
Khursheed et al[21]	2009	16.12%
H Rahman et al[22]	2012	5.4%
Present study	2021	16.6%

Our study result is comparable to the study by Khursheed *et al*.

CONCLUSION

With the usage of combined CTG and UAD, no changes in mode of delivery or difference in NICU admission or perinatal death was seen. However, APGAR score at 1 minute and need of resuscitation were decreased.

Meconium staining of liquor which is a sign of fetal distress, is significantly reduced with the use of CTG and UAD together, perhaps because of timely intervention.

Therefore, amalgamation of the two tools to detect fetal distress in utero has helped in early detection of fetal distress and can be considered for routine use in improving fetal outcome in view of good APGAR score at 1 minute as well as reduction in need of resuscitation.

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