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Full Length Research Paper

Doppler velocimetry of cerebral and middle cerebral artery in normal and growth restricted pregnancies

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To study the outcomes like incidence of Cesarean delivery, birth weight, apgar score and incidence of admission to NICU among the study group and the control group. To study correlation of Cerebro-umbilical ratio with the outcomes and to establish significance of Doppler indices. Prospective observational study in a tertiary care hospital. Total of 120 patients were studied, 60 in study group and 60 in control group. Doppler parameters were studied in both the groups using Chi square test, Kruskall Wallis test and Fisher's exact test. The incidence of induced labour, Caesarean delivery, apgar score being low at 1 minute and NICU admissions were comparatively higher in the study group as compared to control group. S/D ratio of the Umbilical artery showed statistical significance to predict the outcomes mentioned.

Keywords: Pulsatility index, cerebroumbilical ratio, apgar score.

INTRODUCTION

Antepartum fetal surveillance serves the cornerstone in reducing the perinatal morbidity and mortality. The use of ultrasound has revolutionized the fetal assessment. The incorporation of Doppler ascertained hemodynamic parameters allows evaluation of various physiological changes occurring that cannot be ascertained clinically. Doppler ultrasound indicates the state of fetoplacental vascular bed and any evidence of utero-placental insufficiency. Doppler ultrasound indicates that if there is evidence of utero-placental insufficiency, there is risk of adverse pregnancy outcome[1,2].

Doppler was first reported to be used in 1977, when Fitz Gerald and Drumm demonstrated the Doppler frequency shift waveform from the umbilical arterial circulation (3,4). Doppler is based on the hemodynamics of blood circulation in the fetus and thus allows the assessment of the response of the fetus to stress [5]. Doppler velocimetry helps to monitor well-being of the fetus during pregnancy, deciding about antenatal course and timing delivery. Doppler changes are noted as abnormal blood flow patterns before the clinical manifestations of fetal distress. Doppler enables a better analysis of haemodynamic changes and is considered the most important tool for fetal surveillance in IUGR pregnancies and helps to decrease the adverse perinatal outcome [6].

MATERIALS AND METHODS

This study is a Prospective Observational study, carried out over one year, in the Department of Obstetrics and Gynecology, in a tertiary care hospital, Karnataka.

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Study Population

Pregnant women with gestational age 28 – 40 weeks.

Inclusion Criteria for the Study Group

Known date of last menstrual period
Clinical discrepancy of fundal height of four weeks or more with the dates
USG showing fetal weight less than 10th percentile of their gestational age based on Femur length (FL), biparietal diameter(BPD) and abdominal circumference(AC).

Inclusion Criteria for the Control Group

Normal pregnant women with known date of last menstrual period
Examined clinically and on USG

Exclusion Criteria

Chronic hypertension
Chronic nephritis
Diabetes
Heart diseases
Pregnancy induced hypertension
Bad obstetric history
Hydramnios
Multiple pregnancies

Approval and Registration

Prior to enrolment ethical committee clearance was obtained from Hospital Ethical Committee. (IEC-KMC MLR 12-14/289).

Sample Size

With 95% confidence level and 80% power, statistical formula used is-
N=Z2p(1-p)/e2
Z= 95% confidence level.
P=80% power
Sample size= 120.

METHODOLOGY

Informed consent was taken from all the enrolled subjects. Cases diagnosed with fetal growth restriction formed the study group. Normal pregnant women served as controls. Detailed history and examination was done. Ultrasound was done using Philips HD7XC with 5 MHz. Fetal biometry was done for confirmation of gestational age. A free loop of cord was visualized, a clear waveform obtained and Doppler indices were measured. Three readings of S/D ratio, PI for umbilical and Middle cerebral artery were recorded and average was calculated. Analysis was done using mean and 95 percent confidence interval for each waveform index during that particular gestational age. “Cerebro-umbilical ratio was calculated as the ratio of pulsatility index of Middle cerebral artery to that of the Pulsatility index of Umbilical artery.” Cases and controls were followed up till delivery. Onset of labour, mode of delivery, birth weight, apgar score and NICU admissions were studied as outcome measures. CU ratio was categorized into two groups, <1 or >1 and outcomes studied in both the groups. Significance of Doppler parameters was established.

RESULTS

Cases and controls were comparable in terms of age, parity and gestational age (table 1,2,3).
Among the study groups, the incidence of induced labour was 60% in cases and 6.6% in the control group. Out of the total emergency LSCS done, 13.3% were in the cases and 5% among control group. The incidence of elective LSCS was 8.3% in the cases and 3.3% in the control group. P value was 0.00, highly significant (fig 1).
Among the cases, 21.7% neonates had birth weight <1.75 kg and none in the controls. Also, number of neonates in the cases had birth weight >2.5 kg whereas it was 95% in the control group. P value -0.00, highly significant (fig 2).
The incidence of apgar score <8 was 61.7% in the cases and 21.7% in the control group. Apgar scores were 9/10 were 38.3% in cases and 78.3% in control group. P value-0.00, highly significant (fig 3).
Among the cases, the numbers of NICU admissions were 48.3% and 18.3% in the control group. P value-0.00,highly significant (fig 4).
Among all the Doppler parameters, Umbilical artery S/D ratio showed statistical significance (table 4, figure 5).

Correlation of Cerebro-umbilical ratio with the outcomes

Outcomes were studied as patients with CU ratio<1 and CU ratio>1. Among the total samples, with cu ratio <1, 8.3% of them underwent elective LSCS, 7.1% underwent emergency LSCS and 4.2% of them had full term normal delivery. Those cases with cu ratio >1, 95.8% had normal vaginal delivery (table 5).
For samples with cu ratio <1, 7.7% of them had birth weight <1.75 kg, 7.5% had birth weight 1.75-2.5 kg

Table 1. Age Distribution.

AGE	CASES	PERCENTAGE	CONTROLS	PERCENTAGE
25 and below	8	13.3%	9	15%
26-30	46	76.7%	49	81.7%
>30	6	10%	2	3.3%

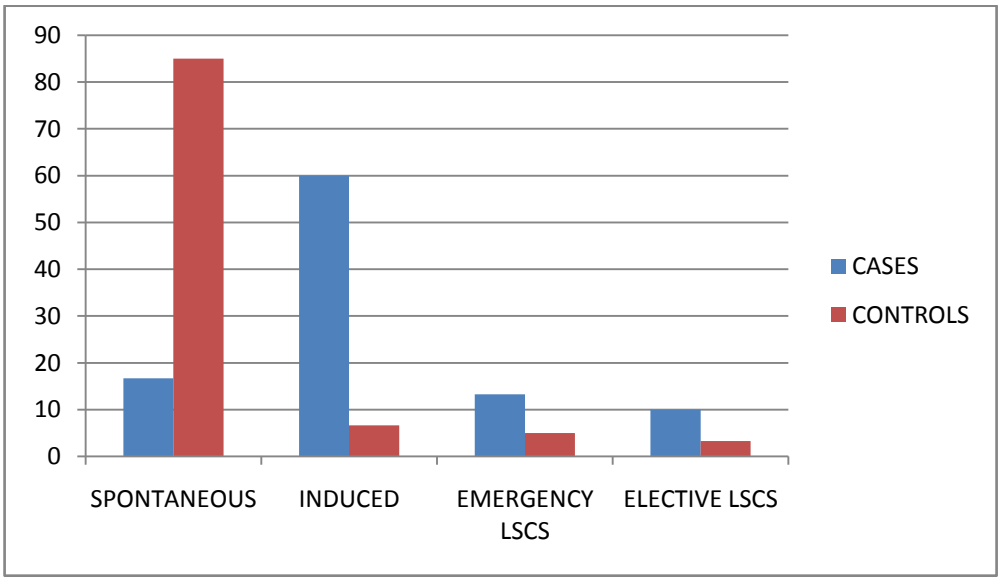
Table 2. Parity.

	CASES	PERCENTAGE	CONTROLS	PERCENTAGE
PRIMI	35	58.3%	32	53.3%
MULTI	25	41.7%	28	46.7%

Table 3. Period of gestation.

WEEKS	CASES	PERCENTAGE	CONTROLS	PERCENTAGE
30-32+6	24	40	19	31.6
33-35+6	20	33.33	21	35
36-38	16	26.6	20	33.3

Figure 1. Mode of delivery.



and 3% of them had birth weight 2.5 kg and above. For those with cu ratio >1, 97% of them had birth weight 2.5 kg and above (table 6).

Among the study samples with CU ratio <1, 0. 8% of them had apgar score <7/10 at 1 minute and 2.5% of them had apgar score 8/10 at one minute. Whereas for those with cu ratio >1, 57.5% of them had apgar 9/10 at 1 minute (table 7). Among the study samples with cu ratio <1, 7.5 % of them had NICU admissions and 96.3 % of them who had CU ratio of >1 had no NICU admission (table 8).

DISCUSSION

In this study we compared the Doppler parameters in IUGR and normal pregnancies and to find out which parameter is a better predictor of perinatal outcome.

Figure 2. Birth weight.

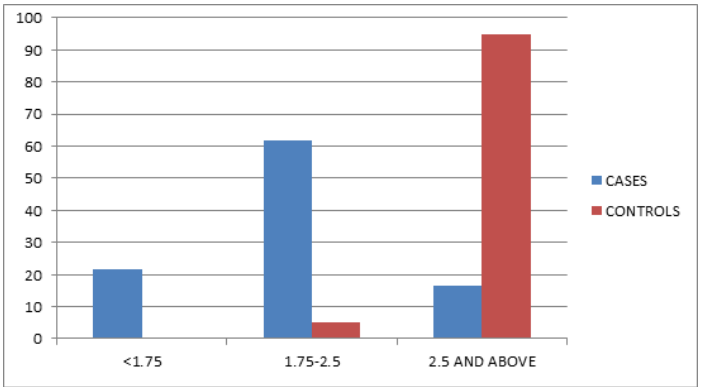


Figure 3. Apgar Score.

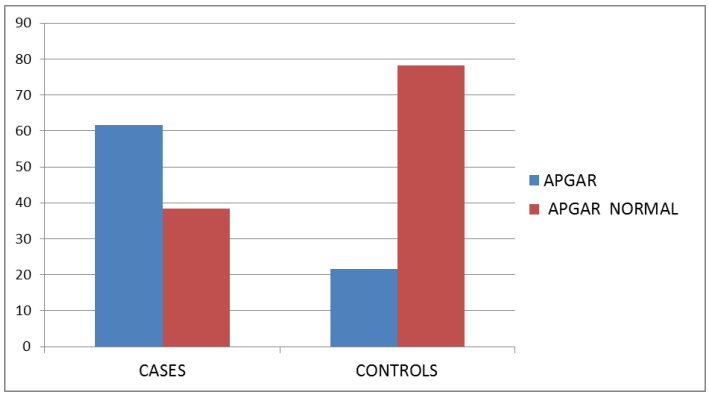
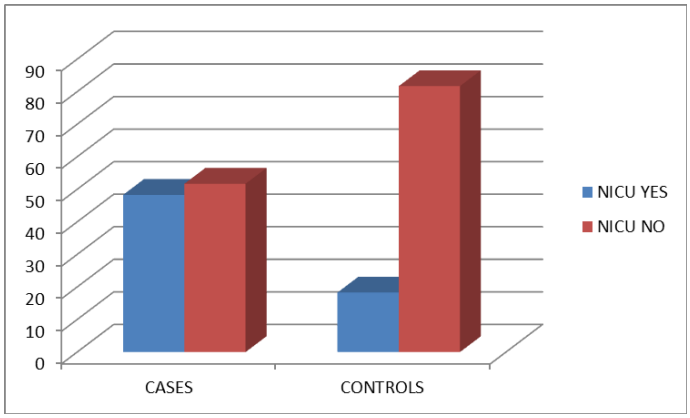


Figure 4. NICU admission.



Both controls and cases were subjected to ultrasound with Doppler . Umbilical artery S/D ratio, PI,MCA S/D, MCA PI and CU ratio were calculated and their relation to outcomes like mode of delivery, birth weight, apgar score, NICU admission was studied. Gramellini et al., observed that “the C/U ratio was constant in the last 10 weeks of pregnancy.

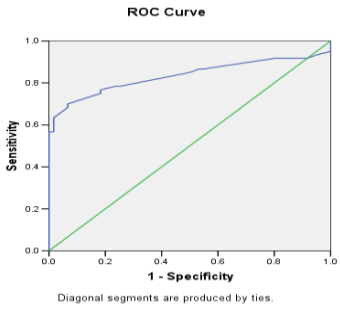
The C/U ratio remains constant during the last 10

Table 4. Doppler indices.

DOPPLER PARAMETERS		MEAN	SD	95% CI		P VALUE
				LOWER LIMIT	UPPER LIMIT	
UMBILICAL ARTERY S/D	CASES	3.06	0.54	2.91	3.20	0.00 SIGNIFICANT
	CONTROLS	2.50	0.24	2.44	2.56	
UMBILICAL ARTERY PI	CASES	0.95	0.26	0.88	1.02	0.68
	CONTROLS	0.93	0.16	0.89	0.97	
MCA S/D	CASES	3.24	0.73	3.05	3.43	0.82
	CONTROLS	3.26	0.37	3.16	3.36	
MCA PI	CASES	1.28	0.26	1.21	1.35	0.02
	CONTROLS	1.38	0.20	1.33	1.44	
CU RATIO	CASES	1.45	0.55	1.31	1.60	0.76
	CONTROLS	1.48	0.29	1.40	1.55	

Figure 5.

ROC CURVE



Umbilical artery S/D ratio
✓Sensitivity - 78%.
✓Specificity - 75%.

weeks of gestation and provides better diagnostic accuracy than either vessels PI considered alone" [7]. In the present study, outcome measures were studied for patients with CU ratio <1 in comparison with those having CU ratio >1.

In a study conducted by Naruls Harneet et al.,[8] with 50 growth restricted and 50 control subjects between 28-37 weeks, it was observed that incidence of induced labour, low birth weight, low apgar and NICU admissions were more in the growth restricted group. Cerebro-umbilical ratio<1.08 was found to be associated with adverse perinatal outcome. It was seen that Umbilical artery Doppler was sensitive in the detection of growth restricted pregnancies.

A study conducted by Shahina Bano et al.,[9], interpreted that "CU ratio was a better predictor of

Table 5. Mode of delivery.

	CU RATIO <1		CU RATIO >1	
	number	%	Number	%
ELECTIVE LSCS	4	3.3	11	91.7
EMERGENCY LSCS	8	6.6	26	92.9
FTND	3	2.5	68	95.8

Table 6. Birth weight

BIRTH WEIGHT (kg)	CU RATIO <1		CU RATIO >1	
	number	%	number	%
<1.75	1	7.7	12	92.3
1.75-2.5	3	7.5	37	92.5
2.5 and above	2	3	65	97

Table 7. Apgar score.

APGAR SCORE AT 1 MINUTE	CU RATIO <1		CU RATIO >1	
	number	%	number	%
<7	1	0.8	21	35
8/10	3	2.5	24	20
9/10	2	1.66	69	57.5

Table 8. NICU admission.

NICU ADMISSION	CU RATIO <1		CU RATIO >1	
	number	%	Number	%
NO	4	3.3	36	30
YES	3	2.5	77	64.1

SGA newborns and adverse perinatal outcome than either the MCA PI or UA PI alone. They also found that C/U ratio had a 100% specificity in diagnosing IUGR and predicting adverse perinatal outcome but had a lower sensitivity of 4.4% . The specificity MCA PIwas 100% , the sensitivity being much lower."

In another study by Ozeren M et al.,[10] the "Umbilical artery S/D ratio had high sensitivity of 88% and diagnostic accuracy of 94% in predicting perinatal outcome." Qahtani mentioned in their review article that umbilical artery Doppler in high risk pregnancies reduced significantly the number of antenatal admissions, induction of labour and Caesarean section for fetal distress.

In the present study, it was observed that the incidence of induced labour, Cesarean deliveries, low birth weight, low apgar at 1 minute and admission to NICU were more in the cases than the control group. P value was found to be significant for each outcome. Among all the Doppler parameters studied, Umbilical artery S/D ratio was found to show significant correlation when compared in both the groups. The sensitivity was found to be 78% and

specificity to be 75%. It was observed that umbilical artery Doppler parameters showed decrease as the gestatinal age advances.

Studies of umbilical artery s/d ratio and the fetal outcome

STUDY	SENSITIVITY	SPECIFICITY
Maulik et al[11]	79	93
Trudinger et al **12**	64	77
Marsal	57	85
Arduini et al	61	73
Berkowit's et al	45	89
Fleischer at al	78	83
Present study	78	75

CPR and NeonatalOutcomes

Cruz-Martinez et found that CPR serves to be a better parameter to study the outcome measures like birth weight <10th centile, incidence of Cesarean and NICU admissions in IUGR pregnancies when compared to normal group. Prior et al conducted a prospective study to evaluate CPR , and reported that CPR is more predictable than other parameters for outcome measures like emergency Cesarean, low birth weight and NICU admission. Khalil et al. in their study concluded that CPR cannot be considered as better predictor of NICU admissions though there was significance in the outcome measures between cases and controls with respect to the incidence of Cesarean deliveries and NICU admissions.

In the present study we found that the incidence pf emergency Cesarean, low apgar at 1 minute and incidence of NICU admissions were more in subjects having CPR <1. Though no significance was observed when compared between cases and controls.

CONCLUSION

It was found that number of induced labour, emergency LSCS, apgar score <7/10 at 1 minute and admission to NICU were more in the study group when compared with the control group.

Cerebro-umbilical ratio showed no statistical significance in prediction of the adverse outcomes.

Umbilical artery S/D ratio was found to be a better predictor of adverse outcome in growth restricted pregnancies.

REFERENCES

1.Callen. Ultrasonography in Obstetrics and Gynecology, 3rd Edition.503-515.

2.Michael Y.Divon et al; Umbilical Artery Doppler Velocimetry: Clinical utility in high risk pregnancy. American Journal Of Obstetrics and Gynecology, Jan 1996,174:10-14,174:33-6.

3.American college of obstetricians and gynecologists. Intrauterine growth restriction; ACOG practice bulletein n0.12.Washington,DC:ACOG;2000.

4.NHL Journal of Medical Sciences/Jan 2015/Vol 4 issue 1.

5.Fitzgerald, P.E. Drumm. Non-invasive measurements of foetal circulation using USG, a new method. British Journal Of Medicine 1977;2:1450.

6.Stuart, Fitzgerald and Drumm. Foetal blood velocity waveforms in pregnancy. British Journal of obstetrics and Gynaec 1980;87:780.

7.Fleischer A, Schulman H, Farmakides G, Bracerol, Blattner P, Randolph G; Umbilical artery flow velocity waveforms and intrauterine growth restriction. AM J Obstet Gynecol,1985;151:502-505.

8.Gadelha-Costa A, Spara-Gadelha P, Filho FM,Gadelha EB. Haemodynamic changes in the fetal arteriesduring the second half of pregnancy assessed by Doppler velocimetry. Eur J Obstet Gynaecol. Reprod Biol.2007 Jun;132(2):148-53.

9. Alfirevic Z, Stampalija T, Gyte GM. Fetal and umbilical Doppler ultrasound in high risk pregnancies. Cochrane Database Syst Rev 2010:CD007529.

10.American College of Obstetricians and Gynecologists. Intrauterine growth restriction. AJOG practice bulletin No.12. Washington DC: American College of Obstetricians and Gynecologists;2000.

11.Royal College of Obstetricians and Gynecologists(RCOG). Green-top guidelines. The investigation and management of the small for gestational age fetus. London, UK: RCOG Press;2002.

12.Marsal K.Routine use of Doppler ultrasound in perinatal medicine. J. Perinat. Med. 1994;22(6):463-74.