ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 1, February - 2023, Page No. : 641 - 646

Prospective study of association of fetal cerebroplacental ratio with perinatal outcomes in uncomplicated term appropriate for gestational age pregnancies

[1]Dr. Bhavini, Resident Doctor, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

[2]Dr. Sana Tak, Resident Doctor, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

[3]Dr. Akansha Kumawat, Resident Doctor, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

[4]Dr. Pushpa Nagar, Senior professor, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

[5]Dr. Aditi Bansal, Associate professor, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

Corresponding Authors: Dr. Aditi Bansal, Associate professor, Department of Obstetrics and Gynaecology, SMS Medical College, Jaipur.

How to citation this article: Dr. Bhavini, Dr. Sana Tak, Dr. Akansha Kumawat, Dr. Pushpa Nagar, Dr. Aditi Bansal, "Prospective study of association of fetal cerebroplacental ratio with perinatal outcomes in uncomplicated term appropriate for gestational age pregnancies", IJMACR- February - 2023, Volume – 6, Issue - 1, P. No. 641– 646.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: One of the main aim of routine antenatal care is to identify the 'at risk' fetus in order to apply clinical interventions which could result in reduced perinatal morbidity and mortality. Doppler ultrasound study of umbilical artery waveforms helps to identify the com promised fetus in 'high-risk' pregnancies and, therefore, deserves assessment as a screening test in AGA pregnancies.

Aim: The aim of the study is to find association of foetal cerebroplacental ratio using Doppler velocimetry with perinatal outcome in uncomplicated term appropriate for gestational age pregnancies.

Materials and methods: A prospective study carried out on 250 uncomplicated term appropriate for gestational age pregnancies admitted in labour room. Transab dominal colour doppler was used to record the UA and MCA waveforms. CPR calculated as mean MCA PI divided by mean UA PI.

Cases were managed according to local protocol and guide lines and neonatal outcome seen. Outcome measures for this study include mode of delivery and diagnosis of foetal compromise was based on meconium - stained liquor, or a combination of these, neonatal out come was assessed by examining 5 min APGAR score, admission to neo natal unit, and perinatal mortality.

Results: Among 250 women; 66.7% who had CPR <1 had LSCS and APGAR Score <7 at 5 mins;33.3% who had CPR <1 had meconium-stained liquor and had NICU Admission.

Keywords: Cerebroplacental ratio; Meconium-stained liquor; LSCS, AGA Pregnancy.

Introduction

Foetal surveillance to identify foetal growth abnormalities is an important aspect of antenatal care. (1) The intrapartum period represents the time during pregnancy when the fetoplacental relationship is challenged to the highest degree. Uterine contractions are associated with up to 60% decline in uterine artery flow velocities, and the associated reduction in placental perfusion may precipitate fetal compromise.

The CPR is defined by the quotient of the Doppler indices of the foetal middle cerebral artery (MCA) and the umbilical artery (UA). The Pulpability Index (PI) is usually used for this purpose. If the fetus is in a hypoxic state or growth retardation, the cerebral vessels dilate to maintain blood flow to the brain ("brain-sparing effect"). This increased end-diastolic blood flow velocity is reflected in decreased doppler indices (PI) of the MCA. Furthermore, the placental blood flow resistance increases and the end-diastolic blood flow velocity in the umbilical vessels decreases. This results in increased Doppler indices (PI) of the UA. As a product of this change in perfusion, CPR decreases.[2]

An abnormal CPR may result from 3 types of doppler patterns. The first is when the MCA and UA PI are in lower and upper range of the normal, respectively, resulting in a low CPR. The second is when there is abnormal low MCA PI and UA PI is normal. The third pattern consists of abnormal low MCA and abnormally high UA PI resulting in abnormally low CPR.[3]

Material and methods

This is a prospective study done in IPD of Obstetrics and Gynaecology, SMS Medical College, Jaipur.250 Women with term pregnancy with appropriate for gestational age who are admitted in the labour room, in the age group of 20 to 35 years are included in the study. Pregnancies complicated by foetal anomaly, aneuploidy, elective caesarean sections are excluded from the study.

Transabdominal colour doppler was used to record the UA and MCA waveforms Measurements were taken at times of foetal apnoea and inactivity, with the angle of insonation as close as possible to zero. PI values were measured in triplicate and the mean used. CPR calculated as mean MCA PI divided by mean UA PI.

Cases were managed according to local protocol and guidelines and neonatal outcome seen.

Outcome measures for this study include mode of delivery, cesarean, and instrumental deliveries for intrapartum foetal compromise (IFC). Diagnosis of foetal compromise was based on FHS irregularities, meconium-stained liquor, or a combination of these. Neonatal outcome was assessed by examining 5 min APGAR score, admission to neonatal unit, and perinatal mortality.

Observation and results

Table 1: Distribution of cases according to association between cerebroplacental ratio and age (n = 250)

Age	Cerebroplacental Ratio			Fisher's Exact Test	
	<1	≥1	Total	$\chi 2$	P Value
18-25 Years	12 (100.0%)	126 (52.9%)	138(55.2%)	10.230	0.005
26-35Years	0 (0.0%)	112 (47%)	90 (36%)		

Table 2: Demographic profile

	CPR<1	CPR>1	Total	P value
Age 18-25 (yrs)26-35	12(100%) 0(%)	126(52.9%) 112(47%)	138(55.2%) 112(44.8%)	0.05
Religion Hindu Muslim	10(83.3%) 2(16.7%)	175(73.5%) 63(26.5%)	185(74%) 65(26%)	0.737
Education Illiterate Literate	4(33.3%) 8(66.6%)	23(9.6%) 215(90.3%)	27(10.8%) 223(89.2%)	0.192
Gravidity Primigravida Multigravida	8(66.7%) 4(33.3%)	124(52.6%) 114(47.9%)	132(52.8%) 118(47.2%)	0.32

Table 3: Distribution of cases according to association between cerebroplacental ratio and mode of delivery (n = 250)

Mode of Delivery	**Cerebroplacental Ratio**			**Fisher's Exact Test**	
	<1	**≥1**	**Total**	**χ2**	**P Value**
Spontaneous vaginal delivery	4 (33.3%)	214 (89.9%)	218 (87.2%)	32.769	<0.001
Lower segment cesarean section	8 (66.7%)	24 (10.1%)	32 (12.8%)		
Total	12 (100.0%)	238 (100.0%)	250 (100.0%)		

This table shows distribution of cases according to mode of delivery and its association with cerebroplacental ratio.

Graph 1:

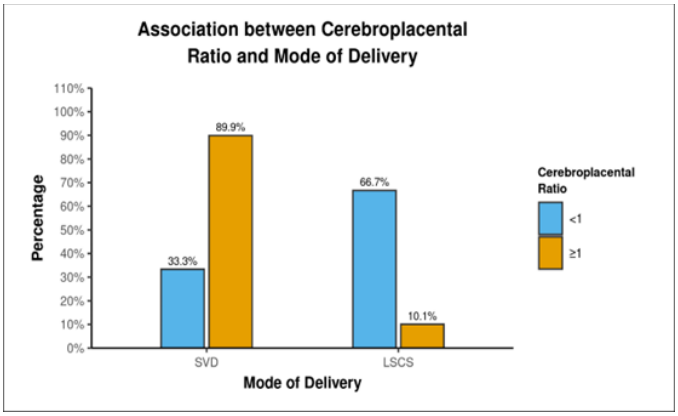
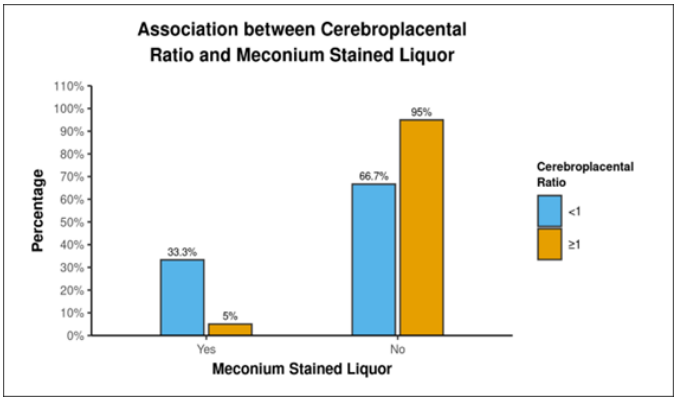


Table 4: Distribution of cases according to association between cerebroplacental ratio and mode of delivery Distribution of cases according to association between cerebroplacental ratio and meconium-stained liquor (n = 250)

Meconium-Stained Liquor	Cerebroplacental Ratio			Fisher's Exact Test	
	<1	≥1	Total	χ2	P Value
Yes	4 (33.3%)	12 (5.0%)	16 (6.4%)	15.264	0.004
No	8 (66.7%)	226 (95.0%)	234 (93.6%)		
Total	12 (100.0%)	238 (100.0%)	250 (100.0%)		

This table shows distribution of cases according to association between cerebro placental ratio and meconium-stained liquor.

Graph 2:



Distribution of cases according to association between cerebroplacental ratio and meconium-stained liquor

Table 5: Distribution of cases according to association between cerebroplacental ratio and APGAR Score (n = 250)

APGAR Score at 5 mins	Cerebroplacental Ratio			Fisher's Exact Test	
	<1	≥1	Total	χ2	P Value
<7	8 (66.7%)	12 (5.0%)	20 (8.0%)	58.945	<0.001
>7	4 (33.3%)	226 (95.0%)	230 (92.0%)		
Total	12 (100.0%)	238 (100.0%)	250 (100.0%)		

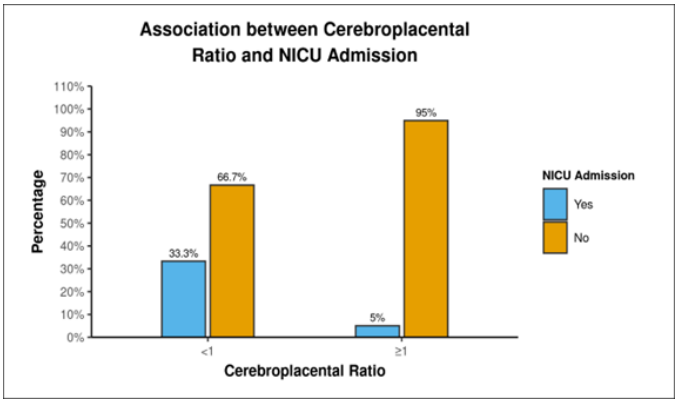
This table shows distribution of cases according to association between cerebro placental ratio and APGAR score.

Table 6: Distribution of cases according to association between cerebroplacental ratio and NICU admission (n = 250)

NICU Admission	Cerebroplacental Ratio			Fisher's Exact Test	
	<1	≥1	Total	χ2	P Value
Yes	4 (33.3%)	12 (5.0%)	16 (6.4%)	15.264	0.004
No	8 (66.7%)	226 (95.0%)	234 (93.6%)		
Total	12 (100.0%)	238 (100.0%)	250 (100.0%)		

This table shows distribution of cases according to association between cerebro placental ratio and NICU Admission.

Graph 3:



Distribution of cases according to association between cerebroplacental ratio and NICU admission

Discussion

Many failure to reach growth potential foetuses are delivered with a baby weight (BW)that is appropriate-for-gestational age (AGA). Hence, a baby with a BW on the 40th centile, but with a genetic potential to be born on the 80th centile, may have suffered more severe and protracted hypoxemia compared with a fetus born with a BW on the 5th centile that has met its growth potential. This may be because small part of placental dysfunction which initially fulfilled foetus's metabolic demands is later on not able to fulfill the same.

In our study, mean age of study population is 25.58 years. All the 12 (100%) cases with CPR<1 belong to age group 18-25 years while in CPR >1subgroup ;126 (52%) belong to 18-25 years.

Our findings are similar to the findings of Khalil et al. (2015) [4]; 8382 pregnancies were included in age group (26-35 years) & women who had operative delivery were older (p <.01) unlike with study done by Prior et al (2013) [5] in which 400 patients were included in the age group 18-47 years and no difference in maternal age was observed between normal vaginal delivery and lower segment cesarean section. In a study done by Anand et al (2019)[6] 127 AGA pregnancies were included with mean age being 27 years for patients with CPR<1 and mean age being 26 years for patients with CPR >1 which was not significant.

In our study; 185 (74%) cases belong to Hindu community while 65 (26%) cases belong to Muslim community. Same trend was seen in both subgroups of CPR and this is not statistically significant.

In our study, maximum cases i.e 223 (89.2%) were literate while 27(10.8%) were illiterate. Only 23 (9.6%) cases with CPR>1 and 4(33.3%) cases with CPR <1 were illiterate.

In our study,132 (52.8%) cases were primigravida and 118 (47.2%) cases were multigravida. In subgroup CPR>1;124 (52.1%) cases were primigravida while 114 (47.9%) cases were multigravida. In subgroup CPR <1; 8 (66.7%) cases were primigravida while only 4 (33.3%) cases were multigravida. Our findings are consistent with study done by Prior et al (2013) [5]; 400 patients were included in the study; of which 262(65.5%) were primigravida and 37 out of 44 patients who had CPR <1 were primigravida. Our findings are similar to the findings of Khalil et al. (2015)[4]; in which women who had operative delivery for presumed foetal compromise were nulliparous (p<.01).

In our study; 218(87.2%) cases had spontaneous vaginal delivery and 32 (12.8%) cases had Lower segment cesarean section (LSCS). In subgroup CPR<1 ,4 (33.3%) cases had spontaneous vaginal delivery while 8(66.7%) had LSCS. Among 8 cases who delivered by LSCS 4 patients had meconium-stained liquor,3 patients had decelerations on CTG, 1 patient was operated for failed induction. In subgroup CPR>1; 214(89.9%) cases had spontaneous vaginal delivery while 24 (10.1%) cases had LSCS. Evidence of LSCS is higher in CPR <1, these findings show significant association of CPR with mode of delivery. Our findings are consistent with study done by Prior et al (2013) [5], out of 400 cases; patients with CPR <1; 22.7% had spontaneous vaginal delivery, 36% had Lower segment cesarean section for foetal compromise, 52.3% had instrumental delivery, 11.4% had LSCS for other indications. In a study done by Khalilet al. (2015)[4]; the rates of both cesarean delivery and instrumental delivery for presumed foetal compromise were significantly higher for AGA babies with low CPR MoM compared to AGA with normal CPR MoM (11.2% v/s 8.7%; p=0.043 and 11.2% v/s 7.8%; p=0.003 respectively).

Conclusion

Fetal cerebroplacental ratio (CPR) assessed before labour might be useful for the prediction of operative delivery for intrapartum fetal compromise (IFC) and for the detection of adverse neonatal outcomes in appropriately grown (AGA) fetuses. CPR stratification may allow more informed decisions to be made regarding the mode and place of delivery as well as a more targeted approach to intrapartum monitoring.

Limitations of study

This study was performed in a single Centre which is a tertiary referral Centre. It is

not representative of the whole population. More multi centric trials need to be done.

Acknowledgement

The authors would like to thank everyone who supported and assisted throughout all aspects of our study and for their help in writing the manuscript.

References

1. Erkan Kalafat and Asma Khalil. Clinical significance of cerebroplacental ratio. Curr Opin Obstet Gynecol. 2018 Dec;30(6):349-354.

2. L. Mecke et al: The importance of the cerebro placental ratio for the prognosis of neonatal outcome in AGA fetuses. https:// doi.org/ 10.1007/ s00404 - 022-065 96-2

3. Teresa M. Mac Donald et al. Reduced growth velocity across the third trimester is associated with placental insufficiency in foetuses born at a normal birth weight. BMC Medicine 2017 Aug; 15:164

4. Khalil AA, Morales-Rosello J, Morlando M, et al. Is foetal cerebroplacental ratio an independent predictor of intrapartum foetal compromise and neonatal unit admission? Am J Obstet Gynecol 2015; 213:54. e1-10

5. Tomas Prior, Edward Mullins, Phillip Bennett et al. Prediction of intrapartum foetal compromise using the cerebroumblical ratio: a prospective observational study. Am J Obstet Gynecol 2013; 208:124. e1-6

6. Shikha Anand, Seema Mehrotra, Urmila Singh, Vandana Solanki, Shuchi Agarwal: Study of association of foetal cerebroplacental ratio with adverse perinatal outcome in uncomplicated term AGA pregnancies. J obstet Gynecol India Jul 2019 https://dol.org/10. 1007/ s13224-020-01357-x.