ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 9, Issue – 6, December – 2024 , Page No. : 77 – 84

Evaluate The Effectiveness of Cerebroplacental Ratio in Predicting Neonatal Outcome in Low Risk Pregnancies with Reduced Fetal Movement in Third Trimester

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Citation this Article: Dr Megha Gupta, Dr Kamlesh Yadav, Dr Usha Rao, Dr Arti Soni, " Evaluate The Effectiveness of Cerebroplacental Ratio in Predicting Neonatal Outcome in Low Risk Pregnancies with Reduced Fetal Movement in Third Trimester", IJMSIR - December - 2024, Vol – 9, Issue - 6, P. No. 77 – 84.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Antepartum stillbirth significantly contributes to perinatal mortality, surpassing deaths from prematurity and sudden infant death syndrome.

Aim: To evaluate the effectiveness of CPR in predicting neonatal outcomes in low-risk pregnancies with RFM.

Methodology: This hospital-based cross-sectional study will be conducted in the Department of Obstetrics and Gynecology at PBM Hospital, Bikaner, over a duration of one year, from September 2023 to August 2024.

Result: In our study of 300 cases, the majority were aged 19-25 years (69.67%), with 57.33% being primigravida; mean UAPI and MCAPI were 0.81 ± 0.41 and 1.07 ± 0.60, respectively; CPR was <1.1 in 15% of cases; 93.75% of non-reassuring fetal status cases with CPR ≤1.1 were delivered by LSCS; live birth rates were 97.77% for CPR ≤1.1 and 99.21% for CPR >1.1; 80% of CPR ≤1.1 cases had normal weight, and mean birth weights were 3.14 ± 0.53 kg for CPR ≤1.1 and 3.20 ± 0.61 kg for CPR >1.1; NICU admissions showed APGAR ≤7 in 50% of CPR ≤1.1 and 58.06% of CPR >1.1 cases, with significant findings regarding birth weight differences.

Conclusion: This study of 300 low-risk term subjects concluded that low CPR is not significantly linked to increased obstetric interventions or adverse perinatal outcomes, but further large randomised trials are necessary for its clinical application.

Keywords: Cerebroplacental Ratio, Pulasitile Index, Reduced Fetal Movement.

Introduction

Antepartum stillbirth significantly contributes to perinatal mortality, surpassing deaths from prematurity and sudden infant death syndrome. Fetal movements are a key indicator of well-being, though maternal perception of these movements varies and lacks a standardised definition[1] Foetal movements differ during the pregnancy with an increase from week 16-20 to week 36 and a slight

decline throughout the last month of pregnancy[2]. The movements vary during normal pregnancies depending on the quantity of amniotic fluid, the position of the foetus, maternal medication and the wellbeing of the fetus[3]. Previous studies have shown that decreased foetal movements are associated with pregnancy complications such as preterm birth, foetal growth restriction and stillbirth[4,5]. Monitoring foetal movements offers reassurance of well-being, but discrepancies exist between maternal perception and ultrasound assessments, with decreased fetal movements linked to risks such as stillbirth and adverse neonatal outcomes[6-8]. RFM are self-reported by the mothers, with guidance from midwifes and obstetricians. There is no gold standard method for counting and reporting RFM. The maternal perception of foetal movements can be affected by stress and anxiety[9]. medication and smoking[10], localization of placenta[11], maternal position[12], and the perception changes throughout the pregnancy. It is crucial that the health care providers inform the pregnant woman about the importance for her to perceive and assess foetal movements. At the same time, we know that instructing women to monitor foetal movements can be associated with increased maternal anxiety[13]. Counting foetal movements is challenging for mothers due to a lack of consensus on accurate methods, primarily "fixed time" and "fixed number."[14]. Current guidelines highlight the importance of maternal perception of reduced foetal movements (RFM), which is linked to nearly double the risk of late stillbirth. Newer approaches aimed at increasing awareness, such as mind fetalness, have shown mixed results, leading to more healthcare visits without reducing low Apgar scores but decreasing caesarean sections and small for gestational age (SGA) babies[15]. RFM affects approximately 6–10% of pregnant women in the third trimester[16], with many reporting it before intrauterine foetal death. Placental insufficiency can lead to chronic impaired nutrient exchange, resulting in small for gestational age foetuses and reduced foetal movements (RFM) as potential early indicators of acute foetal compromise[17]. Although routine foetal movement monitoring[18] lacks strong evidence for assessing this condition[19], factors such as placental location, amniotic fluid levels, and maternal characteristics may influence the perception of foetal movements[20], while studies show that placental ageing does not increase umbilical artery resistance but affects the cerebro-placental ratio in cases of placental insufficiency[21,22]. The cerebro-placental ratio (CPR) is emerging as a critical predictor of adverse pregnancy outcomes, with low CPR associated with increased risk of intrapartum foetal distress and acidemia[23], particularly in appropriate-for-gestational-age foetuses. While studies suggest CPR can effectively forecast complications during labour, its optimal thresholds and predictive value require further research, especially since many cases of intrapartum hypoxia occur without prior risk factors, complicating prediction and management.

Aim

To evaluate the effectiveness of CPR in predicting neonatal outcomes in low-risk pregnancies with RFM.

Methodology

This hospital-based cross-sectional study will be conducted in the Department of Obstetrics and Gynecology at PBM Hospital, Bikaner, over a duration of one year, from September 2023 to August 2024. The study population will consist of low-risk pregnant females experiencing decreased foetal movement, who are admitted to the labour room of the Obstetrics and Gynecology department. Inclusion criteria for the study will encompass patients aged 18 years and older, those willing to participate, singleton low-risk pregnancies, and

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a gestational age of more than 37 weeks. Conversely, the exclusion criteria will include patients who refuse to give consent, those with multiple pregnancies, congenital foetal anomalies, and high-risk pregnancies, such as those involving hypertension, heart disease, or thyroid disorders. A simple random sampling technique will be employed to select participants for the study.

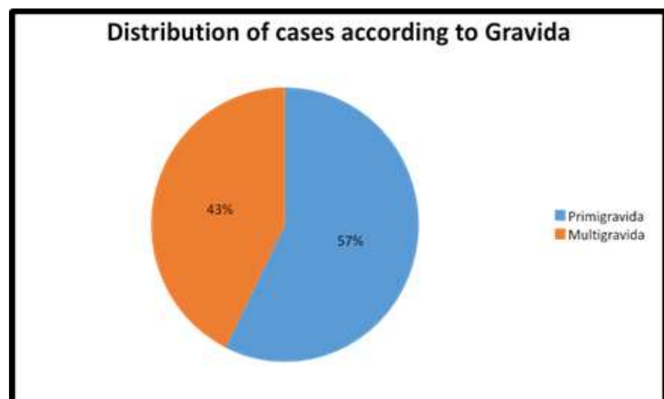
Result

Table 1: Distribution of cases according to Age

Age Distribution (Years)	N	(%)
19-25	209	69.67
26-30	61	20.33
31- 35	22	7.33
>35	8	2.67
Total	300	100.00
Mean ± Sd	25.55 ± 5.6	

Table:1 Shows Distribution of cases according to age out of 300 cases maximum 209 (69.67%) cases were in 19 – 25 yr age group followed by 61 (20.33%) cases were in 26– 30 yr age group followed by 22 (7.33%) cases were in 31 – 35 yr age group whereas minimum 8 (2.67%) were in >35 yrs age group mean age was 25.55 ± 5.6 yr.

Graph 1: Distribution of subjects according to their Gravida



Graph Shows Distribution of subjects according to their gravida Maximum 172 (57.33%) cases were primigravida whereas minimum of 128 (42.67%) were multigravida.

Table 2: Distribution of cases according to their Ultrasound findings

Ultrasound findings	Mean	Range
UAPI	0.81 ± 0.41	0.1 – 2.91
MCAPI	1.07 ± 0.60	0.09 – 1.77

Table Shows Distribution of cases according to their Ultrasound findings on ultrasound the mean value of UAPI was found to be 0.81 ± 0.41 with range from 0.1 – 2.91. Mean value of MCAPI was found to be 1.07 ± 0.60 with range from 0.09 – 1.77.

Table 3: Distribution of cases according to their CPR

CPR	No.	%
<1.1	45	15.0
>1.1	255	85.0
Mean	1.38 ± 0.38	

Table Shows Distribution of cases according to their CPR out of 300 cases CPR was255 (85%) cases had CPR >1.1 whereas <1.1 for 45 cases (15%) Mean CPR was 1.38 ± 0.38.

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Table 4: Shows Distribution of cases according to Maternal outcome according and CPR

Mode of Delivery	≤1.1 CPR		>1.1 CPR	
	No.	%	No.	%
Normal Vaginal Delivery	35	77.78	177	69.41
LSCS	10	22.22	77	30.20
Forceps	0	0.00	1	0.39
Total	45	100.00	255	100.00
P value	0.498			

In evaluating maternal outcomes by CPR levels, 77.78% of cases with CPR ≤1.1 were delivered vaginally, compared to 69.41% with CPR >1.1, with the differences being statistically insignificant ($p>0.05$).

Table 5: Shows Distribution of cases according to Mode of delivery with non-reassuring foetal status according and CPR

Mode of Delivery	≤1.1 CPR		>1.1 CPR	
	No.	%	No.	%
Normal Vaginal Delivery	1	6.25	3	33.34
LSCS	15	93.75	6	66.66
P value	0.228			

Among 25 cases of non-reassuring fetal status, 93.75% of those with CPR ≤1.1 were delivered by LSCS compared to 66.66% of those with CPR >1.1, with the difference being statistically insignificant ($p>0.05$).

Table 6: Shows distribution of cases according to their neonatal outcome and CPR

Neonatal outcome	≤1.1 CPR		>1.1 CPR	
	No.	%	No.	%
Live	44	97.77	253	99.21
Still birth	1	2.23	2	0.79
Total	45	100.00	255	100.00
P value	0.953			

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In the analysis of neonatal outcomes based on CPR levels, 97.77% of cases with CPR ≤1.1 resulted in live births compared to 99.21% in cases with CPR >1.1, with the difference being statistically insignificant (p>0.05).

Table 7: Shows distribution of cases according to Neonatal Birth Weight according and CPR

Birth weight (kg)	≤1.1 CPR		>1.1 CPR	
	No.	%	No.	%
Very low birth weight (1.0 –1.5)	3	6.67	8	3.14
Low birth weight (1.5 – 2.5)	6	13.33	18	7.06
Normal weight (>2.5)	36	80.00	229	89.80
Total	45	100.00	255	100.00
Mean	3.14 ± 0.53		3.20 ± 0.61	
P value	0.176			

In a comparison of neonatal birth weight and CPR levels, 80% of cases with CPR ≤1.1 had normal weight, while 89.80% of cases with CPR >1.1 were normal weight, with mean birth weights of 3.14 ± 0.53 kg and 3.20 ± 0.61 kg respectively, showing statistically insignificant differences (p>0.05).

Table 8: Shows distribution of cases according to their cause of NICU admission and CPR

NICU Admission	≤1.1 CPR		>1.1 CPR	
	No.	%	No.	%
MSL	2	20.00	4	12.90
Very low birth weight	3	30.00	8	25.81
APGAR ≤7	5	50.00	18	58.06
Resuscitation	0	0.00	1	3.23
Total	10	100.00	31	100.00
P value	1.000			

In a study of NICU admissions based on CPR levels, cases with CPR ≤1.1 showed that 50% had APGAR ≤7, while those with CPR >1.1 had 58.06% APGAR ≤7, with differences between the groups being statistically insignificant (p>0.05).

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Discussion

In our study, out of 300 cases maximum 209 (69.67%) cases were in 19 – 25 yr age group followed by 20.33% in 26 – 30 yrs whereas minimum 2.67% were in >35 yrs age group followed by 7.33% in 31 – 35 yr group. Mean age was 25.55 ± 5.6 yr. Fatemeh Golshahi et al. (2022)[24] found that out of the total 150 participants, the mean age of the participants was 31.53 ± 4.91 yr old. The minimum age was 21 yr old and the maximum age was 42 yr old.

In our study, maximum 57.33% cases were primigravida whereas minimum 42.67% were multigravida. Similarly, Nandita Maitra et al. (2020)[25] found that 184 (51.54%) were Nulliparous whereas 173 (48.45%) were multiparous.

In our study, On ultrasound the mean value of UAPI was found to be 0.81 ± 0.41 with range from 0.1 – 2.91. Mean value of MCAPI was found to be 1.07 ± 0.60 with range from 0.09 – 1.77. Similarly Fatemeh Golshahi et al. (2022)[24] found that Umbilical artery pulsatility index was 0.91 ± 0.19 (min - 0.45, max - 1.25), Middle cerebral artery pulsatility index 1.59 ± 0.44 (min. - 0.85 max. - 2.82).Julia Binder et al. (2021)[26] Women who presented with RFM had significantly lower MCA PI (p<0.001).

In our study, out of 300 cases CPR was <1.1 for 45 cases (15%) whereas 255 (85%) cases had CPR >1.1. Mean CPR was 1.38 ± 0.38.Ala Aiob et al. (2022)[27] There was no significant difference in UA-PI (0.871 ± 0.171 vs. 0.815 ± 0.179, P = 0.446), MCA-PI (1.778 ± 0.343 vs. 1.685 ± 0.373, P = 0.309), or CPR (2.107 ± 0.635 vs. 2.09 ± 0.597, P = 0.993) between the groups.

In our study, out of 45 cases of CPR ≤1.1 maximum 77.78% cases were delivered by vaginal method and 22.22% were delivered by LSCS, whereas out of 255 cases of CPR >1.1 maximum 69.41% cases were delivered by vaginal delivery followed by 30.20% by LSCS and minimum 0.39% by forceps. The difference was found to be statistically insignificant.(p>0.05) Similarly Nandita Maitra et al. (2020)[25] founds that 21 of 68 (30.8%) subjects of CPR <5 had undergone cesarean delivery of which 15 subjects required cesarean delivery for fetal distress whereas CPR >5 had 232 (80.27%) cases had vaginal delivery and difference in observations due to the mode of delivery was statistically significant at p value of 0.01.

In our study, out of 25 cases of non-reassuring foetal status 16 cases had CPR ≤1.1 and rest 9 cases had CPR >1.1. Out of 16 cases of CPR ≤1.1 maximum 93.75% cases were delivered by LSCS and 6.25% were delivered by vaginal method, whereas out of 9 cases of CPR >1.1 maximum 66.66% cases were delivered by LSCS followed by 33.34% by vaginal delivery. The difference was found to be statistically insignificant.(p>0.05)

In our study, out of 45 cases of CPR ≤1.1 maximum 97.77% cases had live birth and 2.23% had still birth, whereas out of 255 cases of CPR >1.1 maximum 99.21% cases had live birth and minimum 0.79% were still birth. The difference was found to be statistically insignificant.(p>0.05)

In our study, out of 45 cases of CPR ≤1.1 maximum 80% cases had normal weight and 13.33% were low birth weight and minimum 6.67% were VLBW whereas out of 255 cases of CPR >1.1 maximum 89.80% cases had normal weight followed by 7.06% had low birth weight and minimum 3.14% had VLBW. The difference was found to be statistically insignificant.(p>0.05) IN CPR ≤1.1 mean birth weight was 3.14 ± 0.53 kg and 3.20 ± 0.61 kg in CPR >1.1. the difference was found to be statistically significant. (p>0.05) Similarly Nandita Maitra et al. (2020)[25] founds that mean birth weight in CPR <5th centile was 2.72 ± 0.28 kg whereas 2.73 ± 0.25 kg in CPR >5th centile.(p=0.70)

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In our study, out of 10 nicu admission of CPR ≤1.1 cases maximum 50% had APGAR ≤7 followed by 30% VLBW and 20% MSL whereas out of 31 nicu admission of CPR >1.1 cases, maximum 58.06% had APGAR ≤7 followed by 25.81% VLBW and 12.90% MSL and resuscitation 3.23%. The difference was found to be statistically insignificant.(p>0.05) Out of total 297 live births 34 cases had APGAR ≤7 at 1 min whereas only 19 had APGAR ≤7 at 5 min.

Conclusion

We concluded this prospective study on 300 low-risk subjects at term with reduced fetal movement found that low CPR is not associated with a higher risk of obstetric intervention for intrapartum foetal compromise and adverse perinatal outcomes. The CPR below the ≤1.1 had an association with Apgar ≤ 7 at 5 minutes, induced labour and NICU admission but was not significant. However, CPR in this clinical context needs to be studied in well-designed large randomised clinical trials, before it can be introduced into routine clinical practice.

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