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COMPARATIVE STUDY OF NORMAL AND LOW BIRTH WEIGHT BABIES IN RELATION TO MATERNAL PARAMETERS AND UMBILICAL ARTERY DOPPLER

Neonatology

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ABSTRACT

Introduction: Birth weight (BW) is a surrogate marker for neonatal health status. The causes for low birth weight (LBW) are multifactorial including maternal and placental parameters (1,2). Hence a study was planned to assess these parameters in relation to BW. **Objective:** To determine and find out the association between maternal characteristics like age, BMI, medical conditions – anemia, gestational diabetes and hypertension, cardiac disease and hypothyroidism, cord length, placental weight and umbilical artery Systolic/Diastolic (S/D) ratio and BW. **Study Setting:** Retrospective cohort study by reviewing case records in a medical college hospital in South Tamil Nadu. **Materials And Methods:** 100 Singleton babies, 33-40 weeks 50 each in normal BW (Group I) and LBW (Group II) were included. Relevant data obtained from the case records during the period 2019 to 2022 was computed and analyzed using SPSS version 21. Association between maternal and doppler parameters with BW was analyzed using Chi square test with significant p value <0.05. **Result:** Male 51 and female 49. Term- 62%, Preterm -38%, AGA -70%, SGA -30%. Median BW -2490 g, IQR 795, Range1.54-3.89 kg; Median maternal age -26.5, IQR 5, Median maternal BMI 24.8, IQR 6.5, Median cord length 48 cm, IQR 9.25, Median placental weight 522 g, IQR 107.5. There was a positive association between maternal BMI (p=0.01), cord length (p=0.01), placental weight (p=0.000) and BW (Table 1). Umbilical artery S/D ratio showed a negative association with BW (p=0.01). There was no association with maternal age and maternal medical conditions (p>0.05). **Conclusion:** The finding that Maternal BMI, placental weight and cord length are associated with BW, warrants prenatal counselling and regular antenatal care. Umbilical artery S/D ratio is suggested as a marker of LBW for undertaking anticipatory intervention.

KEYWORDS

Birth weight, placental weight, umbilical artery S/D

INTRODUCTION

Birth weight (BW) is an important surrogate marker for neonatal health status [1]. BW ≤ 2500 gram is considered to be low birth weight (LBW). The causes are multifactorial and the major contributing factor for it are maternal parameters. Most of the causes can be prevented by proper care during in utero [2]. Placental weight provides a clue about the in utero fetal nutrition [3]. Placenta, umbilical cord length and blood flow predicts the well-being of the fetus [4]. Hence this study has concentrated on these factors to provide an overall knowledge about its influence over the BW.

OBJECTIVE

To determine and find out the association between maternal characteristics like age, BMI, medical conditions – anemia, gestational diabetes and hypertension, cardiac disease and hypothyroidism, cord length, placental weight and umbilical artery Systolic/Diastolic (S/D) ratio and BW.

METHODOLOGY

A retrospective cohort study was conducted in a tertiary teaching hospital SreeMookambika Institute of Medical Science, Tamil Nadu. It was a review of hospital records of 100 babies who were > 32 weeks, born alive and healthy. Group I had 50 babies of LBW ≤ 2500 g (Term-22, Preterm-28) and Group II had 50 babies of Normal BW ≥ 2500 g (NBW) (40-Term and 10-Preterm). Babies with congenital anomalies and intrauterine infections were excluded. Maternal characteristics like age, BMI, parity, Gestational age (GA), previous abortions, maternal medical problems like gestational hypertension, gestational diabetes mellitus, cardiac disease and hypothyroidism were noted from the medical records. Maternal BMI was classified as per Indian guideline [5]. Maternal anemia was classified according to WHO classification [6]. Umbilical artery S/D ratio centiles was analyzed in relation to GA as shown below.

Reference values for serial measurements of the umbilical artery S/D ratio[9].

Gestation (weeks)	2.5th	5th	10th	25th	50th	75th	95th	97.5th
33	1.66	1.79	1.94	2.23	2.60	3.03	3.48	3.77
34	1.61	1.73	1.88	2.16	2.53	2.95	3.39	3.68
35	1.57	1.68	1.83	2.11	2.46	2.87	3.30	3.59
36	1.52	1.64	1.78	2.05	2.40	2.80	3.23	3.51
37	1.48	1.59	1.73	2.00	2.34	2.74	3.15	3.43
38	1.44	1.55	1.69	1.95	2.28	2.67	3.08	3.36
39	1.40	1.51	1.64	1.90	2.23	2.61	3.02	3.29
40	1.36	1.47	1.60	1.85	2.18	2.56	1.96	3.22

Flexible tape was used to measure the cord length from the cord end nearest to the placenta to the cord end near to the umbilicus and was classified into ≤ 50 and > 51 cm [4]. Placental weight was recorded using an electronic weighing machine with the nearest adjustment to 10 grams and categorized into ≤ 500 and > 500 g [3]. Data was analyzed using SPSS software 21. Association between maternal and doppler parameters with BW was analyzed using Chi square test with significant p value <0.05.

RESULT

Maternal characteristics and doppler S/D ratio in relation to BW were summarized in Table I. Gestational age 33-40 weeks, BW 1.54-3.89 kg; median 2.49, IQR 0. 795. Maternal age 18-38 years; median 26.5, IQR 5. There was no association between LBW and maternal age (p>0.05). Maternal BMI 17.7 - 42.6; median 24.8, IQR- 6.5. Underweight 3, normal 26, overweight 23 and obese 48. There was significant association between maternal BMI and BW (p = 0.01). Among 3 mothers who were underweight,2 of them had LBW babies (66%). Subgroup analysis of AGA (n=70) and SGA (n=30) showed only placental weight had significant association. Majority of the mothers did not have anemia (n=66) and there was no association between BW and maternal anemia (p> 0.05).

There were 67 babies with cord length ≤ 50 in which 58.2 %(n=39) had LBW and 33 babies had cord length > 51 in which 66.6% (n=22) had NBW. Association between cord length and BW was statistically significant (p = 0.01).34 babies have ≤ 500 grams of placental weight. Out of that 85.3% babies (n = 29) had LBW. 66 babies had > 500 grams of placental weight, of which 68.2% (n= 45) has NBW. Association between placental weight and BW was statistically significant (p <0.001). Newborns of mother with maternal risk factors like hypothyroidism(n=11) and gestational hypertension(n=13) was not significantly associated with BW as they were all on optimum medication and had good control during the pregnancy period. In newborns of GDM mother (n = 14),28.6 % (n=4) had LBW. There were no cases of macrosomia.12 mothers had cardiac disease, of which 66.7% (n = 8) had LBW babies. UA doppler value was < 50th centile for

44 babies of which 63.6%(n=28) has NBW and > 50th centile for 56 babies of which 60.7%(n=34) has LBW.As the S/D ratio of umbilical artery value increases, there is a decrease in BW. There was a statistically significant negative association between BW and Umbilical artery S/D ratio (p = 0.01).

Table 1. Association Between Maternal Characteristics And Doppler Findings In Umbilical Artery In Relation To BW(n=100)

Parameters		LBW n=50(%) Group I	NBW n=50(%) Group II	Total n=100	P value
Maternal age	<20	2 (40)	3 (60)	5 (100%)	>0.05
	21-29	40(52.6)	36 (47.4)	76(100%)	
	>30	8(42.1)	11(57.9)	19(100%)	
BMI	Underweight (<18.5 kg/m^2)	2(66.6)	1(33.3)	3(100%)	0.01
	Normal (18.5–22.9 kg/m^2)	17(65.4)	9(34.6)	26(100%)	
	Overweight (23.0 –24.9 kg/m^2)	15(65.2)	8(34.8)	23(100%)	
	Obese (≥25 kg/m^2)	16(33.3)	32(66.6)	48(100%)	
Anemia	No (11 or more)	33(50)	33(50)	66(100%)	>0.05
	Mild 10-10.9)	11(52.4)	10(47.6)	21(100%)	
	Moderate (7 – 9.9)	6(50)	6(50)	12(100%)	
	Severe (<7)	0	1(100)	1(100%)	
Maternal risk factor	GDM	4(28.6)	10(71.4)	14(100%)	>0.05
	Gestational Hypertension	6(46.2)	7(53.8)	13(100%)	
	Cardiac	8(66.6)	4(33.3)	12(100%)	
	Hypothyroidism	5(45.5)	6(54.5)	11(100%)	
Umbilical cord length	<50	39(58.2)	28(41.8)	67(100%)	0.01
	>51	11(33.3)	22(66.6)	33(100%)	
Placental weight	<500	29(85.3)	5(14.7)	34(100%)	<0.001
	>500	21(31.8)	45(68.2)	66(100%)	
Umbilical artery UA S/D ratio	<50th Centile	16(36.4)	28(63.6)	44(100%)	0.01
	>50th Centile	34(60.7)	22(39.3)	56(100%)	

DISCUSSION

This study was a retrospective analysis of 100 babies case records and it was categorized into group I (LBW 50) and group II (NBW 50). In this study maternal age was not statistically significant with BW as similar to the study done by Goisis A[11] when the confounding factors were removed it was found that advance maternal age didn't lead to LBW. Study by Gul R showed that maternal BMI has significant association with BW similar to our study[12].In this study maternal medical risk factors was not significantly associated with BW which is contradicted by the study done by KCA[13].Mature placenta weighs around 500 grams [3]. Positive association noted between placental weight and BW was comparable to the study by Panti AA and Jaya DS [3,8]. Normal cord length varied from 30 to 100 cm with a median of 50 cm [4]. Cord length had positive association with BW which is comparable to the Study done by Sharma S [4]. Significant negative association noted between BW and umbilical artery S/D is similar to the study by Moon AE in which S/D ratio >3 has more chance for LBW and <2 for NBW[10].

CONCLUSION

In view of the finding that Maternal BMI, placental weight and cord length are associated with BW, prenatal counselling and regular antenatal care are recommended. Umbilical artery S/D ratio is suggested as a marker for LBW for undertaking anticipatory intervention. A larger multicentric trial addressing these issues is recommended.

LIMITATIONS

1. Small sample size.
2. Umbilical artery S/D ratio is measured by different sonologists so there can be interobserver variations.

RECOMMENDATIONS

By sonological evaluation of the placental weight and the UA S/D value we can predict the future chance for LBW and early intervention can be done before hand.

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