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Correlation of placental morphometry with the birth weight of newborn in Kerala population

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Abstract

Background: Morphology and morphometric measurements of the placenta will provide an insight into the aetiology of newborn and maternal complications. **Objective:**This study aimed to observe the gross morphometric assessment of placenta and to correlate the placental indices with birth weight of the baby in hypertensive and normal pregnancies. **Methods:**The present study was a comparative descriptive study with analytical components. A total of 86 pregnant women comprising 40 normotensive subjects and 46 hypertensive women within the age group of 18-40 years, parity between 1-4, gestational age between 37 weeks-40 weeks, who attended antenatal clinic of the hospital and delivered by either vaginal route or caesarean section were included in this study. After collecting their placenta, the weight, diameter, surface area, thickness, shape of the placentae was recorded. Weight and sex of baby was also recorded. For statistical analysis, Pearson correlation coefficient test was employed. **Results:** Positive correlation was observed between the placental surface area ($p<0.05$; $p<0.001$), diameter ($p<0.05$; $p<0.001$) weight ($p<0.001$; $p<0.05$) and the corresponding birth weight of the baby among both the normotensive and the hypertensive mothers. All these relationships were statistically significant. **Conclusion:** From this study, it can be concluded that placental morphometry has a

direct relationship with the birth weight of the baby irrespective of the blood pressure of the mother during pregnancy.The study results may help in understanding of the maternal-placental programming of chronic diseases.

Key words: Placenta, correlation, birth weight.

Introduction

Women and children are most vulnerable from the point of health care in terms of disease and death. In most of the developing countries, they are the underprivileged group in terms of nutrition, education, financial status and health care. It was reported that the genetic, socioeconomic racial and environmental factors influence the birth weight of the baby. Other factors include hypertensive disorders and gestational diabetes mellitus.Diseases of pregnancy and pathologic condition of placenta are important contributors to the morbidity and mortality for both maternal and fetal health.[1] Some life threatening disease like hypertension during pregnancy is closely associated with the placental dysfunction due to the poor vascularization of the placenta. Hypertensive disorders of pregnancy and their complications rank as one of the major causes of maternal mortality and morbidity in the world.[2] As placenta plays a key role in the survival of fetus and is the major communication between the mother and fetus, the effect of maternal disorders on the neonatal outcome can be assesed by studying placenta.[3]

The placenta at term is almost a circular disk with a diameter of 15-20 cm and thickness of about 3 cm at its center. It feels spongy and weighs about 500 gm, the proportion to the weight of the baby being roughly 1:6 at term.[4-5] Both fetal or maternal diseases such as severe anemia, hypertension, and fetal hydropsusually influence fetal and placental weight.[6- 7] The surface area is roughly parallels that of the expanding uterus, the increasing thickness of the placenta results from the arborization of existing villi.[8] Villous area and fetal metabolism are related to the placental weight,so it is significant functionally.[9] Morphology and morphometric measurements of the placenta will provide an insight into the aetiology of newborn and maternal complications. Cumulative development of the fetus from conception to delivery can be obtained from the dimensions of placenta. Size of the newborn is also influenced by the hormonal factors in utero and the pathologic adaptation of placenta to racial factors.[10-11] As far as our knowledge no such reports on newborn birth weight relationship with placental indices in population of Kerala , a southern state of India has been published. Therefore, this study has been designed to observe the gross morphometric features of placenta and to correlate the placental indices with birth weight of the baby in hypertensive and normotensive pregnancies in Kerala population.

Methods

The present analytical study observed some morphometric measurement of the placenta from normotensive and hypertensive pregnant after delivery. The study was conducted at the Department of Anatomy and the placentae were collected from the Department of Obstetrics and Gynaecologyof P. K. Das Institute of Medical Sciences Vaniamkulam, Ottapalam, Palakkad, Kerala between 2016-2018. A total of 86 pregnantwomen aged between 18-40, parity1-4, gestational age between 37-40 weeks, who attended antenatal clinic of the hospital and delivered by either vaginal route or caesarean section were included in this study by purposive sampling.Among 86 pregnant women 46 were normotensive and 40 were hypertensive and placentae from them were collected immediately

after delivery. Informed written consent was taken from participant mothers. Medical, social and obstetric history was taken and clinical investigations of the mother were noted. The following inclusion and exclusion criteria were followed for recruiting the participants.

Inclusion criteria

Normotensive - All subjects had no history of raised blood pressure at any stage of their life and had no evidence of proteinuria or any other complications prior to the pregnancy.

Hypertensive -Hypertensive woman whohad history of hypertension before pregnancy or during the first 20 weeks of gestation, had consistently recorded systolic blood pressure (SBP) and diastolic blood pressure (DBP) of 140and 90 mmofHg, respectively and with or without proteinuria.

Exclusion criteria

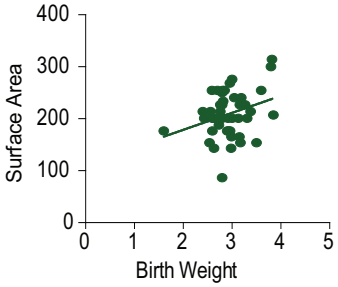
Pregnant women who had experience of any complications during pregnancy like diabetes mellitus, hypothyroidism, anemia, abruptio-placentae, multiple pregnancies, jaundice were excluded from study.

After collecting placenta, weight, diameter, surface area, thickness and the shape of the placentae was recorded. The weight of the placentae was taken using a standard weighing machine. The shape of the placentae was noted and it is categorized as oval, circular, triangular or irregular in shape. The Diameter was measured in cms using a graduated metallic scale.The maximum diameter was recorded for two times. The mean of the two maximum diameters was calculated as the diameter of placenta. Knitting needle calibrated in cms was inserted at the center of the placenta andthe thickness of the placenta was measured. The maternal surface area of the placenta was calculated using the following formula:Surface area= $\pi d1 \times d2/4$, (where d1 is the largest diameter and d 2 is the smallest diameter.[12] Weight and sex of baby was also recorded.

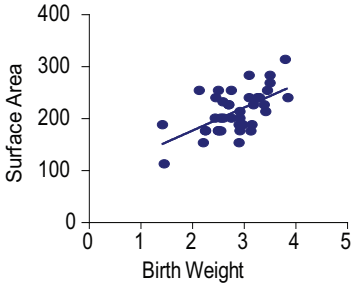
Data analysis Data was analyzed using Microsoft excel. The degree of correlation between the birth weight and some relevant placental parameters viz weight, area and diameter were analyzed using Pearson's correlation coefficient. P value less than 0.05 was considered as significant.

Results

There was a positive correlation between the birth weight of the baby with the placental surface area among the normotensive and the hypertensive group of pregnants and it was statistically significant. (Figure 1). There was a positive correlation between the birth weight of the baby and the placental diameter among the normotensive and the hypertensive group, the result was statistically significant (Figure 2). There was a significant positive correlation of the birth weight of the baby with the placental weight among the normotensive and the hypertensive group, (Figure 3).



r^2=0.01958 , p value=0.0409 (A)



r^2=0.3391,p value<0.0001 (B)

Figure 1: Correlation between the birth weight of the baby with the placental surface area among the (A)normal and the (B)hypertensive group.

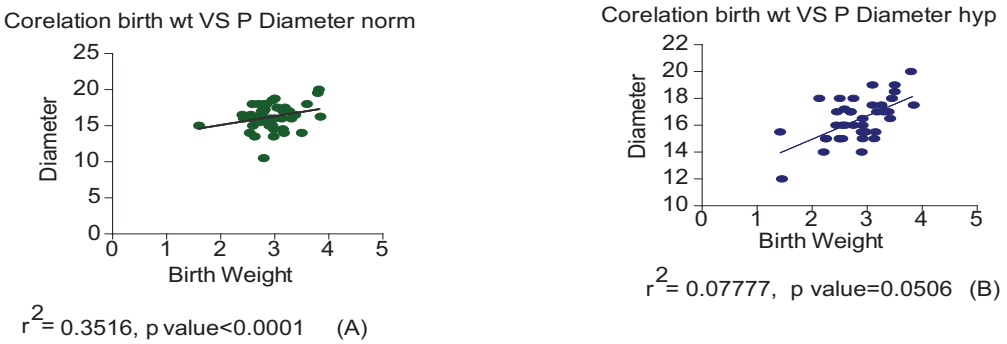


Figure 2: Correlation between the birth weight of the baby and the diameter among the (A)normal and the (B) hypertensive group.

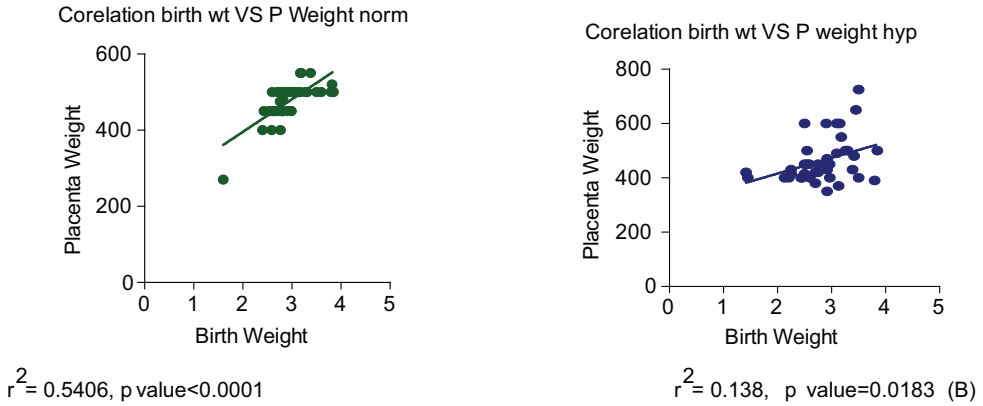


Figure 3: Correlation between the birth weight of the baby and the placental weight among the (A) normal and the (B) hypertensive group.

Discussion

In the present study, placental weight,surface area and the diameter showed significant positive correlation with the birth weight of the baby. Earlier reports stated that the placental weight and birth weight showed positive correlation.[9,3,15] Our results supports this earlier reports as there was a significant positive correlation between the placental weight and the neonatal weight in the present study. Udainia and Jainin 2001 also reported linear relation existed between the placenta weight and newborn weight in uncomplicated,mild and severe pregnancy induced hypertension.[16] Singh and Gugapriya reported that decrease in the placental weight was associated with reduced birth weight which was related to increase in severity of hypertension in pregnants.[17]The weight of the placenta is intimately related to the villous area and foetal metabolism. Placental weight and birth weight of neonate are widely variable measures and the ratio of which is a useful marker of fetal nutrition and utero-placental function.[18] If fetal nutrients or oxygen supply is reduced, the placental weight will increase compared to fetal weight. Placental weights have beenshown to be high in comparison to birth weight when fetal nutrient or oxygen is reduced.This is believed to be a

compensatory mechanism through which placental weight have been found to be predictive of maternal disease, obstetric outcome, perinatal morbidity and mortality, childhood growth and development.[19-23] Increased placental weight was reported to be associated with increased risk of hypertension in adults between 46 and 56 years of age.[22] Reduced placental weight and surface area were also associated with hypertension in later life.[22] Placental weight is higher in African Americans and lower in those of Asian ethnicitywhen compared to all other ethnic groups.[23-25]

Gupta et al. compared weight,volume, diameter,thickness and surface area of theplacenta and found significant strong correlation with the fetal weight. So this means that if there is any abnormality in the placenta, it will be strongly reflected in the fetus.[26] This was in accordance with the present study regarding the surface area, diameter and placental weight which showed significantly positive correlation but the thickness had no correlation with the birth weight in this present study.[26] In contrast, other study reported that there was no correlation probably due to genetic environmental or ethnic factors.[10] Birth weight has a positive relation with both second and third trimesters placental thickness; however, placental thickness changes could not predict low birth weight.[27] Thompson et al. also reported that there was no correlation between a thick placenta and poor obstetrical outcome, apart from a mild association with severe preeclampsia.[28]

Research evidence from previous studies suggested that the capacity of the fetal growth is determined by the placental growth.[29] The expansion of the chorionic plate begin in the early pregnancy is the principal determinant of the ability of the placenta to translate its mass into the birth weight.[30] As chorionic disc area and thickness increase, birth weight and placental weight also increase.[31]Duration of disease and severity of preeclampsia are important determinants of placental abnormality. Studies have shown that diminished placental size precedes fetal growth retardation as IUGR is associated with impoverished villous development and feto-placental angiogenesis.[32-33] Abnormalities of the placenta are recognized as the leading causes of stillbirths and are frequently mentioned as the primary cause of death.[34-37] It was suggested that the placental indices have significant role in foetal growth.[37] Examination of the placenta and its measurementswill be helpful to the obstetricians and pediatricians in clinical practice.

Conclusion

From this study, it can be concluded that there exists a significant positive relationship between the birth weight of the baby and placental variables. The study results may help in understanding of the maternal-placental programming of chronic diseases.

Limitations

The results of our study may not be generalized to the general population. However,they do closely mirror the hospital registry because they present similar demographic,clinical and obstetrical maternal data.

Ethical consideration The study protocol was approved by the institutional human ethical committee of P.K. Das Institute of Medical Sciences, Kerala, India. (CRF/CRL/P11-1/Ph.D.)

Conflicts of interest Authors confirm that there was no conflict of interest to declare.

References

1. Kumar V, Abbas AK,Fausto N, Mitchell R. Robbins Basic Pathology. 8thed.Philadelphia, USA: Elsevier; 2007.p.:224
2. Gupta G. A case control study to evaluate correlation of anemia with severe pre eclampsia.Int J ReprodContraceptObstetGynecol 2018;7:2773-7.
3. Salafia CM et al. The relationship between birth and placental weight changes with placental size. Early Hum Dev 2017; 111:56-9.

4. Dutta D, Konar H. DC Dutta's Textbook of Obstetrics.7th ed. New Delhi: Jaypee Brothers Medical Publishers;2013.p.:**33.**

5. J. F. Yetter III. Examination of the placenta. Am Fam Physician.1998; 57:1045–54.

6. Thame M, Osmond C, Wilks RJ, Bennett FI, McFarlane AN, Forrester TE.Blood pressure is related to placental volume and birth weight. AFP 1998;2: 168.

7. Heinonen S, Taipale P, Saarikoski S. Weights of placentae from small-for-gestational age infants revisited. Placenta 2001; 22: 399–404.

8. Sadler TW. Langman's Medical Embryology. 12th ed. Philadelphia: Wolters Kluwer Health; 2012:105.

9. Shekhar KY, Ratindranath S, ArunD, GulamAK.Placental co-efficient in Nepalese population and it's clinical relevance. Int J Anat Res2016;4:3058-62.

10. Afodun AM, Ajao MS, Enaibe BU. Placental Anthropometric Features: Maternal and neonate characteristics in North Central Nigeria. Adv Ana 2015;1:22-7.

11. *RasoulK,Soheila B, Mohammad S, Behzad M, Soghrat F and Fatemeh M.*Assessing the correlation of placental thickness with fetal weight in the second and third trimester. JMSCR 2018; 6:720-26.

12. Pryse DJ, Beazley JM., Leach G. A study of placental size and chorioamnionitis in a consecutive series of hospital deliveries. Br. J. Obstet. Gynaecol1973; 80: 246-51.

13. Grandi C, VeigaA, Mazzitelli N, CavalliRDC , Cardoso V. Placental Growth Measures in relation to birth weight in a Latin American population. Rev Bras Ginecol 2016; 38: 373-80.

14. Panti, Abubakar A. et al. The Relationship between the weight of the Placenta and birth weight of the neonate in a Nigerian hospital. Niger Med J 2012;53: 80–4.

15. Afadha liD, Russa, KMK. The effect of placental weight and cotyledon count to the fetal birth weight outcome at a regional referral hospital in Tanzania. Int J Ana Res 2017; 5:38-42.

16. Udainia A, Jain ML. Morphological study of placenta in pregnancy induced hypertension with its clinical relevance. J AnaSoc India 2001; 50:24-7.

17. Sabitha S, Gugapriya TS. A cross sectional morphometric study of hypertensive with normal placenta and its co-relation with fetal outcome. Int J AnaRes 2014; 2:437-42.

18. Adesina KT, Ogunlaja OO, Aboyeji AP, Akande HJ, Adeniran AS, Olarinoye A, FawoleAA. Relationshipbetween gross placental characteristics and perinatal outcome of low-risk singleton deliveries.Niger Postgrad Med J 2016; 23**:**191-95.

19. Williams RL, Creasy RK, Cunningham GC, Hawes WE, Norris FD, Tashiro M. Fetal growth and perinatal viability in California. Obsgynec 1982; 59:624-32.

20. Lubchenco LO, Hansman C, Dressler M, Boyd E. Intrauterine growth as estimated from liveborn birth-weight data at 24 to 42 weeks of gestation. Pediatrics1963;32:793.

21. Usher R, McLean F. Intrauterine growth of live-born Caucasian infants at sea level. Standards obtained from measurements in 7 dimensions of infants born between 25 and 44 weeks of gestation. J pedia 1969; 74:901-10.

22. Babson SG, Behrman RE, Lessel R. Fetal growth. Liveborn birth weights for gestational age of white middle class infants. Pediatrics 1970; 45:937-44.

23. Barker DJP, Bull A, Osmond C, Simmonds S. Fetal and placental size and risk of hypertension in adult life. BMJ 1990; 301:259-62.

24. Baptiste RK, Salafia CM, Nicholson WK, Anne D,Nae-Yuh W et al. Maternal risk factors for abnormal placental growth. The national collaborative perinatal project. BMC pregnancy childbirth 2008; 8:44.

25. Perry IJ, Beevers DG, Whincup PH, Bareford D. Predictors of ratio of placental weight to fetal weight in multiethnic community. BMJ 1995; 310:436-39.

26. Gupta C, harode HA, D'souza AS, Sharma A. A morphological and morphometric study of placenta with its clinical implications. Trop J Med Res 2015 ;18:85-8

27. Afrakhteh M, Moeini A, Taheri MS, Haghighatkhah HR. Correlation between placental thickness in the second and third trimester and fetal weight. Rev Bras Gynecol Obstet 2013; 35:317-22.

28. Thompson MO, Vines SK, Aquilina J, Wathen NC, Harrington K. Are placental lakes of any clinical significance? *Placenta* 2002: 23: 685-90.

29. KinareAS, Natekar, MC. ChinchwadkarMC,Yajnik CS, Coyaji KJ, Fall CH et al. Low midpregnancy placental volume in rural Indian women: a cause for low birth weight? Ajog 2000; 182: 443–48.

30. Salafia CM, Charles AK, Maas EM. Placenta and fetal growth restriction. COG2006;49:236-56.

31. Salafia CM, Zhang J, Miller RK, Charles AK, Shrout P, Sun W. Placental growth patterns affect birth weight for given placental weight. Birth defects research. ClinMolTeratology 2007; 79:281-8.

32. Wolf H, Oosting H, Trefferes PE. Second trimester placental volume measurement by ultrasound: prediction of fetal outcome. Am J Obstet Gynecol 1989;160:121–26.

33. Mayhew TM, Wijesekara J, Baker PN, Ong SS. Morphometric evidence that villous development and fetoplacental angiogenesis are compromised by intrauterine growth restriction but not by pre-eclampsia. Placenta 2004;25:829–33.

34. Gardosi J, Kady SM, McGeown P, Francis A, Tonks A. Classification of stillbirth by relevant condition at death : Population based cohort study. BMJ2005; 331:1113-17.

35. Vergani P, Cozzolino S, Pozzi E, Cuttin MS, Greco M, Ornaghi S, et al. Identifying the causes of stillbirth: A comparison of four classification systems. Am J ObstetGynecol 2008; 199:319.e1-4.

36. Salafia C, VintziloesAM. Why all placentae should be examined by pathologist?Am J ObstetGynaecol 1999; 163:1282-93.

37. Lurie S, Feinstein M, Mamet Y. Human fetal-placental weight ratio in normal singleton near-term pregnancies ObstetGynaeco Invest l999; 48:155-57.