Original Article

Relationship between Gross Placental Characteristics and Perinatal Outcome of Low-risk Singleton Deliveries

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Abstract

Background: Gross examination of the placenta may provide useful insight into the aetiology of newborn and maternal complications. A review of literature revealed only a few epidemiological studies that determined the relationships between placental abnormalities, gestational age and occurrence of adverse outcome in babies of healthy pregnant women in our region.

Patients and Methods: A prospective cross-sectional study was conducted at the Department of Obstetrics and Gynecology of University of Ilorin Teaching Hospital, between 1st February and August 2013. Pregnant women in labour at ≥28 weeks' gestational age with singleton pregnancies were recruited. Gross examination of the placenta and umbilical cord after delivery were performed.

Results: Four hundred and twenty-eight singleton deliveries were studied. The average placental weight was 580.8 ± 130.6 g (range = 125–1500 g). The mean values of the umbilical cord length and width were 52.7 ± 10.5 cm and 1.96 ± 1.11 cm, respectively. Placental abnormalities occurred in 1.2%. The umbilical cord was centrally inserted in 290 (67.8%), marginally in 31% of cases. There was significant but weak positive correlation between the placental weight, birth weight and gestational age at 40 weeks ($P \leq 0.001$, $r = 0.356$). Placental weight was directly related to birth weight ($P < 0.0001$, $r = 0.244$) and greater in babies with congenital abnormalities ($P = 0.002$).

Conclusions: There was an association between placental parameters and foetal outcome at birth. Placental weight was positively correlated with birth weight, gestational age and occurrence of congenital abnormalities.

Key Words: *Foetal outcome, placenta, placental parameters, placental weight*

Introduction

The human placenta is a discoid-shaped organ which develops with contribution from the uterus and the developing embryo. It is a highly vascularised organ that functions in the maintenance of pregnancy and promotes normal foetal development.[1,2] Owing to the delicate and important nature of the placenta, it is sometimes referred to as the 'mirror of the perinatal period, which has not been sufficiently polished'.[3,4] It provides an indirect link between the maternal circulation and that of the foetus and serves as the organ for the exchange of nutrients, gases and waste products through diffusion.[5,6] The placenta also has metabolic and endocrine functions which include hormone production for maintaining pregnancy, foetal weight and relaxation of the cervix during parturition.[6,7]

The placental weight cannot be measured accurately until after birth; however, the dimensions of the delivered placenta reveal the cumulative development of the placenta from conception to delivery.[8] Placental weight is one of the standard placental measurements by which placental growth can be characterised.[8] It is a summary of different dimensions of growth, including placental thickness, shape, number of blood vessels, cord insertion, arborisation of the villous and vascular nutrient exchange surface, reflected in increasing thickness of the disk.[6] However, these simple measurements may have limitations in depicting the often much more variable chorionic plate growth of placenta from complicated pregnancies; growth of the placenta is directly related to its functional efficiency as the sole foetal source of both nutrients and oxygen.[3,4] The mainstay of placental imaging is ultrasound which is readily available and cheap. Colour and power Doppler techniques are utilised in the indirect visualisation of placental vascularity.[9] Sonographic techniques of three- and four-dimensional imaging may ultimately be

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of value in placental measurements and vascular imaging.[9] Magnetic resonance imaging is another imaging modality for the placenta; however, its use is limited by the high cost and technical know-how.[10]

Abnormalities of the placenta are recognised as the leading causes of stillbirths and are frequently mentioned as the primary cause of death.[11-13] Furthermore, maternal risk factors are often associated with placental growth restriction, hypertrophy or both, which are likely to be compensatory mechanisms for the pregnancy risks.[14] The examination of the placenta may discover the hidden complications of the pregnancy which may give insight into the pathogenesis of neurologic and other developmental disorders.[15] Few epidemiologic studies have related placental abnormalities to gestational age or adverse outcome of the newborn in a healthy population of pregnant women in this environment. Therefore, this study was designed to describe placental parameters and abnormalities in low-risk pregnancies. It also aimed at determining the possible relationship between placental morphology and perinatal outcome.

Patients and Methods

This was a cross-sectional, prospective analytical study conducted in the Department of Obstetrics and Gynecology of University of Ilorin Teaching Hospital, Ilorin, between 1st February and August 2013. Ethical approval was obtained from the Research and Ethics Committee (reference number ERC1162, dated 14/01/2013). Apparently, healthy pregnant women in labour with singleton pregnancies at 28 weeks and above were randomly selected. Exclusion criteria in this study included the following: underlying medical conditions such as diabetes mellitus, hypertensive disorders; antepartum haemorrhage, abnormal presentations, multiple pregnancies, abdominal deliveries and retained placenta were excluded. The gestational age was calculated from the last menstrual period and first-trimester ultrasound. Patients who met the criteria for this study were informed, counselled and informed consent was obtained.

Immediately after delivery of the baby, the umbilical cord was clamped and cut 5 cm from foetal insertion at the foetal end with scissors taking care not to milk the cord. Placental delivery was by controlled cord traction as part of active management of the third stage of labour. The remaining cord from the cut end to the placental insertion was measured with a tape measure in centimetres. Five centimetres was added to the length of the measured umbilical cord. The entire umbilical cord was examined for features such as vasculature, knotting, cord around the neck, insertion and abnormalities.

Only gross examination of the placenta was done within 5 min of delivery of the placenta in the second stage room. No further dissection or cutting of the placenta was done. Universal safety precautions were observed during the conduct of the study. The placental examination included weight of the placenta on a bassinet baby weighing scale (corrected to zero), the point of umbilical cord insertion, cord width and length, presence of retroplacental clots and any other gross abnormality. The cord width was measured at 6 cm from the foetal end before cutting. In our centre, the placenta is disposed by the parturient or her relative(s) and this was done accordingly in this study. Where abnormalities were detected, the parturient was informed and counselled on their clinical implications.

Measures of perinatal outcome

Perinatal outcome was assessed by APGAR scores, birth weight, sex of baby, admission to the Neonatal Intensive Care Unit (NICU) and indications for admission. Data were analysed with SPSS software version 20 (SPSS Inc., Chicago, IL, USA). The continuous variables were analysed using Student's *t*-test while categorical variables were analysed with Chi-square. Further multivariate analysis was done with analysis of variance. $P < 0.05$ was taken as statistically significant. Spearman's rank correlation coefficient and partial correlation test were used to determine associations between placental parameters and measures of perinatal outcome. Partial correlation was used to correct for effect of the gestational age in the relationships because data had some minor degree of skewness.

Results

A total of 428 women who had singleton deliveries were studied. The mean parity and ages of these women were 2 ± 0.44 and 29.2 ± 4.92 years, respectively. The average weight of the placenta was 580.8 ± 130.6 g (range = 125–1500 g). The median placental weight was 560.0 g with an interquartile range of 500–650 g. At a gestational age of 36 weeks and above, the range of placental weight was 125–1000 g. The mean values of the umbilical cord length and width were 52.7 ± 10.5 cm and 1.96 ± 1.11 cm, respectively. The mean birth weights of male and female neonates were 3.17 and 3.09 kg, respectively. The umbilical cord was centrally inserted in 290 (67.8%) cases. It was marginally inserted in 134 (31.3%) cases, and velamentous insertion was identified in 4 (0.9%) cases. Placental and congenital foetal abnormalities occurred in 1.2% and 1.7% of the study population, respectively. Placental and birth weights (mean and ranges) at 36 weeks and above are displayed in Table 1. There was a significant relationship between placental and birth weights at 40 weeks ($P < 0.001$) with a weak positive correlation ($r = 0.356$). Further partial correlation while controlling for gestational age showed a weak positive correlation between placental and birth weight ($P = 0.0001$, $r = 0.244$) [Table 2].

The various neonatal parameters compared with gross placental features were gestational age at delivery, birth weight, Apgar scores at first and fifth minutes, sex of baby, admission into the NICU and congenital foetal abnormalities. At ≥42 weeks, male neonates weighed more than female neonates and this was statistically significant (3.3 vs. 2.8 kg, $P = 0.012$).

In the study population, there were five cases of placental abnormalities which were hyperplacentosis, calcification, placenta accreta and placental haemorrhage. It was observed that 5 out of 7 babies with reported congenital anomalies had normal gross placental features, and when compared with others, the difference was statistically significant ($P < 0.001$). Other parameters did not have significant relationship with

Table 1: Comparison of placental and birth weights at different gestational age groups

GA (weeks)	*n*	Birth weight (kg)		Placenta weight (g)		*r* (*P*)
		Range	Mean±SD	Range	Mean±SD	
36	13	2.20–3.50	3.01±0.32	390–650	522.31±77.15	0.424 (0.148)
37	56	1.50–4.20	3.08±0.47	250–900	566.61±113.99	0.163 (0.229)
38	63	2.00–4.20	3.10±0.40	350–900	570.00±94.05	0.144 (0.277)
39	93	2.00–4.20	3.13±0.41	300–900	572.83±110.16	0.172 (0.101)
40	127	1.90–4.50	3.23±0.43	125–900	608.53±131.09	0.356 (<0.001*)
41	31	2.50–4.80	3.19±0.48	300–1000	599.68±145.18	−0.088 (0.637)
42	14	2.40–4.25	3.02±0.43	500–900	656.15±127.90	−0.402 (0.173)
43	3	2.90–3.50	3.13±0.32	400–500	463.33±55.08	0.500 (0.667)
44	1	3.30		600		

*$P > 0.05$, GA: Gestational age, SD: Standard deviation

placental abnormalities. However, only two out of five babies with placental abnormalities had congenital anomalies while the remaining three had none. The various congenital abnormalities seen were hydranencephaly, spina bifida, talipes, congenital hydrocele, achondroplasia and choanal atresia. The average placental weight of babies with congenital anomalies was more than the mean placental weight of babies without anomalies, and the difference was significant, 728.6 versus 578.3 kg ($P = 0.002$). Conversely, the mean placental weight of babies that required admission to the NICU was lower than the average weight of others ($P = 0.046$) as shown in Table 3. Placental weight or abnormality was not related to the site of insertion of the umbilical cord on gross examination ($P = 0.804$).

Table 2: Relationship between placental weight and some foetal outcome while controlling for gestational age at delivery

Foetal outcome	Placental weight	
	r	*P*
Birth weight	0.244	0.0001*
Apgar score at 1 min	0.083	0.109
Apgar score at 5 min	0.087	0.093

*$P<0.05$. *r*: Partial correlation coefficient

Table 3: Comparison of foetal outcome with placental weight

Variables	*n*=428	Placenta weight (g), mean±SD	*t*	*P*
Sex of baby				
Male	223	584.73±134.57	0.649	0.517
Female	205	576.45±126.26		
Congenital abnormality				
Yes	7	728.57±349.83	3.049	0.002*
No	421	578.30±123.25		
Need for NICU admission				
Yes	47	544.57±135.58	−2.001	0.046*
No	381	585.24±129.46		

*$P<0.05$, *t*: Independent samples *t*-test. NICU: Neonatal Intensive Care Unit, SD: Standard deviation

Discussion

The mean birth weight obtained in this study was 3.14 ± 0.44 kg, and this was found to be similar to the birth weights obtained from the previous studies from other locations within Nigeria.[16,17] The weight of the placenta is used in the determination of the fetoplacental ratio because there is a relationship between the placenta weight and the weight of the baby.[18,19] This positive correlation was also verified in another study.[19] The placental weight was said to give an idea of the amount of substance that is exchanged between the mother and the foetus. The mean placental weight obtained from this study was 584 g for male neonates and 576 g for female neonates. Other authors obtained a range of 300–890 g, with a mean of 590 ± 82 g, both findings are alike.[18] Variations in placental weight could be attributed to factors such as nutrition, genetics, socio-demographic and socio-cultural factors.[20] The weight of the placenta was found to have significant but weak positive correlation with the birth weight of the baby. Since the weight of the placenta correlated positively with the weight of the baby, it then implies that foetal and placental weights are influenced by similar factors. This is not surprising as they both developed from the embryo, and thereafter, the placenta maintains and promotes normal foetal development until birth.[1,6] Researchers have defined placental abnormalities using its weight. According to Van den Broek *et al*., a placenta that weighs more than 600 g is pathologic, but more importantly, the fetoplacental ratio should be considered.[21] Chronic low uteroplacental blood flow is the most frequent cause of small placenta, but often the foetal weight is affected, so the ratio is normal.[21]

The low incidence of placental abnormalities is not too surprising as low-risk pregnancies in healthy women were reported in this series. Even though babies with congenital anomalies had fewer placental abnormalities, further studies on placentation in congenital foetal anomalies are required to reach a conclusion. However, the placentae of babies with congenital anomalies were heavier on the average than placentae of other neonates. This is probably due to enlargement. The cause of placenta enlargement may be unknown, but it is often revealed if the following are considered - maternal diabetes, maternal anaemia, fetomaternal blood group incompatibility; foetal malformation, especially

of the lungs and alpha thalassaemias.[22] Other causes are acute infection, placental mesenchymal dysplasia, placental haemorrhage and molar pregnancy;[22] which are possibilities in the study population after excluding obstetric conditions. Since the placental unit shares a common origin with the foetus, studies to evaluate incidences and factors related to placental abnormalities are required in our parturient.

The umbilical cord insertion had no significant relationships with either placental weight or abnormalities. This was similar to findings of Winje *et al*.[23] but different from findings of Ebbing *et al*. that anomalous cord insertions were associated with foetal malformations, small for gestational age and pre-term births.[24] There exist conflicting reports on these associations, and this may be due to study designs and populations. While our study excluded confounding maternal factors, the earlier studies were population-based without exclusion of maternal factors. An average placental weight of 544.57 ± 135.58 g was significantly associated with neonatal admission in this study (P = 0.046) while placental weight had a weak positive correlation with gestational age. This is comparable to findings in a Thailand hospital, where the abnormal placental weight for gestational age was related to adverse pregnancy outcomes such as neonatal admission and low Apgar scores in 238 normal pregnancies.[25] Furthermore, the placental weight increased with increasing gestational age which was also observed in the Thai study[25] except for a decline at 43 weeks. Interpretations of placental weight should take into consideration, the population, sex, gestational age and birth weight ratios.[26]

Conclusions

The findings of this study revealed the important link between the foetus and the placenta and verified the existing knowledge about the significance of the placenta as a fetomaternal component. Correlations between placental and foetal weight at birth and congenital foetal and placental anomalies were weak. In low-risk pregnancies, gross examination of the placenta may be beneficial in addition to other perinatal assessment. This will facilitate the identification of neonates that may require special care despite an uneventful pregnancy. The gross placental examination is not without limitations. Findings in stillborn and live neonates may be similar, and differences can only be discovered on histopathologic examinations. We also need to investigate further into placental abnormalities; the affected population in this study was too small. Hopefully, this will pave the way for a future study on the relationship of the histological findings of the placenta and perinatal outcome in our environment.

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Conflicts of interest

There are no conflicts of interest.

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