A STUDY OF PLACENTAL WEIGHT AND BIRTH WEIGHT RATIO (PW/BW) AND IT'S EFFECTS ON PERINATAL OUTCOME

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ABSTRACT

Objective*: The placenta weight/birth weight (PW/BW) ratio has been shown to be associated with certain long-term fetal outcomes; however, its association with short-term outcomes has not been evaluated. Our aim was to assess the correlation between the PW/BW ratio and short-term adverse obstetrics outcomes in full-term, appropriate-for-gestational-age (AGA) newborns.*
Design: *Prospective, randomized.*
Setting*: Dr. D.Y. Patil Medical College & Hospital, Pimpri, Pune*
Methods*: In our study, three groups of full-term neonates have been taken, according to their PW/BW ratio (high, normal and low) and are compared. Our primary outcome includes the admission rate to the neonatal intensive care unit (NICU) and secondary outcomes included an Apgar score < 7 at 5 minutes.*
Results*: Our study showed that the high PW/BW ratio group was associated with increased rates of admission to the NICU and Apgar scores < 7 at 5 minutes as compared to normal PW/BW ratio. The low PW/BW ratio group showed decreased rates of NICU admission. A high PW/BW ratio is significantly correlated with short-term adverse perinatal outcomes.*
Conclusion*: The possibility of short term health risks for newborns can be predicted by the PW/BW ratio.*

Key words: *Placental weight, birth weight, PW/BW ratio, NICU admission.*

INTRODUCTION

The placenta-'the life of the fetus in utero'- functions diversely to support the growth of the fetus, interacts with the two individuals, the mother and the developing fetus. It is the most accurate record of the infant's prenatal experiences.[1]

Pregnancy complications which are associated with high perinatal morbidity and mortality are reflected in the placenta both macroscopically and microscopically.[2] It has been shown that development of placenta has got influence on birth weight and placental weight.[3,4] So ratio of two has been studied extensively to determine its association with long term adverse fetal outcomes. e.g. high PW/BW ratio was found to be associated with increased risk in hypertension in adulthood, coronary heart disease, cardiovascular mortality and impaired glucose tolerance.

Most of the studies agree that high PW/BW ratio has been associated with long term fetal outcomes. Eg- development of diabetes/ hypertension.[5] Somehow its association or correlation with short come outcomes has not received much attention. So we are intending to focus on this aspect by our study. There is a positive correlation between placental weight and birth weight of the neonate as shown by Abubakar et al[6].The placental weight is "functionally significant" because it is related to villous surface area and to fetal metabolism[7].

Many studies have been done on different aspects of placenta and fetus, on anatomical, physiological and morphological basis. But very few studies have been done on aspect of PW/BW ratio which is a very simple calculation and can be done in primary levels of medical centers by training nurses, mid wifes and daies. The main purpose of normal delivery is to have healthy mother and baby, however at the same time we have to recognize the risk of the neonate in post natal period. A study published by F Shehata has shown that, the high PW/BW ratio is associated with

increased risk of NICU admission, apgar score is <7, respiratory distress syndrome, whereas the comparison of low PW/BW ratio shows decreased risk of NICU admission and good perinatal outcome.[5] Our research study is based on this standard study and we want to study the results of PW/BW ratio in Indian population so as to identify neonates at risk at primary level and to reduce perinatal morbidity and mortality.

In contrast to the extensive study done in PW/BW ratio and long-term fetal outcomes, the association between the ratio and short-term fetal outcomes has not received much attention. Only one paper by Lao and Wong[8] reported an increased incidence of low Apgar score (<7.0) in a small population of non-diabetic mothers with high PW/BW ratios.[8]

Our aim was to find/ evaluate the average weight of placenta and fetus in our area, to find placental weight /birth weight ratio in normal singleton pregnancies from 37-40 weeks and to evaluate whether there is an association of abnormal placental weight and its ratio with adverse neonatal short term outcomes.

MATERIALS AND METHOD

A Prospective, hospital based, randomised study was conducted in Department Of Obstetrics and Gynaecology, Padmashree Dr D Y Patil Medical College Hospital and Research Centre, Pimpri Pune-18. Our study has been approved by ethical committee of our institution (Dr D Y Patil medical college and D Y Patil University (DPU), Pimpri Pune-18. Consent of the patient was taken after explaining our plan of study. All singleton deliveries which were conducted from period of August 2012 to December 2013 were taken in our study. All full term deliveries (with gestational age 37 weeks to 40 weeks) were included in the study. Our sample size was 120 pregnancies. Inclusion criteria was all patients who have given consent for the study, gestational age between 37 to 40 weeks. Exclusion criteria included patients who did not give consent and withdraw from study, cases like intra uterine death, multiple pregnancies, congenital anomalies in newborn, mother with chronic illness and on long term medications, Antepartum haemorrhage (APH), adherent placenta, patients whose gestational age is not known and not confirmed, premature delivery, abnormal placenta, abnormal cord.

Method of Selection of Different Groups: We did a general survey of 200 patients to find out the different values required for our study. The mean placental weight ratio was 18.3%, 10th percentile was 15.95%, 90th percentile was 22.4%. So we selected cut off value accordingly by forming following three groups.

First group of 40 patients with low PW/BW ratio ranging from 12 to 15.99.

Second group of 40 patients with normal PW/BW ratio 16 to 19.9.

Third group of 40 patients with high PW/BW ratio is 20 to 35.

Placental Preparation

Placentae were prepared according to the method of placental preparation as described in the following manner. An accurate weighing of the placentas was done by trimming off all membranes and severing the umbilical cord at the insertion site on the placenta surface. Superficial fetal vessels were drained of all blood. Adherent blood clots were removed from the maternal surface. The placenta was weighed three times on a calibrated digital device to the nearest gram. The weights were recorded. The weighing was accomplished within one hour after delivery. The birth weight of newborns was recorded to the nearest gram on electronic weighing machine immediately after delivery. APGAR scores were recorded at 1 and 5 minutes. Ratio of PW and BW multiplied by 100 was calculated and divided into three groups (low, normal, high) PW/BW ratios.

After comparing all the data, different tests of significance in the statistics were applied to know the variation of PW/BW ratio in different conditions and its significance.[9]

F. Shehata has concluded that cut off values of low PW/BW ratio, normal PW/BW ratio and high PW/BW ratio in his studies

on percentile basis. His results has shown that, deliveries with a PW/BW ratio below the tenth percentile were considered to comprise the low PW/BW ratio group, those with a PW/BW ratio above the 90th percentile were considered to comprise the high PW/BW ratio group, leaving the rest as the normal PW/BW ratio group.[5] We have followed similar method for forming three groups of patients.

STATISTICAL ANALYSIS

Data analysis was done using the SPSS version 11 for window. ANOVA, Chi-square test, proportion test, odds ratio were used to find the significance of placental weight/ birth weight ratio, NICU admission, apgar score and medical disorders. A 'P' value <0.05 considered as significant.

RESULTS

In our study, three subgroups low PW/BW Ratio (12 to 15.99), normal PW/BW Ratio (16-19.9) and high PW/BW Ratio (20-35) were compared and our study shows following results. Placental weight (in gms) Mean ± SD in low PW/BW ratio (474.38±80.33), normal PW/BW ratio (472.50±44.42), high PW/BW ratio (492.75±81.27) and P value is >0.05.

This means that, high PW/BW ratio is having more placental weight than low PW/BW ratio and normal PW/BW ratio, but not statistically significant as P value is >0.05. Birth weight (in kgs) Mean ± SD in low PW/BW ratio (3.26±0.52), normal PW/BW ratio (2.82±0.32), high PW/BW ratio (2.06±0.48) and P value is <0.0001.This means that, low PW/BW ratio having significantly high birth weight than normal PW/BW ratio and high PW/BW ratio.

PW/BW ratio Mean ± SD is 18.3% and SD is 5.08.

STUDY OUTCOMES

Our primary outcome for the study was admission to the neonatal intensive care unit (NICU). Secondary outcomes included an Apgar value < 7 at 5 minutes. In our study, NICU admissions are as follws- 2 admissions in low PW/BW ratio, 3 in normal PW/BW ratio and 12 in high PW/BW ratio.

Comparison of obstetric outcomes between high PW/BW ratio and normal PW/BW ratio groups

The high PW/BW ratio group showed an increased risk of NICU admission and APGAR score <7 at 5 minutes

Table 1: NICU admission, APGAR score of the high and normal PW/BW ratios group

Parameter	High (%) **(n=40)**	Normal (%) **(n=40)**	OR	95% CI	P Value
NICU admission	12 (30)	3 (7.5)	5.28	1.36 – 20.53	<0.01
APGAR score<7	12 (30)	0	-	-	<0.0001

Comparison of obstetric outcomes between low PW/BW ratio and normal PW/BW ratio groups

Contrary to the above, in our study, the comparison of the low ratio group with the normal PW/BW ratio group revealed decreased or comparable risk of perinatal outcome for the same variables tested.

Table 2: NICU admission, APGAR score of the low and normal PW/BW ratios group

Parameter	Low (%) **(n=40)**	Normal (%) **(n=40)**	OR	95% CI	P Value
NICU admission	2 (5)	3 (7.5)	0.65	0.10 – 4.11	>0.05
APGAR score<7	0	0	-	-	-

Testing various predictors for adverse obstetrics Outcomes in our study

The predictor variables in our study included were HTN, DM, IUGR, oligohydraminos, anaemia The PW/BW ratio and increased number of NICU admission was seen in hypertensive patients when compared to other variables (as shown in Table 3).

Table 3: Association between medical disorder and PW/BW ratios in study group

Medical disorder	PW/BW ratio			Chi-square	P Value
	Low	Normal	High		
DM	1	3	2	1.05	>0.05
HTN	1	6	20	27.81	<0.0001
IUGR	0	0	11	24.22	<0.0001
Oligohydraminos	3	1	5	2.88	>0.05
Anemia	0	1	3	3.62	>0.05
Rh negative	1	1	1	0	>0.05

DISCUSSION

Placenta plays a vital role in normal fetal development and fetal disorders may result from failure of placenta to gain weight and insufficiency of its function. Factors influencing placental weight include parity, maternal height and weight, increase in placental size is significantly associated with maternal weight, and it is an independent predictor of birth weight. Large placental size and low birth weight have been implicated as factors predicting high blood pressure in adulthood.[10] It has been shown that maternal or fetal diseases (gestational diabetes, severe anemia, hypertension, hydrops fetalis) influence fetal and placental weight.[11,12,13,14] The higher blood pressures have occurred in later life, who had been small babies with large placentas.[15] It has been shown that placental weight has a significant role in fetal growth in terms of weight, body length, and cord length.[16] While some other studies have shown less correlation between mentioned factors and placental weight [17].

The placental ratio tends to increase in AGA group both for women with uncomplicated pregnancies and women with pregnancies complicated by intrauterine growth retardation, pregnancy induced hypertension etc.[13]

Pregnancies with hypertension result in high placental weight.[17] Our findings indicate that the prevalence of high and low placental weight is seen in preeclampsia.[19]

With evaluation and follow up of placenta growth in early pregnancy, we can prevent the risks for fetal life and improve infant health. Shehata. F has shown that, in a large obstetric population considered to be a normal population (AGA and term newborns), there was a significant increased risk for adverse neonatal outcome in newborns with high PW/BW ratios[5]. This increased risk is independent of other risk factors which are known to increase perinatal morbidity, namely PIH, DM. In contrast, a low PW/BW ratio was associated with comparable and even better obstetrics outcome than the normal PW/BW ratio. However, other risk factors such as PIH, DM might induce their effects through the PW/BW ratio[5]. Our study also shows similar results. The strength of our paper lies in the following points: all newborns in the three study subgroups were delivered in the same tertiary care centre and an electronic database recording was available for all of the various perinatal, maternal and demographic outcomes. NICU admission rate followed a trend where it was increased in the high PW/ BW ratio and was decreased in the low PW/BW ratio group[5].

In our study birth weight was comparable among the three groups, which eliminated its impact as a confounding factor on adverse outcomes. Dividing our groups into low, normal and high ratios gave us a better reflection of the trends in adverse obstetric variables. Our aim is to examine closely the effect of PW/BW ratio on various short-term perinatal outcomes in full-term AGA neonates.[5]

Our study is similar to F.Shehata et al study who divided the AGA population into high, normal, low PW/BW ratios. When compared with normal PW/BW ratios and the high PW/BW ratio group his results showed that there is with increased rates of admission to the NICU, of Apgar scores < 7 at 5 minutes, [5]. On the contrary, the low PW/BW ratio group showed decreased rates of NICU admission.

We believe our study should be the trigger for further research on the mechanism involved in inducing placental hypertrophy, concomitantly with normal birth weight, resulting in a high PW/BW ratio and a higher risk for adverse obstetrics outcomes. The exact mechanism by which the placenta may become stimulated and increases in weight in response to a suboptimal fetal intrauterine environment is unclear. It is possible that the placenta acts as a sensor for mild fetal distress, or that the fetus might be sending some signals alerting the placenta of the imbalance between fetal demand and maternal supply. Alternatively, it is possible that the placenta is continuously monitoring the fetal condition, and reacts by increasing its weight trying to meet fetal demands. Appropriate for gestational age and full-term newborns may conceal an imminent adverse outcome that cannot be recognized or identified by commonly used markers, such as gestational age or birth weight where PW/BW ratio is more useful as shown in our study.

CONCLUSION

Our study proves that there is a strong relationship between the placenta and the fetus suggesting that the wellbeing of the fetus is highly dependent on the placenta since it serves as a link between the mother and the developing fetus for nutritional support, excretory functions as well as immunological and hormonal support. The best indicator of fetal weight is placental weight. Critical examination of the placenta and umbilical cord immediately after delivery should be used to determine the wellbeing of the baby. It is our belief that the PW/BW ratio may serve as an easy clinical marker for short-term adverse obstetric outcomes and the calculation of PW/BW ratio is simple and easy and can be practiced at primary health centres.

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