ORIGINAL RESEARCH

Assessment of Effect of Placental Weight and Birth Weight Ratio (PW/BW) On Perinatal Outcome at a Tertiary Care Centre

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Abstract
Background: The placental weight to birth weight ratio (PW/BW ratio) is an important parameter in obstetrics and neonatology, offering insights into fetal and placental health.
Aim and objectives: The present prospective cross-sectional study was conducted to evaluate effect of placental weight and birth weight ratio (PW/BW) on perinatal outcome.
Materials & Methods: 75 full term deliveries (with gestational age 37 weeks to 40 weeks) divided into 3 groups based on. Group I was of 25 patients with low PW/BW ratio ranging from 12 to 15.99. Group II was of 25 patients with normal PW/BW ratio 16 to 19.9. Group III was of 25 patients with high PW/BW ratio is 20 to 35. Parameters such as admission rate to the neonatal intensive care unit (NICU) and an APGAR score < 7 at 5 minutes was recorded.
Results: NICU admission was seen in 4 in group I, 2 in group II and 9 in group III. APGAR score < 7 was found in 12 patients in group III but not found in any patient in group I and II. The difference was significant (P< 0.05). Hypertension was seen in 2 in group I, 1 in group II and 6 in group III, DM in 4 in group I, 3 in group II and 9 in group III, IUGR in 1 in group I, 2 in group II and 10 in group III where the difference was significant (P< 0.05) and anaemia in 1 in group I and 7 patients in group III.
Conclusion: Since the placenta acts as a conduit between the mother and the developing fetus, there is a strong correlation between the placenta and the fetus, indicating that the foetus's health is greatly dependent on it for conditions like IUGR, adult-onset hypertension, coronary heart disease, cardiovascular mortality, and impaired glucose tolerance. The PW/BW ratio may be a simple clinical indicator of unfavourable short-term obstetric outcomes.
Keywords: Birth weight ratio, neonatal, placenta

Introduction
The placental weight to birth weight ratio (PW/BW ratio) is an important parameter in obstetrics and neonatology, offering insights into fetal and placental health. This ratio helps to evaluate the efficiency of the placenta in supporting fetal growth and can be an indicator of potential complications during pregnancy.[1] The normal PW/BW ratio typically ranges from

1:5 to 1:7. This means that for every gram of placental weight, there are approximately 5 to 7 grams of birth weight.[2] For example, if a newborn weighs 3,500 grams (3.5 kg), a normal placental weight would be between 500 to 700 grams. A high PW/BW ratio can indicate that the placenta is disproportionately large compared to the fetus. This can be associated with conditions such as maternal diabetes, maternal anemia, chronic hypertension, infections and intrauterine growth restriction (IUGR).[3] Both macroscopically and microscopically, the placenta exhibits pregnancy problems linked to elevated perinatal morbidity and death. Research has demonstrated that placental and birth weight is influenced by placenta development.[4] Therefore, the ratio of two has been thoroughly investigated to ascertain its correlation with unfavourable foetal outcomes in the long run. For instance, a high PW/BW ratio has been linked to a higher risk of adult hypertension, coronary heart disease, cardiovascular death, and impaired glucose tolerance.[5]

Aim and objectives
The present prospective cross-sectional study was conducted to evaluate effect of placental weight and birth weight ratio (PW/BW) on perinatal outcome.

Materials & Methods
The present prospective cross-sectional study was conducted on 75 full term deliveries (with gestational age 37 weeks to 40 weeks) attending the OPD/Emergency, Department of Obstetrics and Gynaecology, Government Medical College and Hospital, Purnea, Bihar, India, after getting ethical clearance over a period from July 2023 to February 2024. The study was conducted at Department of Obstetrics and Gynaecology, Government Medical College and Hospital, Purnea, Bihar, India. All parents were informed regarding the study and their written consent was obtained those who met the specified criteria for inclusion and exclusion. The Institutional Ethics Committee gave the study its approval. Data such as name, age, gender etc. was recorded.

Inclusion Criteria
- Patients to give written informed consent
- All women who delivered at term (with gestational age 37 weeks to 40 weeks)
- Available for follow up.

Exclusion Criteria
- Patients not give written informed consent
- Retained and adherent placentas. Placentas weight which were incorrectly weighed
- Patients with antepartum haemorrhage (APH), adherent placenta, patients whose gestational age is unknown or not confirmed, premature delivery, abnormal placenta, and abnormal cord, cases like intrauterine death, multiple pregnancies, congenital anomalies in newborns, mothers with chronic illnesses, and those on long-term medications, withdraw from the study
- Those unable to attend follow-up.

Sampling size determination and sampling technique
The following simple formula would be used for calculating the adequate sample size in prevalence study
$$n = Z^2 P (1-P)/d^2$$
n= sample size, Z= level of confidence, P= prevalence, d= Absolute error or precision
Z = Is standard normal variate (at 5% type 1 error (P< 0.05) it is 1.96 and at 1% type 1 error (P<0.01) it is 2.58). As in majority of studies P values are considered significant below 0.05

hence 1.96 is used in formula. p = Expected proportion in population based on previous studies or pilot studies. d = Absolute error or precision The sample size was calculated using a single population proportion formula, by considering, 95% confidence level, a 5% margin of error, and a 5% estimated prevalence among patients.

Sample size = $1.96^2 \times 0.05 (1\text{-}0.05)/0.05^2$

=72

Considering 4% non-response rate, the total minimum sample size for study was 75 patients. Patients were divided into 3 groups based on. Group I was of 25 patients with low PW/BW ratio ranging from 12 to 15.99. Group II was of 25 patients with normal PW/BW ratio 16 to 19.9. Group III was of 25 patients with high PW/BW ratio is 20 to 35. Parameters such as admission rate to the neonatal intensive care unit (NICU) and an APGAR score < 7 at 5 minutes was recorded. The participants were monitored and follow up for a period of 1 year.

Statistical Analysis

Statistical analysis was performed on the obtained data by using SPSS version 22.0 (IBM Corp., 2016) and Microsoft 16. Odd ratio, Calculation of the 95% Confidence Interval (CI) for the OR, Chi-square test and Fisher's Exact test 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

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

Parameters	Group I (n=25)	Group II (n=25)	Odd Ratio	95% CI	P value
NICU admission	4	2	2.19	0.364,13.20	0.384
APGAR score < 7	0	0	-	-	-

Table 1 show that NICU admission was seen in 4 in group I, 2 in group II. APGAR score < 7 was not found in any patient in both groups. The difference was not significant (P > 0.05).

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

| Parameters	Group III (n=25)	Group II (n=25)	Odd Ratio	95% CI	P value
NICU admission	9	2	6.47	1.232,33.97	0.017
APGAR score < 7	12	0	-	-	<0.0000856

Table 2 shows that NICU admission was seen in 9 in group III and 2 in group II. APGAR score < 7 was seen in 12 in group III and 0 patients in group II. The difference was significant (P< 0.05).

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

Parameters	Group I (n=25)	Group II (n=25)	Group III (n=25)	Chi-square Test	Degree of freedom(df)	P value
HTN	2	1	6	1.4182	4	0.699
DM	4	3	9	0.1738	4	0.978
IUGR	1	2	10	16.36	4	<0.001
Anemia	1	0	7	5.396	4	0.251

Table 3 and figure I shows that hypertension was seen in 2 in group I, 1 in group II and 6 in group III, DM in 4 in group I, 3 in group II and 9 in group III, IUGR in 1 in group I, 2 in

group II and 10 in group III where the difference was significant (P< 0.05) and anaemia in 1 in group I and 7 patients in group III.

Figure I: Association between medical disorder and PW/BW ratios
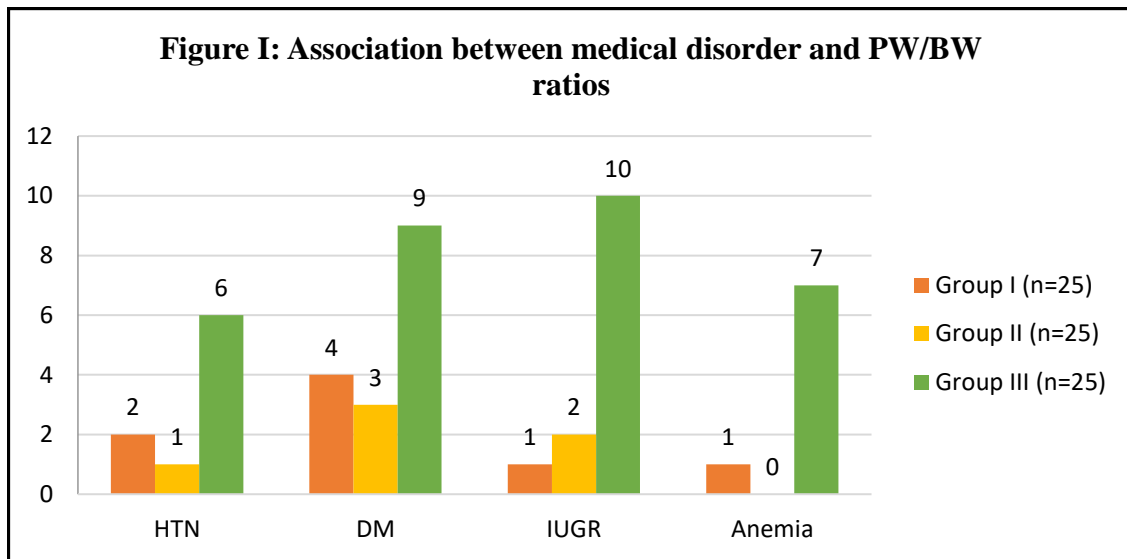
Discussion

The placenta is essential to healthy fetal growth, and deficiencies in its function or inability to gain weight can lead to fetal diseases.[6] Parity and the height and weight of the mother are factors that affect placental weight.[7] An increase in placental size is a strong correlation with maternal weight and an independent predictor of birth weight.[8] Low birth weight and large placental size have been linked to an increased risk of high blood pressure in adulthood.[9,10] The present study was conducted to evaluate effect of placental weight and birth weight ratio (PW/BW) on perinatal outcome. Adult-onset hypertension, heart disease, cardiovascular death, and decreased glucose tolerance.

We found that NICU admission was seen in 4 in group I, 2 in group II and 9 in group III. APGAR score < 7 was found in 12 patients in group III but not found in any patient in group I and II. The difference was significant (P< 0.05). Madkar et al[11] assessed the correlation between the PW/BW ratio and short-term adverse obstetrics outcomes in full-term, appropriate-for-gestational-age (AGA) newborns. 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. The 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.

We observed that hypertension was seen in 2 in group I, 1 in group II and 6 in group III, DM in 4 in group I, 3 in group II and 9 in group III, IUGR in 1 in group I, 2 in group II and 10 in group III where the difference was significant (P< 0.05) and anaemia in 1 in group I and 7 patients in group III. Asgharnia et al[12] evaluated placental weight and factors associated with low weight placentas. In a longitudinal cross-sectional study, women with single pregnancy, and gestational age between 37-42 weeks were studied. The subjects were categorized in high (> 750 g), normal (330-750 g), and low placental weights (< 330 g). The placental weight, birth weight, maternal age, gestational age, parity, pre-eclampsia, history of maternal diabetes, delivery approaches, infants' gender; and Apgar score in 5th minutes after delivery

were examined. One thousand eighty- eight pregnant women were included in the study. The mean and standard deviation for maternal ages and gestational ages at deliveries were 25.35 ± 5.6 and 247.51 ± 9.56 days, respectively. The mean and standard deviation of neonates' weights at birth and placental weights were 3214.28 ± 529 and 529.72 ± 113 g, respectively. The prevalence of low and high placental weights were 2% and 2.8%, respectively. There were statistically significant relationships between placental weight and birth weight, fetal distress, Apgar score, maternal diabetes, pre-eclampsia and approaches of deliveries (α = 0.05). Findings indicate that placental weight can be associated with important variables influencing some maternal and neonatal outcomes and placental weight lower than 330 g can be a warning sign.

Limitation of the study
The shortcoming of the study is small sample size and short duration of the study.

Conclusion
Authors found that since the placenta acts as a conduit between the mother and the developing fetus, there is a strong correlation between the placenta and the fetus, indicating that the foetus's health is greatly dependent on it for conditions like IUGR, adult-onset hypertension, coronary heart disease, cardiovascular mortality, and impaired glucose tolerance. The PW/BW ratio may be a simple clinical indicator of unfavourable short-term obstetric outcomes.

Acknowledgement

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