ABSTRACT

Background: Pregnancy induced hypertension is a common pathological problem which leads to placental insufficiency. This in turn leads to significant foetal and maternal morbidity and mortality. The aim of the present study is to study the morphological changes in placenta in Pregnancy Induced Hypertension.

Methods: A cross-sectional study was conducted in Department of Anatomy, Nobel Medical College and Teaching Hospital from May 2021 to April 2022. A total of 100 placentas were collected from postpartum mothers with Pregnancy Induced Hypertension. Statistical analysis was done using Microsoft Excel (2007) and the Statistical Package for the Social Sciences (SPSS) version 11.5.

Results: The mean weight of placenta in this study was 486.68±65.86. The mean diameter was 17.84±1.89. The mean thickness was 2.67±0.45. There was a strong positive correlation between weight of placenta and weight of neonate ((r = 0.434, p<0.01). Similarly, there was a positive correlation between placental thickness and placental diameter with the neonatal weight ((r=0.39, p<0.01) and (r=0.318, p<0.01) respectively.

Conclusions: There is significant reduction in weight and dimensions of placenta in Pregnancy Induced Hypertension. These may result in placental insufficiency as a result of compromised utero-placental blood flow. This may have an adverse effect on the neonatal birth weight.
Sample size was calculated using the formula:

\[ n = \frac{Z^2 \times P \times Q}{D^2} \]

Where,
- \( Z = 1.96 \)
- \( P = \text{prevalence} = 2.7\% \)
- \( Q = 100 - P = 93 \)
- \( D = \text{allowable error} = 5\% \)

Thus, \( n = 100.035 \approx 100 \)

The inclusion criteria were women diagnosed of PIH, women with complete information on their socio-demographic characteristics, known gestational age, singleton pregnancy, live birth neonate, availability of mother’s ANC card. The exclusion criteria were women with previous history of hypertension, women with multiple pregnancy, unknown gestational age, unavailability of ANC card and incomplete information on maternal socio-demographic characteristics.

The placenta with attached umbilical cord were collected soon after delivery, washed in running tap water, and then fixed with 10% formalin. The weight, diameter, thickness at center, number of cotyledons, and site of insertion of umbilical cord were noted. The maternal indices like age, gestational age, anemia and neonatal indices like birth weight, body length, head circumference, abdominal circumference, sex and presence of gross foetal abnormality was noted. Foeto-placental weight ratio was calculated. The data collected from morphological and morphometric studies were recorded. Statistical analysis were done using Microsoft Excel (2007) and the Statistical Package for the Social Sciences (SPSS) version 11.5.

### RESULTS

Out of 100 neonates 53 % (53) were females and 47% (47) were males. The birth weight had a mean of 2860.5 gm while mean Ponderal index was 2.66.

#### Table 1: Neonatal Indices

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW(gm)</td>
<td>2860.5±438.39</td>
<td>1900-4500</td>
</tr>
<tr>
<td>BL(cm)</td>
<td>47.81±2.85</td>
<td>40-54</td>
</tr>
<tr>
<td>HC(cm)</td>
<td>35.28±2.71</td>
<td>32-46</td>
</tr>
<tr>
<td>AC(cm)</td>
<td>38.86±3.12</td>
<td>31-45</td>
</tr>
<tr>
<td>PI</td>
<td>2.66±0.53</td>
<td>1.8-4.68</td>
</tr>
</tbody>
</table>

SD=Standard deviation, BW=Birth weight, BL=Body length, HC=Head circumference, AC=Abdominal circumference, PI=Ponderal index

### Table 2: Morphology of placentae

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean±SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>486.68±65.86</td>
<td>340-675</td>
</tr>
<tr>
<td>Diameter</td>
<td>17.84±1.89</td>
<td>14-23</td>
</tr>
<tr>
<td>Thickness</td>
<td>2.67±0.45</td>
<td>1-3.3</td>
</tr>
<tr>
<td>No. of Cotyledons</td>
<td>18.38±2.03</td>
<td>14-24</td>
</tr>
</tbody>
</table>

The mean weight of placentae was 486.68 gm

### Table 3: Summary of correlation analysis of foetal indices and placental morphometry

<table>
<thead>
<tr>
<th>Variables</th>
<th>Statistics</th>
<th>Neonatal weight</th>
<th>Neonatal length</th>
<th>Neonatal head circumference</th>
<th>Ponderal Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placental weight</td>
<td>Pearson Correlation</td>
<td>.434**</td>
<td>.199*</td>
<td>0.099</td>
<td>.212*</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0</td>
<td>0.047</td>
<td>0.925</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Placental diameter</td>
<td>Pearson Correlation</td>
<td>.392**</td>
<td>-0.099</td>
<td>-0.019</td>
<td>.476**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0</td>
<td>0.328</td>
<td>0.853</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Placental thickness</td>
<td>Pearson Correlation</td>
<td>.318**</td>
<td>.214*</td>
<td>-0.06</td>
<td>0.072</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>0.001</td>
<td>0.033</td>
<td>0.553</td>
<td>0.478</td>
</tr>
</tbody>
</table>

### DISCUSSION

The placenta is a complex multifunctional organ. It is the derived from two separate individuals, the mother and the foetus and is the primary metabolic regulator for the respiratory, nutritional, excretory, endocrine and immunological functions of the foetus necessary for foetal growth.\(^{11,12}\)

Preeclampsia is the presence of a systolic blood pressure (SBP) greater than or equal to 140 mm Hg or a diastolic blood pressure (DBP) greater than or equal to 90 mm Hg or higher, on two occasions at least 4 hours apart in a previously normotensive patient, OR an SBP greater than or equal to 160 mm Hg or a DBP greater than or equal to 110 mm Hg or higher. In addition to the blood pressure criteria, proteinuria of greater than or equal to 0.3 grams in a 24-hour urine specimen, a protein (mg/dl)/creatinine (mg/dl) ratio of 0.3 or higher, or a urine dipstick protein of 1+ (if a quantitative measurement is unavailable) is required to diagnose preeclampsia.\(^{13}\)

The weight of the placenta is used to determine the foeto-placental ratio. The amount of substance that is exchanged between the mother and the foetus may be determined by the weight of the placenta. The mean placental weight was 486.68 gm (SD = 65.86) with a range of 340-675 gm. The weight of the placenta was found to have a significant positive correlation with the weight of the baby (\( r = 0.434, p<0.01 \)) while head circumference (\( r = 0.01, p>0.01 \)) and length of baby (\( r = 0.2, p>0.01 \)) did not have significant positive correlation with weight of placentae.

Luz, in a study found that the mean placental weight was 537 gm
(SD=96gm). A study by Lurie et al, found the mean placental weight to be 613.0 (SD=123.8gm)15 while a study by Lo et al, found the mean placental weight to be 646.2 (SD=0.3gm).16 Comparing the mean placental weight obtained in this experiment to those obtained above, it was observed that the mean placental weight obtained by Luz was quite close to the mean obtained in the present study14 while the mean placental weight in Lurie et al study was found to be higher than the one obtained here.15 This suggests that the mean placenta weight may differ from one place to another and may be because of so many factors such as nutrition, genetics, gestational age, maternal size, etc.

As the weight of the placenta correlated positively with the weight of the neonate, it suggests that placental weight may be an important predictor of neonatal weight.

The mean placental diameter was 17.84 cm (SD=1.89) with a range of 14 to 23 cm. The diameter of the placentae had strong correlation with neonatal weight(r=0.39, p<0.01)) but no correlation with neonatal head circumference(r=0.019, p>0.01) and neonatal length(r=0.09, p>0.01). The diameter of the placentae is an indicator of the size of the placenta which in turn gives information about the foeto-placental ratio. The placentae diameter of the placentae affects the amount of nutrients, oxygen and carbon dioxide that will pass from the mother to the child and vice versa. Borton 18 and Ohagwu et al18 reported a term placental diameter range of 15 cm to 25 cm while Yetter12 reported a mean of about 22 cm. Comparing the mean placental diameter obtained in the present study with that of these investigators, the mean placental diameter is lower than that of Yetter12 but falls within the range of Borton 17 and Ohagwu et al.18

In this study, there was significant correlation between the placental diameter with the weight of the neonate but insignificant with head circumference and length of the neonate. The positive correlation with placental weight shows that foetal factors which directly affect the weight of the placentae will indirectly affect the diameter of the placenta and vice versa.

In this study, the mean placental thickness was 2.67 cm (SD=0.45) with a range of 1.2 - 3.3 cm. Thickness of the placentae had a strong correlation with neonatal weight(r=0.318, p<0.01) and neonatal length(r=0.214 p<0.01) but no correlation with neonatal head circumference(r=-0.06, p>0.01). Ohagwu et al,18 reported an average placental thickness of 3.0 cm while Borton17 reported a range of 2 cm to 4 cm. Yetter12 gave the range of 2.0 cm to 2.5 cm. The average placental thickness for the present study is lower than that of Ohagwu et al.18 and the range is less than those of Yetter12 and Borton.17

Since there was no significant correlation between the placental thickness and the head circumference and the length of the neonate, it appears that an increase in any of these factors may not influence the thickness of the placentae significantly. Placentae less than 2.5 cm thick are associated with IUGR of the foetus whilst placenta more than 4 cm thick may be associated with maternal diabetes mellitus, foetal hydrops and intrauterine foetal infections.19

The limitation of this study is small sample size.

CONCLUSION

It was seen that there is significant reduction in weight and dimensions of placenta in PIH. These may lead to placental insufficiency as a result of compromised utero-placental blood flow which in turn may have an adverse effect on the neonatal birth weight.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES:


