Original Article

A Study on Variation of Placental Index in Different Gestational Age Groups of Healthy Pregnant Mother of Bangladesh

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Abstract

Background: *The placenta is an organ that is absolutely essential to the survival of the fetus. All the enabolites needed for fetal metabolism come from the mother's blood and fetal catabolites are passed back into the mother's circulation through the placenta. So, as a mirror, it reflects the intra-uterine status of the fetus.*

Objectives: *This study was done to provide information about the placental index in different gestational ages of healthy pregnancies.*

Materials and Methods: *This cross sectional descriptive study was performed on 80 human placentas in the Department of Anatomy, Mymensingh Medical College, Mymensingh, from January to December 2018 of healthy Bangladeshi pregnant mother in relation to different gestational age. By purposive sampling technique the collected samples were divided into three gestational age groups. They were Group A (28 to 36 weeks), Group B (37 to 40 weeks) and Group C (above 40 weeks) and examined morphologically by fine dissection method. The placental index (placental coefficient) was calculated by dividing placental weight by the birth weight of the baby.*

Result: *The mean (± SD) placental index was 0.17±0.09 in group A, 0.14±0.01 in group B and 0.15±0.03 in group C. It was also observed that the mean placental index decreased with gestational age up to certain level then increased. The mean difference of the placental index between groups A and C was statistically moderately significant (p < 0.01) but difference between groups A and B, B and C was statistically non-significant (p > 0.05).*

Conclusion: *The present study showed an increase in birth weight will be followed by increased placental weight which is useful both clinicians and researchers for further studies to evaluate the correlation of placental index with pregnancy and neonatal outcome.*

Keywords: *Placental weight, Fetal weight, Gestational age, Healthy pregnant mother of Bangladesh, Placental index.*

Introduction

The placenta is a flattened circular organ in the uterus of pregnant mammals that nourishes and maintains the fetus through the umbilical cord.[1] At full term, the placenta is discoid with a diameter of 15 to 25 cm, is approximately 3 cm thick, and weighs about 500 to 600 g. At birth, it is torn from the uterine wall and, approximately 30 minutes after birth of the child, is expelled from the uterine cavity as the afterbirth.[2] The placenta is an organ that is absolutely essential to the survival of the fetus. The term 'placenta' was used for the first time in 1559 and all the enabolites needed for fetal metabolism come from the mother's blood and fetal catabolites are passed back into the mother's circulation through the placenta.[3] So, as a mirror, it reflects the intra-uterine status of the fetus. Its metabolic functions are complex, and it undergoes continuously throughout gestation a change in weight, structure, shape and function in order to support prenatal life.[4] In GDM, when the intra-uterine environment for fetus become hostile, the placenta tries to exert its reserve capacity by changing its morphological structure, as well as some pathological changes occur that are

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compounded principally of some disturbances in its normal rate of maturation.[5] The placental index is defined as the ratio of the placental weight to fetal weight and high placental index was correlated to poor pregnancy outcomes.[6] A growing body of data indicates that placental structural and functional abnormalities can cause numerous adverse pregnancy outcomes. Recent evidence also underscores the importance of placental development in long term health and disease for both mother and offspring. Yet, limited understanding of in vivo human placental development hinders our ability to identify abnormal placental structure or function, predict their impact on maternal and fetal health, or improve clinical decision making. By increasing the understanding of the placenta and the ability to prevent and treat placental abnormalities, we could improve not only pregnancy outcome but also the lifelong health of the child and the mother.[7] Placental index was higher in pregnancies related hypertensive disorders, small for gestational age infants, new born needing cardiopulmonary resuscitation or hospitalization neonatal intensive care unit.[8]

So, this study was undertaken to quantitatively evaluate various dimensions of the placental index and analyze their relationship with fetal birth weight and their clinical significance.

Materials and Methods

Specimens containing placenta were collected just after delivery on different dates from April 2018 to September 2018 from the Department of Obstetrics and Gynaecology of Mymensingh Medical College Hospital, Mymensingh. All the specimens were collected from healthy pregnancy of gestational age at 28 weeks and above. All patients' information regarding the exclusion criteria was collected from the hospital records of MMCH. Just after delivery of the placenta, they were kept in a bucket containing 10% formol saline. Each placenta was allotted an identification number tagged with a piece of waxed cloth. The weights of baby were determined by the measuring weight machine and noted in a record book against respective identification number. All specimens were examined carefully to measure the weight of placenta and corresponding baby. The weights of placentas were measured by a scientific balance within 12–24 hours of delivery after trimming of membranes and umbilical cord. At first, the placenta was dried with tissue paper properly. The set button of the scientific balance was on and the placenta was put on it. The measurement was recorded and expressed in gram (gm). Then the ratio of the placental weight and fetal weight was determined. The collected specimens were divided into 3 groups e.g. A, B, and C according to the gestational age, on the basis of maturation of baby such as group A pre-term 28–36 weeks, group B term 37–40 weeks, group C late term above 40 weeks (Table I) for convenience of differentiating the variation of the placental index at different gestational age. The placental index of each subject was recorded in the pre designed data sheet, analyzed by SPSS program & compared with the findings of other national and international studies and standard text books.

Calculation of placental index = Weight of placenta/Weight of newborn

Results

Table I: Gestational Age Grouping of Samples for Morphological Study.

Group	Gestational in kg	Number of specimens
A	28 – 36	20
B	37 – 40	42
C	Above 40 weeks	18
Total		80

Figure 1: Photograph Showing the Measurement of Weight of Placenta.

Figure 2: Photograph showing the procedure of measurement of weight of baby.

The maximum placental index was 0.17 in Group A, 0.20 in group B and 0.24 in Group C. The minimum placental index was 0.15 in Group A, 0.14 in Group B and 0.15 in Group C. The mean (± SD) placental index was 0.17±0.09 in group A, 0.14±0.01 in group B and 0.15±0.03 in group C. The mean placental index was maximum in group A (0.17) and was minimum in group B (0.14). It was also observed that the mean placental index decreased with gestational age up to certain level then increased in group C. The mean difference of the placental index between groups A and C was statistically moderately significant (p < 0.01) but difference between groups A and B, B and C was statistically non-significant (p > 0.05). Above finding are shown in the table II and figure 3.

Table II: Placental index in Different Gestational Age Groups

Gestational Age Group	Number of Specimen (n = 80)	Placental index Mean±SD (Minimum – Maximum)
A (28 to 36 weeks)	18	0.17±0.00 (0.15 – 0.76)
B (37 to 40 weeks)	42	0.14±0.01 (0.14 – 0.2)
C (Above 40 weeks)	20	0.15±0.03 (0.14 – 0.24)

Comparison of placental index among the gestational age groups

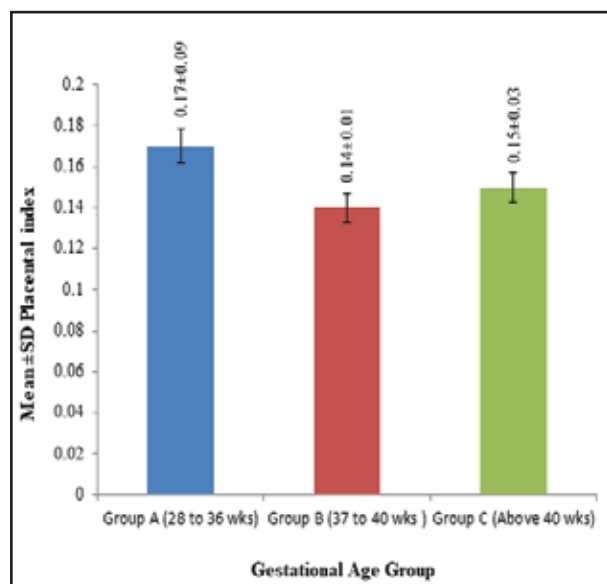| Comparison between gestational age groups	Mean Difference	Std. Error Difference	t	p
A & B	- 0.02873	0.01429	-2.010	0.05
B & C	- 0.00645	0.01504	-0.429	0.67
A & C	0.02228	0.0067	3.325	0.002

Figure 3: Bar Diagram Showing the Placental Index in Different Gestational age groups.

Discussion

The maximum placental index was 0.17 in group A, 0.20 in group B and 0.24 in group C. The minimum placental index was 0.15 in group A, 0.14 in Group B and 0.15 in group C. The mean (± SD) placental index was 0.17±0.09 in group A, 0.14±0.01 in group B and 0.15±0.03 in group C. The mean placental index was maximum in group A (0.17) and was minimum in group B (0.14). It was also observed that the mean placental index decreased with age up to certain level then increased in group C. The mean difference of the placental index between groups A and C was statistically moderately significant (p < 0.01) but difference between groups A and B, B and C was statistically non-significant (p = or > 0.05).

D'Sa and Sangeetha (2018) described that the placental co-efficient in normal birth weight groups was 0.162±0.011 and in low birth weight group was 0.197±o.028. The placental co-efficient fallen as the placental weight increases and high placental co-efficient was seen if the placental weight decreases.[9] Koran-tema & DuBois (2018) mentioned that the placental index usually was 0.09 to 0.28 (average 0.15).[10] Datta (2012) stated that the proportional weight between placenta and fetus at various stages of pregnancy: at 1st month was 6:1, at 4th month was 1:1, at birth was 1:7.[11] Dutta (2011) stated that the average proportion of the weight of the placenta at term and to the weight of the baby was being roughly 1:6.[12] Raghunath, Vijayalakshmi & Shenoy (2011) stated that the average placental coefficient was 0.19.[13] Begum (2010) made a study on 60 human placentas and revealed that the mean± SD placental index was 0.187±0.113 in between 28 to 32 weeks, 0.153±0.025 in between 33 to 37 weeks and 0.166±0.25 in between 38 to above weeks of gestation. It was also observed that mean placental index decreased with age up to certain level then increased.[14] Chamberlain et al. studied on the effect of maternal anaemia and iron deficiency on the ratio of fetal

weight to placental weight. They described that the highest ratio of placental weight to birth weight of baby occurred in the most anemic women with the largest falls in mean cell volume. Large placental weight and high ratio of placental index were also independently associated with high maternal body mass index. Maternal smoking reduced placental weight, but increased the ratio of placental to birth weight.[15] Hargitai et al. studied in examination of the human placenta, they stated that a low placental weight is found in small for gestational age group.[16] Barua found that decreased in placental weight to fetal weight occurred in the severe anaemic women with the largest falls in mean cell volume. Maternal smoking reduced placental weight, but increased the ratio of placental weight to baby's birth weight.[17] Salafia et al. studied in human placenta and described that placental weight alone correlated significantly with gestational age and birth weight of fetus.[18] Janthanapan, Anantakul and Geater described that the placental and fetal weight ratio decreased slightly with advancing gestational age. There was an association between placental weight below the 10th percentile and fetal distress (p=0.003). Placental weight to fetal birth weight ratio below the 10th percentile was also associated with fetal distress above 90th percentile requiring neonatal intensive care admission.[19] Gurapriya R, Vijayalakshmi, Shenoy in 2011 stated that the average placental co efficient was 0.19.[20] Coall et al. showed that the increased placental index was associated with restricted intra uterine fetal development.[21] Waszak et al. stated that the correlation of differences of placental fetal weight ratio and Apgar score was statistically significant (p≤0.01) in the analysis of variance.[22] Majumder et al. studied in placenta in normal and hypertensive pregnancies. They found mean feto placental weight ratio in case of control group is 5.89±10.04 and hypertensive group is 6.23±0.87.[23] Finding of the present study was more or less similar to the findings of above mentioned authors.

Conclusion

The present study showed that the placental index was variable. There was a significant positive moderate correlation between birth weight and placental weight, meaning an increase in birth weight will be followed by increased placental weight. We believe that the information provided in this article is useful to influence both clinicians and researchers for further studies to evaluate the correlation of placental index with pregnancy and neonatal outcome.

Acknowledgment

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