

To study the variations of weight of the placenta, insertion, diameter, and spiral turns of the umbilical cord in Gestational diabetes.

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Abstract:

Background: As the primary materno-fetal unit, the placenta and umbilical cord (UC) provide fetal life support, welfare, and development by facilitating gas and nutrient exchange. **The aim** of the study was to study the variations of weight of the placenta, insertion, diameter, and spiral turns of the umbilical cord in GD pregnancy and to compare the same with the uncomplicated or normal pregnancy. **Materials & Methods:** This research makes use of an observational methodology. After obtaining permission from Institutional Ethics Committee studied at the Department of Anatomy at Indore Medical College & Hospital, Indore. There was a total of 220 human placentas used in this study; 110 were from healthy pregnancies serving as controls, and the remaining 110 were from pregnancies complicated by preeclampsia. The morphology of every sample was analyzed. **Results:** It was determined through statistical analysis that there was no statistically significant difference in diameter between the normal and GD groups ($P = 0.39$, which is greater than 0.05). Statistically the difference in average weight of placenta between normal and GD group was significant ($P = 0.03$ which is <0.05). **Conclusion:** Differences in appearance were observed between normal and GD placentas. Hypoperfusion, a condition associated with GD, appears to be the root cause of these alterations. Larger-scale studies using histological and morphometric techniques on placentas are required before any definitive conclusions can be drawn.

Keywords: Fetus, Umbilical cord; Gestational diabetes; Insertion

Introduction:

As the primary materno-fetal unit, the placenta and umbilical cord (UC) provide fetal life support, welfare, and development by facilitating gas and nutrient exchange [1]. Several factors, including genetics, maternal features, placental and UC anatomy and function, affect the fetal health. The normal human UC consists mostly of a helix of three blood vessels protected by Wharton's jelly, amniotic fluid, spiral patterns, and coiling of the umbilical vessels [2-5]

Abnormalities of the placenta and UC can result in fetal morbidity and mortality. It has been hypothesized that abnormal flow, constriction, or thrombosis in the UC are potential causes of unfavorable fetal outcomes [6]. These effects include respiratory distress, intrauterine growth restriction, and a poor Apgar score associated with UC and placenta abnormalities [7].

Gestational diabetes mellitus (GD) is defined as glucose intolerance with onset during pregnancy and resolution after birth [8]. The effect of GD is not fully known till today, despite the breakthroughs in diabetes and gestational diabetes therapy, it remains a serious danger during gestation. The placenta and UC in GDM parturient are the focus of attention, especially because their damages may be largely accountable for the perinatal difficulties of the stated problematic pregnancies. GD is typically accompanied with hyperglycemia, hyperlipidemia, hyperinsulinemia, and endothelial dysfunction of the placenta [8]. These anomalies lead to decreased endothelial function, vascular inflammation, and hemostasis, which give rise to microcirculatory impairment, generating abnormalities in placental function, resulting to increased fetal morbidity and stillbirth [9,10]. The aim of the study was to study the variations of weight of the placenta, insertion, diameter, and spiral turns of the umbilical cord in GD pregnancy and to compare the same with the uncomplicated or normal pregnancy.

Materials & Methods:

This research makes use of an observational methodology. After obtaining permission from Institutional Ethics Committee studied at the Department of Anatomy at Indore Medical College & Hospital, Indore. There was a total of 220 human placentas used in this study; 110 were from healthy pregnancies serving as controls, and the remaining 110 were from pregnancies complicated by GD. Inclusion criteria: pregnant women with gestational diabetic. Exclusion criteria: All other maternal conditions which lead to small placental size, placental infarcts and Intra-uterine Growth Retardation. After a proper inspection, notes were made about the shape of the placenta and whether or not it had an extra lobe. Each placenta was put into one of three groups: oval, round, or irregular. Their investigation reports were checked (blood sugar, urea, creatinine, hemoglobin levels, urine, pus cells and ophthalmic examinations). Mothers will be considered to be hypertensive if the blood pressure was 140/90 or above mm of Hg and gestational diabetic (i.e. hyperglycemia), specifically if one or more of the following criteria are (i) fasting plasma glucose of 126 mg/dl, (ii) 2-hour plasma glucose was 200 mg/dl following a 75 g oral glucose load; and (iii) random plasma glucose was 200 mg/dl in the presence of diabetes symptoms. All placentas will be collected immediately after delivery in a clean tray and washed in running tap water. The cord at their attachment to the placenta cut off by sharp scissors and cleaned free of blood clots during washing and excess water was removed. Then placenta will be preserved in 10% formalin. Weight of the placenta, insertion, diameter, and spiral turns of the umbilical cord were measured according to the literature [11,12].

Statistical analysis:

IBM SPSS was used to process the raw data. Mean differences between parameters were analyzed using t-tests for samples. Numbers in percentage form were also determined. The cutoff point for statistical significance in this research was set at p 0.05.

Results:

The present observed in 110 specimens in each group, the average diameter of the umbilical cord in normal group was observed as 16.3 ± 2.05 cm, range being (0.5-1.6) cm. The average diameter in GD complicating pregnancies was 18.1 ± 2.1 cm, range being (0.4-1.6) cm. The present observed in 110 specimens in each group, the mean weight of placenta in normal group was observed to be 498.8 ± 110.3 gms, range being (276-940). The mean weight of placenta in GD complicating pregnancies was 556.1 ± 88.1 gms, range being (390-733). It was determined through statistical analysis that there was no statistically significant difference in diameter between the normal and GD groups ($P = 0.39$, which is greater than 0.05). Statistically the difference in average weight of placenta between normal and GD group was significant ($P = 0.03$ which is <0.05).

Table 1: Weight and diameter of the placenta of present study specimen collected

Diameter of placenta	Normal	GD
Mean diameter of Placenta (cm)	16.54 ± 2.05	18.1 ± 2.1
Mean weight of the placenta in grams	498.8 ± 110.3	556.1 ± 88.1

Table 2: Insertion of the umbilical cord (U.C) in the present study

U.C Insertion	Normal	GD	Total
Central	64	10	64
Velamentous	4	0	4
Eccentric	28	79	107
Marginal	12	21	33
Total	110	110	220

The present observed in 110 specimens in each group, 64 specimens from normal pregnancies and 10 from gestational diabetes. Four placental specimens from normal pregnancy and none from GD had velamentous cord insertion. Four normal pregnant placental specimens showed velamentous cord insertion. Velamentous cord insertion was found in four normal, 79 had

gestational diabetes. 28 normal pregnancies have atypical cord insertion placental specimens. 12 placental specimens from normal pregnancies and 21 from gestational diabetes had marginal cord insertion.

Table 3: Spiral turns of the umbilical cord in the present study

UC turns	Normal	GD	Total
Right	28	10	38
Left	74	68	142
Both	0	18	18
Nil	8	14	22
T0tal	110	110	220

The present observed in 110 specimens in each group, 74 placentas had sinistral (left) umbilical cord twist, 28 had dextral (right), compound (both) twist was not seen in normal pregnancy, and 8 had nil (missing) twist. In 110 placentas with umbilical cords in GD complicating pregnancy, 68 had sinistral (left) twist, 10 had dextral (right), 18 had compound (both), and 14 had nil (missing).

Discussion:

The aim of the study was to study the variations of weight of the placenta, insertion, diameter, and spiral turns of the umbilical cord in GD pregnancy and to compare the same with the uncomplicated or normal pregnancy.

Weight of the placenta:

Kumari et al., 2016 [13]; In their study of 70 placenta (50 Hypothyroid and 20 euthyroid patients), the mean weight of placenta in normal group was 430.75 ± 86.18 and 408.80 ± 89.45 in pathologic group. ($p < 0.352$)

Puthuraj et al., 2018 [14]; in his study of 292 placenta, observed that the average weight of the placenta was 477 grams. In 147 uncomplicated pregnancies the weight was 482.68 grams, in diabetes complicating pregnancies the weight ranges from 551-575 grams and in pregnancy induced hypertension weight of the placentae were in the range from 501-525grams.

Talpur et al., 2020 [15]; stated that mean weight of the placenta is 406.90 ± 72.64 gm in uncomplicated placenta/ control group and 311.50 ± 74.09 gm in preeclampsia group respectively. The mean difference between two groups is statistically significant ($P < 0.001$).

Thakur et al., 2022 [16]; They reported that the mean placental weight in normal (60) and hypertensive (60) group was 506 ± 27 gms and 390 ± 88.1 gms ($p < 0.001$).

The present observed in 110 specimens in each group, the mean weight of placenta in normal group was observed to be 498.8 ± 110.3 gms, range being (276-940). The mean weight of placenta in GD complicating pregnancies was 556.1 ± 88.1 gms, range being (390-733).

Insertion of the umbilical cord:

Fatima et al 2016 [17]; in their study of 130 placenta (30 normal, 33 mild PIH, 34 moderate PIH, 33 severe PIH), she established that the marginal insertion of umbilical cord on placenta is associated with hypertension and severity of hypertension deviates the insertion site towards the margin. The mean insertion percentage was $33.22 + 23.23$. The maximum insertion site was found 47.0% eccentric- medial in normal, 39% eccentric-lateral in mild, 41% marginal in moderate and 48.0% marginal in severe hypertension respectively.

Kumari et al., 2017 [13]; in their study of 30 normal placenta, central type of cord insertion was observed in 19 placenta and eccentric cord insertion was noted in 11 placenta.

Puthuraj et al., 2018 [14]; in his study of 292 placenta, he observed that central type of cord insertion in 74 specimens (25.3%), eccentric type of cord insertion in 175 specimens (60%), marginal type of cord insertion in 35 specimens (12%) and velamentous type of cord insertion was observed in 08 specimens (2.7%).

The present observed in 110 specimens in each group, 64 specimens from normal pregnancies and 10 from gestational diabetes. Four placental specimens from normal pregnancy and none from GD had velamentous cord insertion. Four normal pregnant placental specimens showed velamentous cord insertion. Velamentous cord insertion was found in four normal, 79 had gestational diabetes. 28 normal pregnancies have atypical cord insertion placental specimens. 12 placental specimens from normal pregnancies and 21 from gestational diabetes had marginal cord insertion.

Diameter of the umbilical cord:

Williams., 1930 [18]; quoted that the average length of the cord was observed to be 55 cm, range 30 to 100 cm, and the diameter to be 0.8 to 2.0 cm.

Gupta et al., 2015 [19]; in a study of 100 placentae she observed the average length of the cord in both sexes to be 53.5cm, range 30 - 70cm. The average length of the cord in male baby was 54.6 cm and in female baby it was 52.1cm. The diameter of the umbilical cord ranged from 0.6 - 1.1 cm.

Xu et al., 2021 [20]; in a study of 100 placentae she found the average length of the cord to be 38.5 cm and range to be 25 - 85 cm.

The present observed in 110 specimens in each group, the average diameter of the umbilical cord in normal group was observed as 1.3 ± 0.3 cm, range being (0.5-1.6) cm. The average diameter in GD complicating pregnancies was 1.3 ± 0.21 cm, range being (0.4-1.6) cm.

Spiral turns of the umbilical cord:

Thomas et al., 1993 [21]; reported that 38 (4.3%) of 894 fetuses were born with non-coiled umbilical vessels and they were at increased risk for perinatal morbidity and mortality.

Kumar et al., 2022 [22]; evaluated 107 cords at birth, Anticlockwise coils were seen in 82 (76.6%) cases while clockwise coils were seen in 19 (17.8%) cases, giving a ratio of 4.3:1.

The present observed in 110 specimens in each group, 74 placentas had sinistral (left) umbilical cord twist, 28 had dextral (right), compound (both) twist was not seen in normal pregnancy, and 8 had nil (missing) twist. In 110 placentas with umbilical cords in GD complicating pregnancy, 68 had sinistral (left) twist, 10 had dextral (right), 18 had compound (both), and 14 had nil (missing).

Conclusion:

Differences in appearance were observed between normal and GD placentas. Hypoperfusion, a condition associated with GD, appears to be the root cause of these alterations. Larger-scale studies using histological and morphometric techniques on placentas are required before any definitive conclusions can be drawn.

Conflict of interest:

There are no conflicts of interest among the present authors.

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