

Original Articles

Study of Umbilical Cord in Pregnancy Induced Hypertension with and without Diabetes Mellitus

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Abstract

Context : Two organs that can provide a good insight into pregnancy induced hypertension with and without diabetes mellitus are the placenta and the umbilical cord along with their vessels. In the present study the umbilical cord is taken from the placenta of hypertensive and diabetic mothers to measure its diameter, to observe contained vessels and its mode of attachment to the placenta.

Materials and Methods: An observational and analytical type of study was conducted in the department of Anatomy, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka between November 2003 to May 2004 on umbilical cords. To study the umbilical cord, placentas were collected from fifty eight Bangladeshi women who gave birth to a single live baby through Caesarian section after 35 to 40 weeks of gestation. Twenty of the mothers were non hypertensive, non diabetic control, twenty had pregnancy induced hypertension (PIH) and eighteen had pregnancy induced hypertension and gestational diabetes mellitus (PIH+GDM).

Results: No significant difference was found between any groups for diameter of the umbilical cord. All the umbilical cords had same number of vessels. There was variation among the mode of insertion of umbilical cord.

Conclusion: Diameter of umbilical cords did not show significant difference in either of the two diseased groups with the control group in the Post Hoc option of analysis of variance (ANOVA) at 5% level.

Key words: Umbilical cord, pregnancy induced hypertension, gestational diabetes mellitus.

Introduction

The placenta is the primary site for nutrients and gaseous exchange between mother and fetus. Both the placenta and the umbilical cord functions as a transport system for substances passing between mother and fetus. The vessels in the umbilical cord connect the placental circulation with the fetal circulation.

The attachment of the umbilical cord to the placenta is usually near the centre of fetal surface of this organ, but it may attach at any point. For example, insertion of it at the placental margin produces a

battledore placenta, and its attachment to the fetal membranes is a velamentous insertion of the cord². The umbilical cord is usually 1 to 2 cm in diameter and 30 to 90 cm in length (average 55cm). Excessively long or short cords are uncommon. There are usually two arteries and one vein in the umbilical cord that are surrounded by mucoid connective tissue (Wharton Jelly). The umbilical arteries are spirally arranged and present thick wall. In the early part of pregnancy the umbilical veins are two in number. Later the right umbilical vein disappears and the left one persists to convey oxygenated blood from placenta to the fetus. Nerves are not detected in the umbilical cord³. Colour flow Doppler ultrasonography may be used for the prenatal diagnosis of the position and structural abnormalities of the umbilical cord and its vessels².

Both umbilical cord and placenta are morphologically adapted to the essential function of bringing

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fetal and maternal blood streams in close association in normalcy. Among the high risk pregnancies, hypertensive disorders are the most common medical complication of pregnancy and a major cause of maternal and perinatal morbidity and death⁴. Pregnancy-induced diabetes mellitus or gestational diabetes mellitus (GDM) also complicates the pregnancy and is associated with congenital malformation, intrauterine death, perinatal and maternal mortality and morbidity⁵. Like other developing countries, Bangladesh still has alarming maternal and fetal mortality rates. Compensatory changes, therefore, are likely to occur in these organs in disease situations. Changes in the morphology of umbilical cord component is, therefore, considered as area of real importance and interest with implications in both basic and clinical research.

Material and methods

Selection of specimens (placentas with umbilical cords)

A total of fifty eight umbilical cords were examined, all from live births. All the specimens were collected from the pregnant women whose deliveries were conducted through cesarean section in the departments of Gynecology and Obstetrics Departments of BSMMU and BIRDEM hospitals. Among these, twenty placentas were collected from normotensive and normoglycemic mothers as control, twenty placentas were collected from mothers having pregnancy induced hypertension (PIH) and eighteen placentas were collected from mothers having pregnancy induced hypertension (PIH) along with gestational diabetes mellitus (GDM).

The diagnosis of the clinical conditions and other clinical assessments of the patients were confirmed by the registered doctors of the department of Gynecology and Obstetric of BIRDEM and BSMMU hospitals. The patients delivered babies between the 35th and 40th weeks of gestation through Caesarian section. Only the babies of severe PIH cases were delivered before 37 weeks of gestation Gestational age was calculated in early pregnancy using the 1st day of the last menstrual period or from ultrasound measurement of the biparietal

diameter by resistered doctors of the departments of Gynecology and Obstetrics or by registered ultrasonologists respectively.

Operational definitions and grouping

Control group

This group comprised of twenty mothers who did not show any of the common exclusion criteria mentioned above and were non-hypertensive and non-diabetic.

Pregnancy-induced hypertension (PIH)

The mothers of this group had hypertension with first recognition during the present pregnancy. The diagnosis of hypertension was made by measuring the blood pressure of ≥ 140 and/ or ≥ 90 mm(hg) during the 2nd half of the pregnancy that had manifested at least twice ≥ 6 hours apart⁵. Diabetes mellitus and the common exclusion criteria already mentioned were absent.

PIH with gestational diabetes mellitus (GDM)

The mothers of this group developed hypertension and hyperglycemia during the present pregnancy and were normotensive, non diabetic before this pregnancy.

Procedure of studying the variables of the umbilical cord

1) Diameter of the umbilical cord

On the cut surface of the umbilical cord, the maximum diameter was measured with a metallic scale. Then the second maximum diameter was taken at right angles to the first one. Lastly, the mean diameter of the umbilical cord was calculated from these two measurements³

2) Number of umbilical vessels

The number of each of the umbilical vessels (artery and vein) was counted and recorded.

3) Mode of insertion of the umbilical cord

The insertion of the umbilical cord was recorded as "central" when it was attached at the center or within 2 cm of the center of the placenta. When the cord was attached at or within 2cm of the placental margin, it was recorded as a "marginal" or "peripheral" insertion. "Intermediate" position was recorded when the cord was inserted at any point

between the central and marginal point of attachment. Intermediate and marginal insertions were together termed as “eccentric insertion”⁴. “Vellamentous” insertion was recorded when the umbilical cord was inserted on the fetal membranes.

Results

Macroscopic variables of the umbilical cord:

Mode of insertion of umbilical cord:

Table-I shows mode of insertion of umbilical cord in three different groups. Percentage of central insertion was found larger in the control group. Hypertensive groups showed more eccentric insertion than the control group. Among 58 placentas only 3 placentas of PIH & PIH + GDM groups showed villamentous insertion of umbilical cord.

Table-I

Frequencies of different modes of insertion of umbilical cords into the placenta in different groups

Variable	Control n=20	PIH n=20	PIH +GDM n=18
Central	10 (50%)	9 (45%)	8 (44.44%)
Intermediate	6 (30%)	5 (25%)	5 (27.77%)
Marginal	4 (10%)	4 (20%)	4 (22.22%)
Vellamentous	2 (10 %)	1(5.55 %)	

Statistical analysis was not done.

Control: Non-diabetic, non-hypertensive

PIH: Pregnancy-Induced Hypertension

GDM: Gestational Diabetes Mellitus

Diameter and number of the vessels of the umbilical cord:

Diameter of the umbilical cords did not differ significantly in both the PIH and in the PIH with GDM groups as compared with the control group. All the umbilical cords had two arteries and one vein. Figure 1 represents the mean diameter of the umbilical cord in three different groups of the subjects.

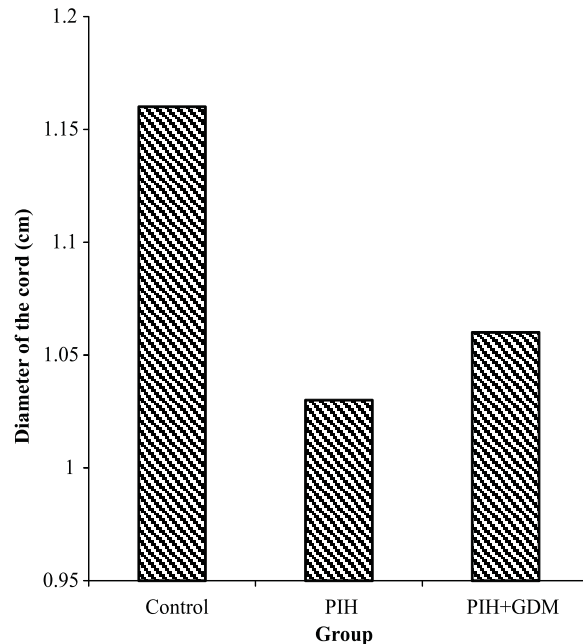


Fig.-1: Bar diagram showing mean diameter of the umbilical cord in three different groups of subjects. Control: Non-diabetic, non-hypertensive PIH: Pregnancy-induced Hypertension GDM: Gestational Diabetes Mellitus

Discussion

According to Pansky⁷, Sadler⁸, Moore² the diameter of the umbilical cord is about 1-2cm . In the present study the mean diameter in all the groups are (1.16 ± 0.36), (1.04 ± 0.17) and (1.06 ± 0.24) in control, PIH and PIH+GDM group respectively. The mean diameter in case of control group has similarities with the study of Akhtari Afrose⁹, Laila perveen Banu¹⁰, Rafiqui Alam¹¹ and Mallika Karmaker¹². In case of hypertensive and/or diabetes mellitus mean diameter of umbilical cord differ at nonsignificant level from the control group. But diameter of umbilical cord was significantly larger in the fetuses of mothers with geststional diabetes mellitus in the study of Weissman Jakobi¹³, which has similarities with the study of Mallika¹². In case of study of Rafique¹¹ the cord diameter was more or less similar in both prolonged diabetic and gestational diabetic groups and also in control group.

Regarding the number of the umbilical vessels, 2 arteries and 1 vein were found in all the samples of

the present study which have the similarities with the study of above mentioned investigators. But it was reported also that there may be absence of one umbilical artery or presence of more than two umbilical arteries in some studies(Hyrti cited by Vientick et al. cited by Rafique¹¹. Nadkarni cited by Rafique¹¹, found in his study that four cords containing three arteries and one containing one artery.

Most of the cords, in the present study, are inserted at the centre of the placenta in case of control group which has similarities with the records of different text of embryology books but is eccentric in position in PIH & PIH + GDM group. In our country, Several investigators found in their studies that most of cords were eccentrically attached with the placentas.

Conclusion

In the present study, variables of umbilical cord did not show significant difference in either of the two PIH & PIH + GDM groups with the control group. There is a possibility of vascular insufficiency in both the PIH & PIH + GDM conditions that the placentas tried to compensate and thus, tries to be adapted to overcome the adverse maternal conditions. As the patients' were admitted in two of the leading hospitals of the country, their control of hyperglycemia and/or hypertension may be assumed to be better than it would have been in case of any cross sectional study of the general population. So before concluding the study, small sample size, and other confounding variables like status of control of diabetes and hypertension, sex of the fetus, severity of the PIH & PIH + GDM conditions are to be considered.

For further study, larger sample size, more severe cases, several biochemical investigations of cord blood, Doppler ultrasound of umbilical artery can be performed to identify any underlying pathology and it can be correlated with the morphometric study of the placenta.

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