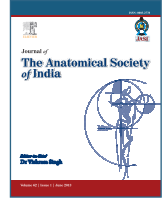




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Original article

Morphological study in Hyrtl's anastomosis of umbilical arteries in pregnancy-induced hypertension

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KEYWORDS

Hyrtl's anastomosis, Normotensive, Pregnancy-induced hypertension.

ABSTRACT

Introduction: The anatomic structure of Hyrtl's anastomosis is of a large variability. The aim of this study is to investigate the occurrence and types of the anastomoses in the umbilical arteries of pregnancy-induced hypertension. Anastomosis between the two umbilical arteries has been described earlier but no comparative morphology between the normotensive and pregnancy-induced hypertension has been carried out. *Method:* A routine dissection method has been performed to demonstrate the occurrence of the anastomosis. *Result:* In an attempt to verify the presence and type of Hyrtl anastomosis, 34 transverse type and 22 oblique were more common. A significant difference was observed between the normotensive and pregnancy-induced hypertension cases, whereas the transverse type of anastomosis was mostly observed in pregnancy-induced hypertension.

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1. Introduction

Placenta is a vital organ that maintains fetomaternal exchange of oxygen, nutrients, and waste products during the fetal development. Hyrtl's anastomosis is a common connection between the umbilical arteries. Its existence was discovered by Hebenstreit in 1737, for the first time drawn by Albin in 1748 and investigated in detail by Joseph Hyrtl in 1870.¹ It has been speculated that it equalizes the blood pressure between the territories supplied by the umbilical arteries. When placental territories of one artery impose increased resistance on fetal blood flow, Hyrtl's anastomosis redistributes the blood flow into the second artery. When one of the arteries conducts a smaller blood flow into the placenta and a relatively smaller pressure gradient is developed, Hyrtl's anastomosis rebuilds the pressure gradient in the affected artery and redistributes blood flow from the unaffected artery to the affected one to improve placental perfusion. It is also considered as a shunt (safety valve) in case of partial compression of the placenta during uterine contractions or occlusion of one umbilical artery. Regarding the function of

Hyrtl's anastomosis during pregnancy, it has been postulated that its absence could be in part responsible for the occurrence of discordant umbilical arteries, a condition often associated with placental anomalies (velamentous and marginal insertion, infarcts).²

2. Materials and methods

The study was carried out on 100 cases of randomly selected patients who had given birth by cesarean section or normal delivery at the Central Referral Hospital, Sikkim Manipal Institute of Medical Sciences, on all working days in a week. History was taken from the patient to differentiate between normotensive and pregnancy-induced hypertension.

Group I: The control material was taken from the placenta of newborn delivered by healthy mothers, with normal blood pressure (systolic 100–135 mmHg, diastolic 60–85 mm Hg).

Group II: Women are diagnosed with pregnancy-induced hypertension if they had blood arterial pressure as systolic >140

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Table 1 – The details of the types of Hyrtl's anastomosis observed in pregnancy-induced hypertension and normotensive umbilical cord.

	Transverse	Oblique	Fenestrated	Fused	Absent anastomosis	Single umbilical artery	Anastomosis by branch
Normotensive	13	12	13	3	3	1	5
PIH	21	10	4	5	4	0	6
Total	34	22	17	8	7	1	11

PIH: Pregnancy-induced hypertension.

mmHg, diastolic > 90 mmHg measured on two or more occasions at least 4 hours apart after the 20th week of gestation, with or without edema and/or proteinuria was included.

Placenta with the umbilical cord was collected and washed thoroughly and no blood clots were present. After washing properly, the placenta was placed in 10% formalin solution for 4 days for fixation. The umbilical cord was then dissected longitudinally. The umbilical arteries and the umbilical vein were then traced all along the length of the umbilical cord to the cord insertion in the placenta for macroscopic examination.

Statistical analysis

Difference in continuous variables among two or more groups was analyzed by one-way analysis of variance (ANOVA). SPSS16.0 was used for data analysis.

3. Results

Of 100 cases investigated, 50 of normotensive and 50 of pregnancy-induced hypertension, an anastomosis could be identified in 73 (Table 1). In 34 cases, the anastomosis was represented by a transverse vessel (13 normotensive and 21 PIH), whereas in 22 cases, the anastomosis was represented by an oblique vessel. The anastomosis was absent in seven cases. Seventeen cases represented fenestrated type of anastomosis, of which thirteen were found in normotensive and only four were found in PIH. In eight cases, the anastomosis was of fused type and only one case of a single umbilical artery was observed. In 11 cases, the anastomosis was between the branches of the two umbilical arteries (5 normotensive, 6 PIH) (Fig. 1).

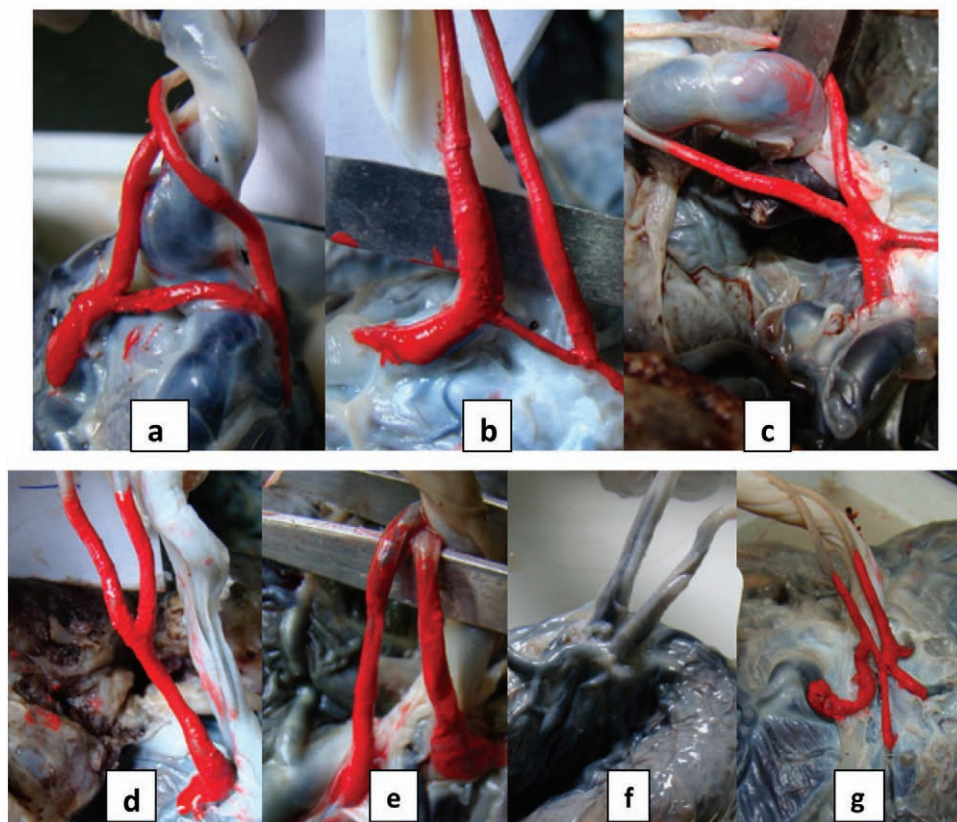


Fig. 1 – The various types of Hyrtl's anastomoses observed. a: Transverse, b: Oblique, c: Fenestrated, d: Fused, e: No anastomosis, f: Single umbilical artery, g: Anastomosis by branch.

4. Discussion

Stieve, Strube,³ and Patten⁴ stated that the placental circulation is established in the first month of the embryonic life, most probably in the third and fourth weeks. At this time, the placental vasculature system is a meshwork with numerous anastomoses between the umbilical arteries. Evidently, these relationships are gradually eliminated to a typical single connection.

Hyrtil described the same principal type of anastomosis and the absence of anastomosis in few cases.¹ Bacsich and Smout studied 50 placentas, 43 had a well-marked transverse communicating branch and 7 were found to be fused at the entrance of the placenta.⁵ Salafia and Popek investigated 69 consecutive term deliveries and found in 13% the umbilical arteries completely fused to form a common channel.⁶ In 41%, a transverse anastomosis was found within 2 cm of the chorionic insertion. Ullberg studied Hyrtil's anastomosis in 67 placentas from full-term infants appropriated for gestational age (AGA) and in 64 placentas from infants small for gestational age (SGA). The anastomosis was constituted by a separate vessel in 112 placentas (85%) and a fusion in 3(2%). In 10, the anastomosis was absent, in 5 of these due to a single umbilical artery.⁷

Seo et al studied 904 cases, 99.7% possessed Hyrtil's anastomosis with frequency according to type as 50.8% oblique, 48.0% transverse, 1.8% of anastomosis between one umbilical artery and the branch of the other, 1.6% of fusion of branches of each umbilical artery, 0.6% of anastomosis represented by two separate vessels between umbilical arteries, 0.1% of anastomosis between branches of each umbilical artery, 0.1% lacking anastomosis, and 0.2% of a single umbilical artery.⁸

Ullberg et al identified in 60 out of 64 placentas and found that in no case there was more than 1 anastomosis. In 56 placentas, the anastomosis was represented by a true vessel, whereas in 2, it was represented by a fenestration between the 2 arteries. In two cases, the arteries were found to be fused. The anastomosis was found to be absent in one case.⁹ Priman reported on the study of 70 full-term normal human placenta with the umbilical cord attached and 96% of the specimens have anastomosis of one type or the other: two umbilical cords were without anastomosis, and one specimen had a single umbilical artery.¹⁰ Young stated that it has been impossible to link any factor to the presence or absence of the anastomosis.¹¹ Arts investigated 65 placentas; besides

one case with single umbilical artery, none lacked an anastomosis, but the types were similar.¹²

However, we found from 50 full-term placentas of pregnancy-induced hypertension, 21 were connected by a transverse vessel and only 4 were connected by fenestration, whereas in normotensive, 13 were by fenestration and 13 by a transverse vessel. Our findings were similar with the findings of previous authors, but findings on one of the types (anastomosis by branch) were not found. In our study, we found out 11 anastomoses by branch out of 100 full-term placentas.

In conclusion, we found that Hyrtil's anastomosis in placentas from pregnancy-induced hypertension had a varied anatomy from normotensive placentas. The findings in the types of anastomosis mainly transverse and fenestration showed a considerable difference in normotensive and pregnancy-induced hypertension, suggesting its contributing part for improved uteroplacental circulation.

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