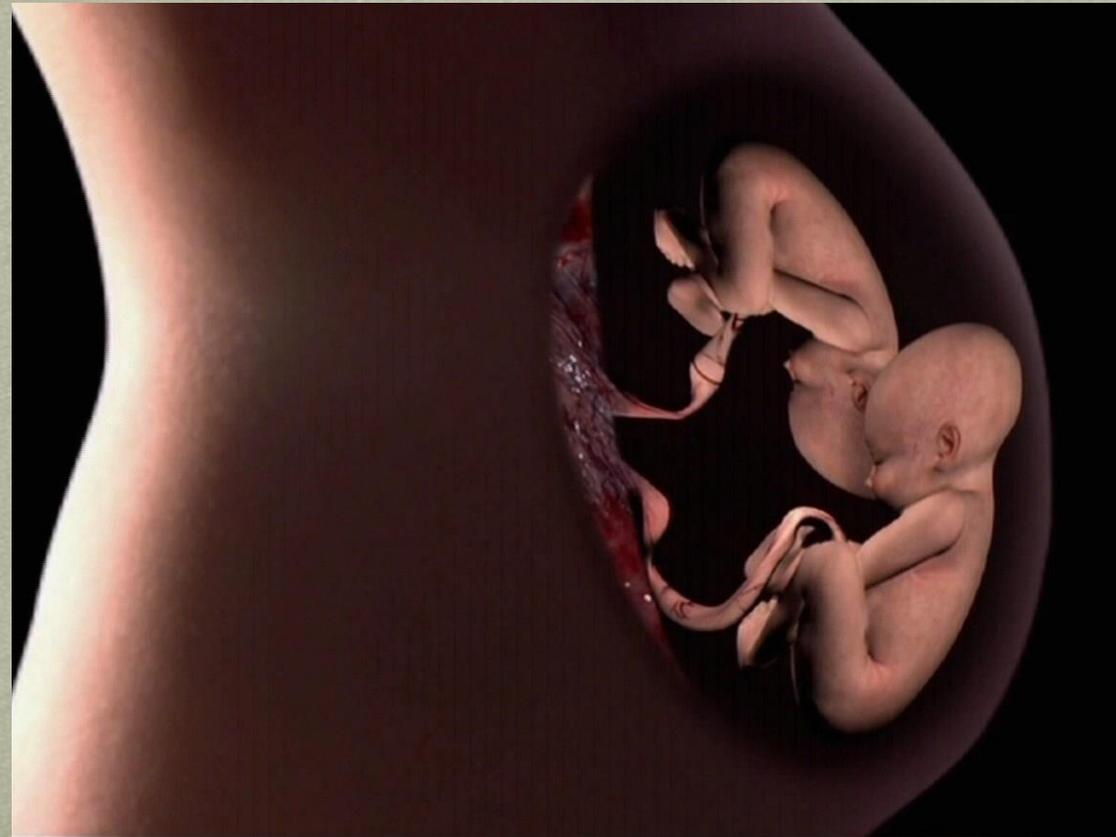


Vascular anastomoses in monochorionic twin placentas: a pathomorphological study using CT

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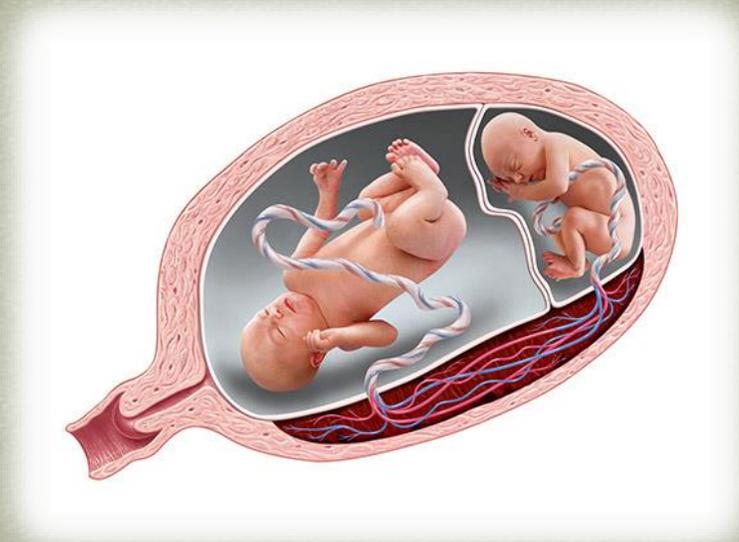


Fetal growth retardation (FGR) is one of the main causes of perinatal morbidity and mortality: the perinatal mortality rate for PFR is 6–10 times higher compared to newborns with normal body weight and length.

[Aucott S.W, Donohue P.K., Northington F.J. Severe early intrauterine growth restriction // J. Perinatol. – 2004. – V.24. – P.435-440]

In Russia, intrauterine diagnostics of fetal growth retardation (FGR) is based on fetometry data from ultrasound, when the estimated fetal weight is below the 5th percentile for a given gestational age. After birth, this diagnosis is made in cases where the weight of the newborn is below the 10th percentile for a given gestational age.

[Акушерство: национальное руководство / Под ред. Г.М.Савельевой, Г.Т.Сухих, В.Н.Серова, В.Е.Радзинского. М.: ГЭОТАР-Медиа, 2016. – С.243-245 (in russian)]

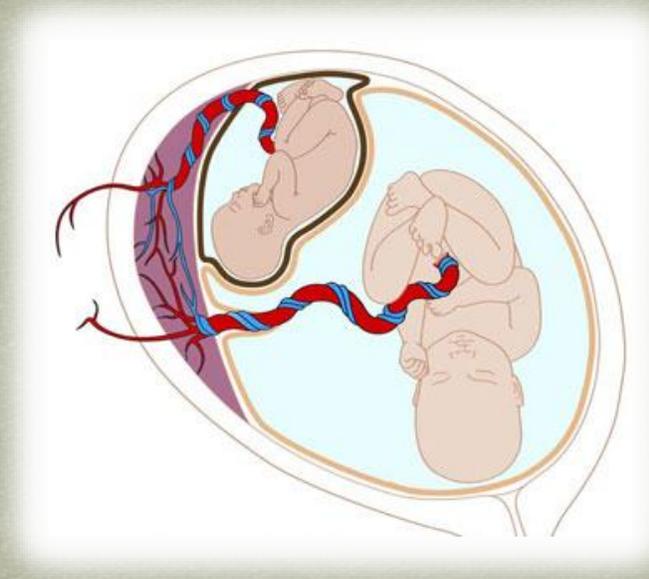


A double pregnancy is characterized by a greater frequency of preeclampsia during pregnancy, fetal growth retardation, prenatal bleeding, preterm birth, stillbirth compared with a single pregnancy.

[Chauhan S, Scardo J, Hayes E, Abuhamad A, Berghella V. Twins: prevalence, problems, and preterm births. Am J Obstet Gynecol. 2010;203:305-15].

Monochorial twins are characterized by a higher risk of complications compared with dichoric twins: the frequency of early preterm birth is 2 times higher, the frequency of intranatal fetal death is 6 times.

The main reasons for the development of discordant fetuses are violations of their blood supply, which are caused by vascular anastomoses and differences in the volume of placental tissue, leading to an uneven metabolism and blood.

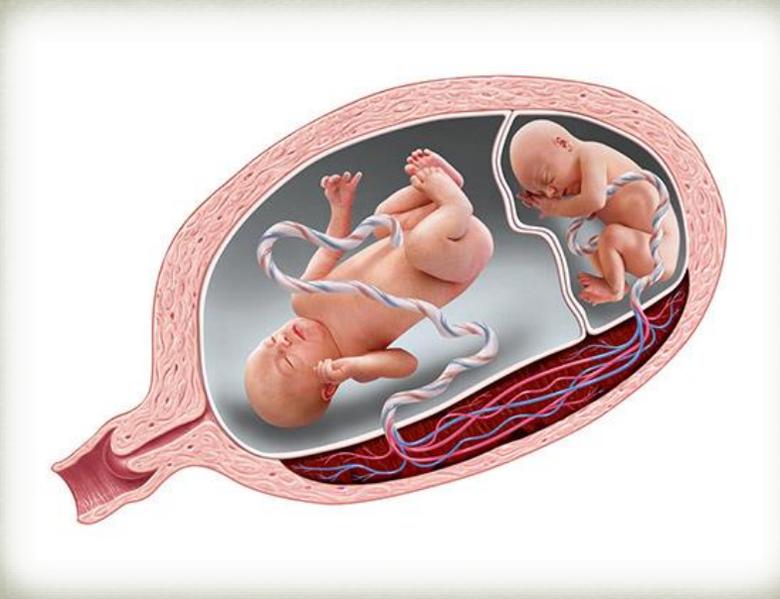


In the monochorionic placenta, there are three types of such anastomoses: arterio-arterial, arterio-venous and veno-venous.

Objective: to study the features of anastomoses in a monochorionic diamniotic placenta in the presence of the fetal growth retardation.

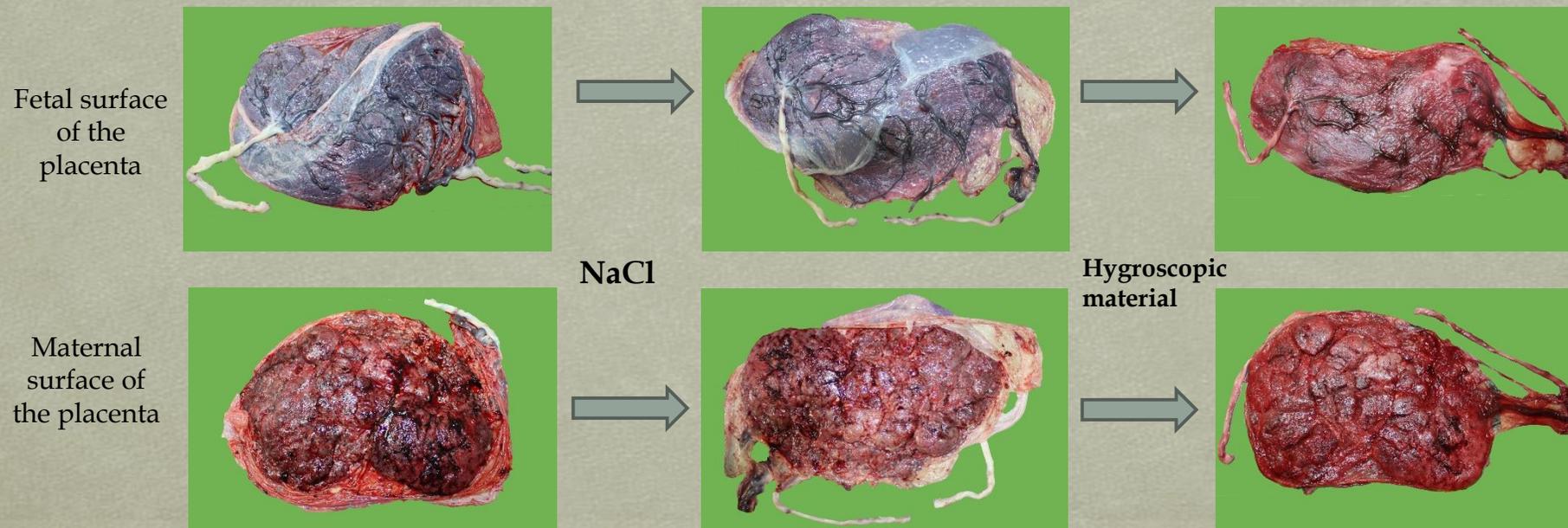
Methodology

The study was carried out with the cooperation of pathologists and radiologists. Macroscopic and microscopic examination of the placenta, as well as CT with contrast enhancement of vessels was carried out.



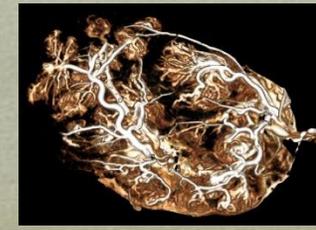
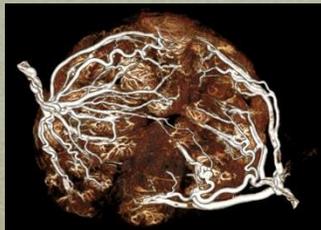
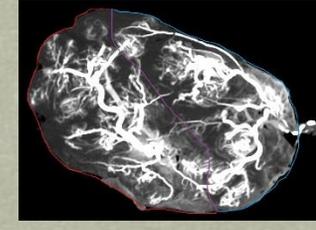
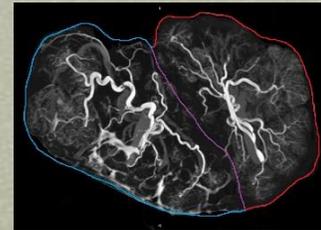
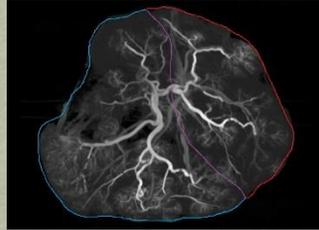
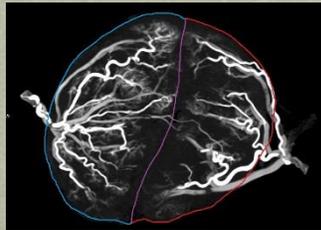
Preparation of the placenta for the study

Objective	Decision
Removal of blood clots and bundles from the vessels of the placenta	Using hypertonic NaCl solution Mechanical (manual) removal of large clots from blood vessels
Removal of blood clots from the vessels of the placenta	Keeping of the placenta on a hygroscopic material at a temperature of +4°
Preparation of the placenta for the introduction of a contrast-staining mixture and macroscopic examination of vessels	Removal of the fetal membranes Cutting off the umbilical cord at a distance of 7-10 cm from attachment to the placenta



Macroscopic characteristic of the placenta

	I (FGR) N=7	II (without FGR) N=7
gestation age	35,4	35,1
larger area from the twin (%)	60,7	53,1
smaller area from the twin (%)	39,3	46,9
ratio of the larger and smaller areas	1,6	1,2
distance between umbilical cords (cm)	12,8	16,3
maximum diameter of the placenta (cm)	22,1	24,7
umbilical cord attachment (%)		
central	14,3	8,3
eccentric	14,3	33,3
marginal	35,7	33,3
membranous	35,7	25

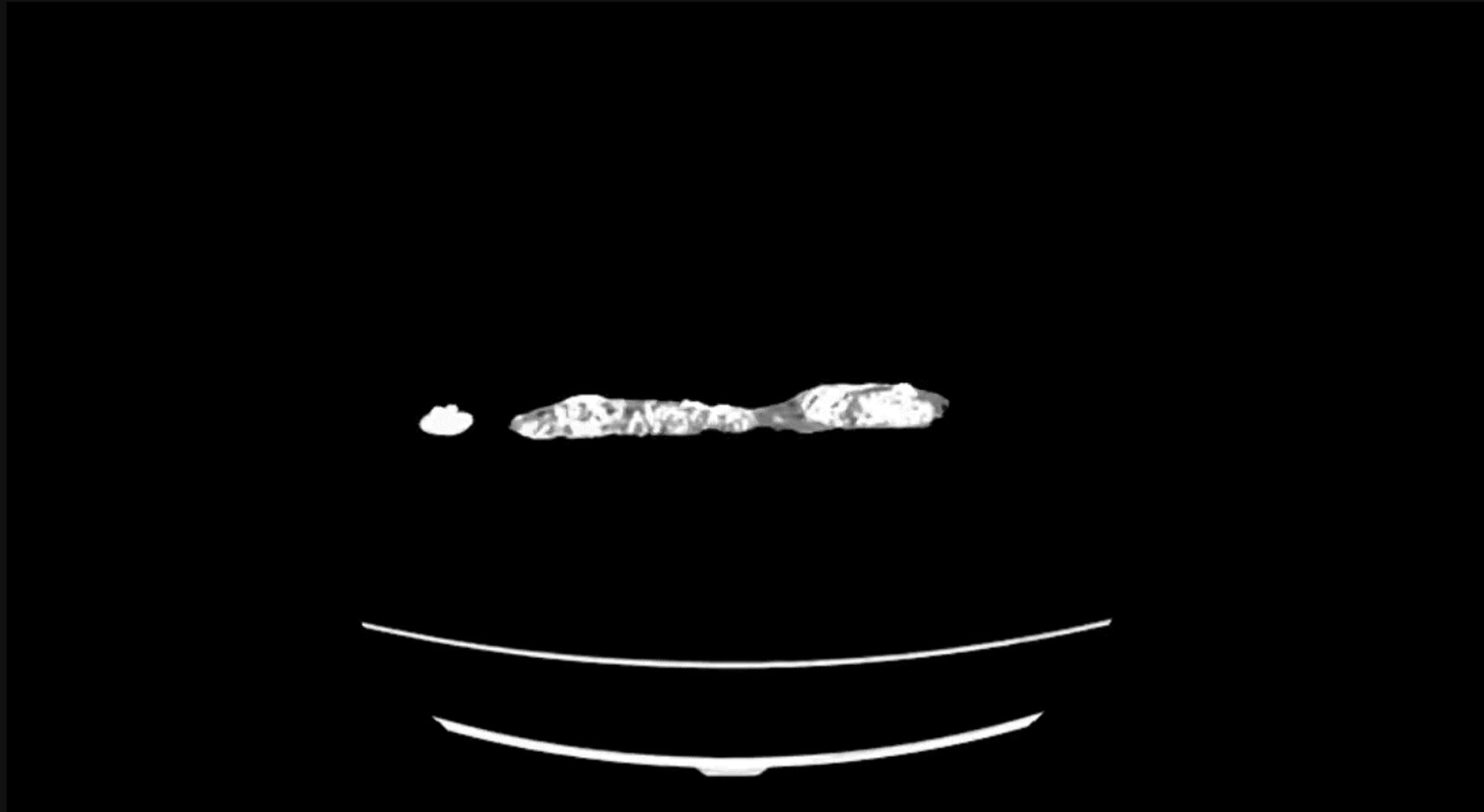


Methodology

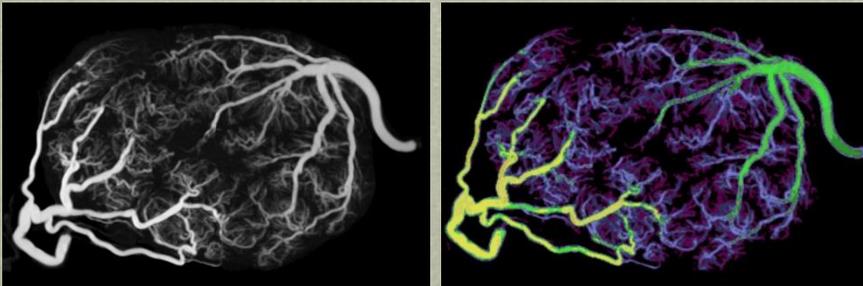
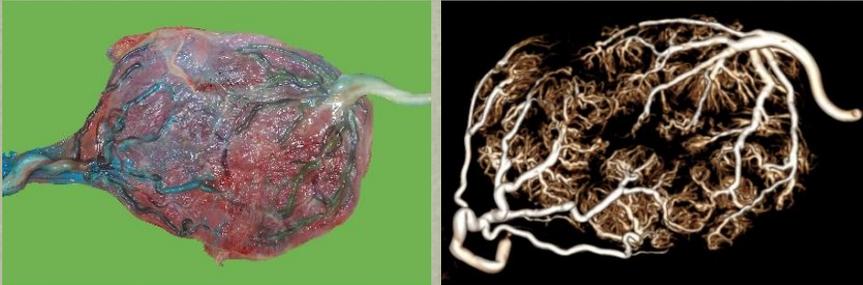
Objective	Decision
Macroscopic examination of blood vessels and anastomoses	Gradual filling of the vessels of the placenta through the vein and umbilical arteries with paint (aqueous solution of gouache paints) of a strictly defined color
Radiographic examination of blood vessels and anastomosis	Phased injection of an X-ray contrast preparation of a strictly calculated volume (based on the mass of the placental part of each fetus) and concentration for the arteries and veins of each umbilical cord. The CT scanning. Processing of CT tomograms with 3D modeling and color mapping
Combined (macroscopic and and radiation) study of anastomoses and placental vascularization	The use of a contrast-coloring mixture of precisely calculated volume, consisting of a combination of paint (a specific color for each vessel) and an X-ray contrast preparation (with a strictly calculated concentration for the arteries and veins of the umbilical cord of each fetus). The CT scanning. Processing of CT tomograms with 3D modeling and color mapping



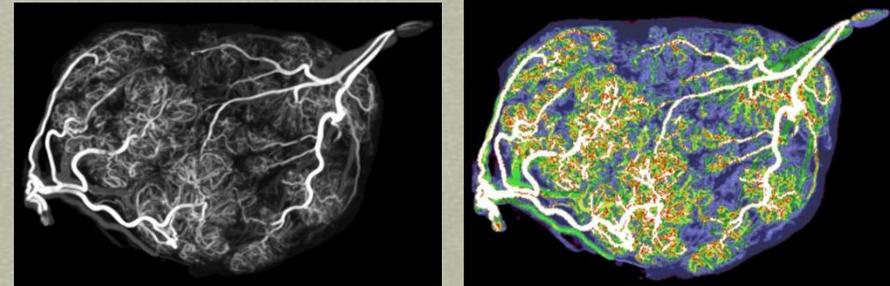
Processing and analysis of CT scans



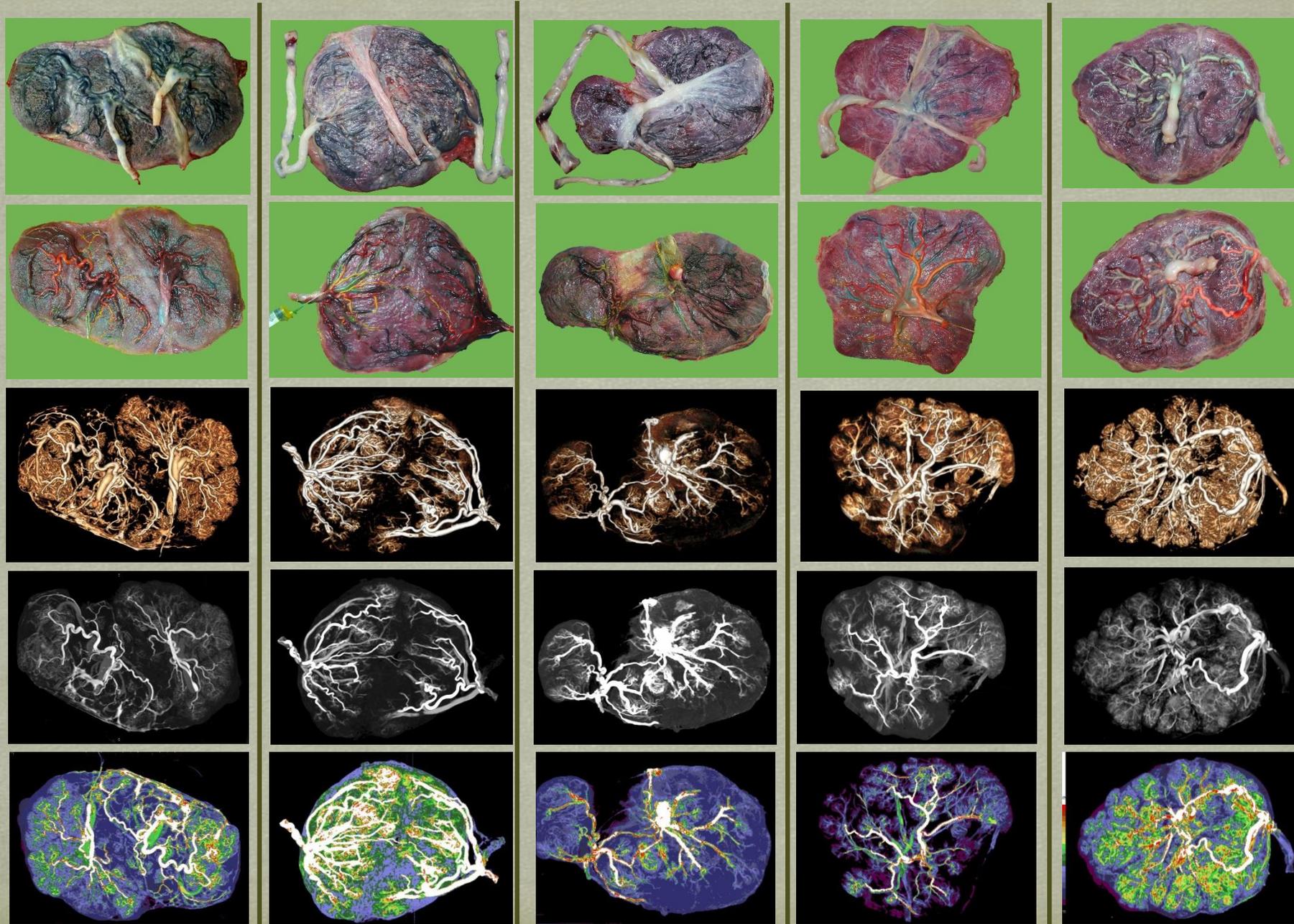
Filling of the veins



Filling of the arteries



Macroscopic and radiographic characteristics of placental vascularization



no

arterio-arterial

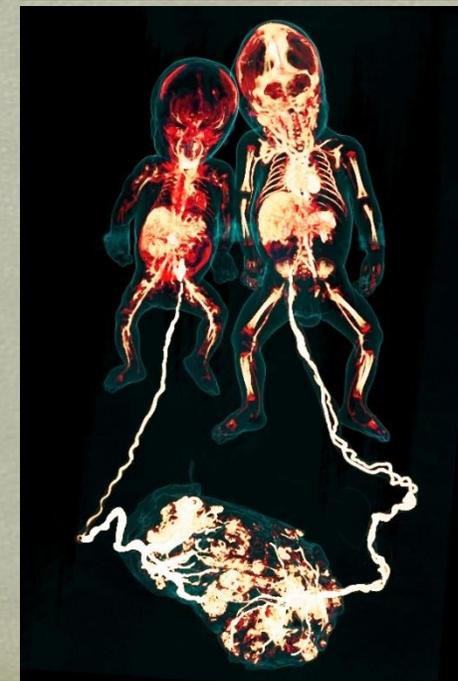
arterio-venous

v-v + a-a

v-v + a-a

Characteristics of anastomoses in placentas with FGR

	I (FGR) N=7	II (without FGR) N=7
The presence of anastomoses (% placenta with anastomosis of the total number in the group)	85,71%	57%
The average number of anastomoses per 1 placenta	2	1
The average diameter of the anastomosing vessels (mm)	4,4	1,7
Branching level of anastomosing vessels	2,6	4
The average indicator of the anastomoses severity	1,8	0,5
The integrated indicator of the anastomoses severity	4,1	0,5
Type of anastomosis (% of detection from the placentas with anastomoses)		
Arterio-arterial (A-A)	43%	57%
Veno-venous (V-V)	43%	-
Arterio-venous (A-V)	57%	-
The average indicator of the anastomoses severity, depending on their type		
severity indicator A-A	2,4	0,5
severity indicator V-V	1,7	-
severity indicator A-V	1,9	-

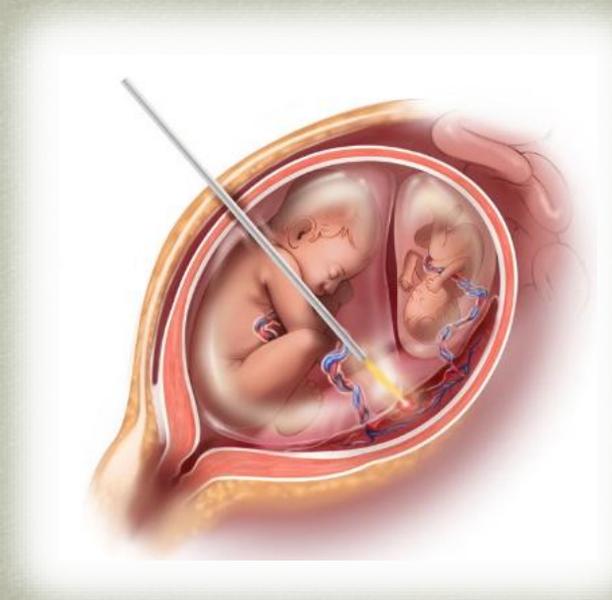


Conclusion

The use of combined macroscopic and radiation evaluation of anastomoses and placental vascularization is recommended for an objective quantitative assessment of the severity of anastomoses in a monochorionic placenta.

The use of the method of introducing the contrast-coloring mixture into the placental vessels, followed by CT and processing of tomograms with three-dimensional modeling and color mapping, allows to identify and evaluate (the number, type, severity) of placental anastomoses.

Peculiarities of anastomoses in the monochorionic diamniotic placenta in case of FGR were revealed as a result of a comprehensive macroscopic and radiation study. In case of FGR, the rate of detection of anastomoses in the placenta is higher, the diameter of the anastomosing vessels is larger, and the level of their branching is less than in the placenta during a normally developing pregnancy. Only arterio-arterial anastomoses were detected in placentas without FGR.



THANK YOU FOR ATTENTION



We are glad to cooperate with you. Contact e-mail: patan777@gmail.com