Novel ultrasound technologies in assessing the state of the “mother-placenta-fetus” system

Blyuss O.[1], Dobrokhotova Y.E.[2], Zubareva E.A.[2], Zalesskaya S.[2]

1 – University College London, 2 – Pirogov Russian National Research Medical University

Relevance. The leading process in the early stages of pregnancy is the formation of the mother-placenta-fetus system. The central link in the mother-placenta-fetus system is the placenta. The structural features of the placenta reflect the complex relationship between the mother's body and the fetus. Violation of the formation and functioning of the placenta underlies the development of such complications as early termination of pregnancy, placental insufficiency, fetal growth restriction, preeclampsia, and premature birth. In this regard, an integrated approach in the study of the hemodynamic system mother-placenta-fetus is of particular importance. Ultrasound remains one of the most promising diagnostic methods.

Materials and Methods. The study included 40 patients at 30-32 weeks of gestation with a singleton spontaneous pregnancy: 20 patients with a normal physiological course of pregnancy and 20 patients diagnosed with placental insufficiency. The ultrasound examination included standard B-mode echography, color Doppler imaging and the use of modern techniques - 3D imaging technology and innovative SMI (Superb Micro-Vascular Imaging) high-precision microvascular imaging technique.

Results and Discussion. In patients with a physiological course of pregnancy, a variant of a three-dimensional model of the vascular network with a complex massive vascular network prevailed, while in the group with placental insufficiency, the three-dimensional vascular model looked simple: several intertwined vessels. Visual assessment of the vascular tree of the placenta using SMI technology in patients with placental insufficiency revealed the absence of a clear vascular pattern in the area of interest, while active placental blood flow was determined in patients with a physiological course of pregnancy.

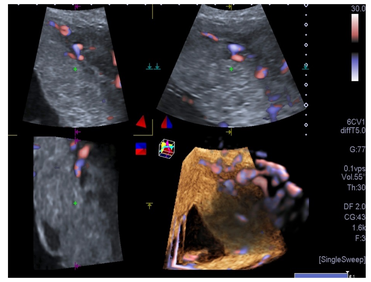

Fig. 1. 3D imaging technology. Group with the physiological course of pregnancy

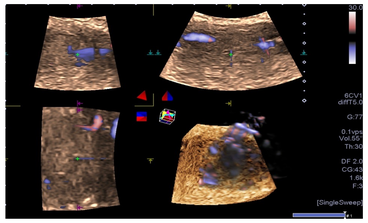

Fig. 2. 3D imaging technology. Group with placental insufficiency

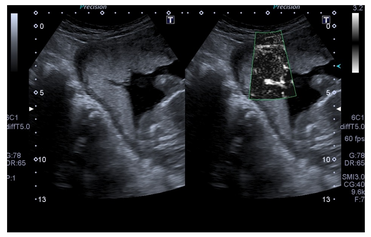

Fig. 3. SMI mode. Visual assessment of the cotyledon vascular tree of the central part of the placenta in a group of patients with placental insufficiency

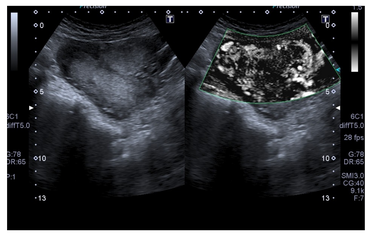

Fig. 4. SMI mode. Visual assessment of the cotyledon vascular tree of the central part of the placenta in a group of patients with a physiological course of pregnancy

Conclusion. The use of modern ultrasound technologies makes it possible to obtain information about the state of placental blood flow, which allows timely diagnosis of the development of placental insufficiency.