
COLOR DOPPLER ASSESSMENT OF THE INTERVILLOUS CIRCULATION IN ALL TRIMESTERS OF PREGNANCY

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Color Doppler sonography can be successfully used for the assessment of the intervillous circulation throughout the three trimesters of pregnancy. The first trimester pregnancies were assessed by the transvaginal route while second and third trimesters pregnancies were evaluated using transabdominal route. Color flow mapping was used for visualization of the outlets of the spiral arteries into the intervillous space and the blood flow inside it. Pulsatile, arterial-like intervillous flow signals and spiral arteries signals were assessed by the use of pulsed Doppler and expressed by resistance (RI) and pulsatility (PI) indices, peak systolic velocity (PSV), end-diastolic velocity (EDV), and temporal averaged maximum velocity (TAMV). Velocities of blood flow of pulsatile signal in the intervillous space increased significantly towards the mid-pregnancy.

After reaching the plateau between 16 and 22 weeks of gestation they remained almost constant until the term. Near the term low-significant decrease of blood flow velocities was noted. The impedance to blood flow within the intervillous space expressed by RI and PI is rather low. The impedance significantly decreases towards the mid-pregnancy and then remains stable. Continuous intervillous flow became stronger and randomly dispersed with advancing the gestation, while the mean peak systolic velocity reached the value of 27.4 cm/s before the delivery. It is our belief that the number of color coded areas represents the formation of preferential blood flow pathways, while increment of blood flow velocities in the spiral arteries and intervillous space accompanied by decrement of the vascular impedance represents the degree of the trophoblastic invasion and lumen widening. During the early pregnancy there were only few color coded areas where spiral and intervillous flow were detected. However, the vascular impedance measured at this site during early pregnancy was quite low and the blood velocities were relatively high. This fact suggests that from its establishment intervillous flow is substantial corresponding to the trophoblast invasion of spiral arteries. After reaching their maximum at mid-pregnancy, by the end of trophoblast invasion, blood flow velocities remain constant until the term. Around the term there is a slight, statistically low-significant, decrease of blood flow velocities. The impedance to flow in the intervillous space, measured in terms of resistance (RI) and pulsatility (PI) indices, is low. It is characterized by significant decrease to the mid-pregnancy. Afterward it remains constant, and there is no significant change until the term. Low resistance is in concordance with the fact that the intervillous space is a voluminous vascular pool which enables the blood to flow on the villi that are freely floating inside it.

COMBINED COLOR DOPPLER AND 3-D ULTRASOUND STUDY OF FETAL ABNORMALITIES

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Considerable progress in sonographic techniques and the introduction of transvaginal sonography in particular have enabled detailed studies to be carried out on early embryonic development. Moreover, Doppler techniques can provide a wealth of information on the physiology and pathology of both the embryonic and the maternal circulation. This non-invasive modality allows analysis of hemodynamic patterns of fetal adaptation to hypoxemia and/or the presence of a severe reduction of oxygen supply to fetal blood and organs. By using this as a second level test in complicated pregnancies it is possible to modulate the characteristics of control and management according to the Doppler findings. Furthermore, color Doppler provides information that can contribute to the improved diagnosis of structural abnormalities of the fetus, particularly the heart defects. Color Doppler is essential to determine the course and direction of the blood flow in great vessels, is helpful but not essential in identifying tiny "jets" in areas of regurgitation from the arterioventricular valves, and finally, it is not essential in diagnosing the majority of anatomical congenital cardiopathies which are generally readily identified with two dimensional ultrasound.

Three-dimensional surface view of the fetal body opens a completely new possibilities in the evaluation of fetal anatomy and detection of fetal anomalies. Fetal body or the affected part of the body can be selectively visualized allowing simultaneous visualization of three orthogonal planes. This provides an on-line display of the third plane, which can not be displayed by conventional ultrasound. This diagnostic method enables the sonographer detailed evaluation of the fetal region of interest, step-by-step simultaneously, using a moving cursor marked by lines at the periphery of the field. Later on surface view of the fetal body or region of interest can be produced on the screen. The possibility to make a complete three-dimensional image and to rotate it enables the sonographer to evaluate the malformation in different angles giving clearly "plastic" impression of the anomaly.

This way of the diagnosis is specially convenient in cases of facial deformalities, cleft lip and palate, malformations or malpositions of hands or feet and spina bifida. It is expected that combined and simultaneous use of color Doppler and 3D ultrasound will offer valuable data in the field of fetal monitoring in not so distant future.