

PIAF study: Placental insufficiency and aortic isthmus flow

Introduction

Over the next few minutes, I intend to discuss Doppler recording during intrauterine fetal growth restriction (IUGR) due to placental circulatory insufficiency. To the maternal and fetal vessels traditionally investigated, I will add the fetal aortic isthmus. The anatomical landmarks, technical aspects of recording, as well as parameters or indices used for analyzing wave velocities will all be described for each vascular site.

Uterine arteries

Anatomical landmarks

The uterine artery originates from the internal iliac artery, then runs along the uterine body and crosses the external iliac artery at the level of the uterine isthmus.

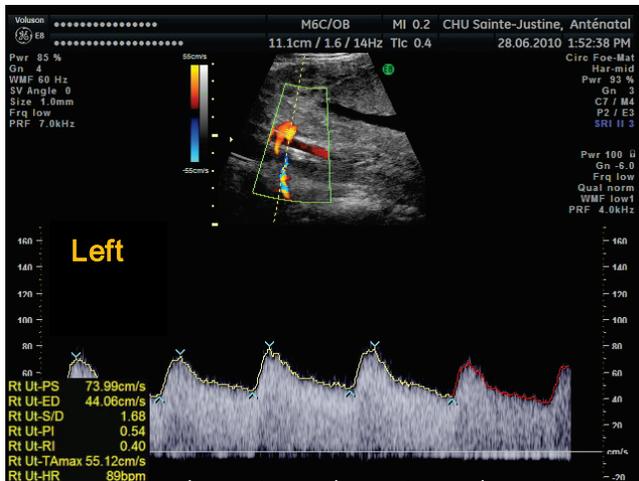
Technical aspects

The probe is placed approximately two to three cm inside the iliac crests. The ultrasound beam is directed towards the pelvis and the lateral side of the uterus. Colour Doppler makes it easier to locate the external iliac artery and the uterine artery that crosses it.

To ensure that Doppler velocities are recorded at the main trunk of the uterine artery before the collateral branches arise, it is recommended to place the sample close to the crossover with the external iliac artery.

The normal spectrum of the uterine artery is characterized by a strong, antegrade diastolic flow, reflecting low resistance of the uterine vascular bed associated with artery wall remodelling after placental trophoblastic invasion. Recording sweep must be adjusted to capture at least three consecutive cardiac cycles on the screen. Flow in both the right and left uterine arteries must be systematically evaluated at each examination.

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Parameters and indices

Analysis of the uterine artery Doppler waveforms can be qualitative or quantitative. Qualitative evaluation is based on the absence (normal profile) or presence (abnormal profile) of a protodiastolic notch on the Doppler velocity curve. Usually, two indices are used for quantitative analysis: the resistance index (RI) which is equal to the peak systolic velocity minus the peak velocity at the end of diastole, divided by the peak systolic velocity, or the pulsatility index (PI) which is equal to the peak systolic velocity minus the peak velocity at the end of diastole, but then divided by the mean velocity. A tracing is considered abnormal when these indices exceed the 95th percentile of reference values according to gestational age. A clearly lateralized placental implantation can cause discordance in the Doppler profile. It is not indeed unusual to see a protodiastolic notch and abnormal indices at the level of the uterine artery situated on the opposite side of the placental implantation. In these cases, the average of the resistance index of the two arteries is usually recommended.

INDICES

Resistance index

$$RI = \frac{(V_s - V_d)}{V_s} = \frac{(S - D)}{S}$$

Pulsatility index

$$PI = \frac{(V_s - V_d)}{V_m} = \frac{(S - D)}{m}$$

V_s (S) = Peak systolic velocity
 V_d (D) = Peak telediastolic velocity
 V_m (m) = Mean velocity

Resistance indices

Gestational weeks	Percentiles	
	90 th	95 th
20	0.67	0.72
28	0.57	0.60
36	0.55	0.58

Chan *et al.* Obstet Gynecol 1995; 85: 596-602