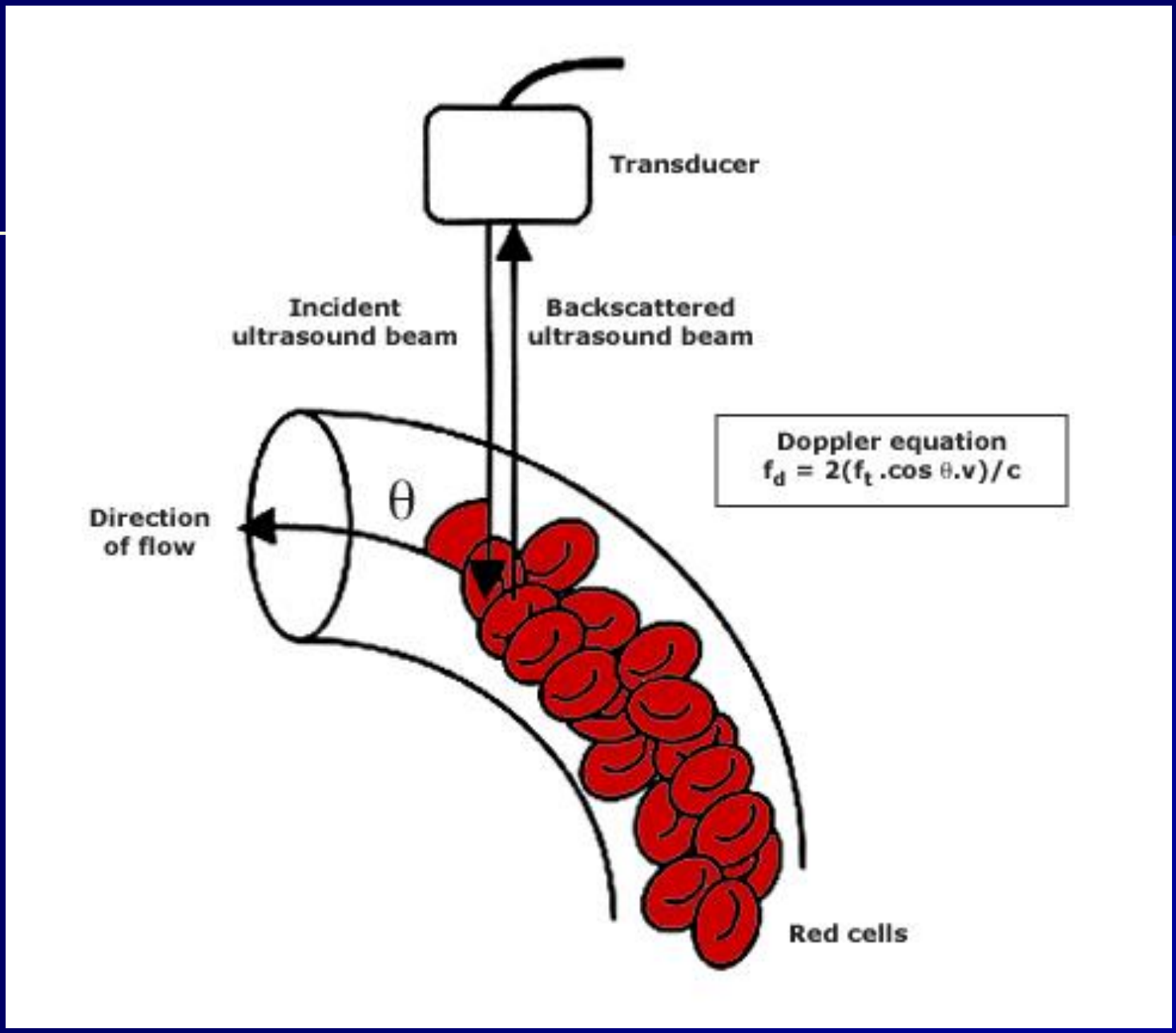

بسم الله الرحمن الرحيم

THE ROLE OF DOPPLER ULTRASOUND IN OBSTETRICS

Doppler sonography :

- غیر تهاجمی است.
- سیستم گردش خون جنین رابررسی می کند
- فرصت منحصر به فردی جهت تخمین وضعیت همودینامیک جنین

برای پایش وضع جنین است


Transducer
Incident ultrasound beam
Backscattered ultrasound beam
Doppler equation
$f_d = 2(f_t .\cos\theta.v)/c$
θ
Direction of flow
Red cells

DOPPLER WAVEFORM ANALYSIS yields:

اطلاعات بدست آمده شامل:

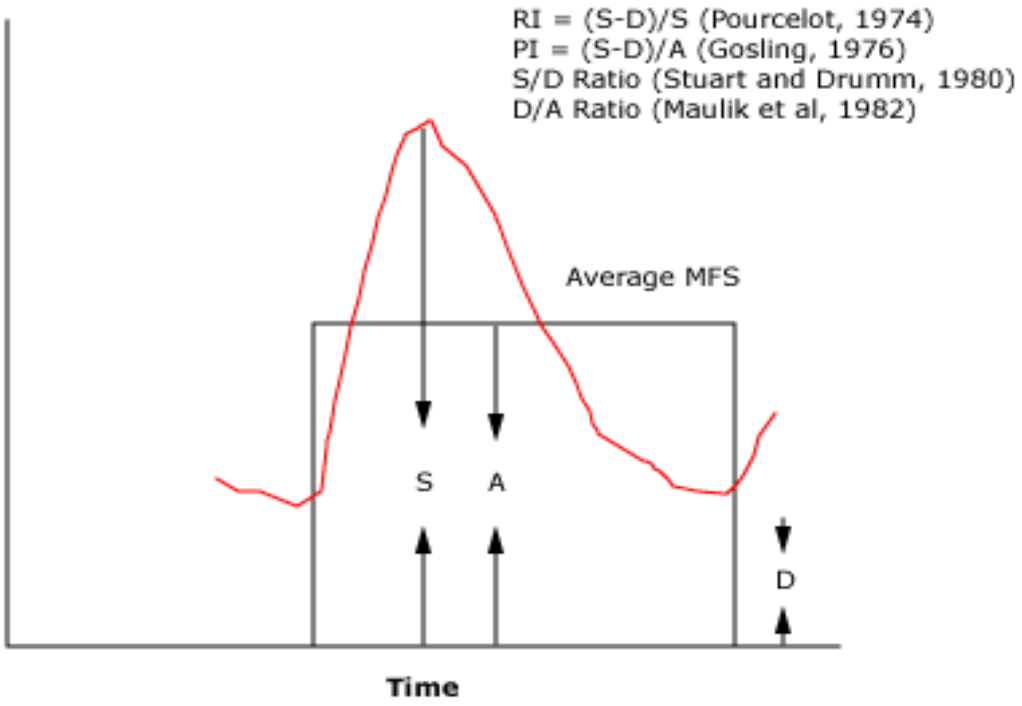
- وجود جریان خون و جهت آن
- حجم خون در جریان
- مقاومت در مقابل جریان

آنالیزداپلر بر اساس مشخصه های زیر اتفاق می افتد:

- Peak systolic velocity (S) اوج سرعت سیستول
- End-diastolic velocity(D) سرعت پایان دیاستولی
- Average frequency shift value over the cardiac cycle (A) متوسط تغییرات ایجاد شده در طول سیکل قلبی
- *Doppler index (DI) اندکس داپلر*

The most commonly used obstetrical applications:

- نسبت اوج سرعت سیستول به سرعت پایان دیاستولی(S/D)
- The resistance index (RI= S-D/S) اندکس مقاومت
- The pulsatility index (PI = S-D/A) اندکس ضربانی



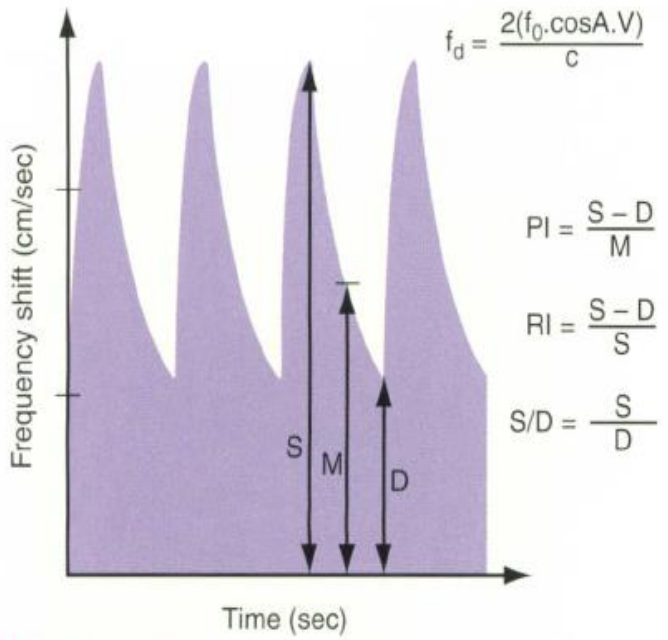


FIGURE 22–2. Doppler indices commonly used in obstetrical imaging. D, diastole; M, mean; PI, pulsatility index; RI, resistance index; S, systole.

Doppler is useful in:

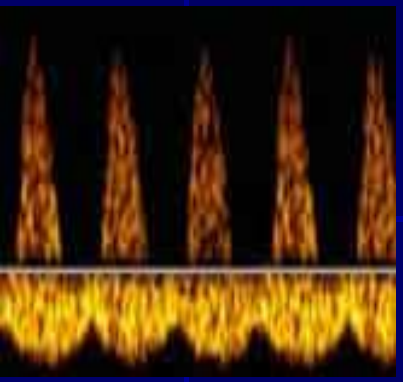
- IUgR and/or preeclampsia
- Doppler identifies the fetal cardiovascular response to hypoxia and acidosis because of placental insufficiency.

Doppler Ultrasound in Fetal Growth Assessment

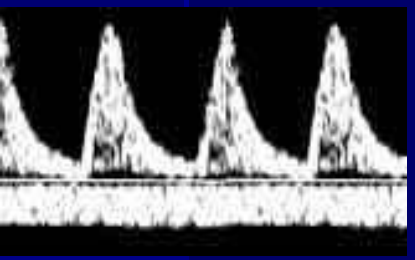
- Uterine artery Doppler
- Umbilical artery Doppler
- Middle cerebral artery Doppler
- Fetal venous Doppler

Umbilical Artery

Normal Pregnancy - Development of the umbilical artery



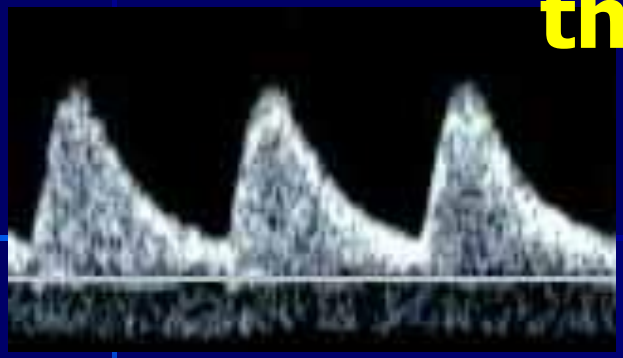
Normal impedance to flow the umbilical arteries and normal pattern of pulsatility at the umbilical vein in ***1th trimester***



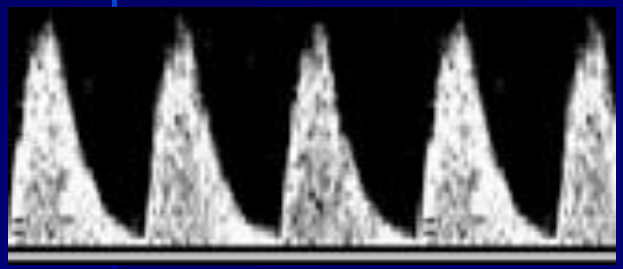
Normal impedance to flow the umbilical arteries and umbilical vein in **early 2th trimester**

Normal impedance to flow the umbilical arteries and umbilcal vein in **late 2th and 3th trimester**

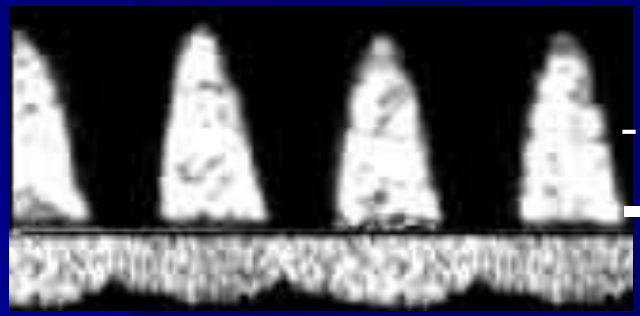
Abnormal Development of the umbilical artery



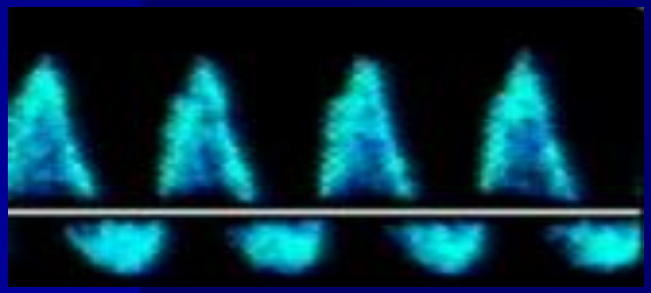
- high pulsatility index



- very high pulsatility index



- Absent end diastolic velocity
- pulsation in the umbilical vein



reversal of end diastolic frequencies

Middle Cerebral Artery

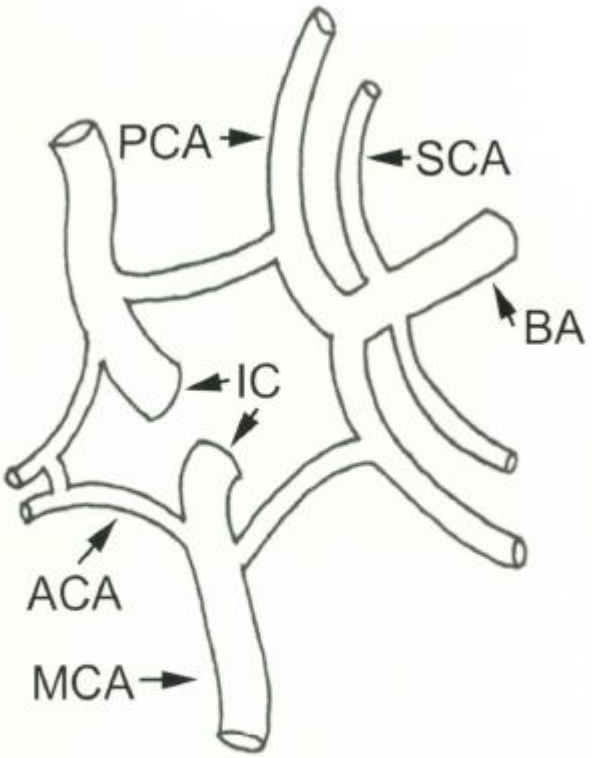


FIGURE 7–30. Circle of Willis. The Circle of Willis is supplied by the internal carotid and the vertebral arteries. It is made up by communicating vessels between the posterior, middle and anterior cerebral arteries. The middle cerebral artery (MCA) carries 80% of cerebral blood flow. Of the cerebral vessels, the MCA is the most accessible to ultrasound. ACA, anterior cerebral artery; BA, basilar artery, IC, internal carotid artery; PCA, posterior cerebral artery; SCA, superior cerebellar

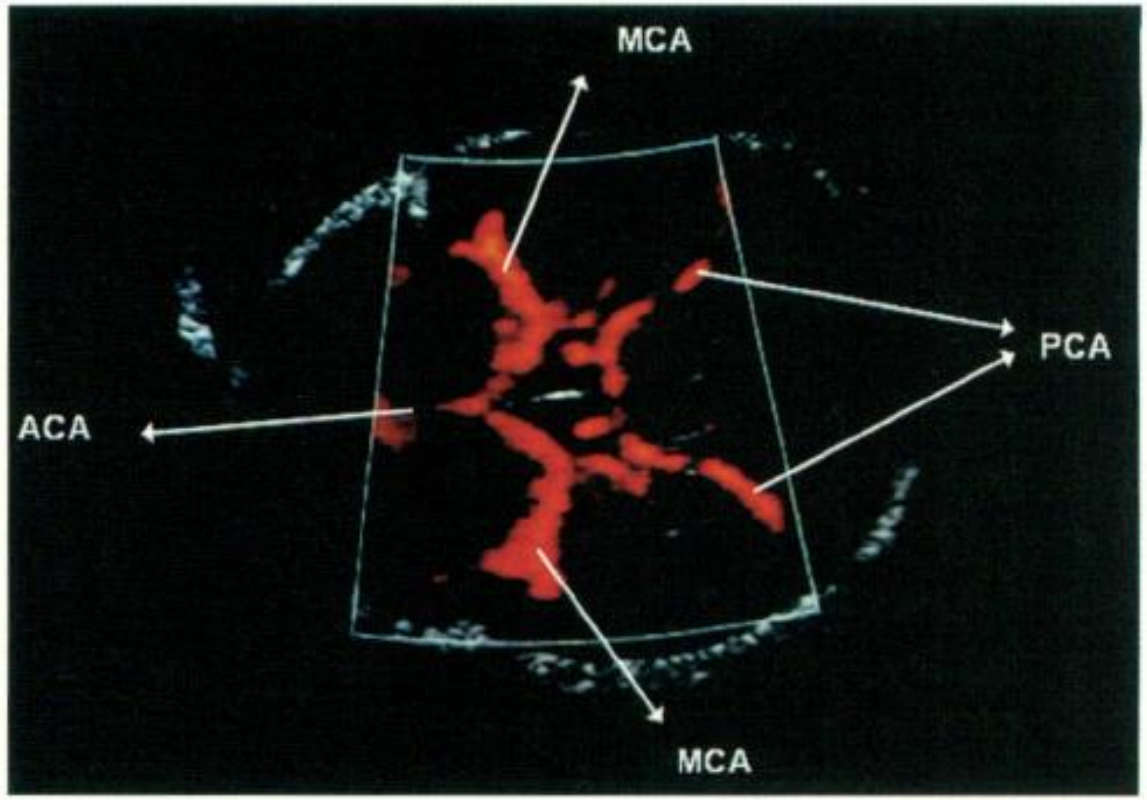


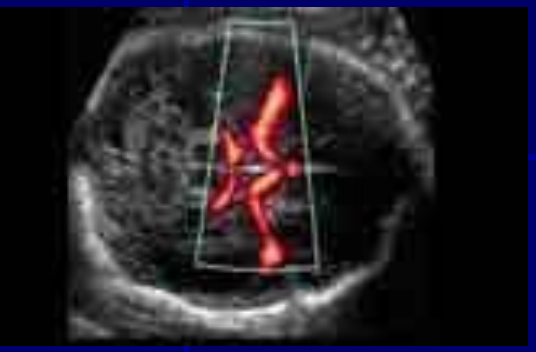
FIGURE 22–6. Circle of Willis shown on color Doppler imaging. ACA, anterior cerebral artery; MCA, middle cerebral artery; PCA, posterior cerebral artery.

Middle Cerebral Artery(MCA)

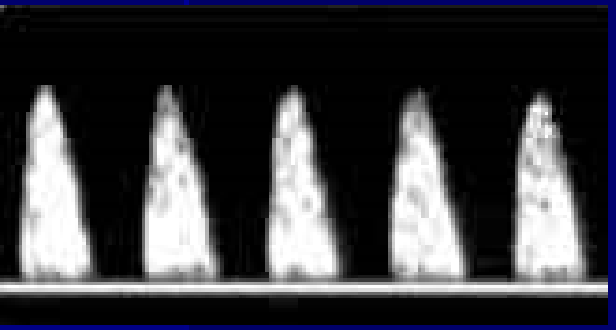
- Is the most accessible cerebral vessel to ultrasound imaging in the fetus.

- The cerebral circulation is normally a high-impedance circulation with continuous forward flow throughout the cardiac cycle.

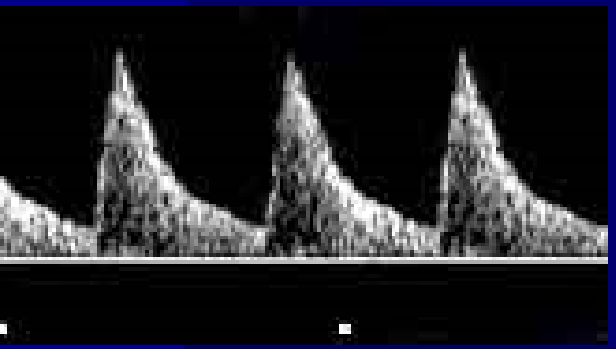
Normal Pregnancy - Development of the MCA



Circle of Willis and the Middle Cerebral Artery

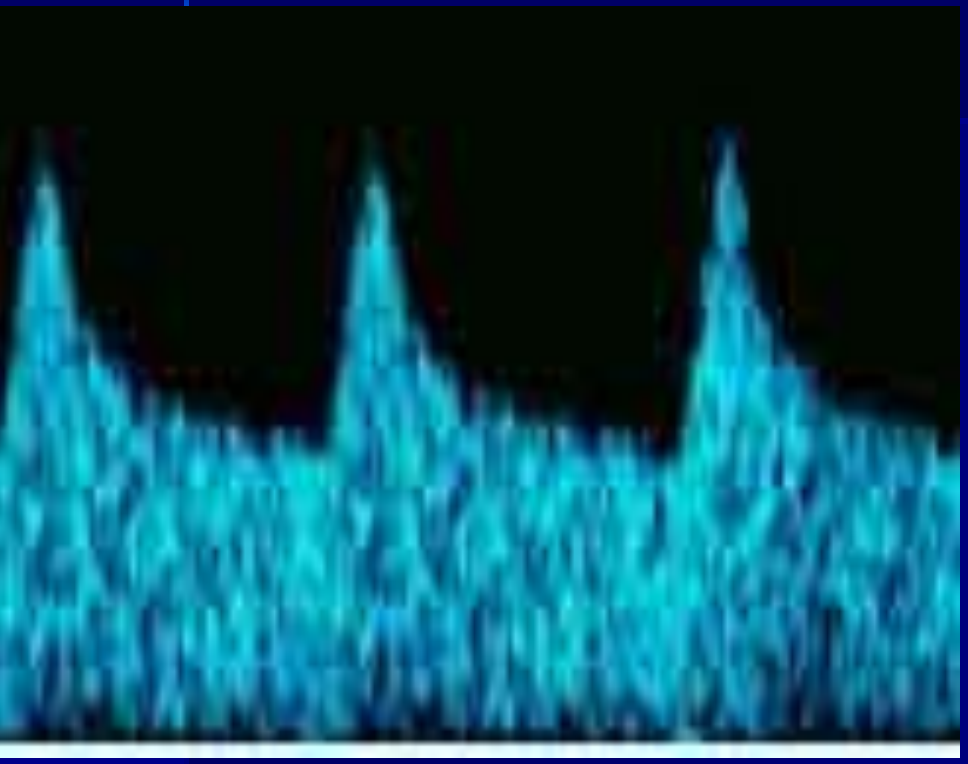


Normal flow of the Middle Cerebral Artery in 1th trimester



Normal flow of the Middle Cerebral Artery in 2th and 3th trimester

Redistribution of blood flow - MCA



Decrease in impedance to flow in the middle cerebral arteries

Fetal MCA systolic/diastolic ratio

Normal

During pregnancy MCA and all other cerebral vessels show high resistance wave forms i.e high systolic velocity and low/ absent diastolic velocity.
A normal fetal MCA S:D ratio should always be higher than the umbilical arterial S:D ratio.

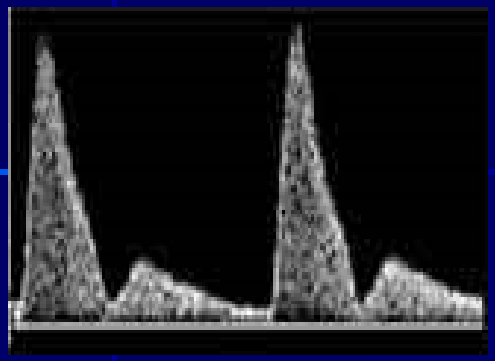
Abnormal

A reduced S/D ratio is abnormal i.e increased diastolic flow in MCA. Loss of high resistance waveform is also an indicator of fetal distress or IUGR.

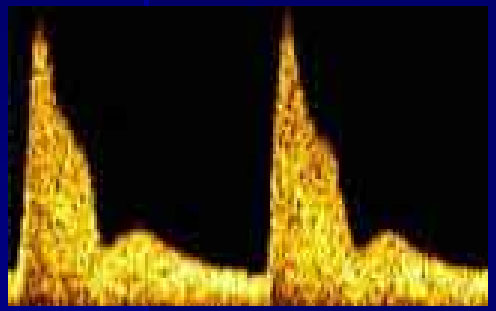
Uterine Artery

- Pregnancy is associated with a progressive decrease in impedance with advancing gestation

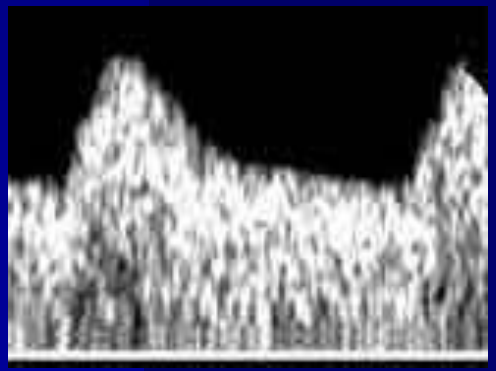
Normal Pregnancy - Development of the uterine artery



Normal impedance to flow the uterine arteries in 1th trimester

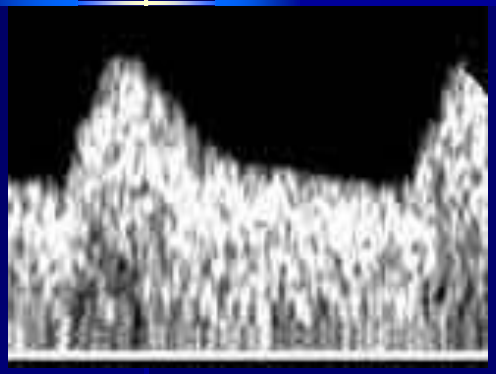


Normal impedance to flow the uterine arteries in early 2th trimester



Normal impedance to flow the uterine arteries in late 2th and 3th trimester

Abnormal Development of the uterine artery



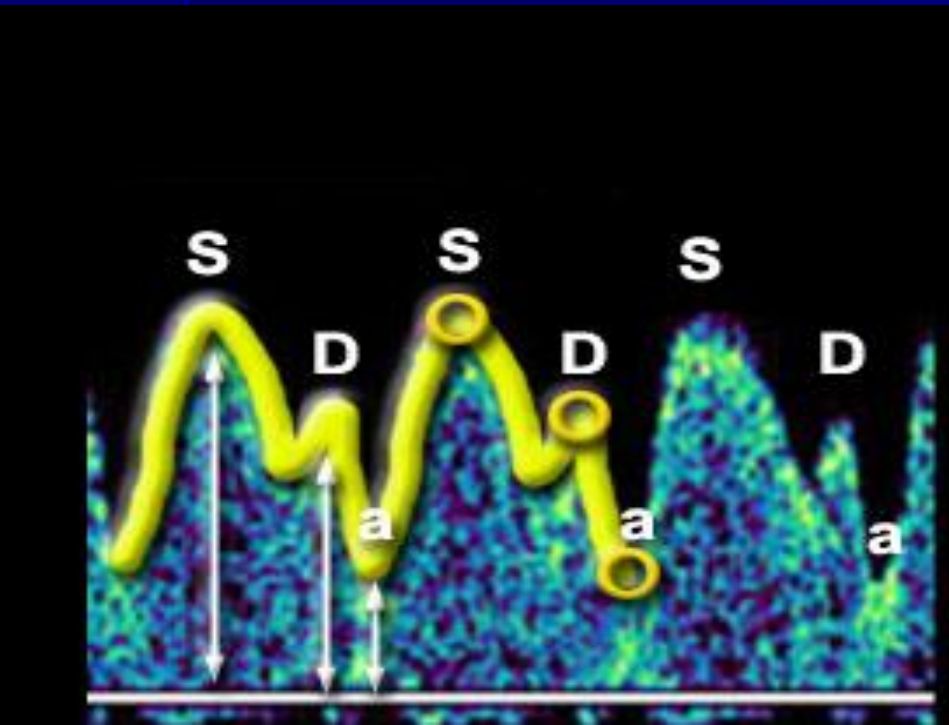
Normal impedance to flow the uterine arteries

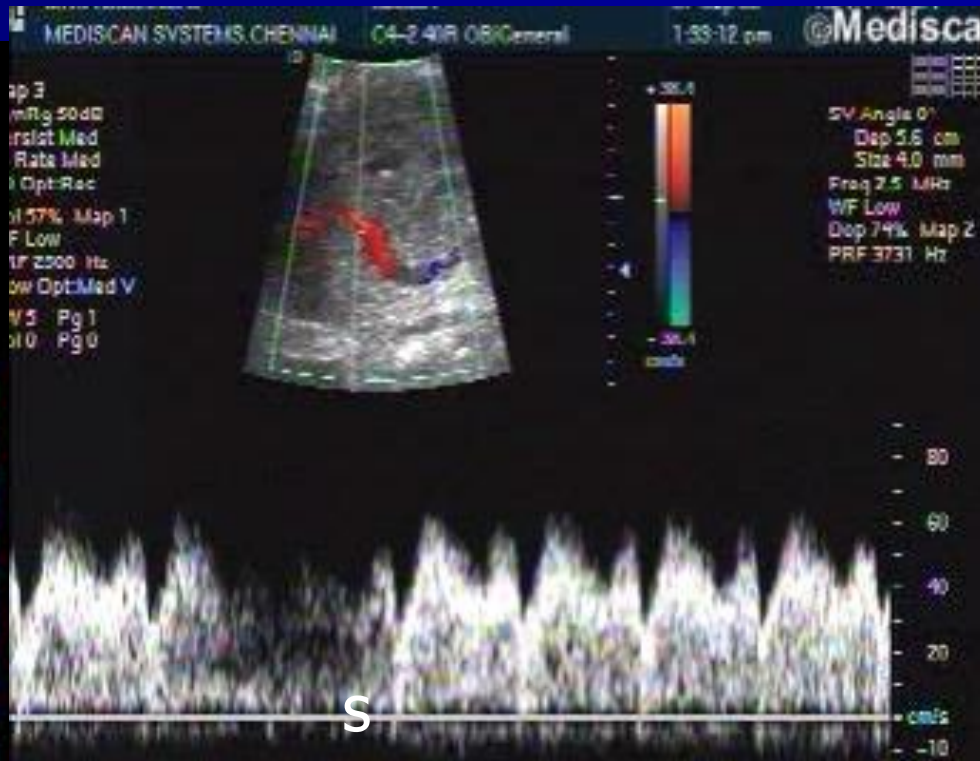
Increased impedance to flow in the uterine arteries (with the characteristic waveform of early diastolic notching)

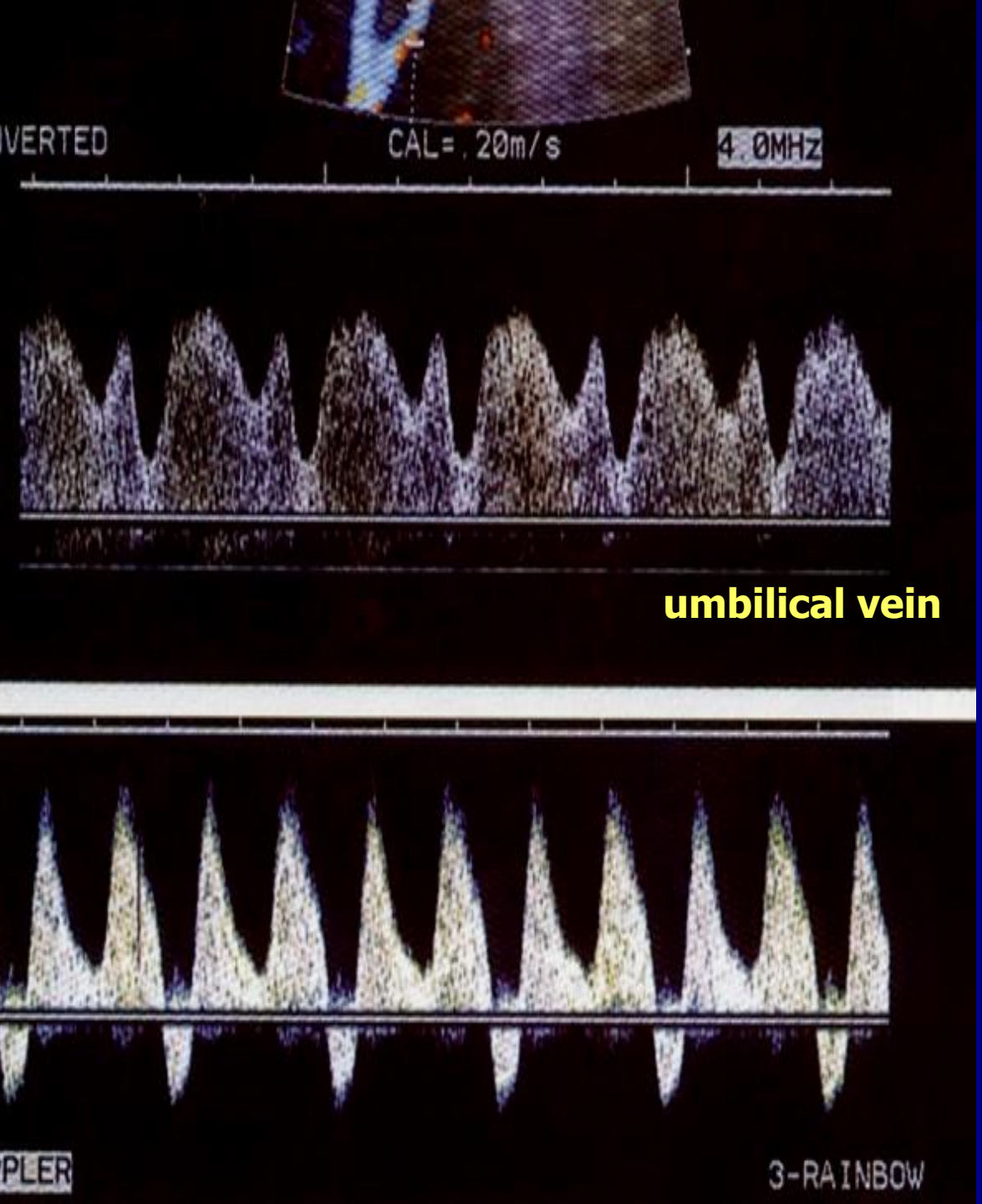
Ductus venosus

DUCTUS VENOSUS

- Highest velocity – 65 – 75 cms/sec
- Ventricular systole – high velocity
- Ventricular diastole – lower velocity
- Atrial systole – lowest velocity







Normal

Reversrd EDF


Thank You