Chelsea and Westminster Hospital NHS
NHS Foundation Trust

Doing a Doppler!

Uterine artery Doppler in pregnancy.

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Uterine artery Doppler

Aims:

- Understanding the physiology of the uterine artery.
- Scan technique for performing uterine artery Doppler.
- Correct interpretation of uterine artery waveform.

Saving Babies' Lives v.3

- SBL v.3 (June 2023): a care bundles to reduce perinatal mortality.
- The 'Saving Babies' Lives' appears to have contributed to the stillbirth rate falling in England.
- The NHS plan is to reduce stillbirth by 50% and preterm birth rate from 8% to 6% by 2025.

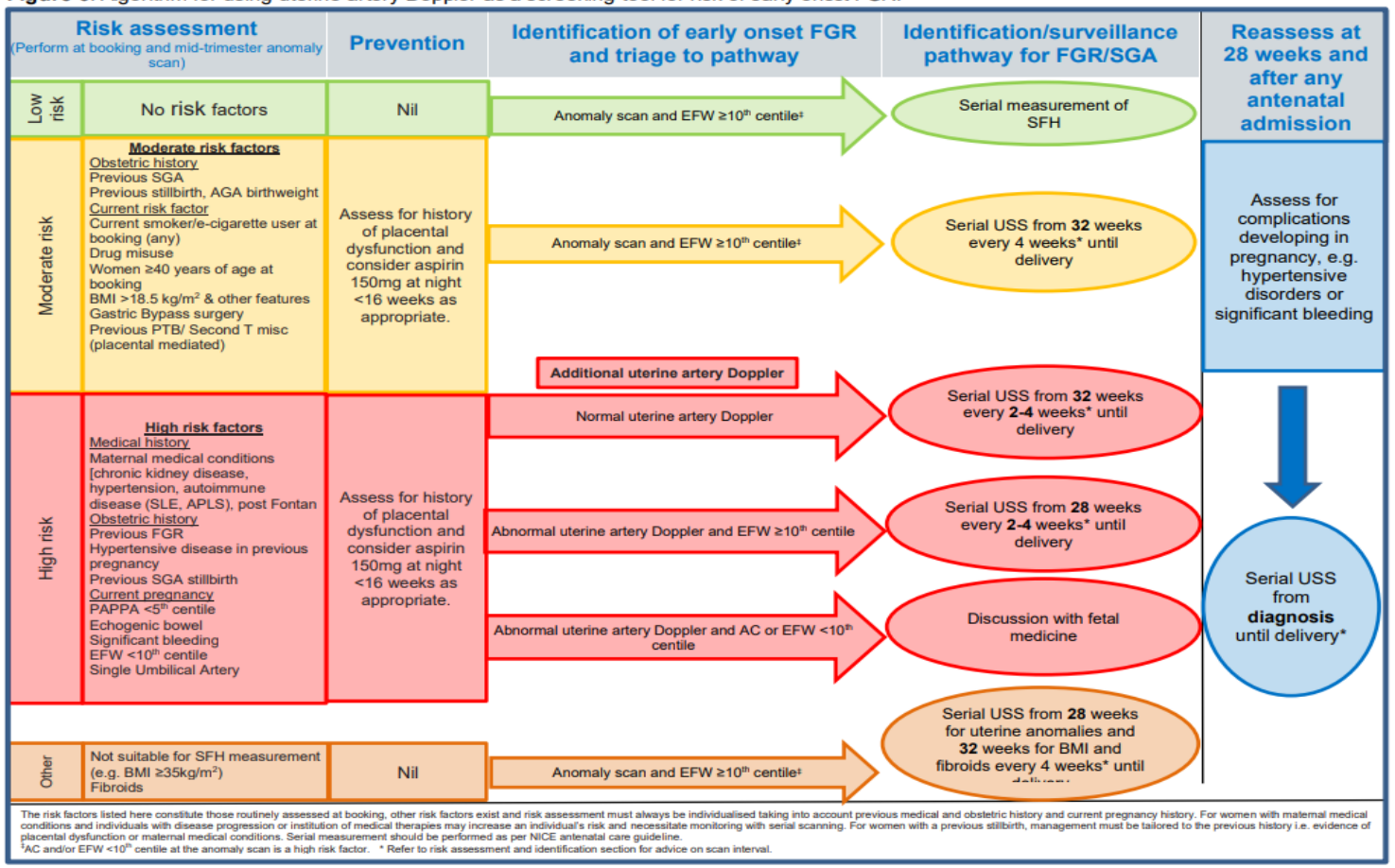
Saving Babies' Lives v.3

There are now 6 elements of care in SBL v.3:

- Reducing smoking in pregnancy.
- Fetal growth: risk assessment, surveillance and management.
- Raising awareness of reduced fetal movements.
- Effective fetal monitoring during labour.
- Reducing preterm birth.
- Management of pre-existing diabetes in pregnancy

Saving Babies' Lives v.3

Figure 6: Algorithm for using uterine artery Doppler as a screening tool for risk of early onset FGR.



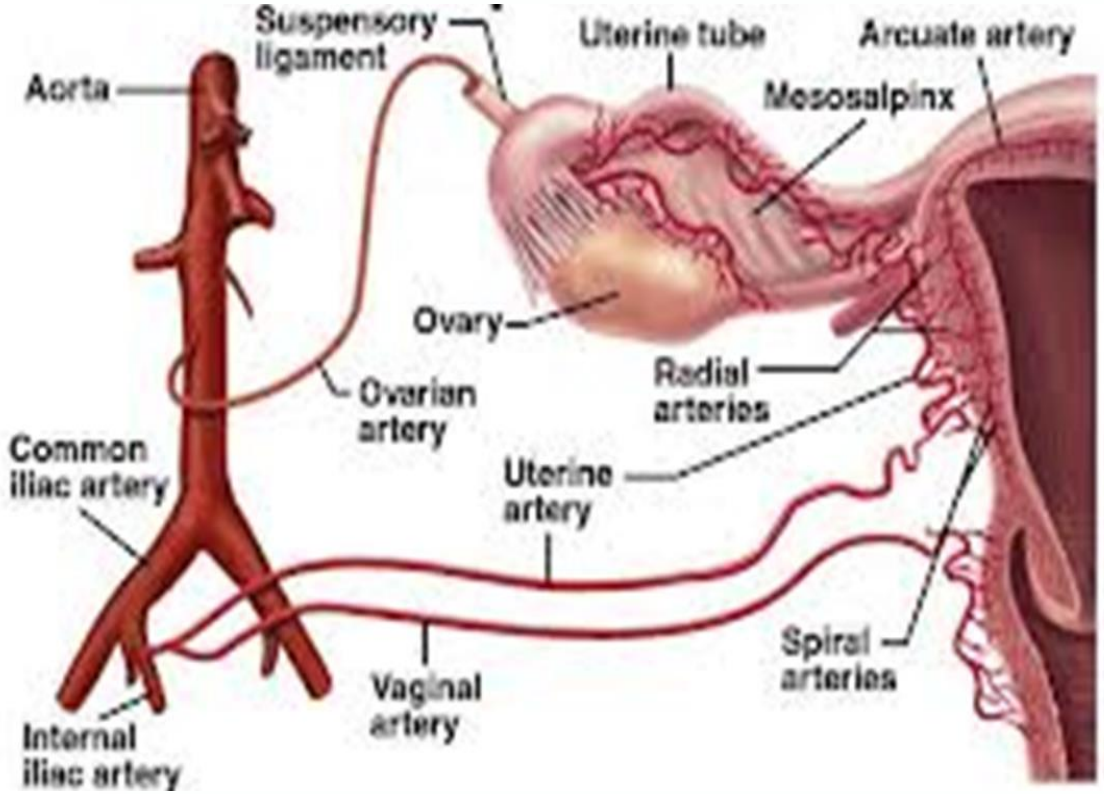
The risk factors listed here constitute those routinely assessed at booking, other risk factors exist and risk assessment must always be individualised taking into account previous medical and obstetric history and current pregnancy history. For women with maternal medical conditions and individuals with disease progression or institution of medical therapies may increase an individual's risk and necessitate monitoring with serial scanning. For women with a previous stillbirth, management must be tailored to the previous history i.e. evidence of placental dysfunction or maternal medical conditions. Serial measurement should be performed as per NICE antenatal care guideline.
‡AC and/or EFW <10th centile at the anomaly scan is a high risk factor. * Refer to risk assessment and identification section for advice on scan interval.

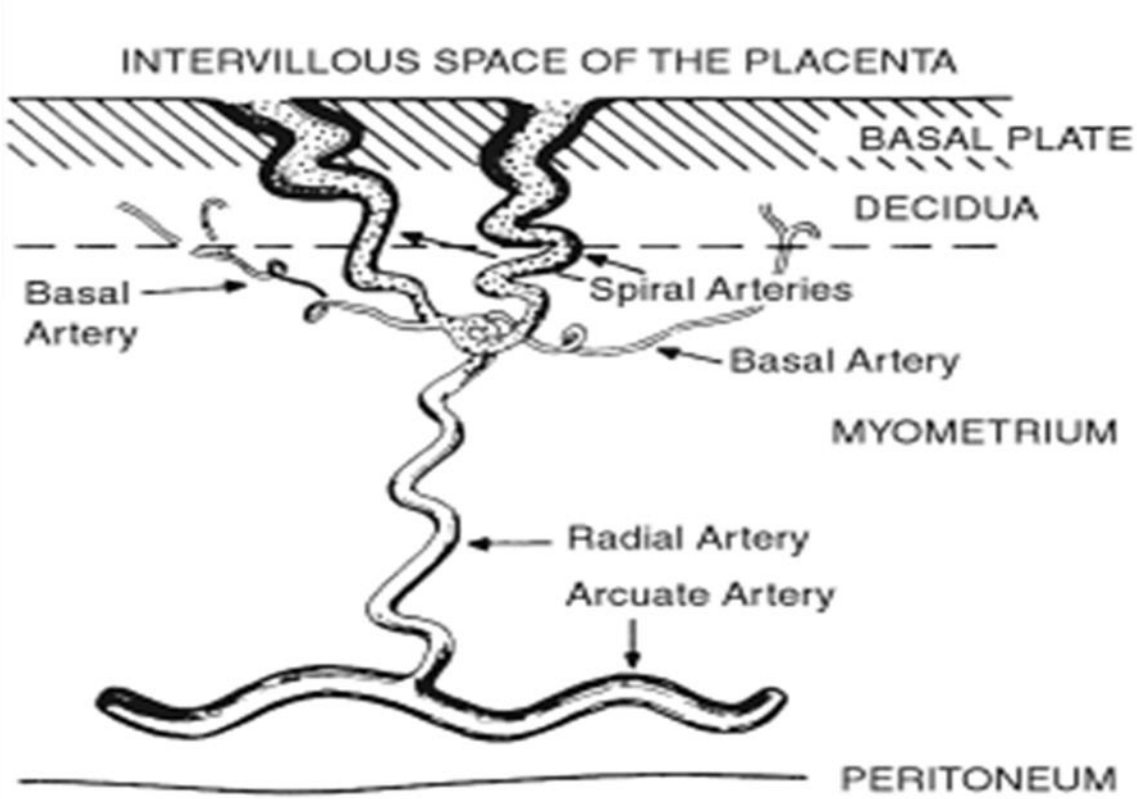
Uterine artery Doppler

- The main goal of the haemodynamic response to pregnancy, is to provide adequate uteroplacental perfusion and nutrition to facilitate fetal growth and development.

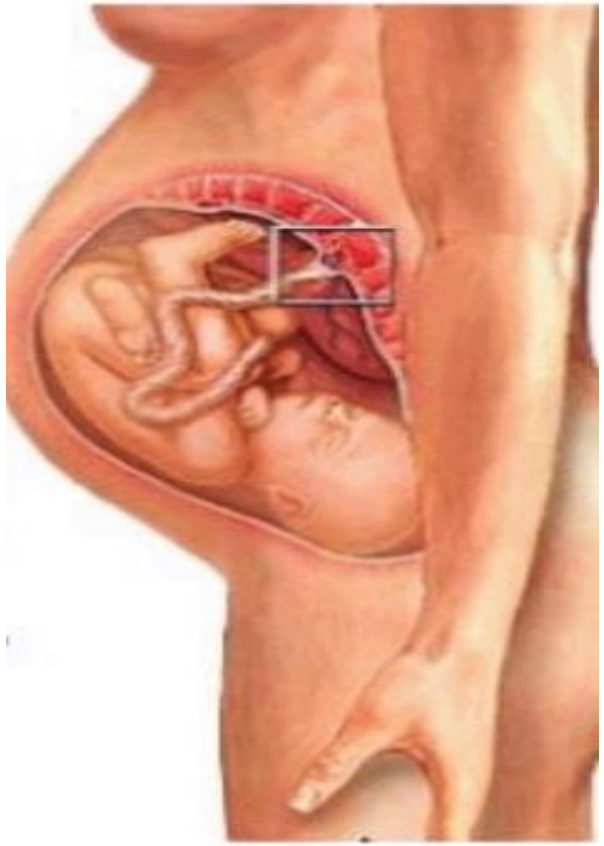
- Uterine artery Doppler can interrogate the uteroplacental circulation and screen for impaired placentation by detecting blood flow alterations.

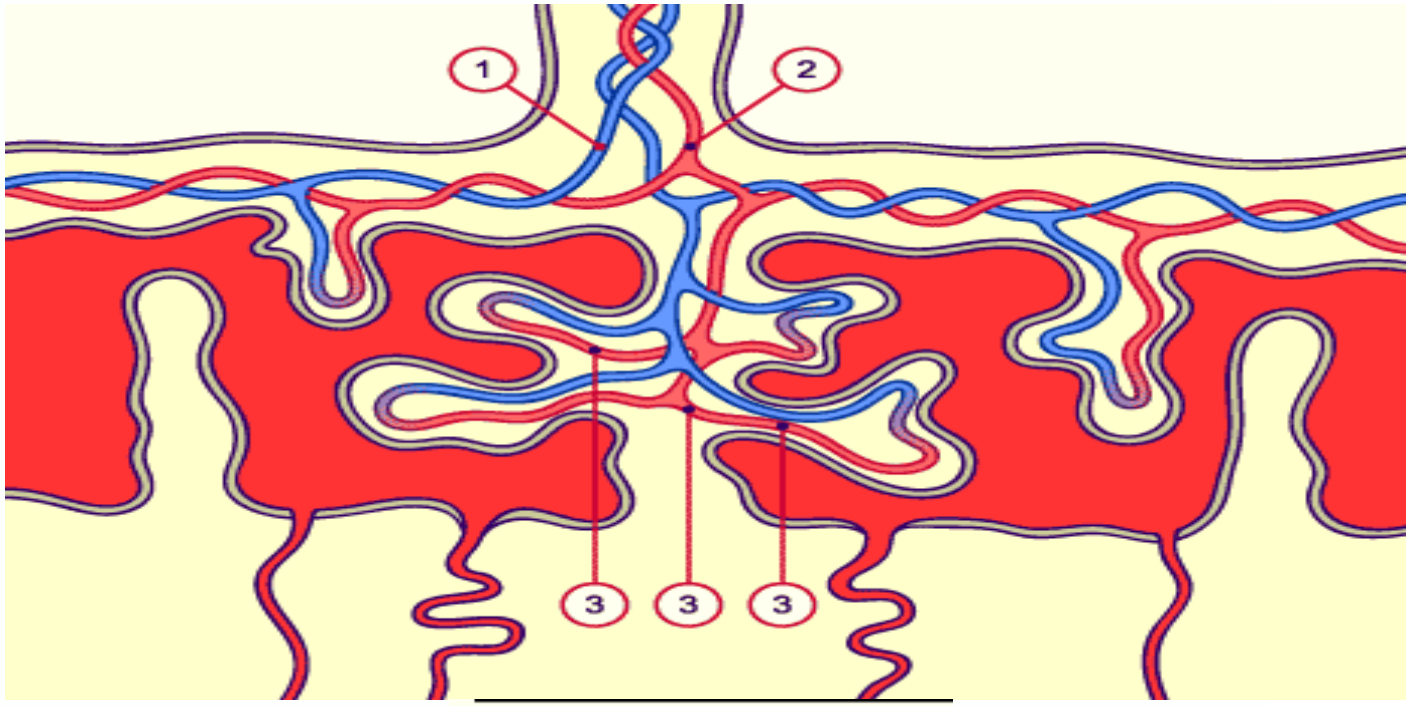
Uterine artery





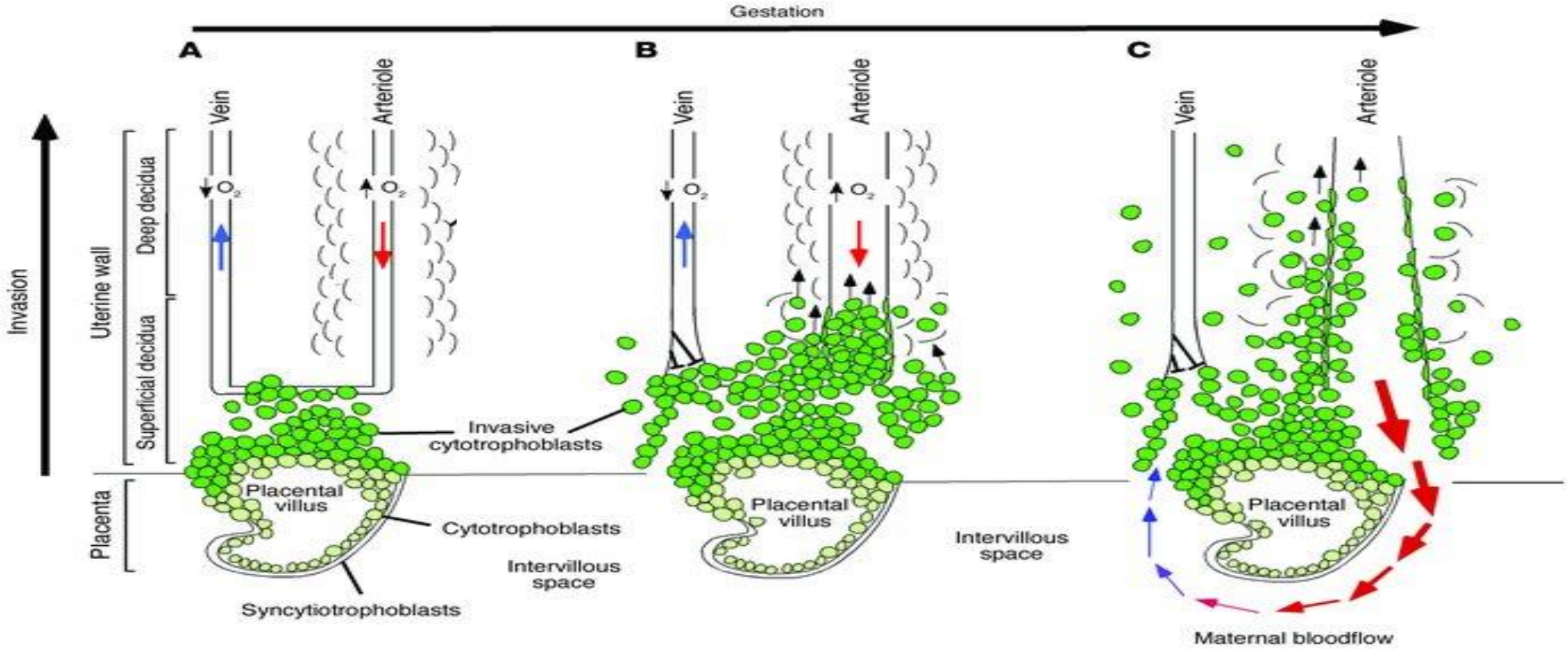
The placenta





1 Umbilical arteries
2 Umbilical vein
3 Fetal capillaries

Trophoblastic invasion

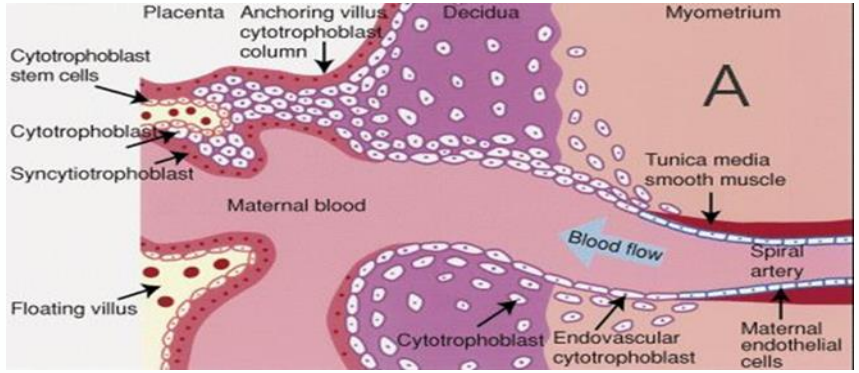


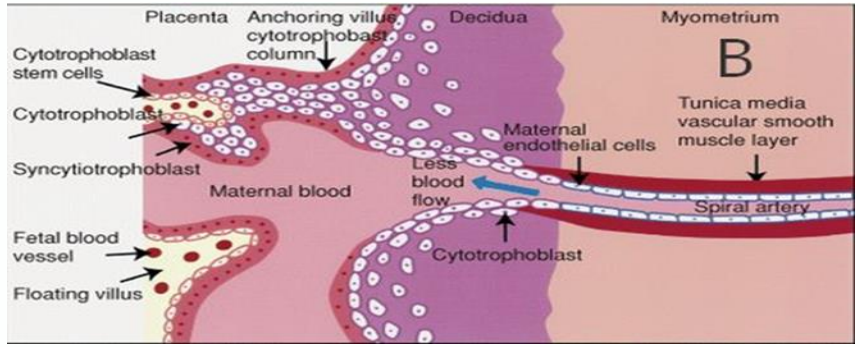
Uterine artery Doppler

- Impedance to flow in uterine arteries decreases with gestation.
- From 20 weeks the fall in impedance is due to trophoblastic invasion of the spiral arteries in the placental bed, which converts them into low-resistance vessels.
- Further fall in impedance is due to a hormonal effect on the elasticity of the arterial walls.

Trophoblastic invasion of the spiral arteries

Normal trophoblastic invasion





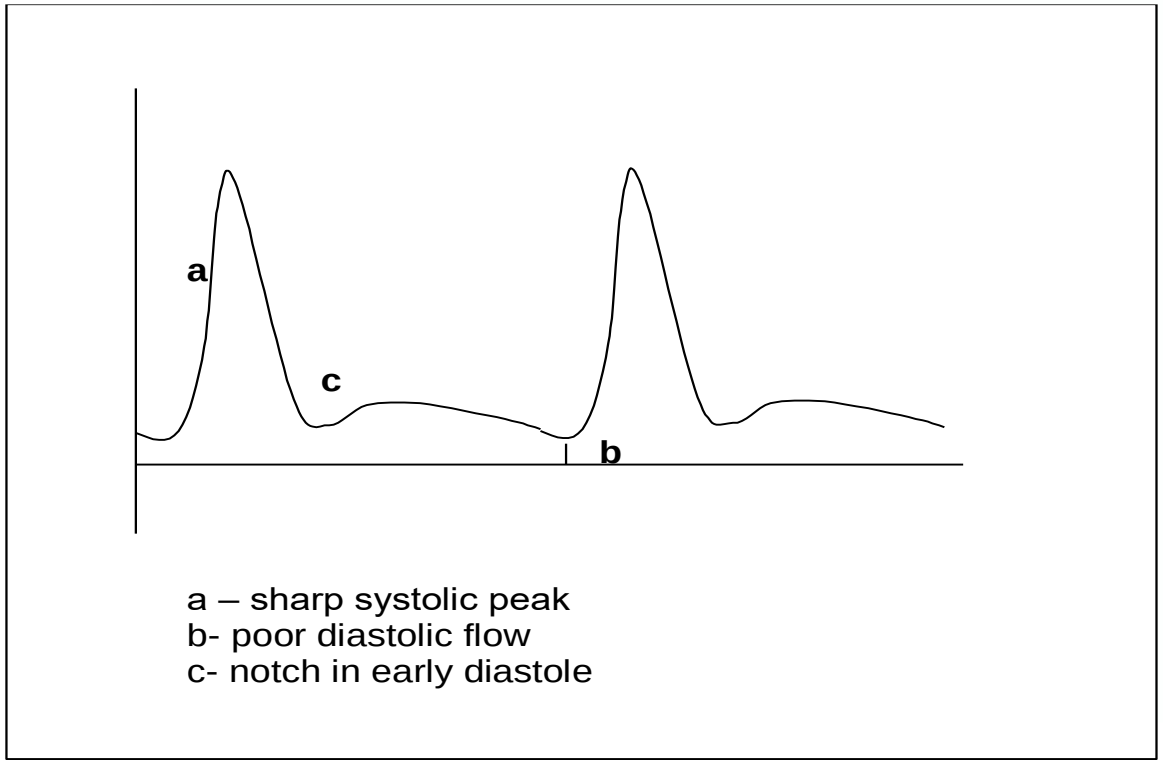
Abnormal trophoblastic invasion

epomedicine.com

- Failure of 2nd Trimester trophoblastic invasion causes uteroplacental insufficiency.
- Maternal spiral arteries retain: -
  - narrow bore
  - muscular walls
  - high resistance
- Flow of maternal blood to the feto-placental circulation is significantly reduced

Uterine artery Doppler

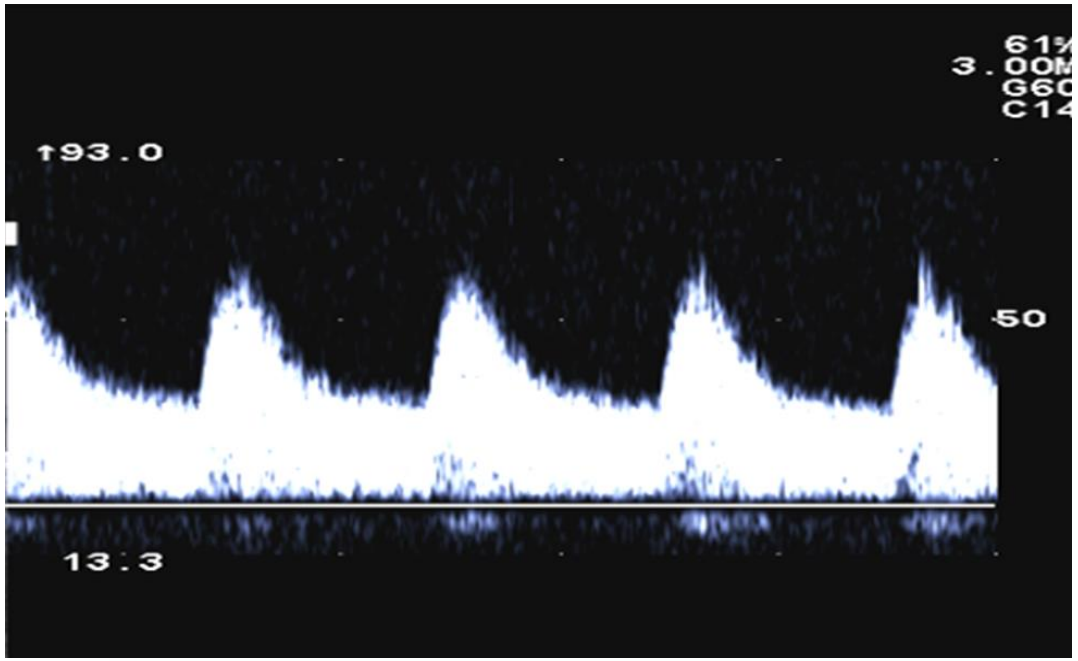
Normal Uterine Artery Waveform in a Non-pregnant Woman



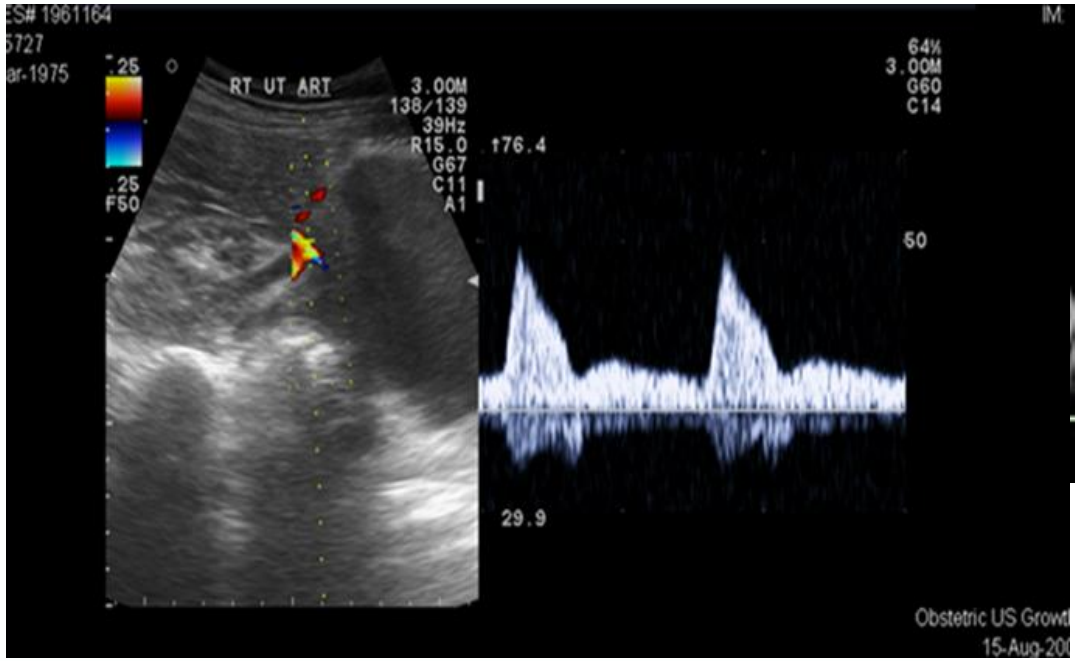
- As pregnancy progresses the early diastolic notch should disappear by 18-20 weeks.
- There is an increase in diastolic flow, which leads to a fall in resistance.

Uterine artery Doppler

Normal Uterine Artery Doppler @20 weeks



Abnormal Uterine Artery Doppler @ 20 weeks



Uterine artery Doppler

If there is defective trophoblast invasion, which leads to impaired placentation, this can result in the following obstetric complications:

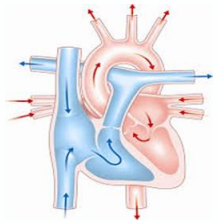
- Pre-eclampsia
- Early onset FGR

Uterine artery Doppler

Maternal diseases:

- Heart disease

  The partial pressure of oxygen in the maternal blood may be decreased.

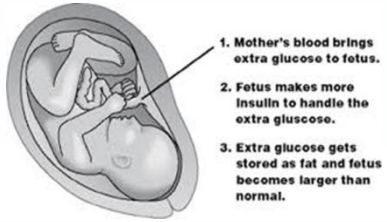


- Pre-existing Insulin-dependent diabetes

  Diabetic vasculopathy

- Gestational diabetes

  Fetal macrosomia



- Autoimmune disease (SLE and APLS)

  Arterial and venous thrombosis of the uteroplacental vasculature and placental infarction.

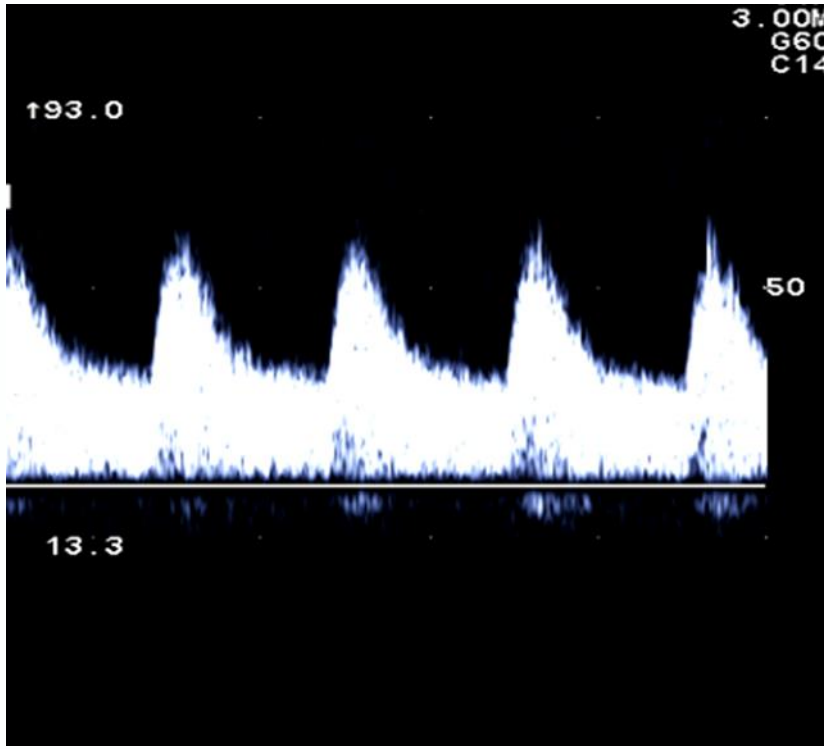
- Chronic renal impairment

  Renal impairment can cause increased maternal blood pressure, which can lead to pre-eclampsia and FGR.

Uterine artery Doppler

Qualitative Information:

- Presence/absence of flow
- Direction of flow
- Quality of flow: laminar or turbulent
- Organ perfusion
- Waveform shape: - low resistance
  - high resistance
  - early diastolic notch



Uterine artery Doppler

Quantitative Information: (velocity measurement indices)

Pulsatility index: $\frac{(\text{peak systole} - \text{minimum diastole})}{\text{mean value}}$

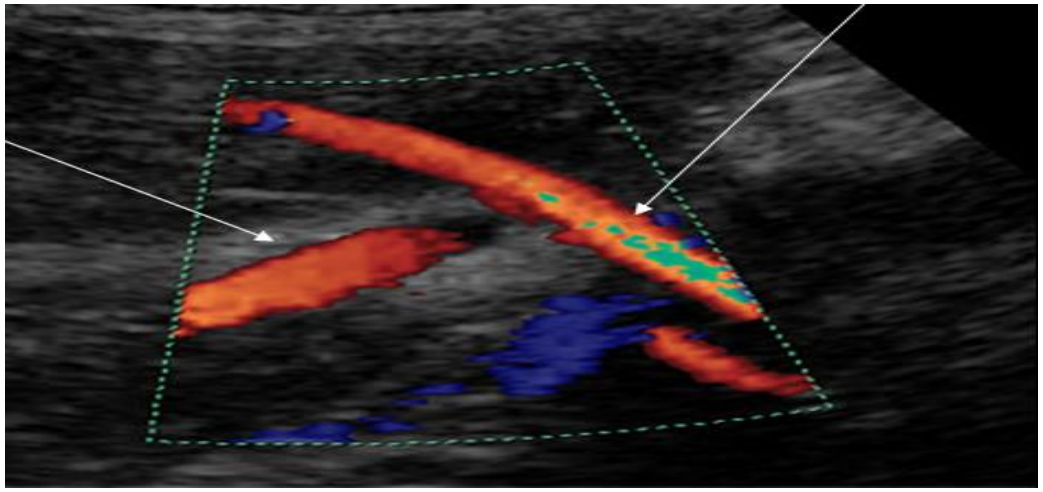
Resistance index: $\frac{(\text{peak systole} - \text{minimum diastole})}{\text{peak systole}}$

Systolic/Diastolic ratio: $\frac{\text{peak systole}}{\text{minimum diastole}}$

Uterine artery Doppler

Uterine artery technique:

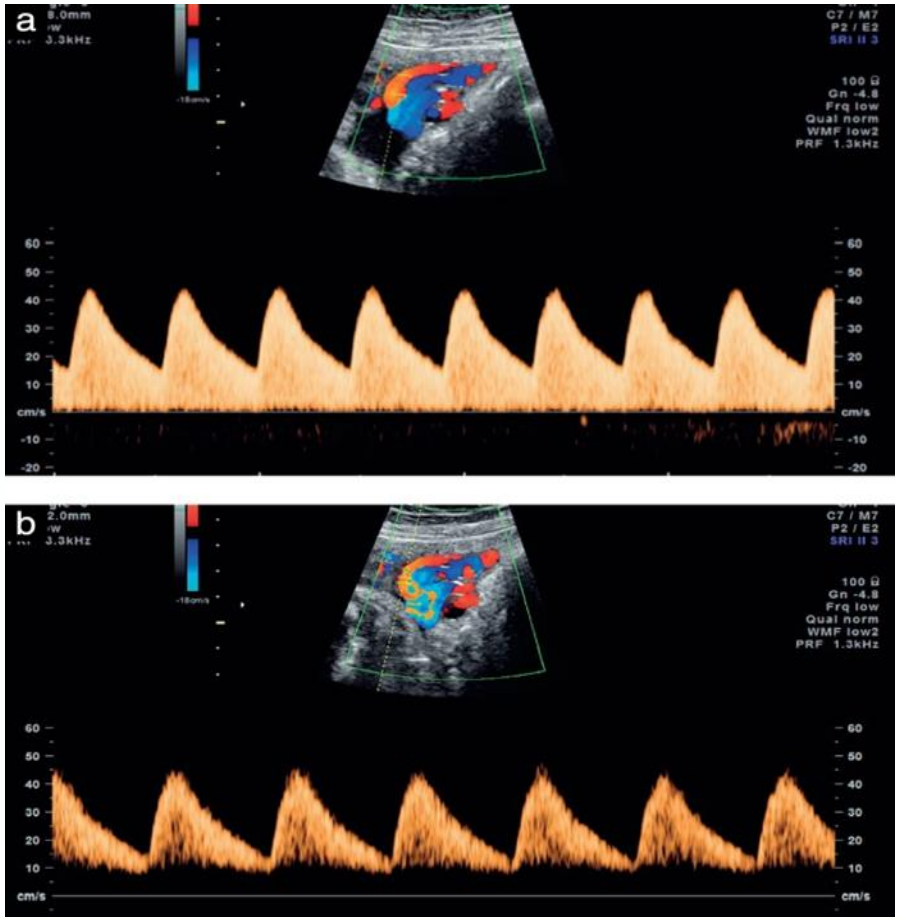
Ultrasound image with colour Doppler showing the uterine artery and the external iliac artery.



•www.centrus.com.br/DiplomaFMF/seriesFMF/doppler/capitulos-html/chapter_03.htm

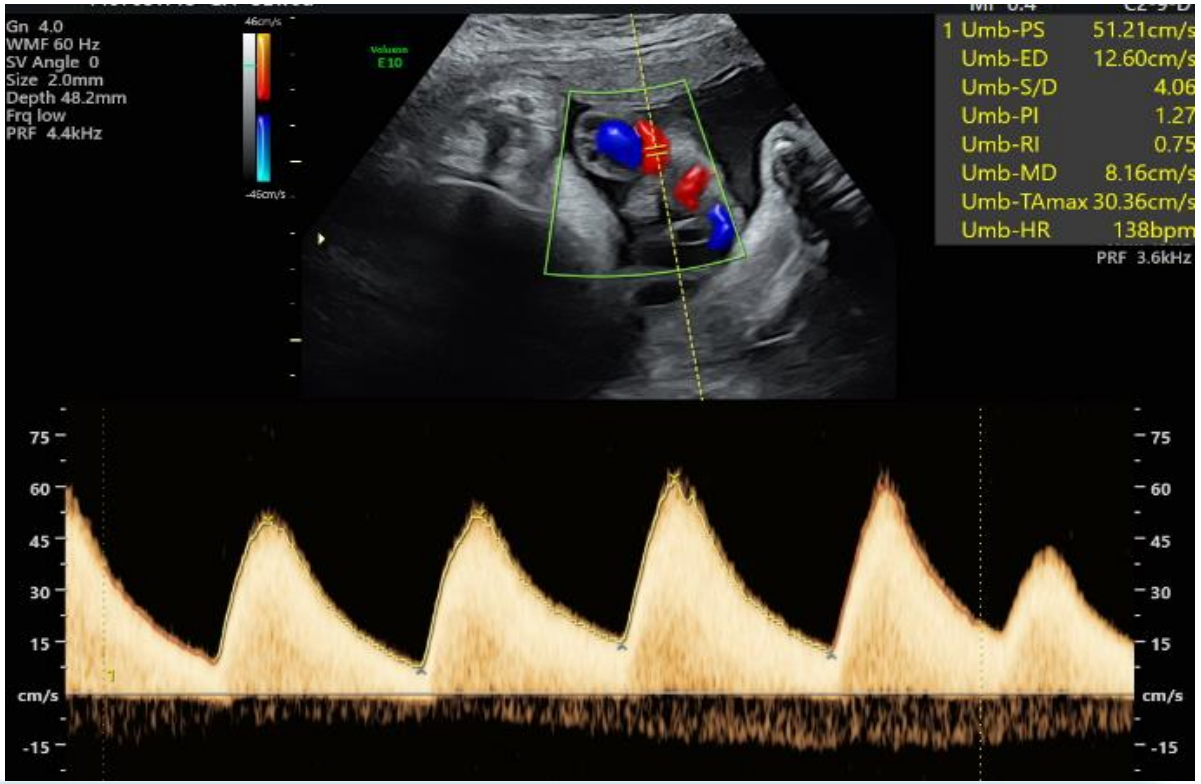
Uterine artery Doppler

- Angle of insonation should be < 30 degrees
- Generate a Maximum velocity envelope (MVE) measurement to show the whole spectral Doppler waveform.
- Make sure your wall motion filter is not too high or too low
- Measure three separate spectral traces.



Uterine artery Doppler

Good Doppler technique:



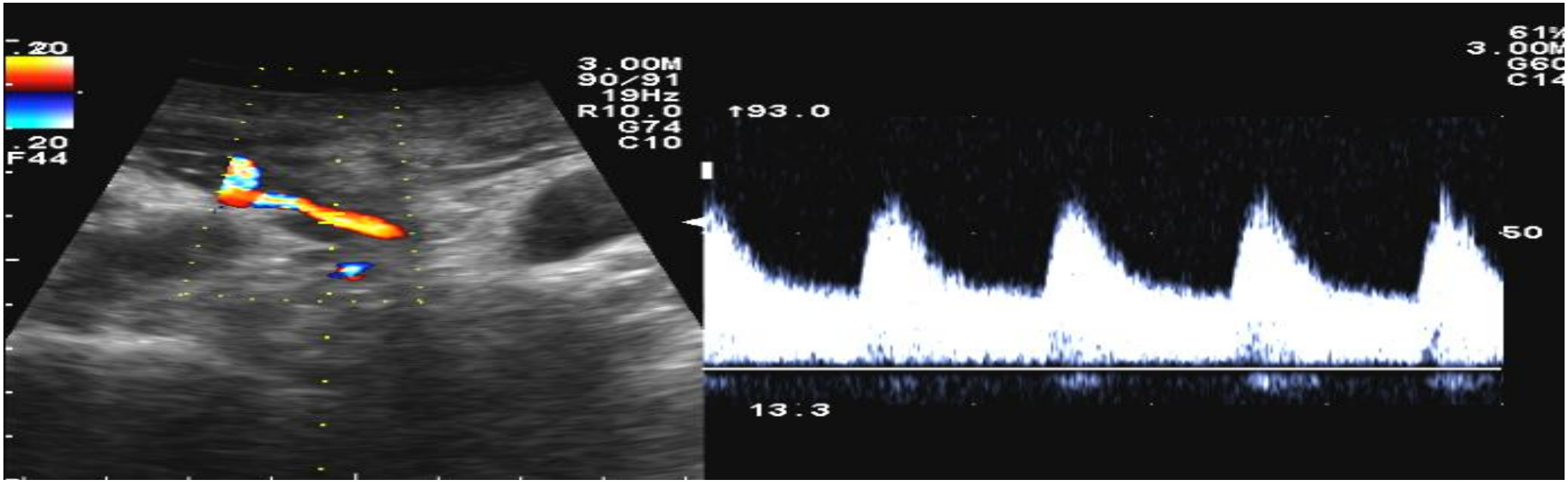
- The sample gate size should match the vessel size (approximately 2mm)

- Use correct sweep speed.

- Ideally you should see five waveforms and measure the best three.

Uterine artery Doppler

Uterine Artery Technique:



Measure 3 best waveforms

Uterine artery Doppler

Uterine artery Doppler assessment:

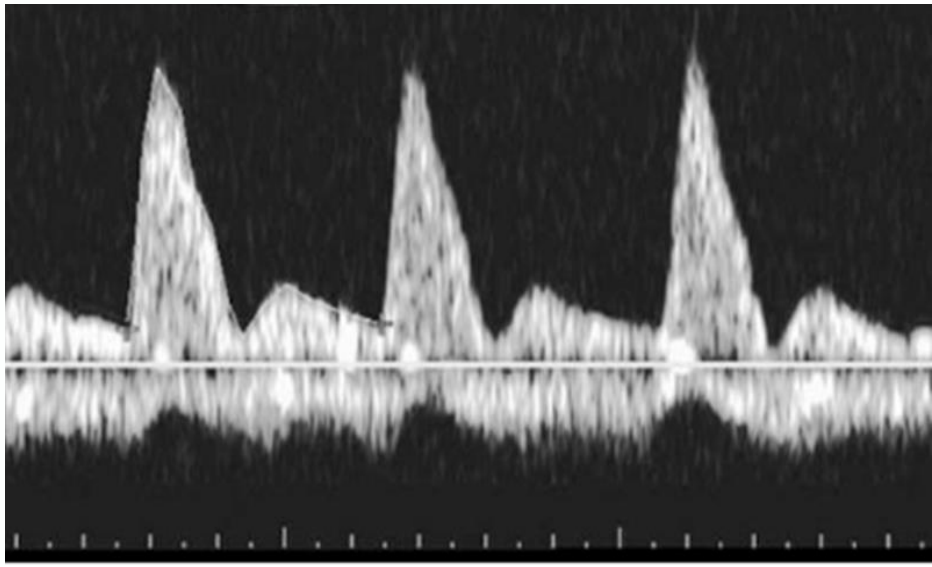
- Scan both left and right uterine arteries

- Report the mean P.I. from both uterine arteries.

Uterine artery Doppler

Abnormal findings of the uterine artery Doppler:

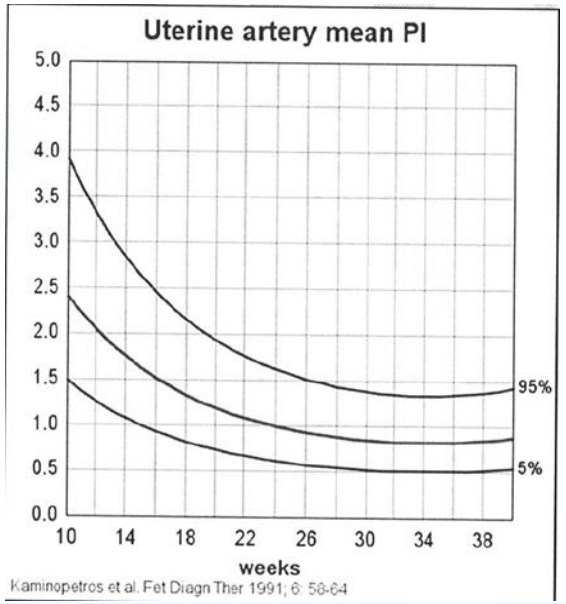
- Mean P.I. above the normal range
- Diastolic notch in one or both uterine arteries.



Uterine artery Doppler

Abnormal findings of the uterine artery Doppler:

- Mean Uterine Artery P.I. above the normal range



Ultrasound Obstet Gynecol 2003; **21**: 170–173
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Comparison of color Doppler uterine artery indices in a population at high risk for adverse outcome at 24 weeks' gestation

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"This removes the operator dependent assessment of a notch, and allows an objective method of calculating a woman's individual level of risk for adverse outcome."

Uterine artery Doppler

- Abnormal Doppler waveform: 50% of patients will develop complications .
- Normal Doppler waveform: less then 2% of patients will develop complications.

Patient management

Management of patient following abnormal uterine artery waveforms:

- Follow SBL v.3 flow chart for management

- Arrange serial growth scans at 28, 32, 36 and 40 weeks.

Take home points

- Use a standardized technique to carry out your uterine artery Doppler.
- Use the mean P.I. as an objective measure to determine if the uterine artery is normal or abnormal.
- Consider adding uterine artery Doppler to the anomaly scan:

  Advantages:

  - prevents bringing women back at 24 weeks
  - prevents having to repeat fetal biometry at 24 weeks
  - prevents having to confirm fetal sex again!

Thank you for listening