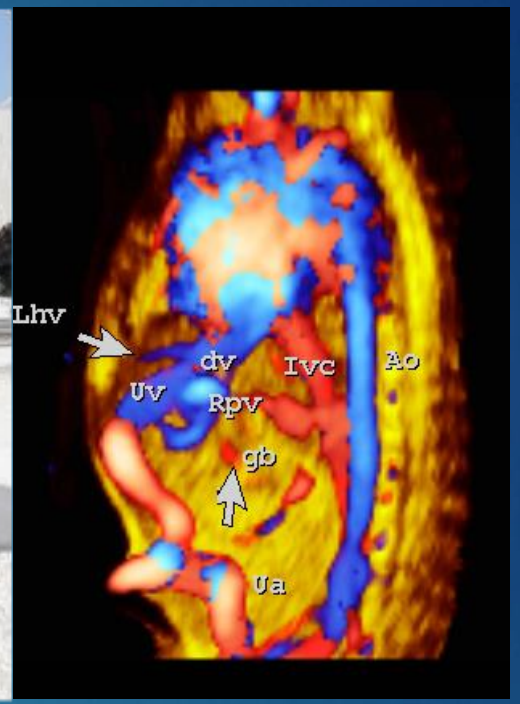
# The Fetal Liver Venous Perfusion in Normal and Growth Restricted Fetuses


Arrow Project – Daniel Zarhin

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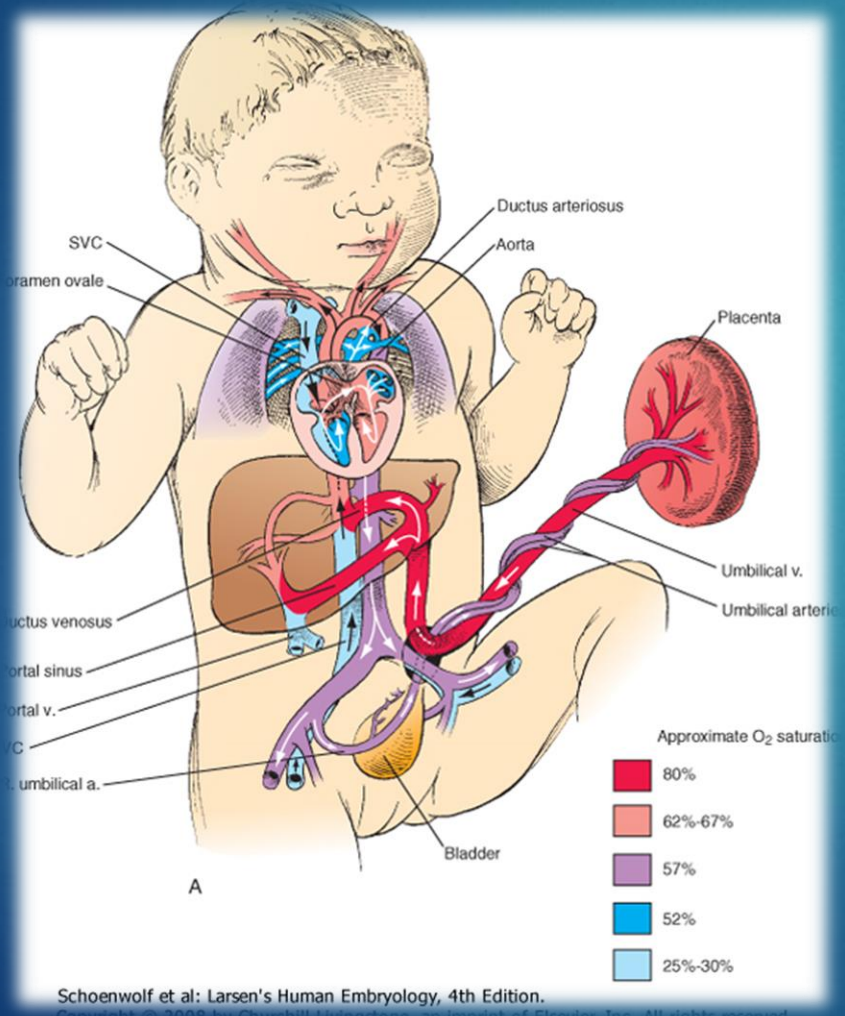
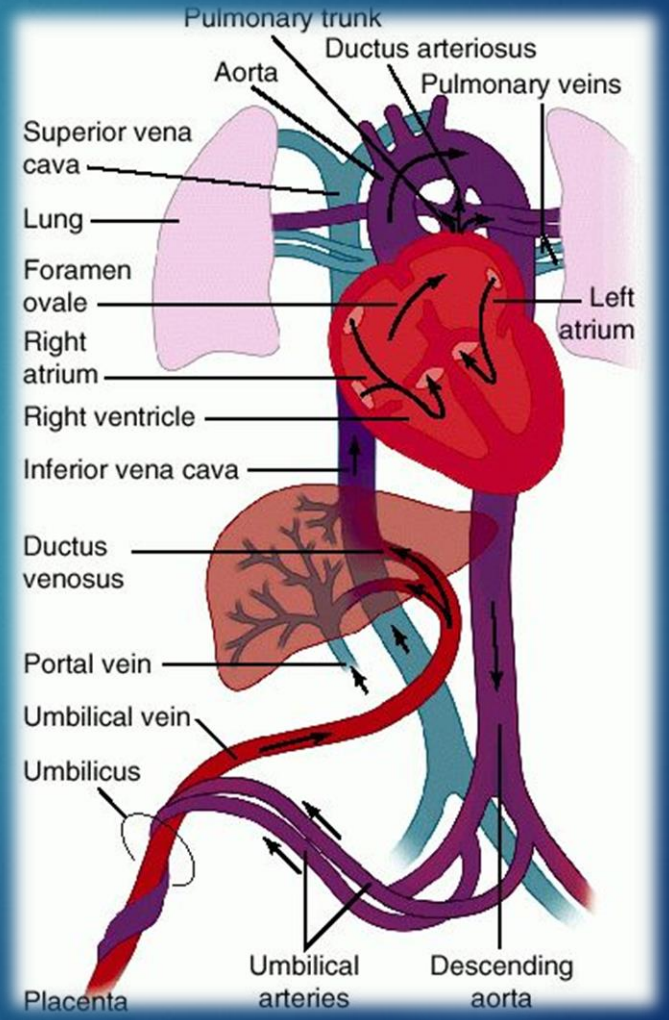
Tel Hashomer

# The current practice regarding monitoring of fetal growth is based on sonographic measurements of the fetal arterial circulation



The Umbilical  and Uterine arteries reflects indirectly placental vascular patency, and the middle cerebral artery monitors the fetal compensatory mechanism  to hypoxia.

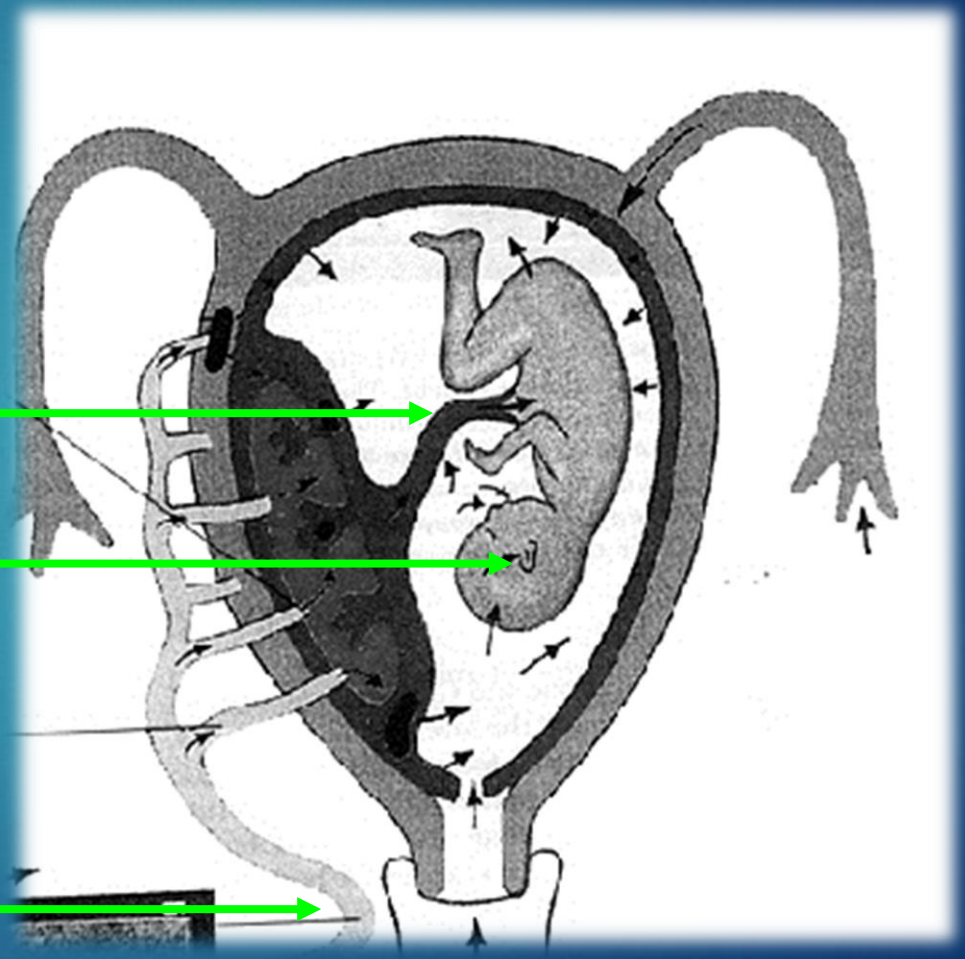
## Fetal-placenatl Unit

Umbilical Art

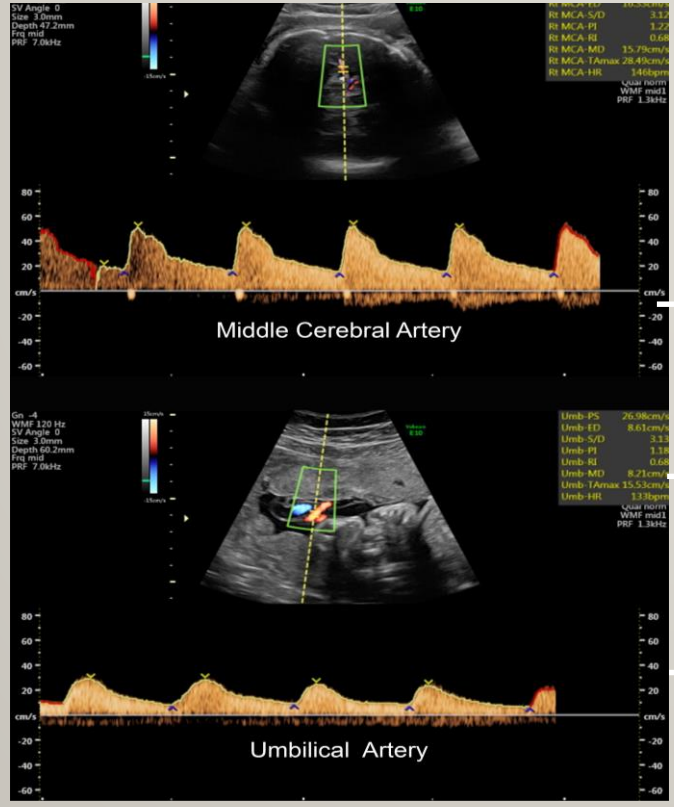
MCA Art

## Matrnal-placenatl Unit

Uterine Art



# Doppler Resistance Index



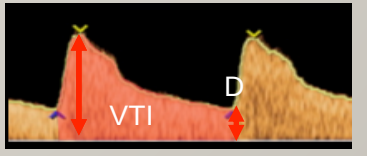

$$S/D = \frac{\text{MCA S/D}}{\text{UA S/D}}$$


S/D=Systole/Diastole

$$RI = \frac{\text{UA RI}}{\text{MCA RI}}$$


RI=(Systole-Diastole)/Systole

$$PI = \frac{\text{MCA PI}}{\text{UA PI}}$$

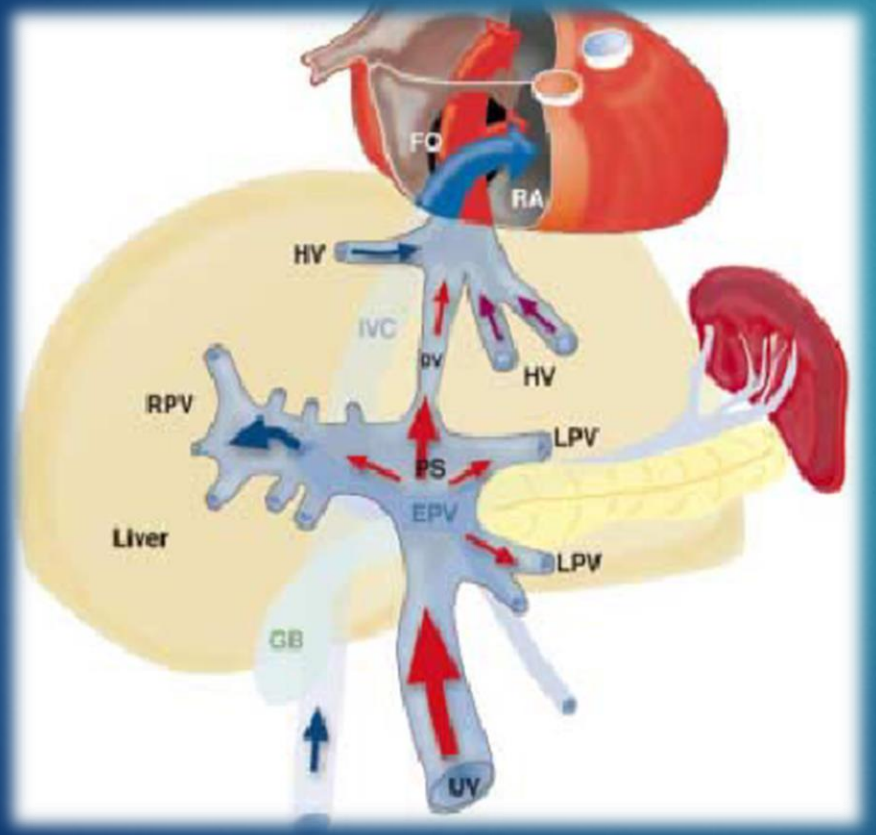


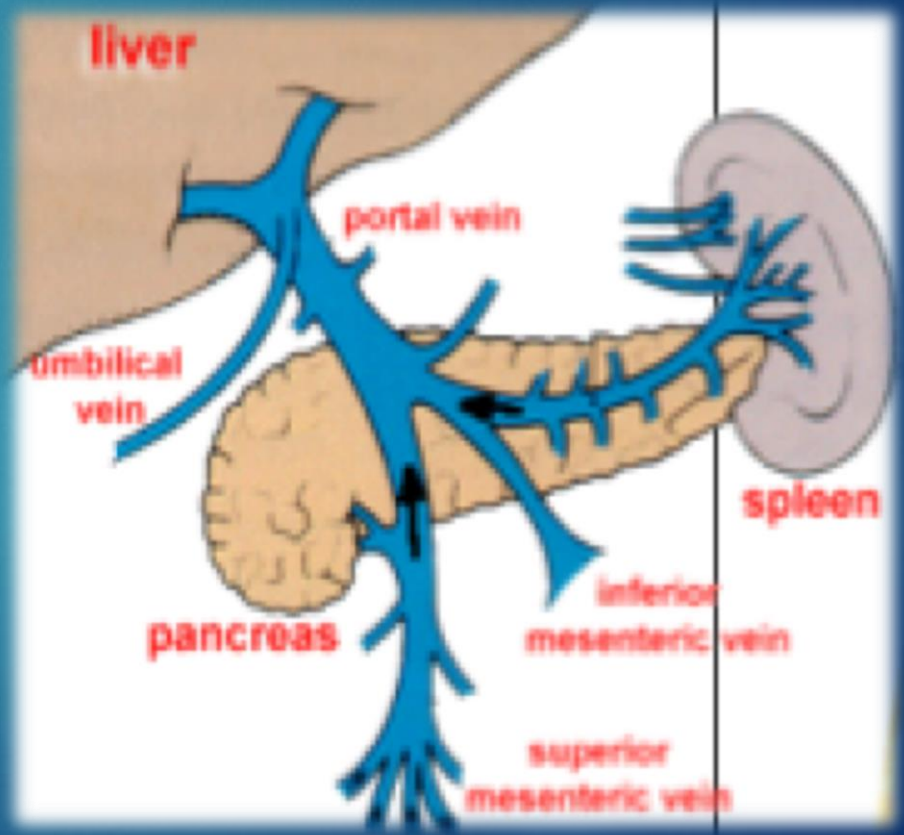

PI=(Systole-Diastole)/VTI

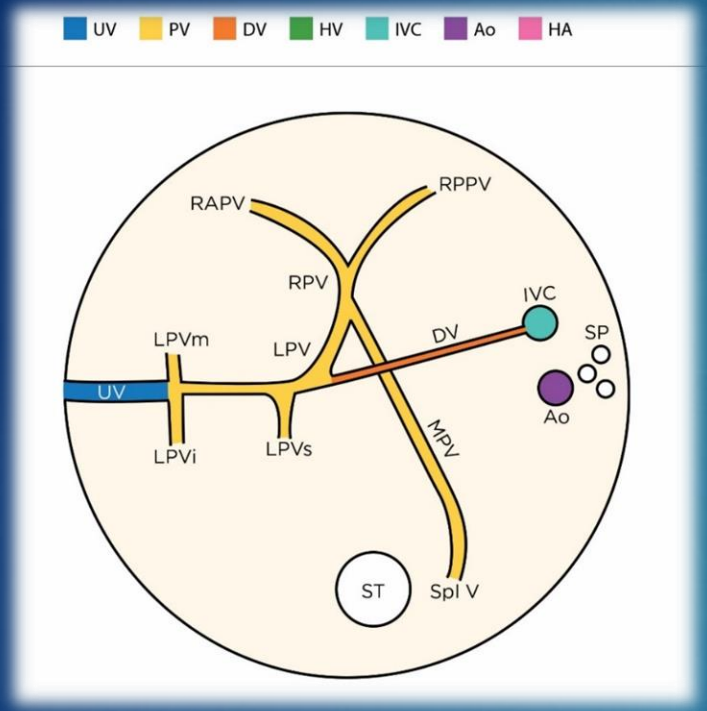
# Introduction

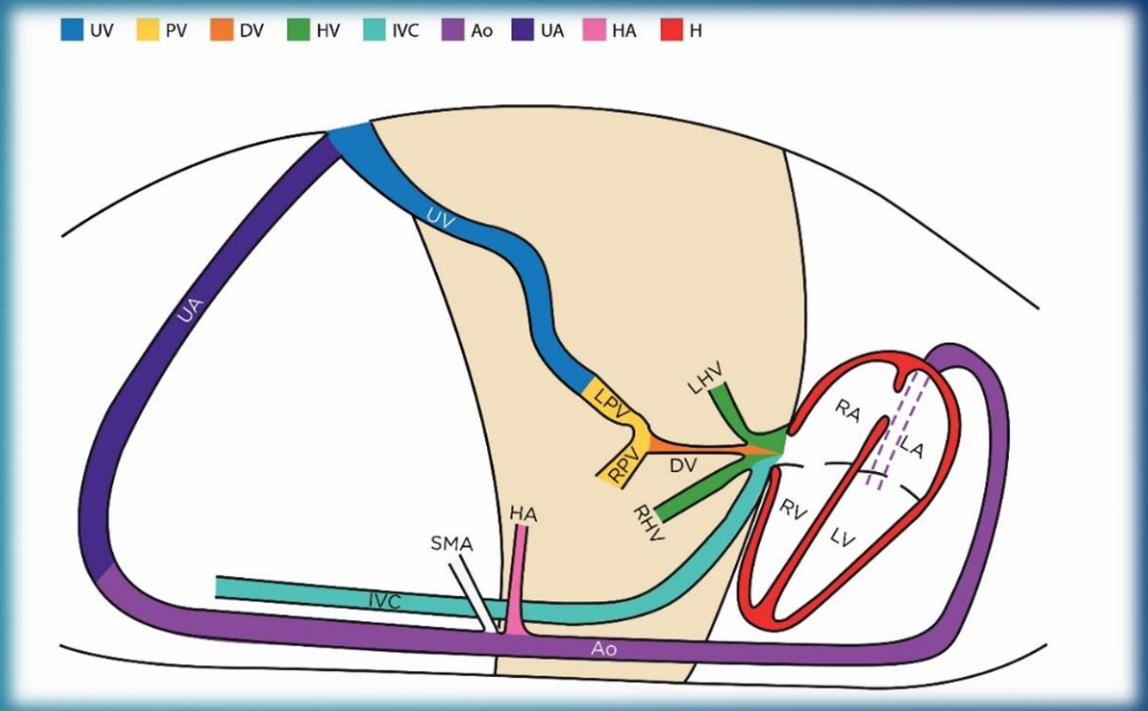
- In the recent years an attention has been paid to the essential role of the liver venous perfusion in the regulation of the fetal circulation[1] and growth.

# Fetal Liver is Perfused by two Systems
## Umbilical Vein and Portal Vein




UV
PV
DV
HV
IVC
Ao
HA
RAPV
RPPV
RPV
IVC
SP
LPVm
LPV
DV
UV
Ao
LPVi
LPVs
MPV
ST
Spl V


UV
PV
DV
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IVC
Ao
UA
HA
H
UV
UA
LPV
LHV
RA
LA
RPV
DV
RHV
RV
LV
HA
SMA
IVC
Ao

# In Growth Restricted Fetuses

- In cases of placental insufficiency, important changes in the perfusion of these two systems occur.

It consists of increased flow in the DV, which result in decreased flow to the LPV, and increased flow from the MPV to the right lobe. As a result of these changes fetal liver and fetal growth are impaired.

# Objective

The aim of our study is to:

- investigate the changes of the fetal venous perfusion in relation to the degree of placental function impairment.
- Construct normal curves for Umbilical Vein (UV) and Portal Vein (PV) flow volumes.
- Assess the correlation of the ratio between UV and PV flow in monitoring the severity of placental insufficiency.

# Methods

- A prospective, cross-sectional study of singleton pregnancies.
- **Two main groups:**

  1) normal fetal growth

  2) IUGR fetuses (estimated fetal growth [EFW]<10$^{th}$%)

- **methods to invasigate:**

**Doppler studies** – for arteries we calculate the Pulsatility index (PI) and for veins we calculate the Flow volume

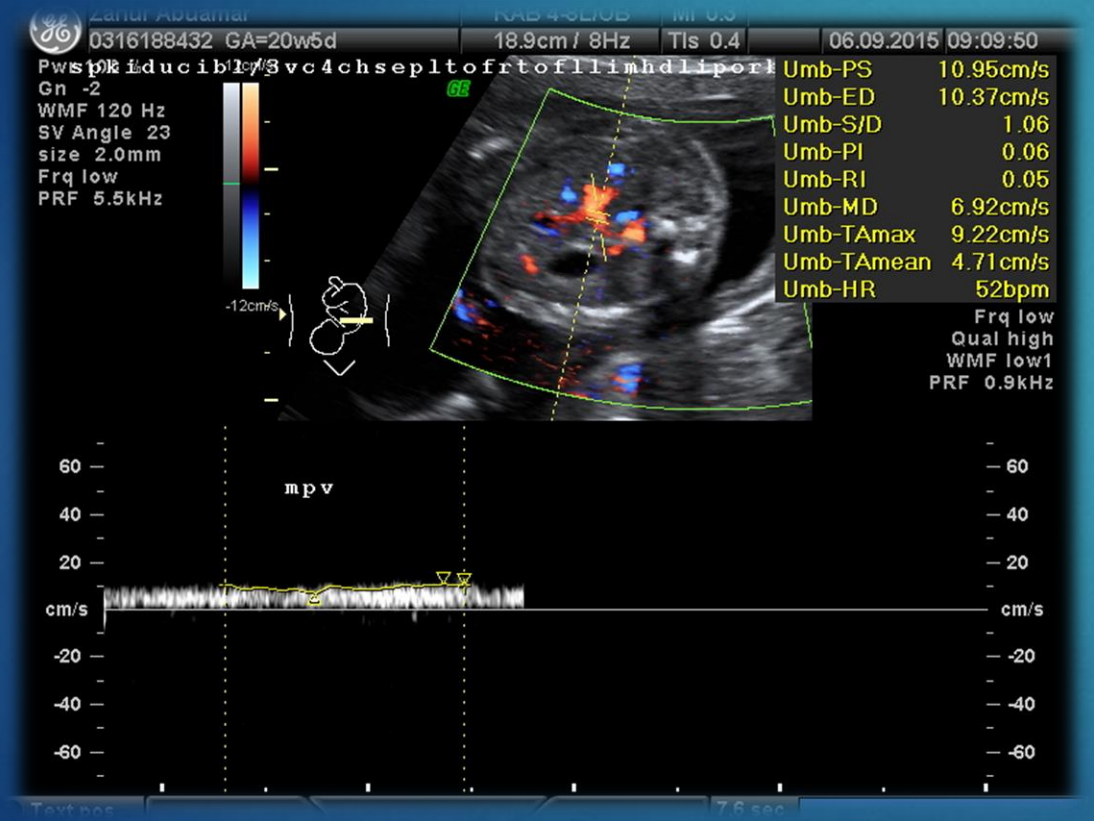
* The flow volume will be calculated using the formula: Volume = $h \times (D/2)^2 \times \pi \times TAMXV$ where D is the vessel diameter and h is the coefficient for the spatial blood velocity profile, and TAMXV is the Time-averaged maximum velocity.

- **Vessels to investigate:**

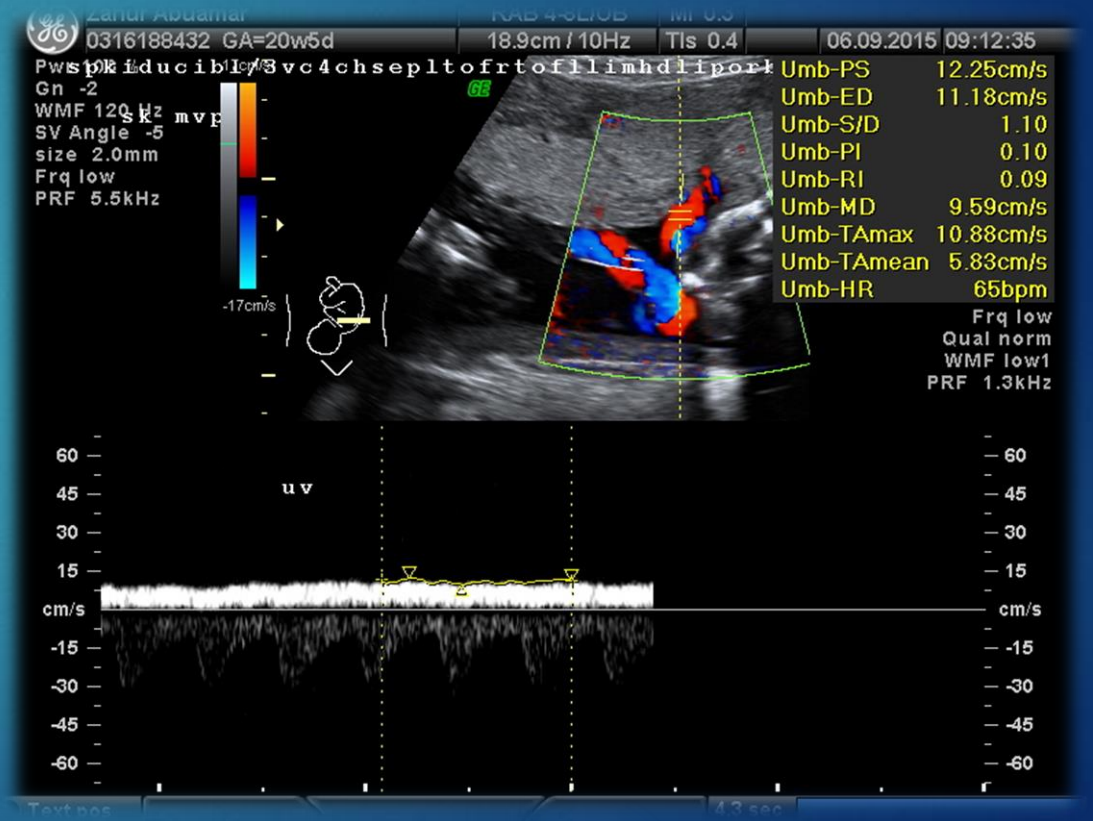
**Arteries:** Uterine pulsatility index (PI), Umbilical PI, MCA PI, Hepatic artery PI.

**Veins:** UV flow volume, MPV flow volume, DV velocity.

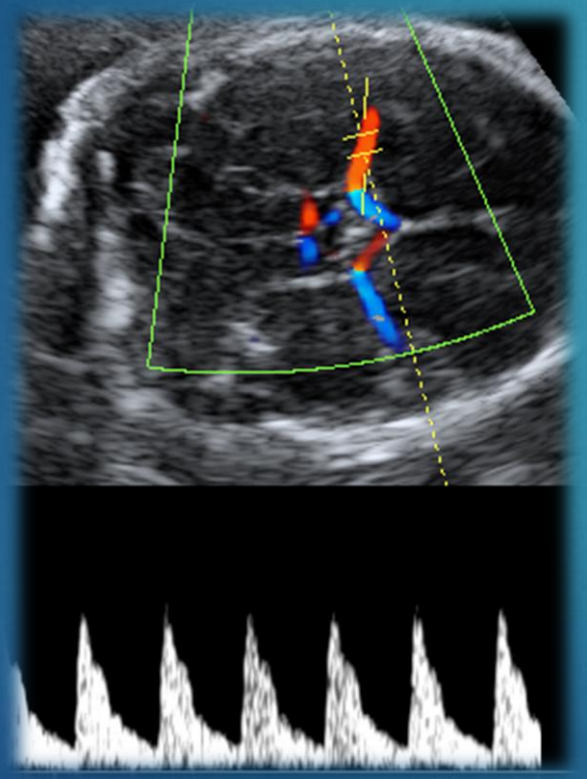
# MPV


0316188432 GA=20w5d
18.9cm / 8Hz
Tls 0.4
06.09.2015 09:09:50
Gn -2
WMF 120 Hz
SV Angle 23
size 2.0mm
Frq low
PRF 5.5kHz
-12cm/s
Umb-PS 10.95cm/s
Umb-ED 10.37cm/s
Umb-S/D 1.06
Umb-PI 0.06
Umb-RI 0.05
Umb-MD 6.92cm/s
Umb-TAmax 9.22cm/s
Umb-TAmean 4.71cm/s
Umb-HR 52bpm
Frq low
Qual high
WMF low1
PRF 0.9kHz
mpv
60
40
20
cm/s
-20
-40
-60

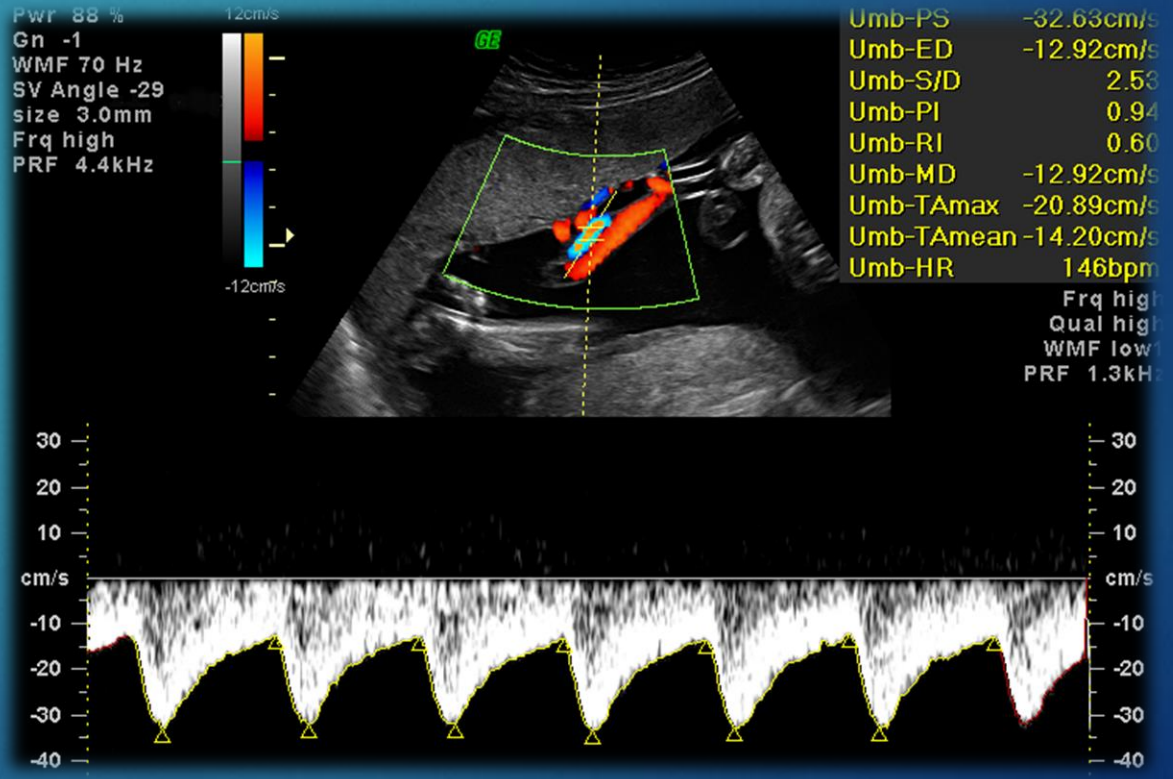
# UV


0316188432 GA=20w5d
18.9cm / 10Hz
Tls 0.4
06.09.2015 09:12:35
Gn -2
WMF 120 Hz
SV Angle -5
size 2.0mm
Frq low
PRF 5.5kHz
-17cm/s
Umb-PS 12.25cm/s
Umb-ED 11.18cm/s
Umb-S/D 1.10
Umb-PI 0.10
Umb-RI 0.09
Umb-MD 9.59cm/s
Umb-TAmax 10.88cm/s
Umb-TAmean 5.83cm/s
Umb-HR 65bpm
Frq low
Qual norm
WMF low1
PRF 1.3kHz
uv
60
45
30
15
cm/s
-15
-30
-45
-60

# MCA



# UA


Pwr 88 %
Gn -1
WMF 70 Hz
SV Angle -29
size 3.0mm
Frq high
PRF 4.4kHz
12cm/s
-12cm/s
GE
Umb-PS -32.63cm/s
Umb-ED -12.92cm/s
Umb-S/D 2.53
Umb-PI 0.94
Umb-RI 0.60
Umb-MD -12.92cm/s
Umb-TAmax -20.89cm/s
Umb-TAmean -14.20cm/s
Umb-HR 146bpm
Frq high
Qual high
WMF low
PRF 1.3kH
30
20
10
cm/s
-10
-20
-30
-40

# Methods

- The raw data will be used:

1) to construct normal curve for gestational age of the UV and MPV flow volume.

2) To calculate the the **UV/MPV ratio**, as a new indicator of placental insufficiency.

- The duration of the study will be approximately two years. The length of the examination will be approximately 30 minutes, and each woman will be examined only once.
- Approximately 300 normal fetuses and 50 cases of each IUGR group will be recruited.

# Thank you