IN THE NAME OF GOD

MANAGEMENT OF IUGR

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When ultrasound examination suggests fetal growth restriction (FGR), prenatal care involves

- confirming the suspected diagnosis
- determining the cause and severity of FGR
- counseling the parents
- closely monitoring fetal growth and well-being
- determining the optimal time for and route of delivery

FGR related to uteroplacental insufficiency has a better prognosis, but the risk for adverse outcome remains increased

INITIAL APPROACH

Confirm the diagnosis

The diagnosis of FGR is based on discrepancies between actual and expected sonographic biometric measurements for a given gestational age.

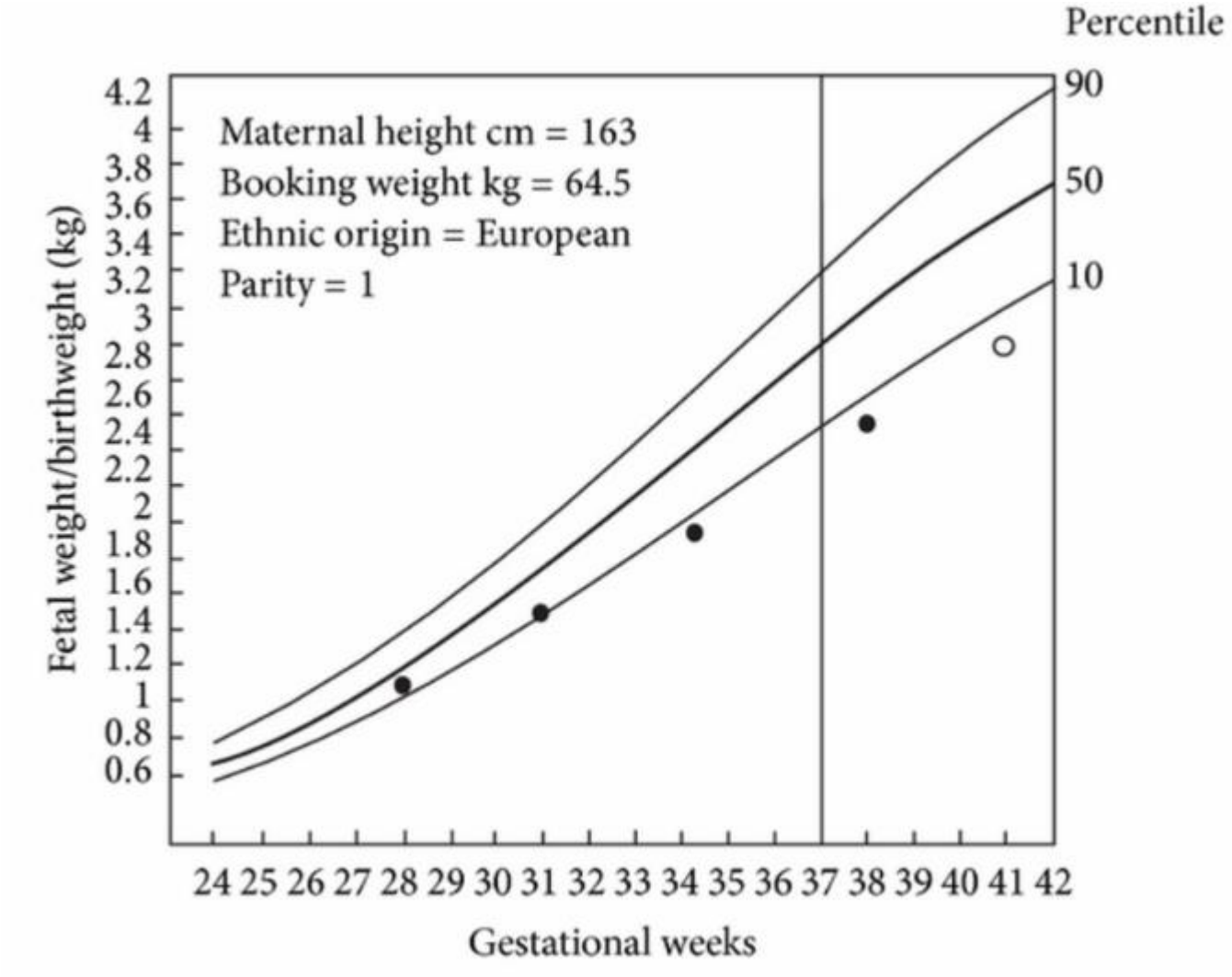
when a fetus <10th percentile weight for gestational age is identified, monitor fetal growth and fetal physiology over time.

Normal growth trajectory, normal Doppler velocimetry of the umbilical artery, and normal amniotic fluid volume suggest a constitutionally small fetus or minimal fetal impact from uteroplacental insufficiency

Distinguishing the constitutionally small fetus from the fetus with pathologic growth restriction is the first challenge for the clinician

- Characteristics that support a diagnosis of a constitutionally small fetus include
  - modest smallness (5^{th} <EFW<10^{th})
  - normal growth velocity across gestation
  - normal physiology (ie, normal AFV and UA Doppler)
  - AC growth velocity above the lowest decile
  - appropriate size in relation to maternal characteristics (height, weight, race/ethnicity), which have a major influence on fetal growth potential

CUSTOMIZED GROWTH CURVES



Determining the cause

The genetically predetermined growth potential of the fetus can be impaired as a result of maternal, placental, or fetal processes

Fetal survey

- A detailed fetal anatomic survey & fetal echocardiogram

Fetal genetic studies

- Early (<24 weeks), severe (<5th percentile), symmetrical FGR
- Major fetal structural abnormalities
- No structural abnormalities but presence of soft ultrasound markers associated with an increased risk of aneuploidy

After 24 weeks, the author does not screen for fetal genetic abnormalities if anatomy is normal and FGR is asymmetric

Work-up for infection

Infections associated with FGR include cytomegalovirus, toxoplasmosis, rubella, and varicella

Thrombophilic Disorders

Assessment for inherited thrombophilic disorders is not recommended

antiphospholipid syndrome, an acquired thrombophilia, is clearly

associated with FGR

PREGNANCY MANAGEMENT

Most of these cases are caused by uteroplacental insufficiency

The optimal management of the pregnancy with suspected growth restriction related to uteroplacental insufficiency has not been established.

Serial ultrasound evaluation of (1) fetal growth, (2) fetal behavior [BPP]), and (3) impedance to blood flow in fetal arterial and venous vessels (Doppler velocimetry) represent the key elements of fetal assessment and guide pregnancy management decisions.

The purpose is to identify those fetuses that are at highest risk of in utero demise and neonatal morbidity who may benefit from preterm delivery

Progression of fetal growth restriction

Placental vascular dysfunction
Increased impedance umbilical artery

↓

Impaired fetal growth

↓

Decreased impedance fetal middle cerebral artery (ie, increased blood flow)
Shunting of blood from peripheral arterial beds to vital fetal organs and placenta
Decreasing amniotic fluid volume

↓

Further increases in umbilical artery impedance with diminished, then absent, then reversed end diastolic flow
Abnormal venous Doppler
- Reversed flow in the fetal inferior vena cava
- Decreased or reversed flow in the ductus venosus during late diastole

Decreased fetal heart rate variability
Nonreassuring tests of fetal well-being
- Nonreactive nonstress test
- Low biophysical profile score (reduction or loss of fetal breathing, movement, and tone)

Spontaneous late decelerations

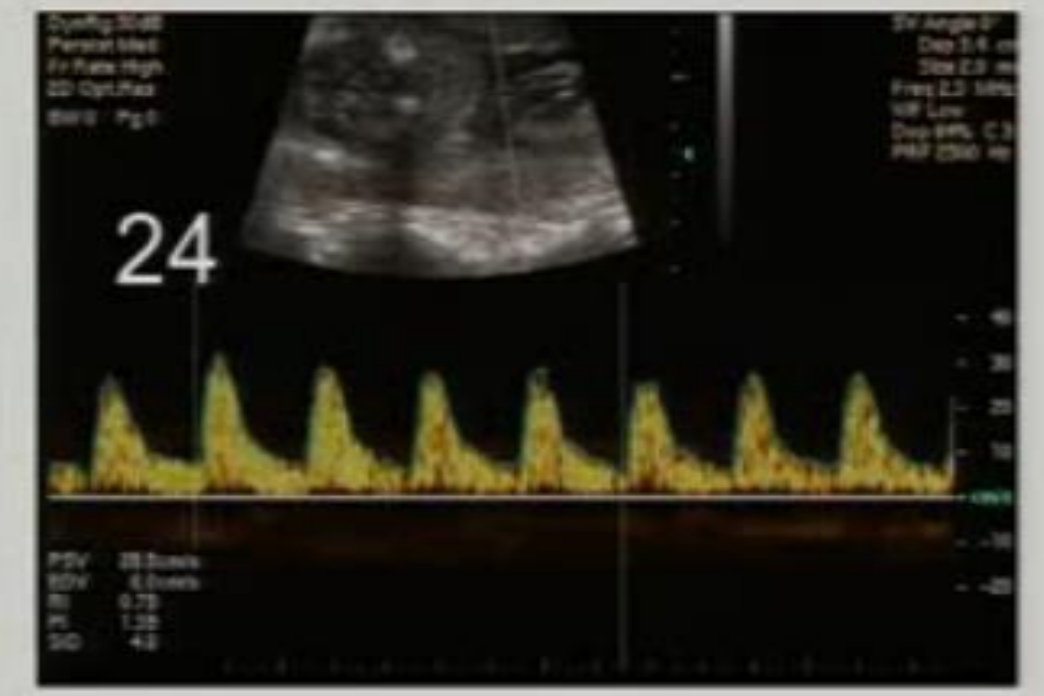
The general sequence of Doppler and biophysical changes in FGR is:

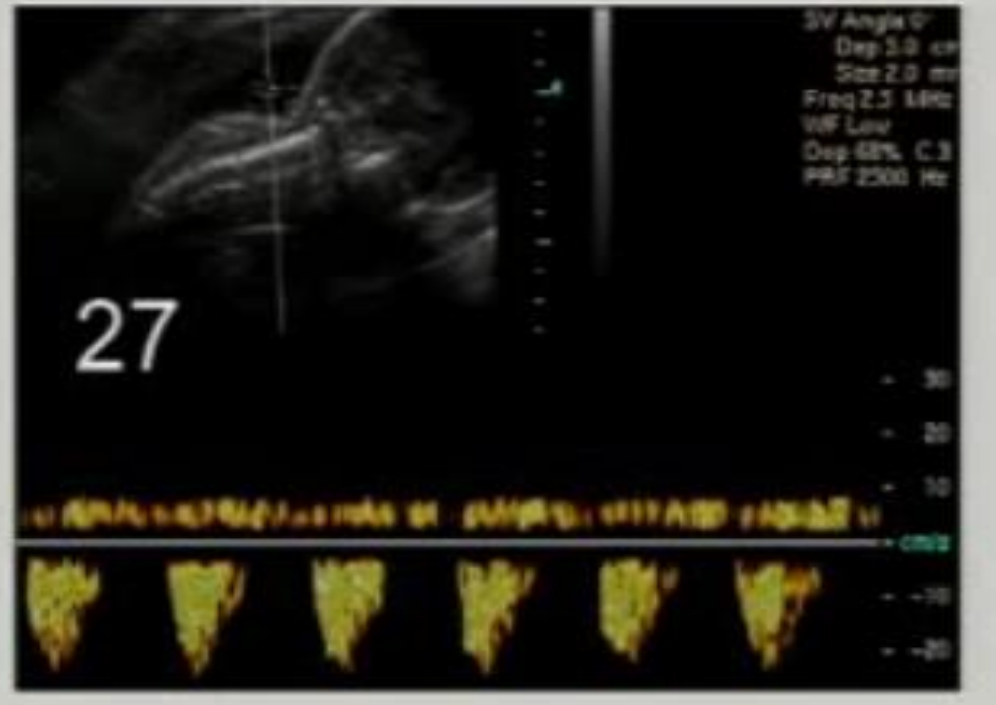
●A reduction in umbilical venous flow is the initial hemodynamic change. Venous flow is redistributed away from the fetal liver and towards the heart. Liver size decreases, causing a lag in fetal abdominal circumference, which is the first biometric sign of fetal growth restriction.

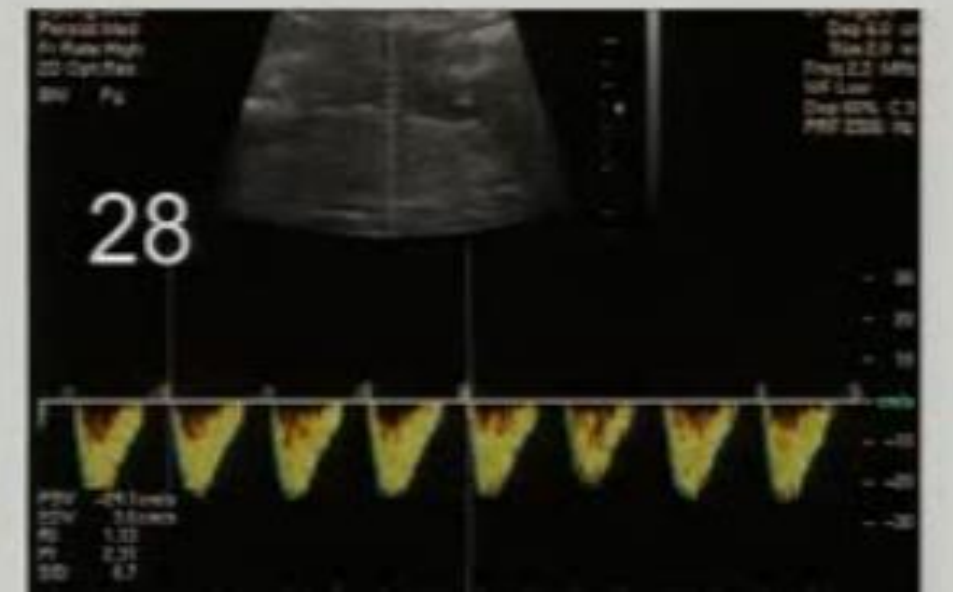
●Umbilical artery Doppler index increases (diminished end diastolic flow) due to increased resistance in the placental vasculature.

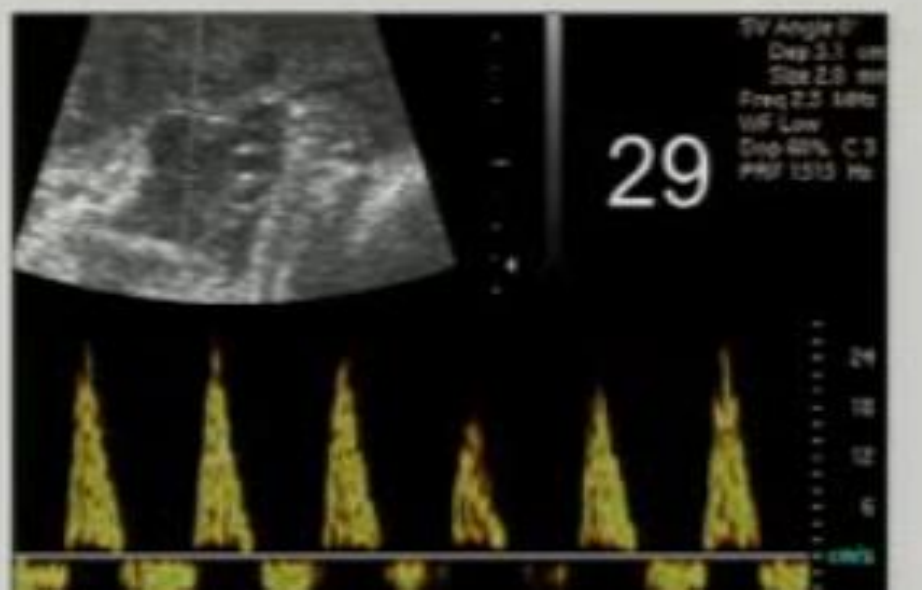
●Middle cerebral artery Doppler index decreases (increased end diastolic flow), resulting in preferential perfusion of the brain (brain-sparing effect).

Decrease of diastole in the umbilical artery of a fetus with IUGR









- Increasing placental vascular resistance results in absent and then reversed end diastolic flow in the umbilical artery.

  ●Middle cerebral artery Doppler index normalizes or abnormally increases as diastolic flow falls due to loss of brain-sparing hemodynamic changes.

  ●As cardiac performance deteriorates due to chronic hypoxia and nutritional deprivation, absent or reversed end diastolic flow in the ductus venosus and pulsatile umbilical venous flow may develop. These can be preterminal events.

Near the end of this sequence, biophysical changes usually become apparent: The nonstress test becomes nonreactive, the BPP score falls, and late decelerations accompany contractions.
However, the cardiovascular (Doppler) and behavioral (BPP) manifestations of fetal deterioration in FGR fetuses can occur largely independent of each other, resulting in discordant Doppler and BPP findings.

Ambulatory monitoring

hospitalization for selected women who need daily or more frequent maternal or fetal assessment (eg, daily BPP score because of reversed diastolic flow

there is no evidence that hospitalization or bed rest improves fetal growth or outcome

Fetal weight assessment

Serial sonograms are obtained at two- to four-week intervals to ascertain the growth velocity

The longer end of this range is appropriate for the fetus with mild FGR (eg, EFW near the 10^{th} percentile, normal amniotic fluid volume, normal Doppler findings

A shorter interval for the fetus with features of moderate or severe disease (eg, EFW $\leq 5^{th}$ percentile, oligohydramnios, abnormal Doppler findings)

Nonstress test and biophysical profile

We prefer the BPP as it evaluates both acute and chronic fetal physiologic parameters

Frequency

- If Doppler indices are normal, this provides strong evidence of fetal wellbeing, especially in the absence of risk factors for, or signs of, uteroplacental insufficiency. If growth velocity is normal as well, we do not order other antenatal testing (eg, NST, BPP).
- In all other cases of FGR, nonstress tests and BPPs are performed at least weekly
- When FGR is associated with oligohydramnios, preeclampsia, decelerating fetal growth, severe growth restriction, increasing umbilical artery Doppler index, or other concerning findings, we increase testing to twice per week (eg, two BPPs, two nonstress tests, or one NST and one BPP).
- For fetuses with absent or reversed diastolic flow, testing is performed daily because these fetuses can deteriorate rapidly

Doppler velocimetry

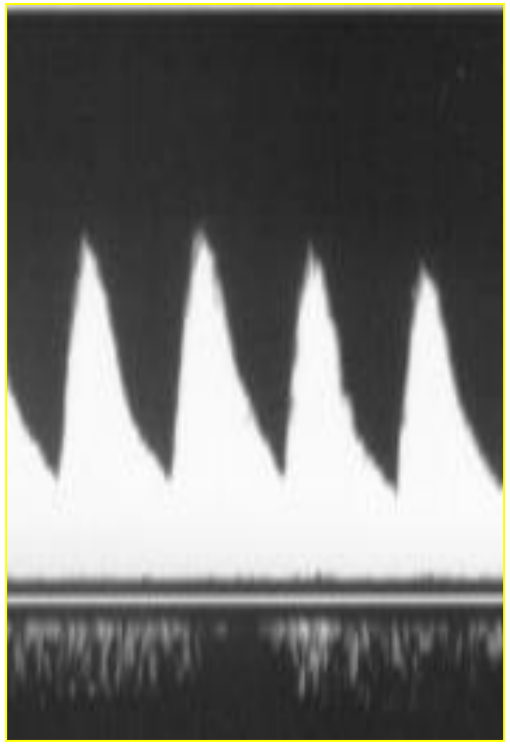
Doppler velocimetry of the UA is a good tool for fetal assessment in FGR

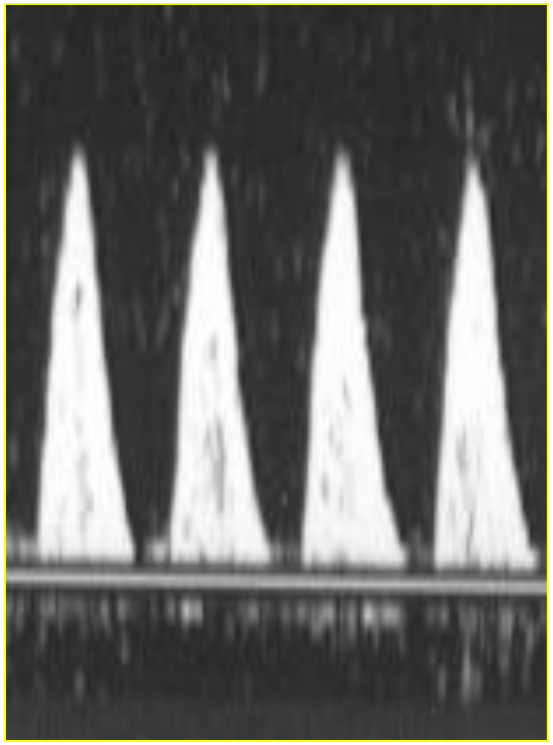
when the etiology is placental dysfunction related to progressive obliteration of the villus vasculature. Placental vascular changes lead to fetal hemodynamic changes that can be evaluated by umbilical artery Doppler

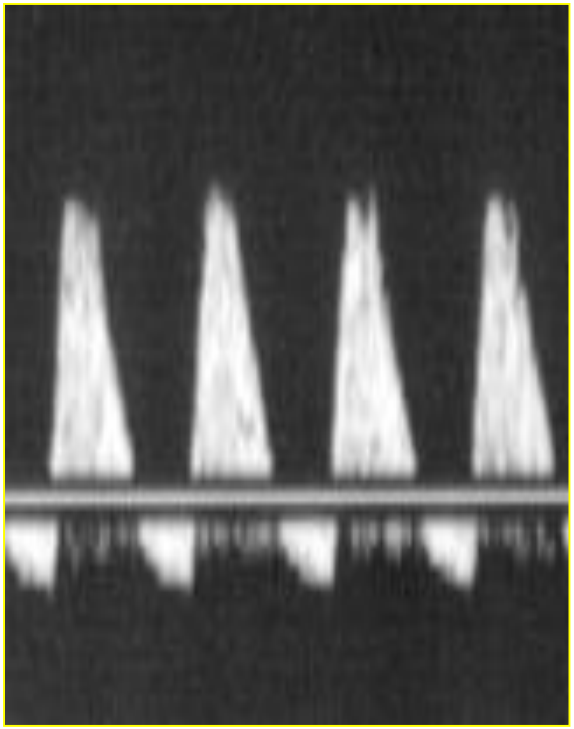
Umbilical artery

- Doppler velocimetry of the UA is the primary surveillance tool for monitoring pregnancies in which FGR is suspected
- Abnormal Doppler was defined as a pulsatility index >95th centile or absent/reversed end-diastolic flow.
- Weekly Doppler velocimetry of the UA upon diagnosis of FGR. If consecutive Doppler results are normal, decrease the frequency of Doppler examination to two-week intervals

DOPPLER FLOW PATTERNS



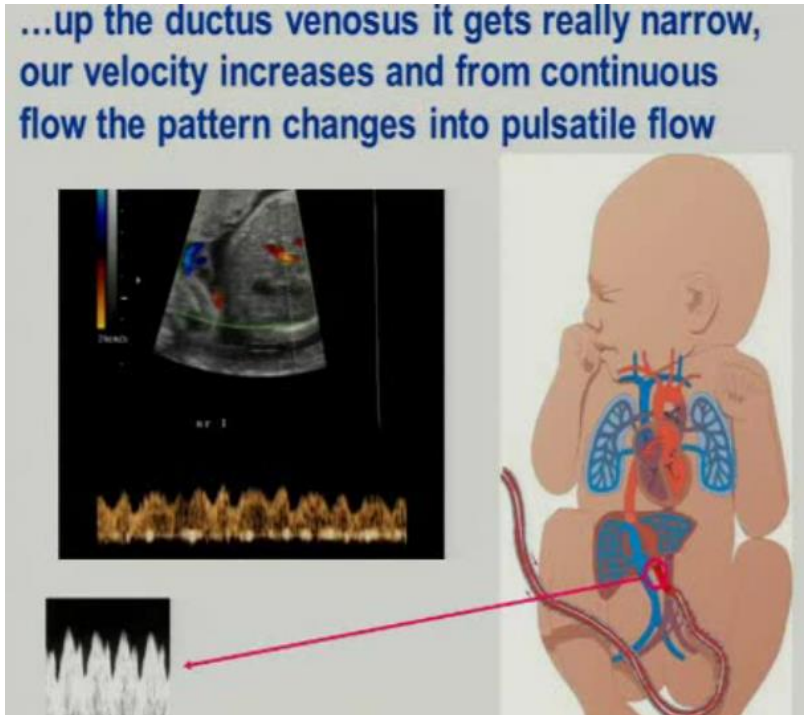


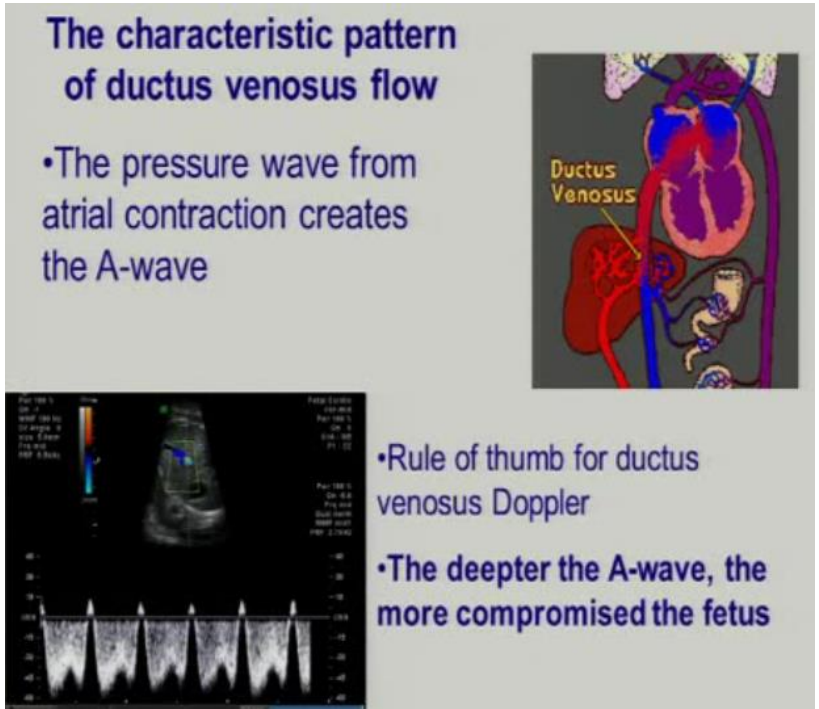


Absent and Reversed flow is associated with obliteration ofMore than 70% of placental arteries.

Ductus venosus

- Doppler interrogation of the ductus venosus provides information about the hemodynamic status of the fetus
- An absent or reversed ductus venous a-wave indicates cardiovascular instability and can be a sign of impending acidemia and death





Ductus venosus

Although the use of venous Doppler interrogation remains largely investigational, an increasing number of maternal-fetal medicine specialists, are using this tool to avoid very preterm delivery in fetuses with absent or reversed end-diastolic arterial flow in the umbilical artery and reassuring antepartum fetal testing (nonstress test, BPP).

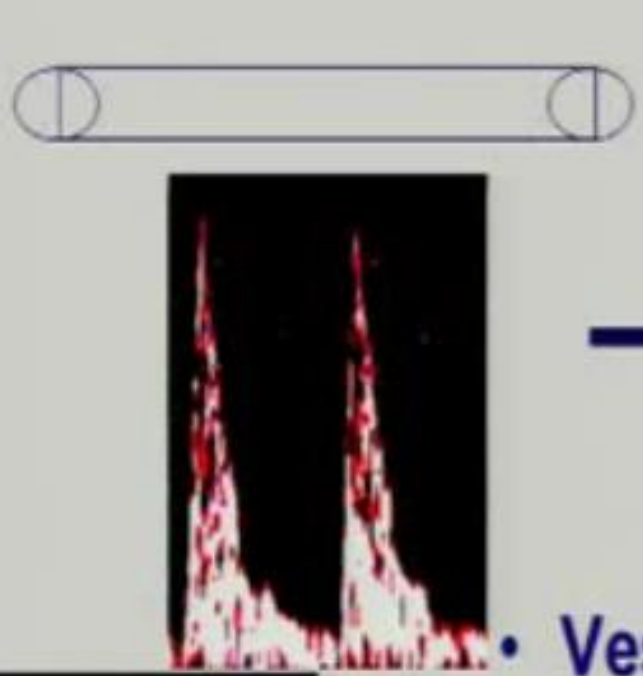
In these pregnancies, the absence of abnormal flow patterns in the ductus venosus has been used to support the decision to extend the pregnancy to 32 to 34 weeks, if the nonstress test and BPP remain reassuring

Middle cerebral artery

Doppler interrogation of the middle cerebral artery (MCA) also provides information about the hemodynamic status of the fetus.
With progressive hypoxia, blood flow increases to compensate for the decrease in available oxygen (brain-sparing effect). This results in a reduction in the Doppler parameters used to assess blood flow through the MCA: the peak systolic to end diastolic blood flow velocity ratio (S/D), RI, and PI.
Subsequent normalization of the indices may occur when the autoregulatory response becomes dysfunctional .

There is no convincing evidence that interrogation of the MCA Doppler alone is useful in guiding clinical decisions about timing of delivery.

Changes in fetal hemodynamis under hypoxic conditions



- **Vessel diameter and blood flow volume increase during asphyxia**
- **Doppler indices PI/RI decrease**

Malcus et al. J Perinat Med 1991

Cerebroplacental ratio

The cerebroplacental Doppler ratio (CPR) is the MCA pulsatility index (or resistance index) divided by the umbilical artery pulsatility index (or resistance index). A low CPR indicates fetal blood flow redistribution (brain sparing) and is predictive of adverse neonatal outcome

CPR was most useful for predicting adverse neonatal outcome when the umbilical artery Doppler pulsatility index was >95th centile

Antenatal steroids

one course of antenatal corticosteroids is given between 24 and 34 weeks of gestation in the week before delivery is expected

Maternal interventions

There is no convincing evidence that any intervention in healthy women improves the growth of growth restricted fetuses

Maternal nutritional supplementation, Oxygen therapy, and Interventions to improve blood flow to the placenta (plasma volume expansion, low-dose aspirin, bed rest, and anticoagulation).

Use of a phosphodiesterase-5 enzyme inhibitor (eg, tadalafil, sildenafil) or a statin appeared promising, and was under investigation.

Antihypertensive therapy of hypertensive gravidas, intensive smoking cessation program

Timing delivery

time the delivery of the growth restricted fetus based on a combination of factors, including gestational age, Doppler ultrasound of the umbilical artery, biophysical profile score, ductus venosus Doppler, and the presence or absence of risk factors for, or signs of, uteroplacental insufficiency

- The following is a synopsis of our approach and is based on the evidence described above: Abnormal ductus venosus Doppler –delivery these pregnancies immediately.
- Reversed diastolic flow ≥32 weeks of gestation – We deliver these pregnancies immediately.
- Absent diastolic flow ≥34 weeks of gestation – We deliver these pregnancies immediately.
- Reversed diastolic flow <32 weeks of gestation or absent diastolic flow <34 WK of gestation, regardless of the presence or absence of oligohydramnios :daily BPP in an attempt to delay delivery until 32 or 34 as long as the BPS remains normal.

- Decreased diastolic flow (pulsatility index >95th percentile) – This is a weak predictor of fetal death. perform a BPP two times per week and deliver these fetuses at term or when the BPP becomes abnormal.
- Delivery at 37 to 38 weeks is reasonable if umbilical artery flow is decreased and risk factors for, or signs of, uteroplacental insufficiency are present, such as oligohydramnios, preeclampsia or hypertension, renal insufficiency, fetal growth arrest, estimated weight <5th percentile, or prior birth of a small for gestational age infant.
- Normal umbilical artery Doppler – This provides strong evidence of fetal well-being, especially in the absence of risk factors for, or signs of, uteroplacental insufficiency. We deliver these fetuses at 39 to 40 weeks of gestation.

ابنرمال

AC<5% یا EFW<10%

کالر داپلر هفتگی تا ۲ هفته

و بررسی AFI

ابنرمال

مقاومت شریان نافی +
نرمال CPR +
نرمالAFI +
BPP ≥ ۸/۱۰

کالر داپلر هفتگی
BPP هفتگی
NST هفته ای ۲ بار

ختم در ۳۷ هفتگی

مقاومت شریان نافی +
CPR < ۵٪ +
نرمال AFI +
BPP> ۸/۱۰

داپلر۳-۲ بار در هفته
BPP و NST ۲ تا ۳ بار در هفته

AEDV
Normal vein
یا
اولیگوهیدرآمنیوس
یا
BPP≤ 6/10

بستری
و BPP روزانه
و داپلر ۲بار در هفته

ختم در ۳۴ هفته

REDV
Normal Vein

بستری
و BPP روزانه
و داپلر روزانه

ختم در ۳۲ هفتگی

اختلال جریان خون وریدی شامل افزایش مقاومت DV (PIبالاتر از ۹۵٪ یا موج a حذف یا معکوس شده

ارجاع به سطح ۳
و ختم بارداری در ۲۶ هفته

نرمال

5% < EFW<10%

EFW<5%

بررسی رشد جنین هر ۳ هفته یکبار

بررسی رشد جنین هر ۲ هفته یکبار کالرداپلر هر۲هفته یکبار BPP هفتگی NST ۲ بار در هفته

ادامه رشد

ختم در ترم(۳۷ هفته)

ادامه رشد

توقف رشد

ادامه حاملگی تا ترم (حداکثر ۳۹ هفته)

ختم در ۳۴-۳۷ هفته


WITH
THANKS