The perinatal mortality
Placental insufficiency
Fetal growth restriction

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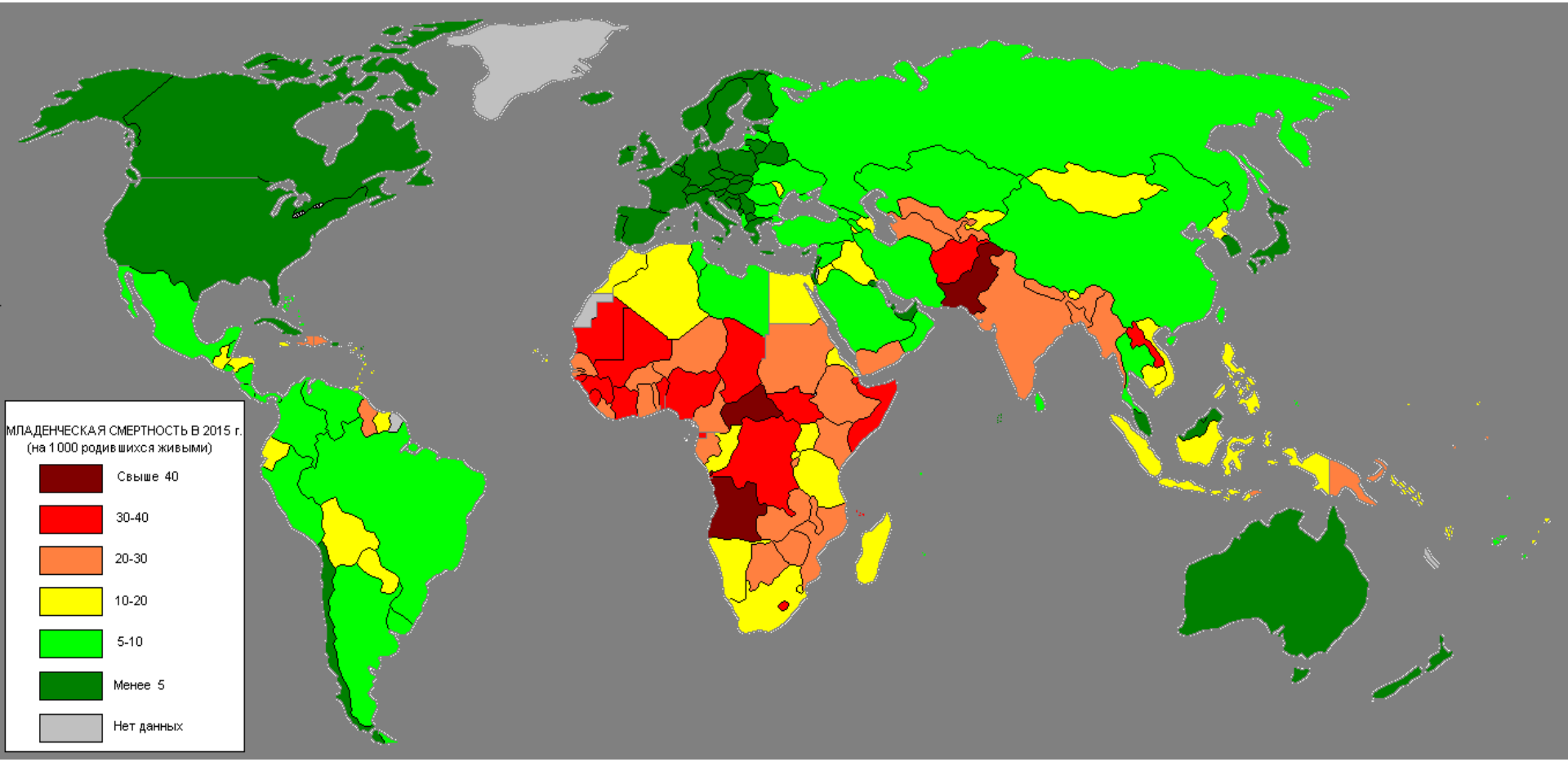
- The World Health Organization

  Perinatal period begins at 22 completed weeks (154 days of gestation) and ends 7 completed days after birth

- **Perinatal mortality** - the "number of stillbirths and deaths in the first week of life per 1,000 total births"**(‰)**
- **Perinatal mortality** -deaths among fetuses weighing 500 g (gestational age 22 weeks) or body length (25 cm crownheel) who die before or during delivery or within the first 7 days of delivery
- **Perinatal mortality rate:**

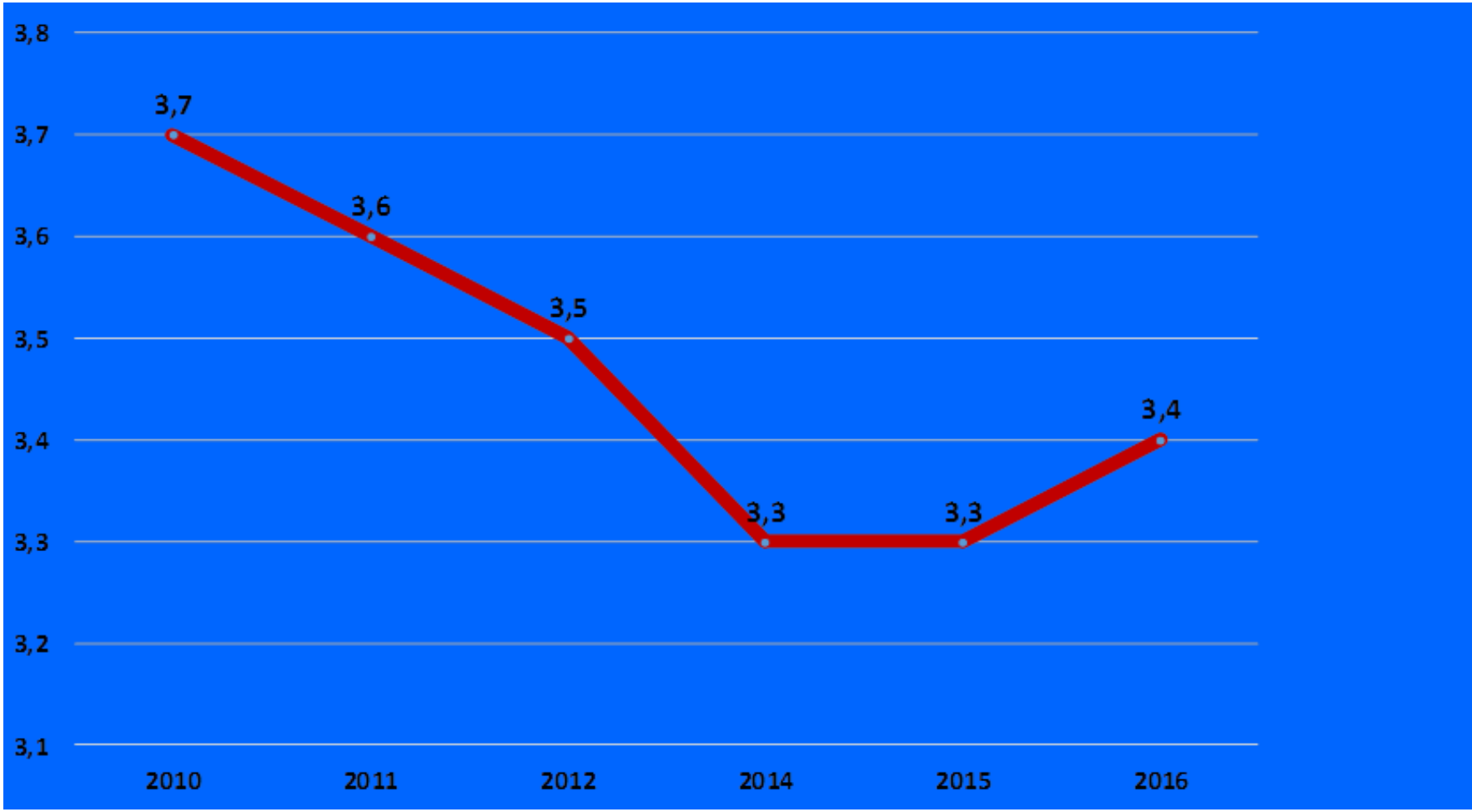
$$\frac{\text{antenatal+intranatal (}\mathbf{\text{stillbirth}}\text{)+early neonatal mortality} \times 1000}{\mathbf{\text{number of live and stillbirths}}}$$

Perinatal mortality in 2017 (WHO)



- The perinatal mortality is less than 10 per 1000 total births in the developed countries while it is much higher in the developing countries
- The perinatal mortality rate closely reflects both the standards of medical care and effectiveness of social and public health measures

Perinatal mortality rate in Belarus



- **Perinatal mortality rate in 2018 - 3,0/1000**

FACTORS OF PERINATAL MORTALITY

- ***Epidemiological:*** Age over 35 years, teenagers, parity above 5, low socioeconomic condition, poor maternal nutritional status
- ***Medical disorders:*** Anemia, hypertensive disorders, diabetes mellitus, infections
- ***Obstetric complications:***

➢**Antepartum hemorrhage** particularly abruptio placenta is responsible for about 10 percent of perinatal deaths due to severe hypoxia

➢**Preeclampsia-eclampsia** is associated with high perinatal loss either due to placental insufficiency or prematurity - spontaneous or induced

➢**Rh- isoimmunization**

➢**Cervical incompetence** responsible for significant perinatal deaths from prematurity

- ***Complications of labor:*** Preterm labor and preterm rupture of the membranes, dystocia from disproportion, malpresentation, abnormal uterine action

- ***Feto-placental factors:***Placental insufficiency

➢**Multiple pregnancy** most often leads to preterm delivery

➢**Congenital malformation** and chromosomal abnormalities -15 % of perinatal deaths

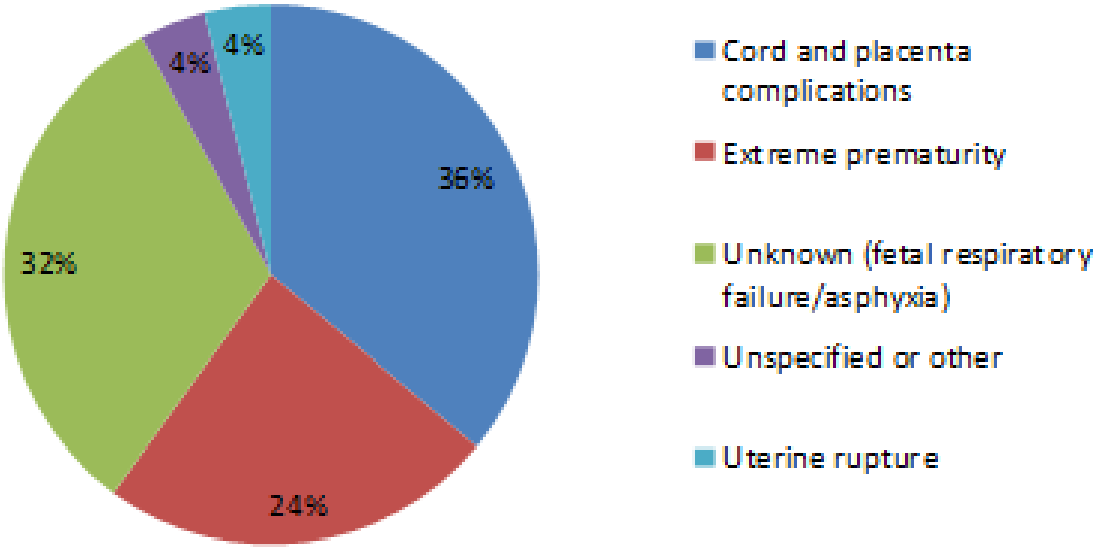
➢**Intrauterine growth restriction and low birth weight** - perinatal deaths of about 50 percent

- ***Unexplained:*** About 20% of stillbirths have no obvious fetal, placental, maternal or obstetric causes

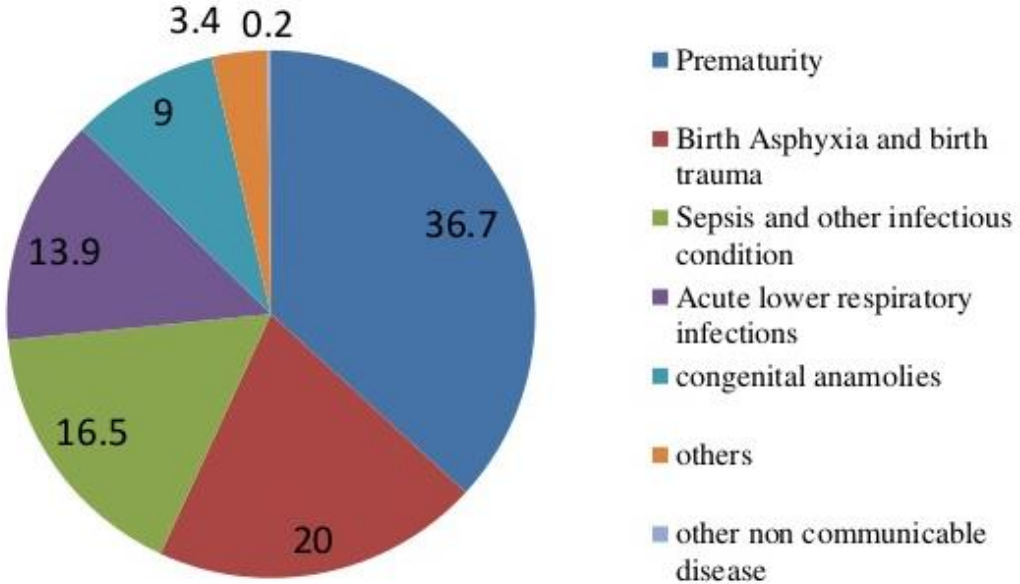
Causes of Antepartum deaths

- **Majority of fetal deaths (70-90%) occur before the onset of labor**
- Chronic hypoxia (30%)
- Pregnancy complications (30%)
- Congenital malformations (15%)
- Infection (5%)
- Unexplained (20%)

Causes of Intrapartum deaths



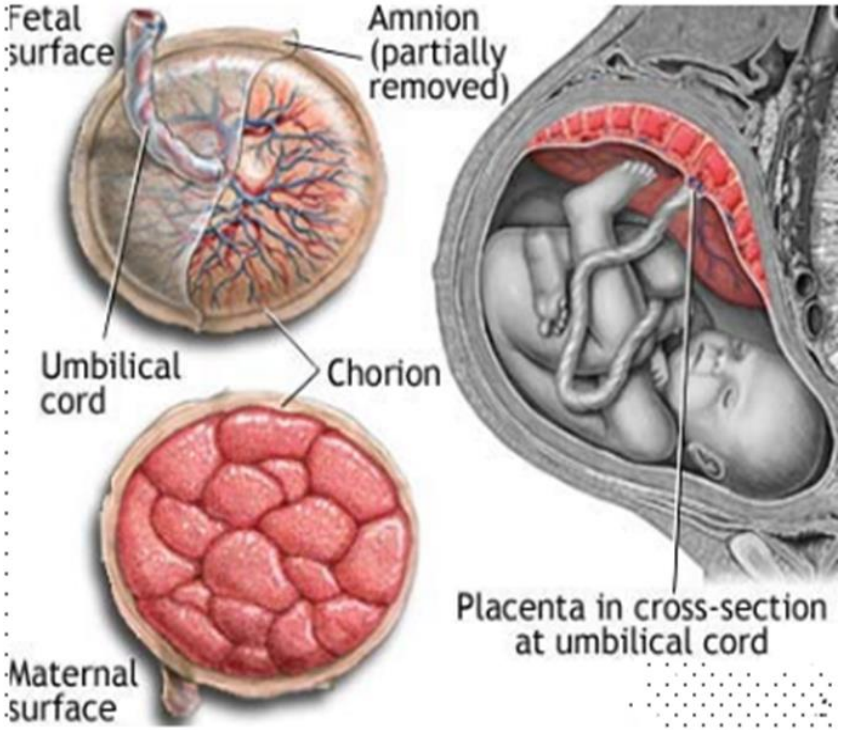
Causes of early Neonatal deaths



The measures for reducing the perinatal mortality

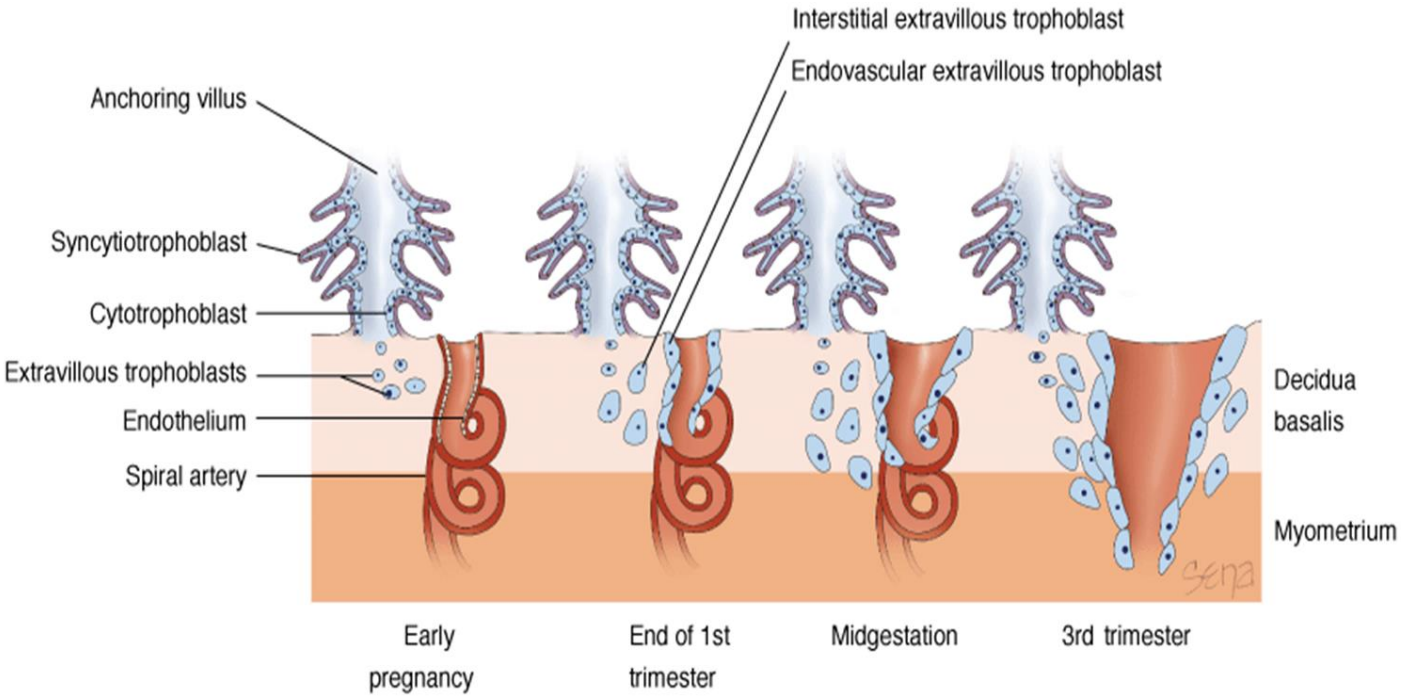
- **Pre-pregnancy health care and counseling**
- **Genetic counseling** in high risk cases and prenatal diagnosis to detect genetic, chromosomal or structural abnormalities. Termination of pregnancy reduce of deaths due to congenital malformations
- **Regular antenatal care** with advice regarding health, diet and rest
- **Detection and management of obstetric complications and medical disorders in pregnancy**
- **Screening of high-risk patients** those of poor socioeconomic status or high parity, extremes of age, and twins, etc. and their mandatory hospital delivery
- **Careful monitoring** in labor to detect hypoxia early to avoid complications during delivery
- **Health care education of the mother about the care of the newborn**

Placental insufficiency



- It is the failure of the placenta to supply oxygen and nutrients to the fetus and remove toxic products of metabolism
- When the placenta fails to develop or function properly, the fetus cannot grow and develop normally
- During pregnancy and labor fetus may be at risk of damage or death from acute or chronic utero-placental insufficiency

Pathophysiology



- Insufficient or incomplete trophoblastic invasion of the spiral arteries in the placental bed
- Increased vascular resistance and decreased blood flow to the placenta in the choriodecidual and myometrium compartments
- Chronic restriction of maternal blood flow through the placenta reduces the capacity of the mother to supply oxygen and nutrients to the fetus

Clinical types of placental insufficiency

- **Acute placental failure** may result from placental separation by hemorrhage (abruptio placentae) or **chronic placental failure** may come at the end of a phase of gradually declining placental efficiency (chronic hypoxia or fetal distress)
- **Intrauterine growth restriction (IUGR)c**hronic restriction of maternal blood flow through the placenta can have a serious effect upon fetal growth and development

Intrauterine growth restriction (IUGR)

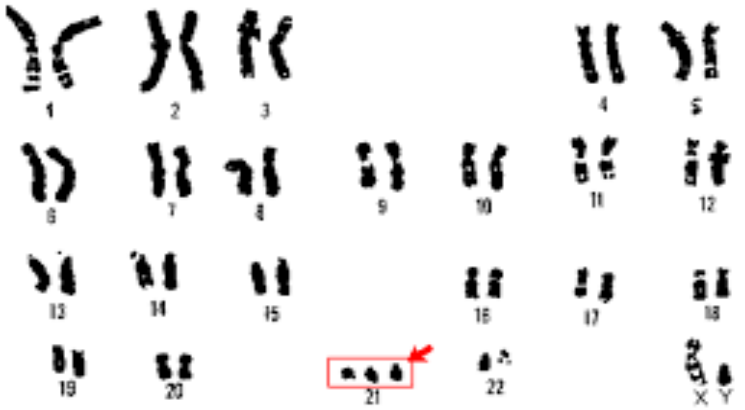
- (IUGR) refers to a condition in which a fetus is unable to achieve its genetically determined potential size
- **IUGR presents in those babies whose birth weight is below the tenth percentile of the average for the gestational age**
- Growth restriction can occur in preterm, term or post-term babies (2-15%)

- Perinatal mortality 120/1000
- 2nd leading contributor to the Perinatal mortality rate
- 40% of all stillbirths are IUGR
- Incidence of intrapartum asphyxia in cases of IUGR is 50%
- IUGR infants have an increased incidence of lower intelligence, learning and behavioral disorders and neurologic handicaps

Maternal causes of IUGR:

- Low socioeconomic status
- Malnutrition (anorexia nervosa, bulimia)
- Cardiovascular diseases (cardiac failures, hypertension, pre-eclampsia)
- Gastroenteric diseases (chronic enteritis, malabsorption diseases)

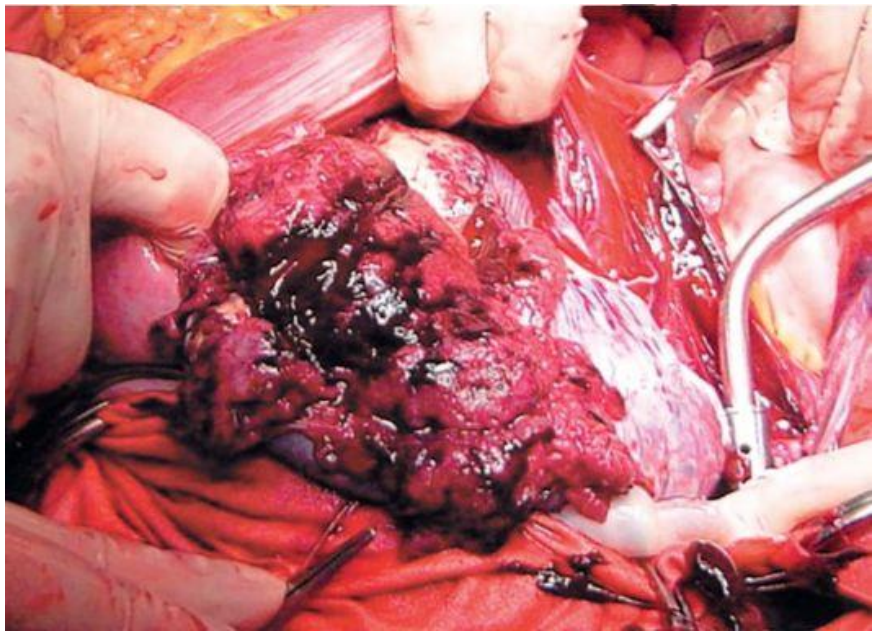
Fetal causes of IUGR:



- Chromosomal abnormalities (triploidy, trisomy 13 and 18)
- Structural malformations (especially cardiac malformations)
- Fetal infections (TORCH, parvovirus B19, syphilis, listeriosis)

Placental causes of IUGR

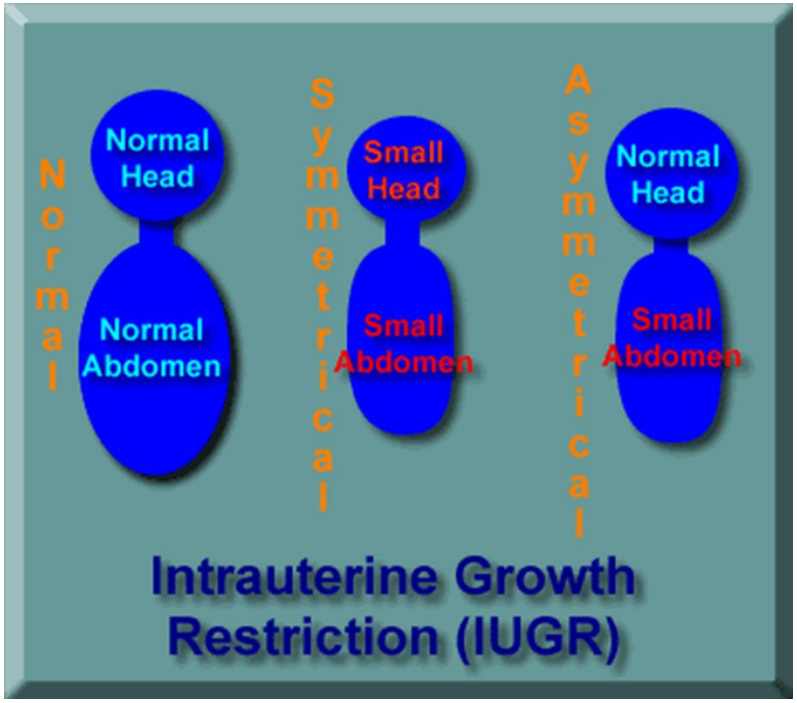
- **The causes include cases of poor uterine blood flow to the placental site for a long time**. This leads to chronic placental insufficiency with inadequate substrate transfer
- Acute placental failure with **fetal distress** may result from placental separation (abruptio placentae)



The placental pathology includes: Placenta previa, Abruption, Circumvallate, Infarction and Mosaicism.

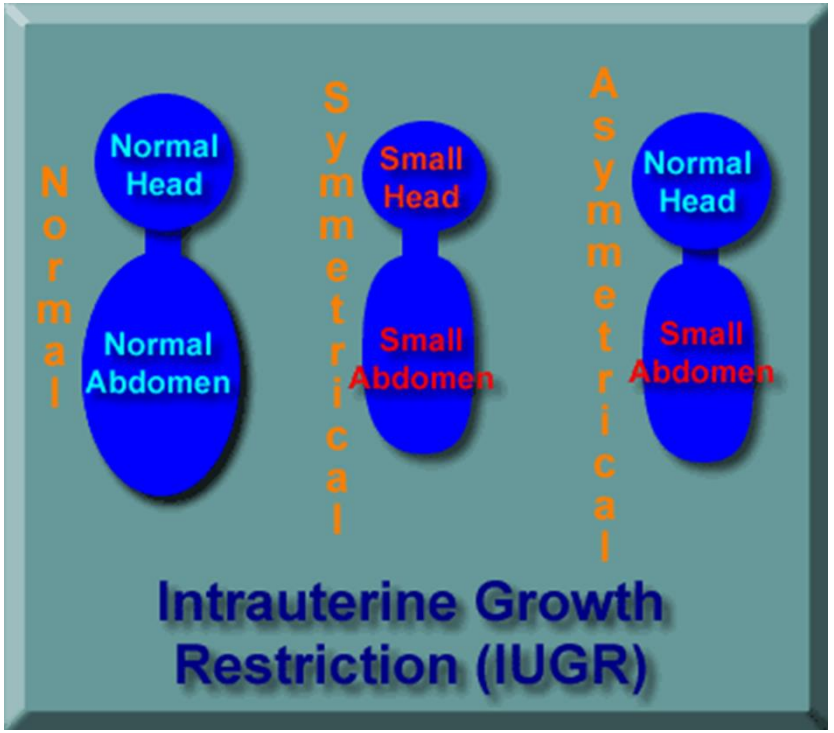
Symmetrical IUGR

- ***Symmetrical (20 %)*:** proportional decrease of the head circumference, abdominal circumference, and long bone growth
- early - from the beginning of the second trimester
- The fetus is affected in the phase of cellular hyperplasia. The total cell number is less
- This form of growth retardation is most often caused by structural or chromosomal abnormalities or congenital infection (TORCH)
- The pathological process involves all the organs including the head



Asymmetrical IUGR

- ***Asymmetrical (80 %)*: affects abdominal growth more than the head circumference
- late onset - around 30 weeks of pregnancy. The fetus is affected during the phase of cellular hypertrophy. The total cell number remains the same but size is smaller than normal.
- This form is most often caused by maternal diseases. These diseases reduce uteroplacental blood flow or by restricting the oxygen and nutrient transfer or by reducing the placental size



Classification of IUGR

TYPE	SYMMETRIC/TYPE 1 (20%)	ASYMMETRIC/TYPE 2 (80%)
ONSET	Early in utero	Later onset
ETIOLOGY	Congenital infections, genetic disorders	Utero-placental insufficiency, maternal malnutrition, hypertension
PATHOPHYSIOLOGY	• Impaired cell division • Decreased cell number • irreversible	• Impaired cellular hypertrophy • Decreased cell size • reversible
CLINICAL FEATURES	• inadequate growth of head and body • head:abdomen ratio may be normal	• brain is spared, therefore head:abdomen ratio increased
PROGNOSIS	Poor prognosis	More favorable prognosis

Degrees of growth restriction

Mild (less 2 weeks to gestational age)

Moderate (2-4 weeks to gestational age)

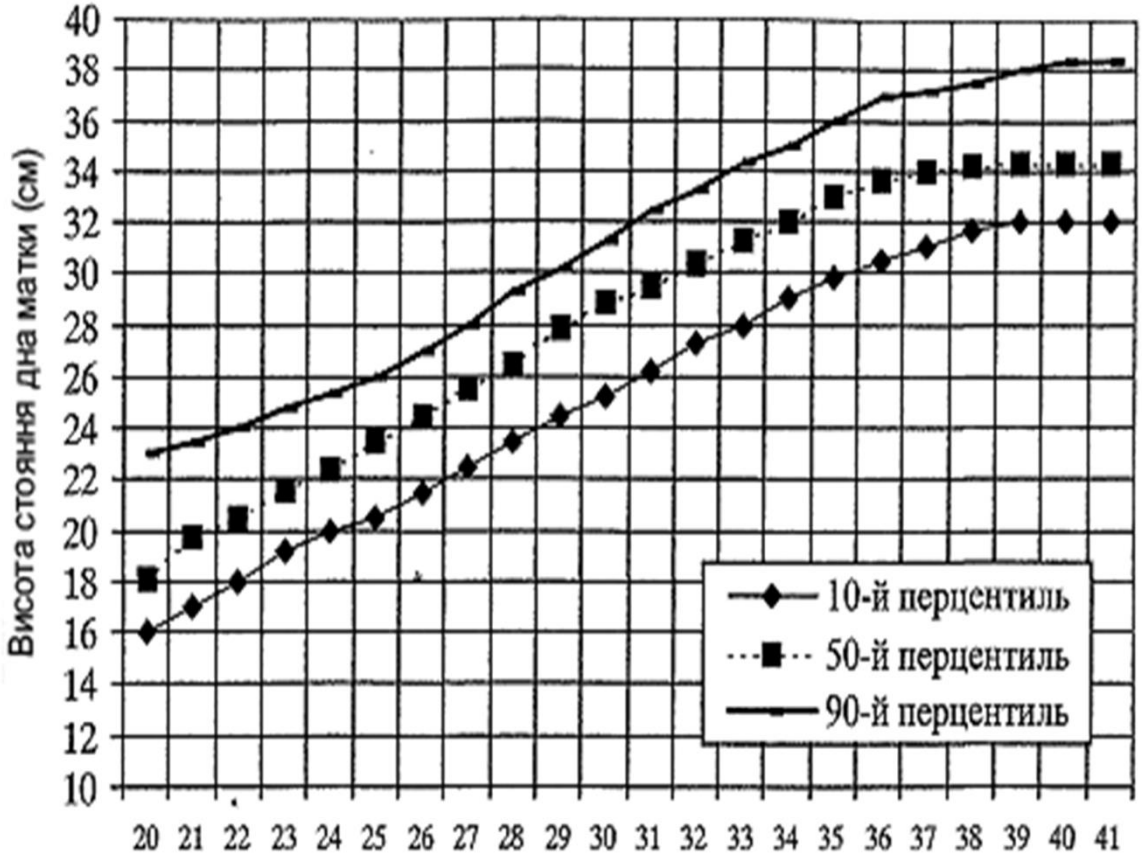
Severe (more 4 weeks to gestational age)

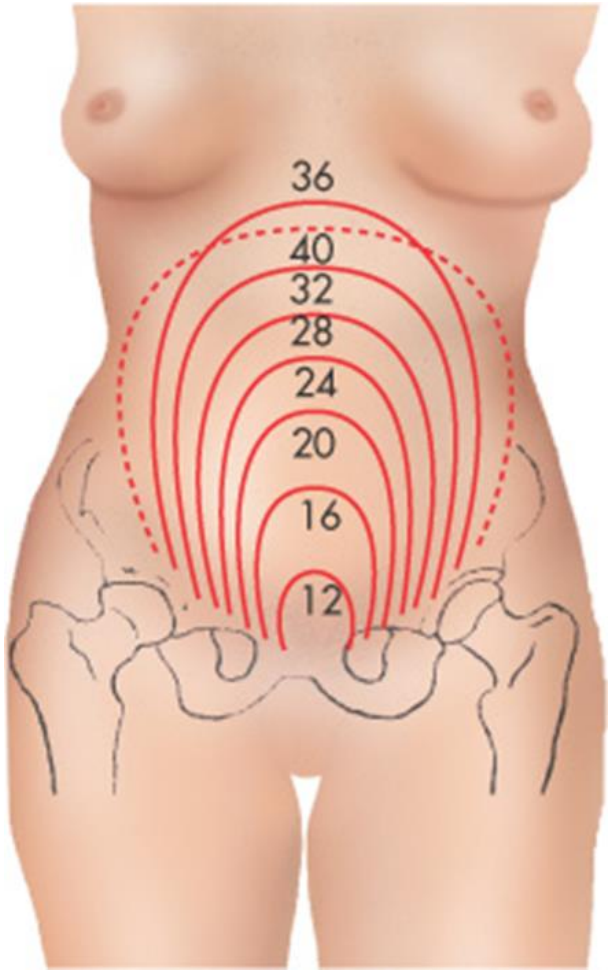
Prenatal Diagnosis:

1. Maternal history

2. Maternal examination - measurement of fundal height is an excellent screening tool for IUGR with 95% sensitivity. Fundal height in cms should be equal to gestation age. A lag of 4 cm or more suggests growth restriction

3. Fetal Kick count (more than10 times a day)





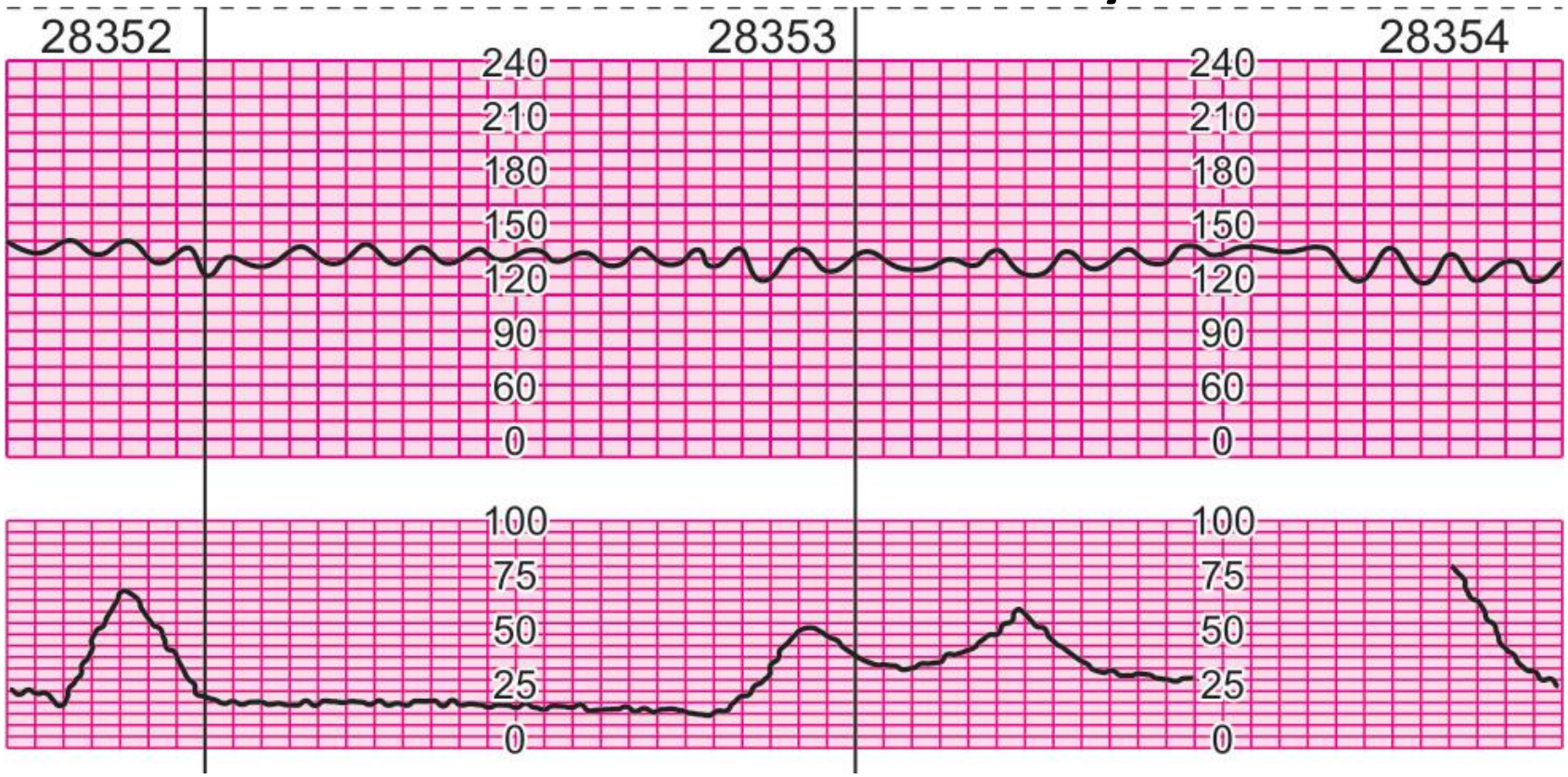
4. Fetal ultrasound

- BPD (biparietal diam) 43-100% accurate but inaccuracy due to head-sparing in asymmetric IUGR
- AC (Abdominal circumference) better sensitivity than that of cephalometry for IUGR detection
- HC/AC (Head circumference/abdominal circumference ratio) is an important measurement for detection of asymmetric IUGR infants
- Ratio of femoral length to abdominal circumference (FL/AC) provides also an accurate prediction of IUGR
- Serial measurements (not less than 2 weeks interval)

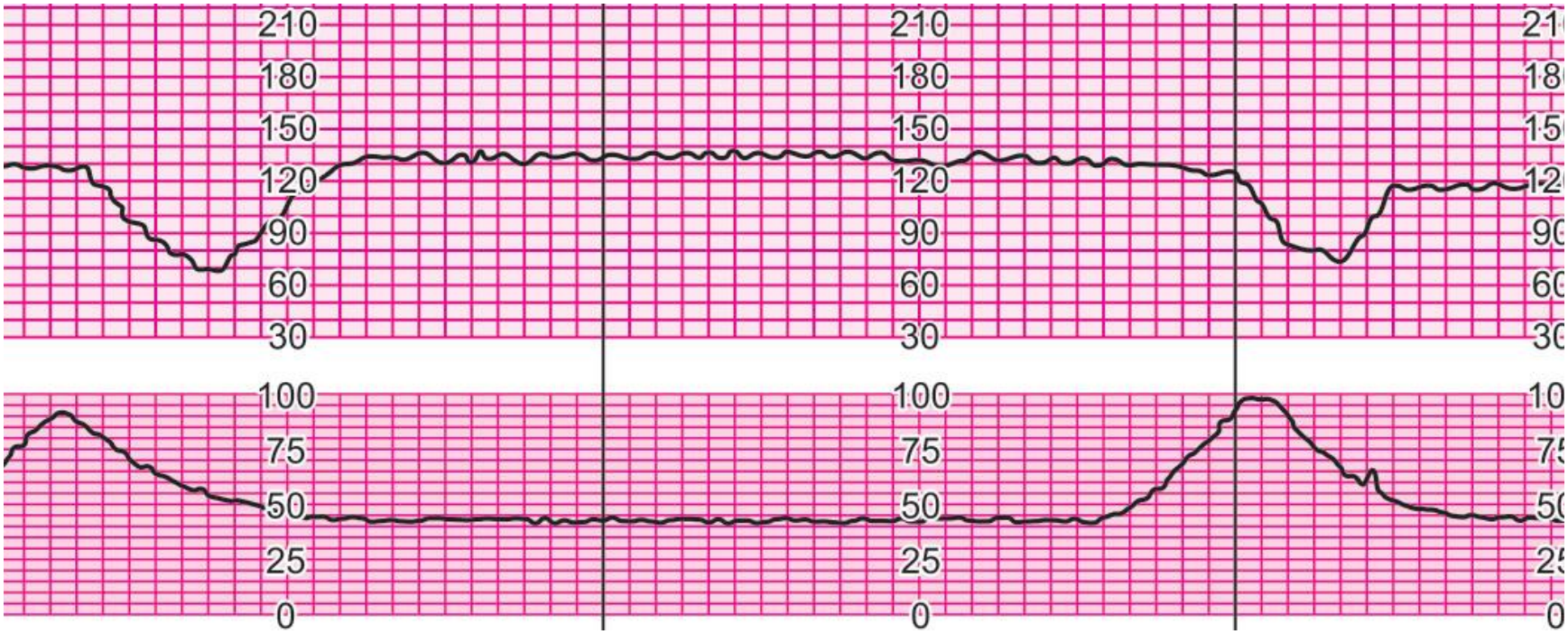
5. CTG

Categorization of fetal heart rate (FHR) features (RCOG, NICE)					Categorization of CTG Traces
Feature	*Baseline (bpm)*	*Variability (bpm)*	*Deceleration*	*Accelerations*	*Based on 4 features (Baseline FHR, variability, decelerations, accelerations)*
Reassuring	110–160	> 5	None	Present	Normal: **All four** features are reassuring Suspicious: **One** non-reassuring and the **rest** are reassuring Pathological: **Two or more** features nonassuring or **one or more** abnormal categories
Non-reassuring	100–109 161–180	< 5 for ≥ 40 but less than 90 minutes	• Early deceleration • Variable deceleration • Single prolonged deceleration up to 3 minutes	Absence of accelerations with an otherwise normal CTG is of uncertain significance	
Abnormal	< 100 > 180 Sinusoidal pattern for ≥ 10 minutes	< 5 for > 90 minutes	• Atypical variable deceleration • Late decelerations > 30 min • Single prolonged decelerations > 3 minutes		

Sinusoidal pattern showing absence of baseline variability

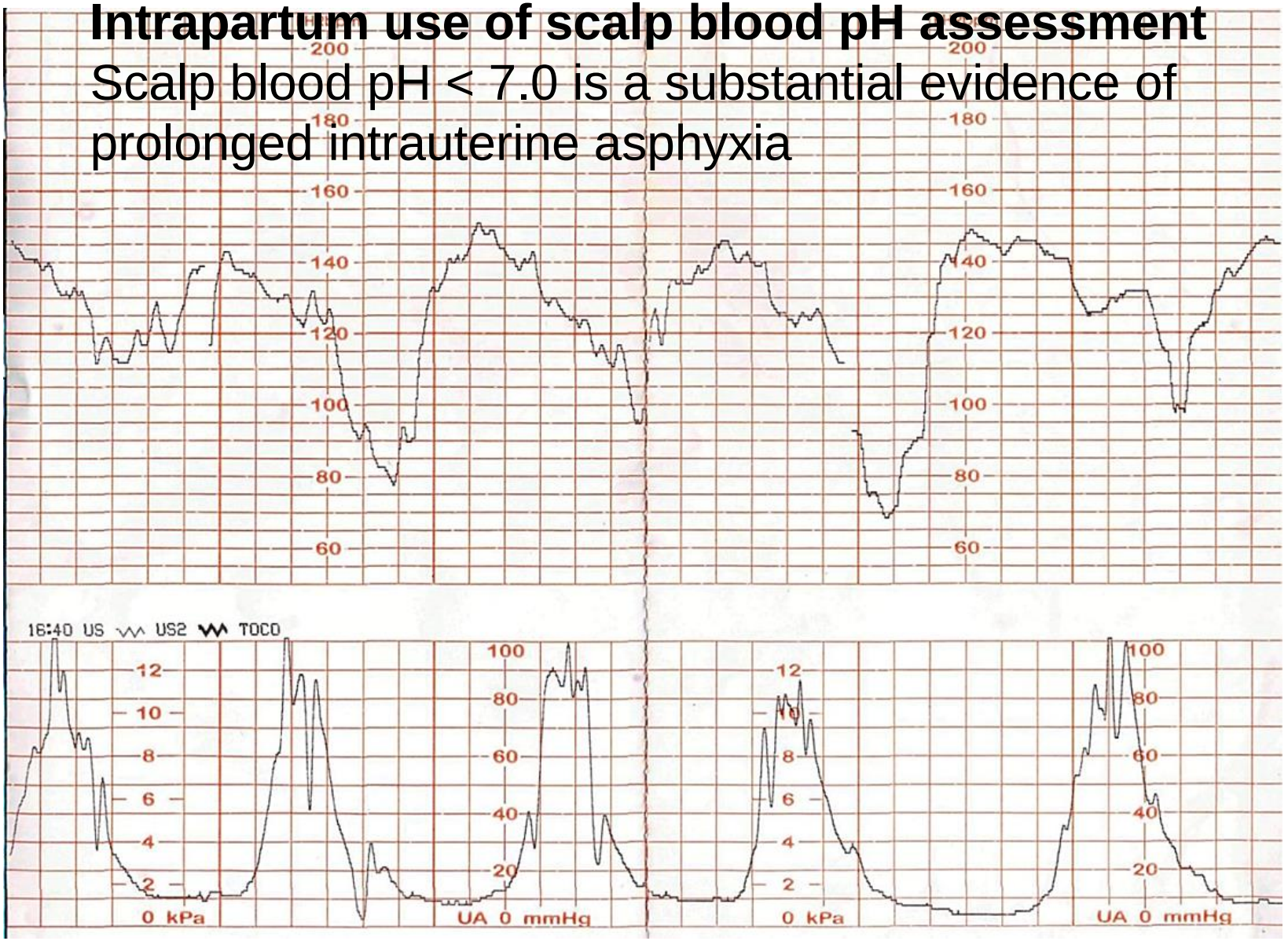


Repeated late decelerations increase the risk of low Apgar score



Intrapartum use of scalp blood pH assessment

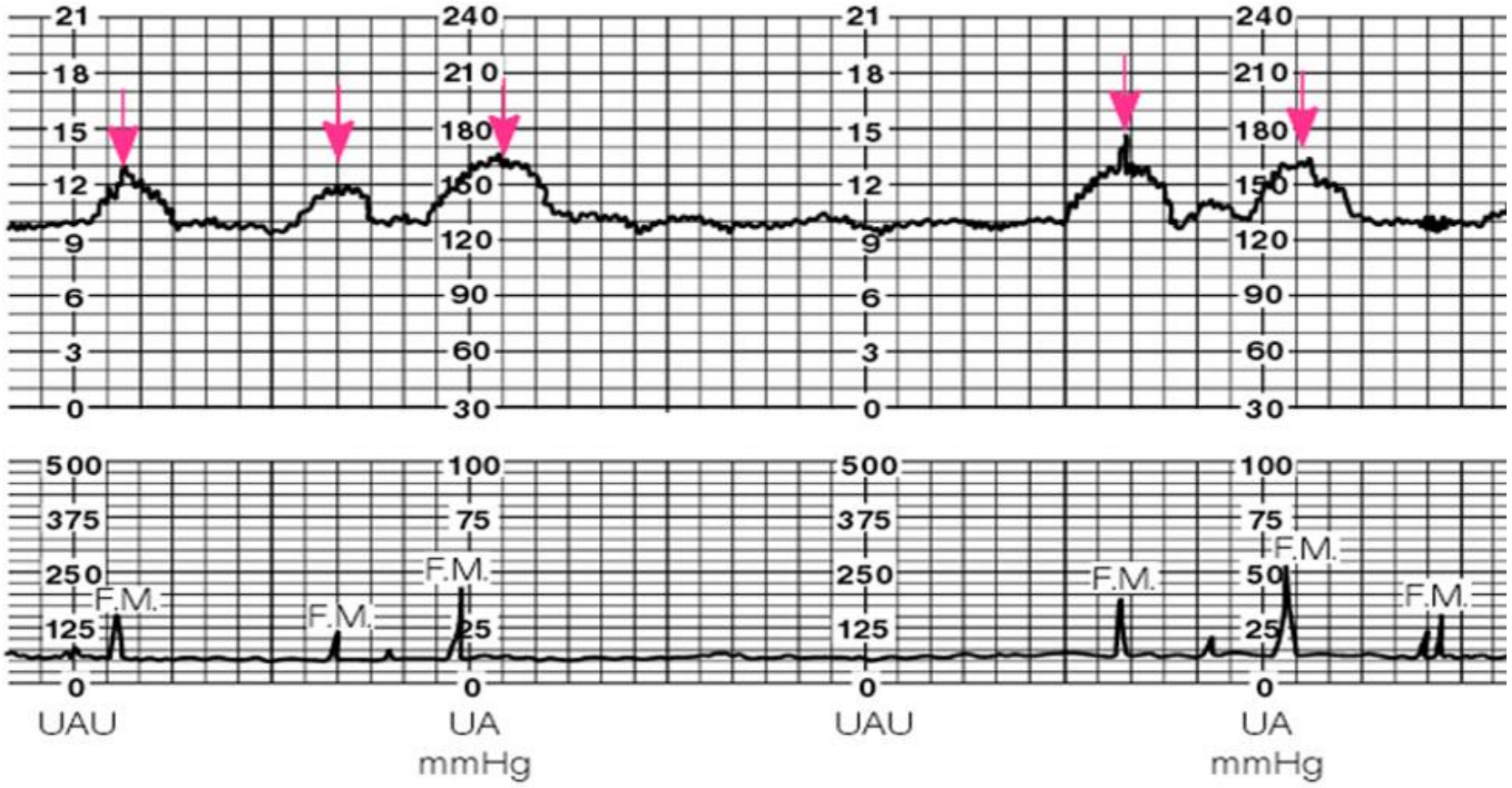
Scalp blood pH < 7.0 is a substantial evidence of prolonged intrauterine asphyxia



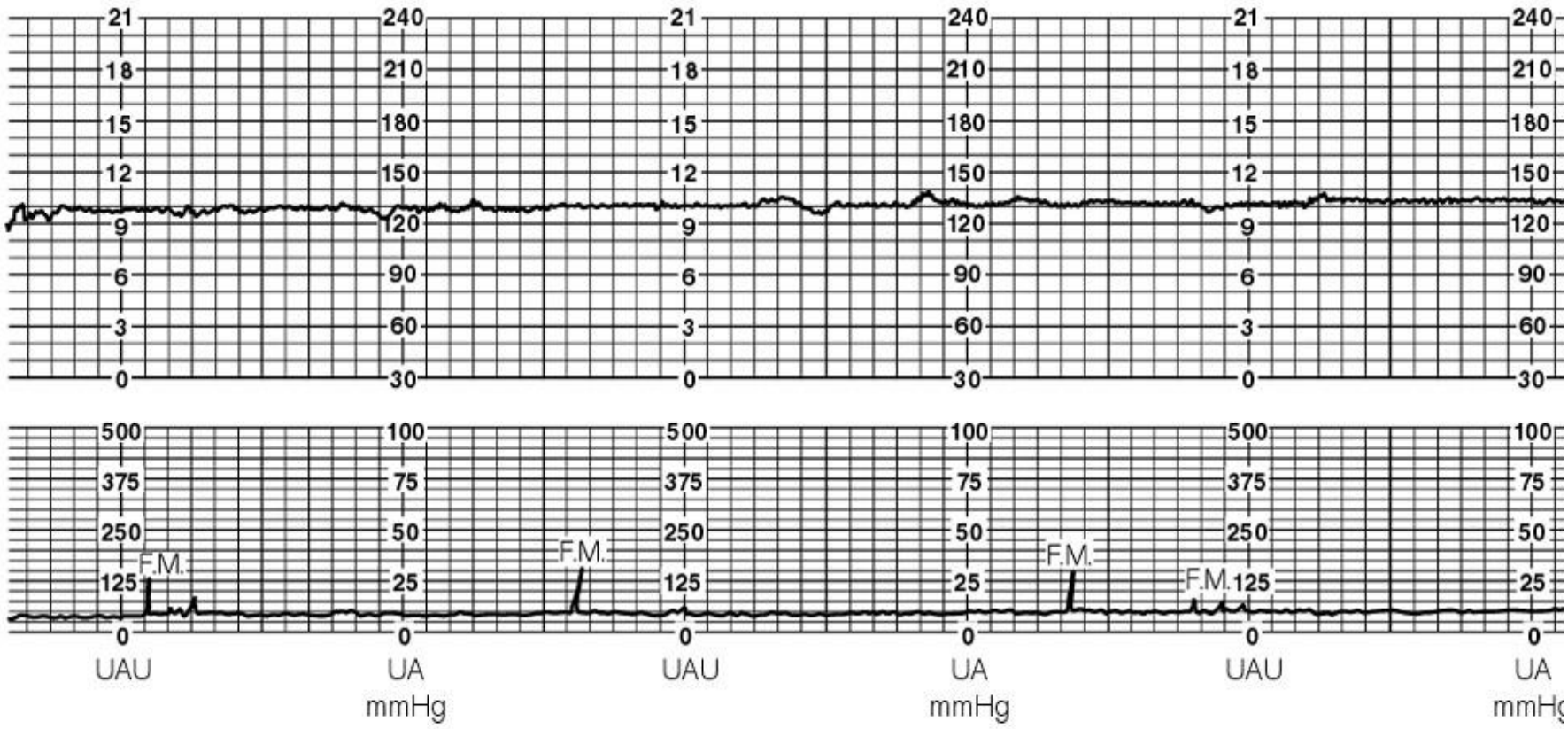
6. Nonstress Test

- Evaluate fetal heart rate with fetal activity
- Reassuring if accelerations occur with fetal movement
- Interpretation
  - **Reactive –** 2 or more FHR accelerations of at least 15 bpm with a duration of at least 15 seconds in a 20 minute interval **(desired)**
  - **Nonreactive – reactive criteria not met within 30 minutes**

Accelerations of 15 bpm lasting 15 seconds with each fetal movement



Nonreactive NST



BIOPHYSICAL PROFILE

variables	normal score = 2	abnormal score = 0
fetal breathing movements	≥1 episodes in 30 min each lasting ≥30 sec	absent or no episode ≥30 sec in 30 min
gross body movements	three or more discrete body or limb movements in 30 min (episodes of active continuous movement = a single movement)	less than 3 episodes of body or limb movements in 30 min
fetal tone	≥1 episodes of active extension with return to flexion of fetal limb(s) or trunk; opening and closing of hand is considered normal tone	slow extension w/return to flexion, movement of limb in full extension, or fetal movement absent
reactive fetal heart rate	≥2 episodes of accelerations (≥ 15 beats/min) in 20 min, each lasting ≥ 15 sec and associated with fetal movement	< 2 episodes of accelerations or acceleration of < 15 beats/min in 20 min
qualitative amniotic fluid volume	≥1 pockets of fluid measuring > 1 cm in 2 perpendicular planes	pockets absent or pocket < 1 cm in 2 perpendicular planes

	score	notes
normal	8 – 10 (if amniotic fluid index is adequate)	CNS is functional & fetus is not hypoxemic
equivocal	6	
abnormal	< 4	along w/oligohydramnio→ labor induction

Assessment by US of 5 biophysical variables

1) Fetal breathing movement
2) Fetal movement of body or limbs
3) Fetal tone (extension and flexion of extremities)
4) Amniotic fluid volume
5) Reactive NST with activity

8. Doppler Velocimetry: Elevated systolic/diastolic (S/D) ratio and/or presence of **diastolic notch** are associated with IUGR and intrauterine fetal hypoxia

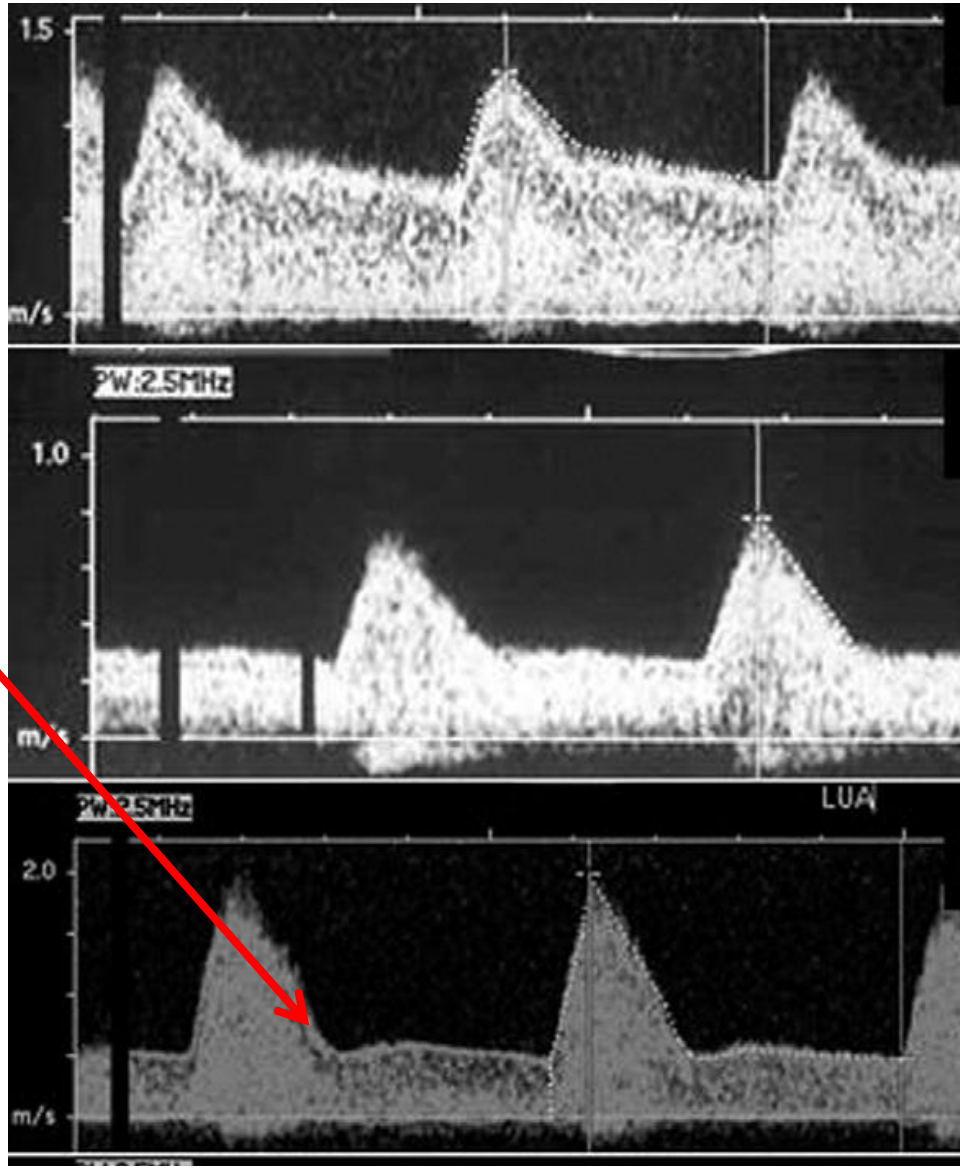
Uterine artery: The presence of **diastolic notch** suggests incomplete invasion of placental trophoblasts to the uterine spiral arteries

Reduced or absent or reversed diastolic flow in the **umbilical artery** indicates fetal jeopardy and poor perinatal outcome

Middle cerebral artery (MCA): Increased diastolic velocity (brain sparing effect) is observed in a compromised fetus

Examination of the middle cerebral artery, ductus venosus, and umbilical vein if it is necessary

Persistence of an early diastolic notch in the uterine artery flow velocity is evidence of increased spiral artery blood flow resistance



9.Biochemical data:

- Estriol: low 24 hours urinary estriol excretion is associated with 21% of IUGR infants

DELIVERY

The factors to be considered are:

- Presence of fetal abnormality
- Duration of pregnancy
- Degree of growth restriction
- Associated complicating factors
- Degree of fetal compromise
- Previous obstetric history
- Availability of neonatal intensive care unit

- **Pregnancy > 37 weeks:** Delivery should be done
- **Pregnancy < 37 weeks**
- **Uncomplicated mild IUGR:** treatment to improve the placental function may be employed. The pregnancy is allowed to continue till at least 37 weeks
- Growth scans every 2 weeks
- Daily fetal movement profile
- NST twice weekly
- BPP weekly if NST is abnormal
- Doppler study during US
- If fetal growth starts to plateau, amniotic fluid index starts to decline, or fetal tone or gross movements are diminished or absent - admission to hospital and delivery

Treatment to improve the placental function

- Adequate bedrest
- Wellbalanced diet
- Maternal hyperoxygenation
- Relaxation of uterus
- Improve microcirculation

Severe degree of IUGR

- Delivery should be planned
- Preterm IUGR fetus requires highest level of neonatal intensive care unit. The delivery should be in an equipped institution where intensive intranatal monitoring is possible. Intrauterine transport to an equipped centre is ideal in such a case
- **If the lung maturation is achieved** delivery is done
- **If the lung maturation has not yet been achieved** betamethasone therapy is given to accelerate pulmonary maturation when gestational age is less than 34 weeks. Corticosteroids also reduce the risk of neonatal HMD and intraventricular hemorrhage
- A pediatrician should be available at the time of delivery
- The baby should be placed preferably in the neonatal intensive care unit

- Low rupture of the membranes followed by oxytocin is employed in cases such as pregnancy beyond 34 weeks with favorable cervix and the head is deep in the pelvis. Prostaglandin (PGE2) gel could be used when the cervix is unfavorable. The color of the liqor could be a guide for further management
- Intrapartum monitoring by clinical, continuous electronic and scalp blood sampling is needed as the risk of intrapartum asphyxia is high
- Cesarean delivery without a trial of labor is done when the risks of vaginal delivery are more (presence of fetal acidemia, absent or reversed diastolic flow in umbilical artery or unfavorable cervix)

Prevention

- In subsequent pregnancies, the use of low-dose aspirin may be of benefit in reducing the incidence of IUGR in selected high-risk women. It should be initiated between 12 and 16 weeks' gestation and continued until 36 weeks.