Neonatology

for

Obstetricians

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Objectives

- By the end of this presentation the student should be able to:
  - Know the basics of neonatal resuscitation.
  - Know the importance of Apgar's score and its limitations.
  - Know the prematurity and its management.
  - Know the intrauterine growth restriction (IUGR) and dysmaturity.
  - Know the types of congenital malformations

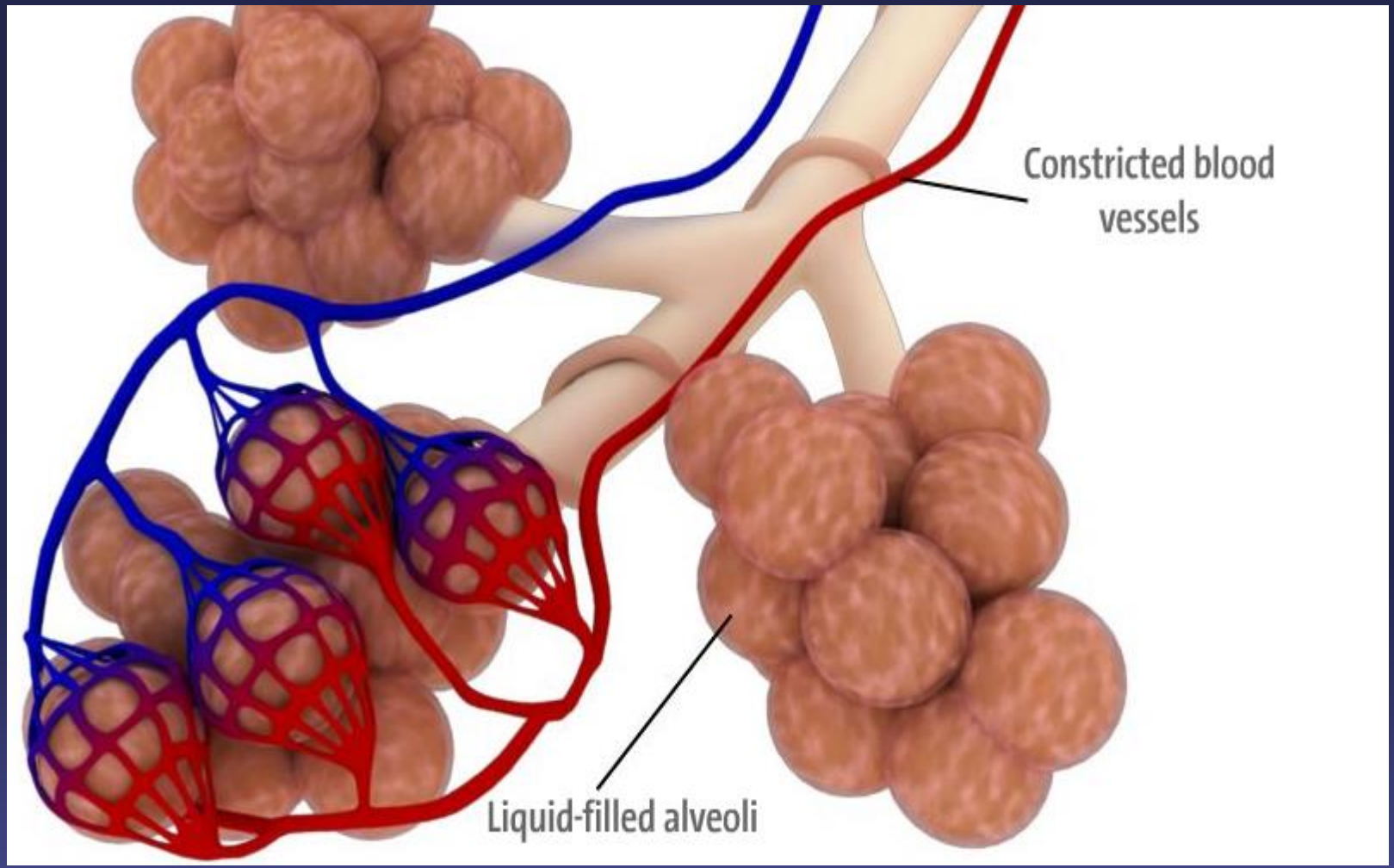
Neonatal Resuscitation

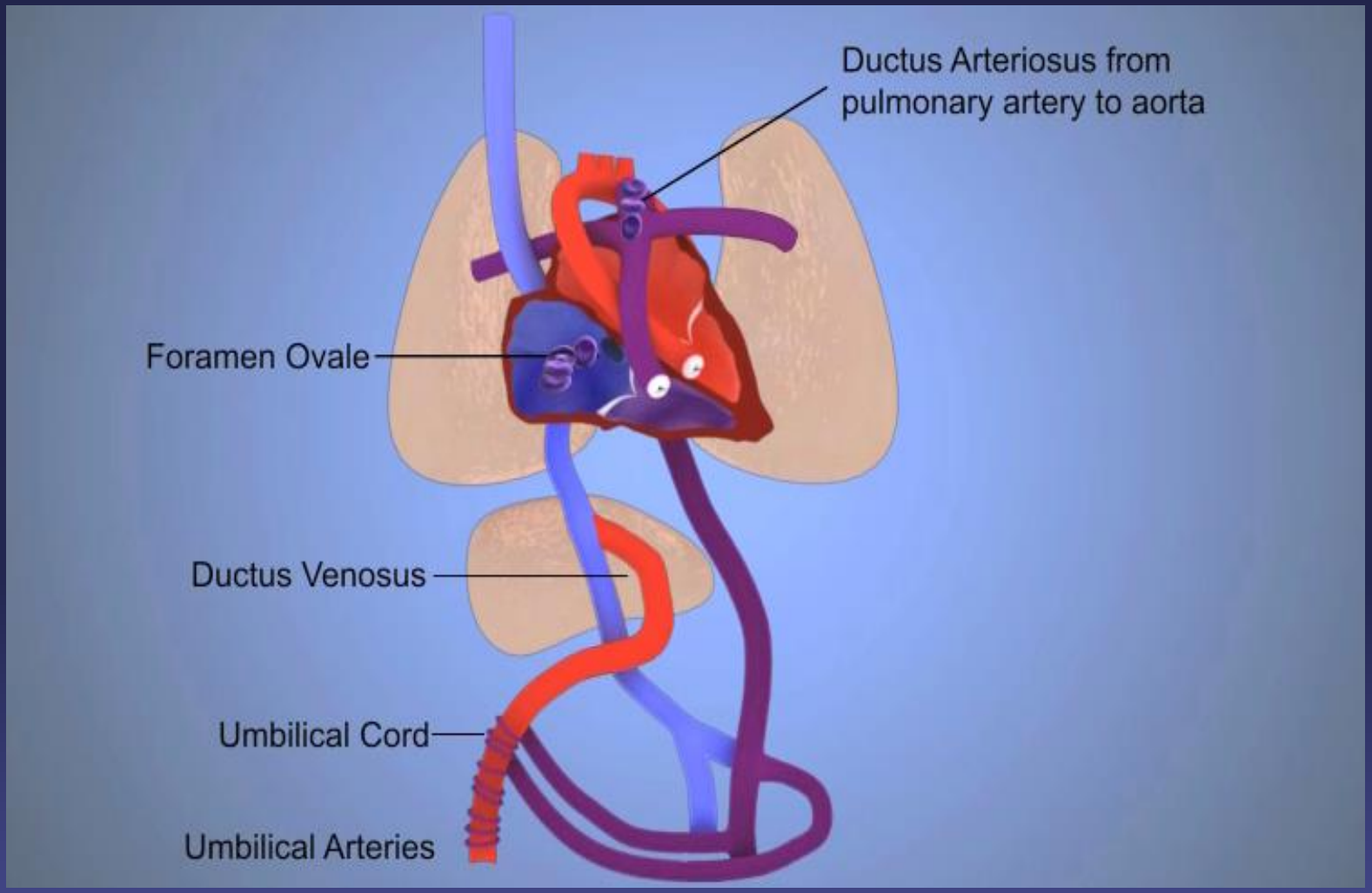
Who Requires Resuscitation?

- Most newly born babies are vigorous.
- About 10% of newborns require some assistance.
- Only 1% need major resuscitative measures (intubation, chest compressions, and/or medications).

In Utero

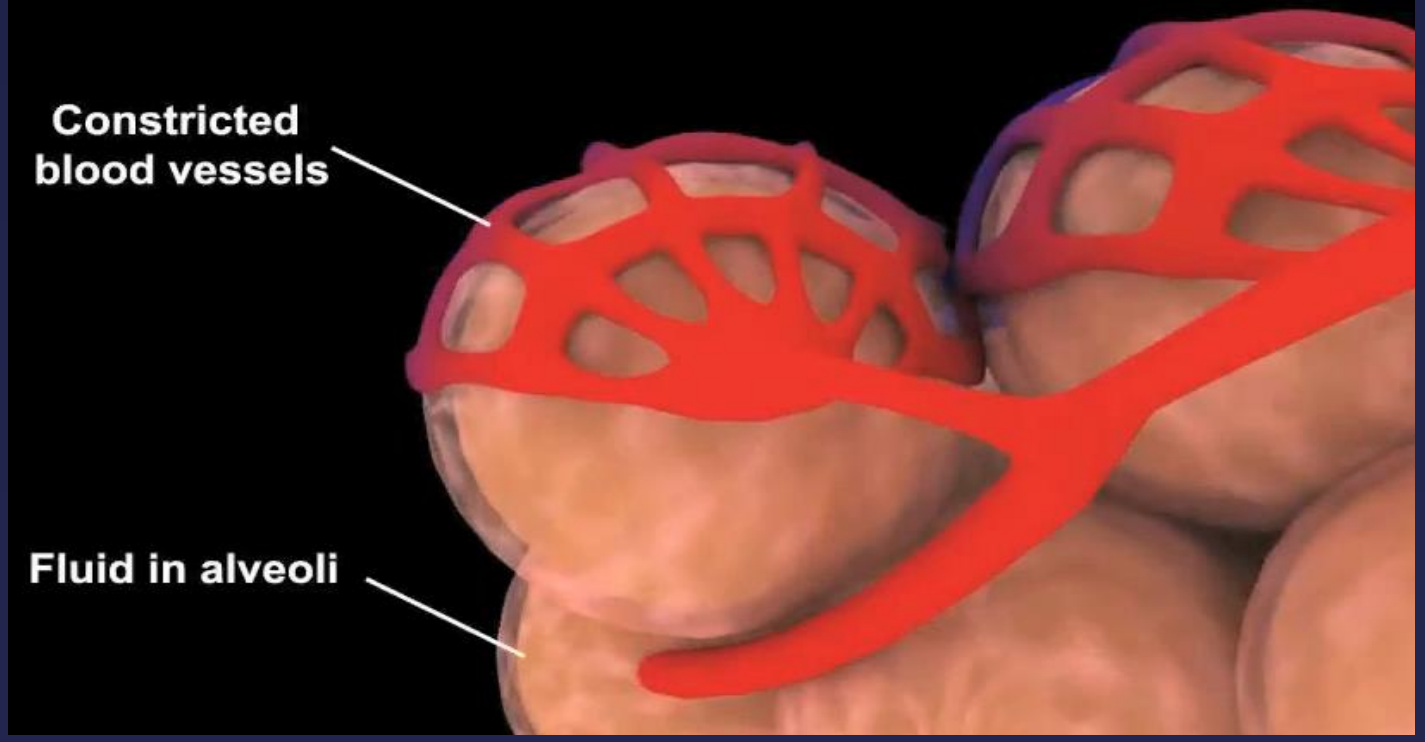
- Alveoli filled with lung fluid.
- Pulmonary arterioles constricted.
- Blood flow diverted across ductus arteriosus.
- Pulmonary blood flow diminished.

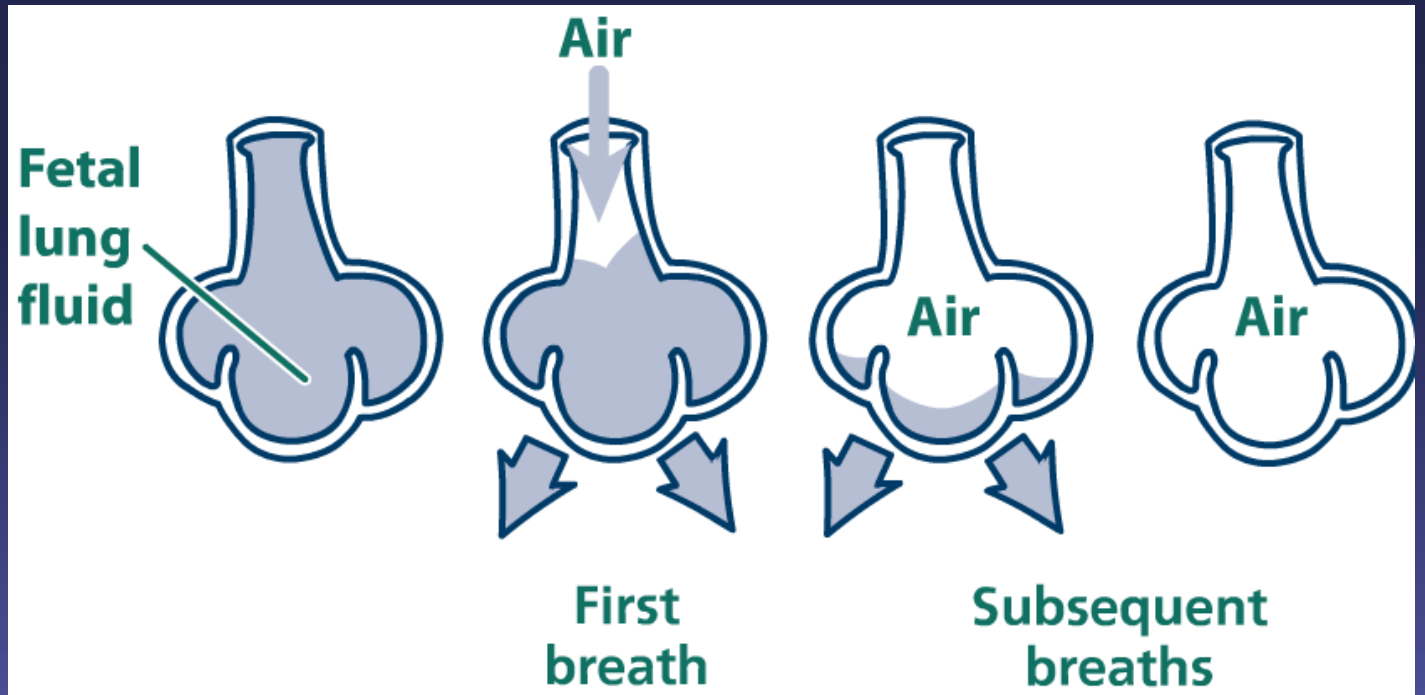

Constricted blood vessels
Liquid-filled alveoli

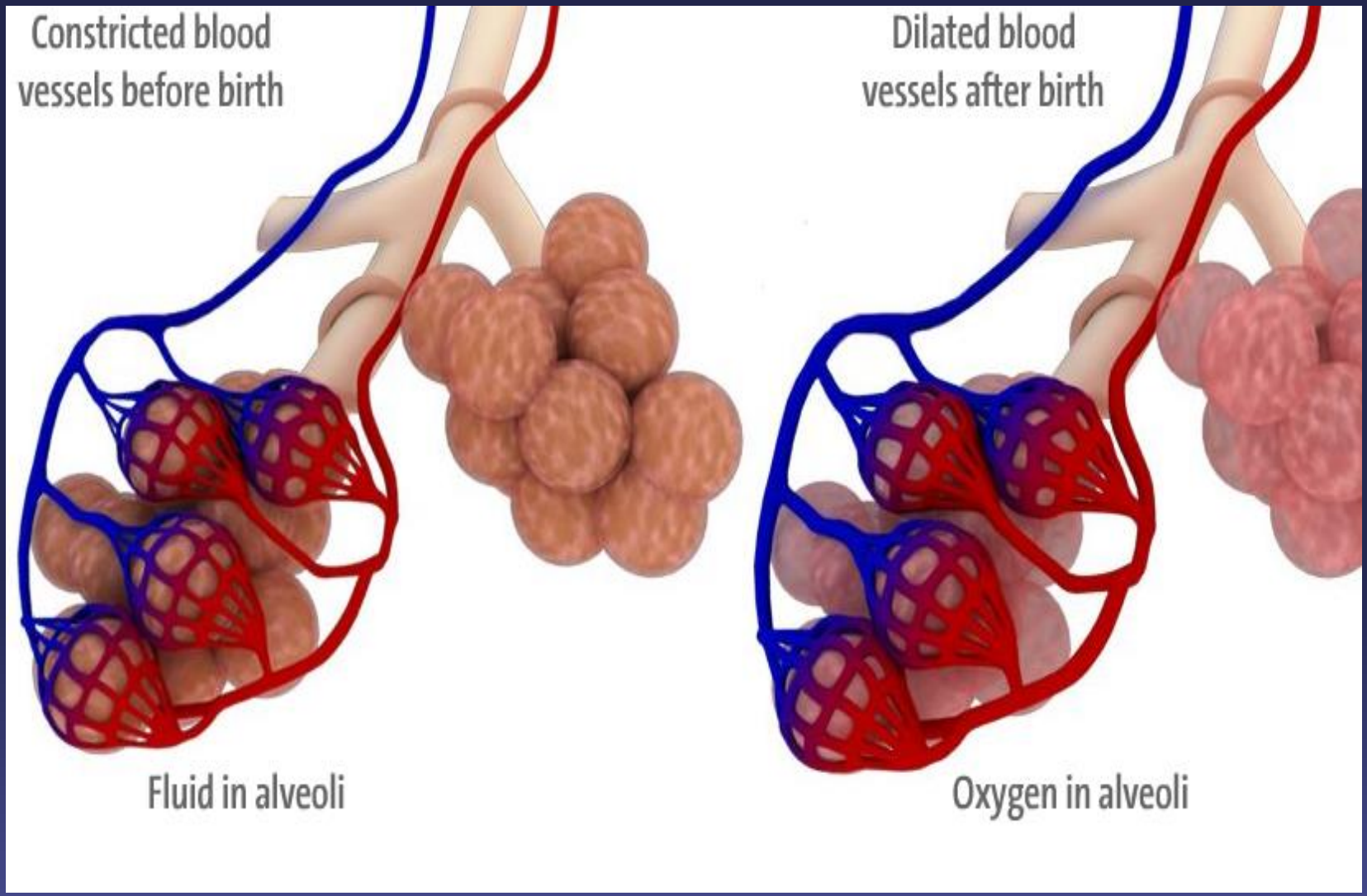

Ductus Arteriosus from pulmonary artery to aorta
Foramen Ovale
Ductus Venosus
Umbilical Cord
Umbilical Arteries

After Delivery

- Lungs expand with air
- Fetal lung fluid leaves alveoli
- Pulmonary arterioles dilate
- Pulmonary blood flow increases

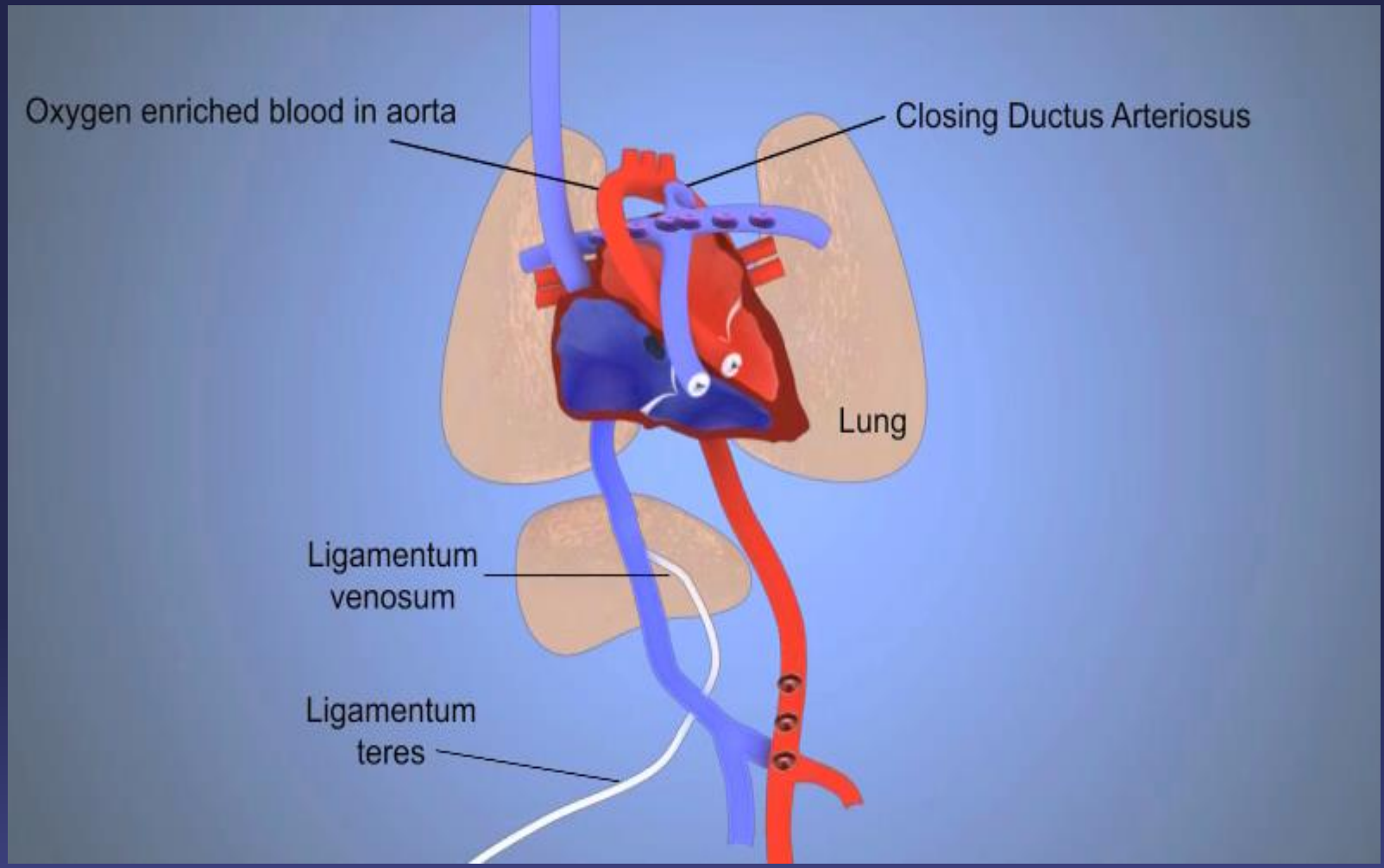

Constricted blood vessels
Fluid in alveoli


Air
Fetal lung fluid
Air
Air
First breath
Subsequent breaths


Constricted blood vessels before birth
Dilated blood vessels after birth
Fluid in alveoli
Oxygen in alveoli

Normal Transition

- The following changes take place soon after birth:
  - Fluid in alveoli absorbed
  - Umbilical arteries and vein constrict thus increasing blood pressure
  - Ductus arteriosus constricts
  - Blood vessels in lung relax
  - Blood flows through lungs to pick up oxygen
  - Blood oxygen levels rise


Oxygen enriched blood in aorta
Closing Ductus Arteriosus
Lung
Ligamentum venosum
Ligamentum teres

Transition Abnormalities

- Lack of ventilation of the lungs → sustained constriction of the pulmonary arterioles, preventing systemic arterial blood from being oxygenated
- Prolonged lack of adequate perfusion and oxygenation to the baby's organs can lead to damage to many organs (especially the brain), or death

Signs of the perinatal compromise

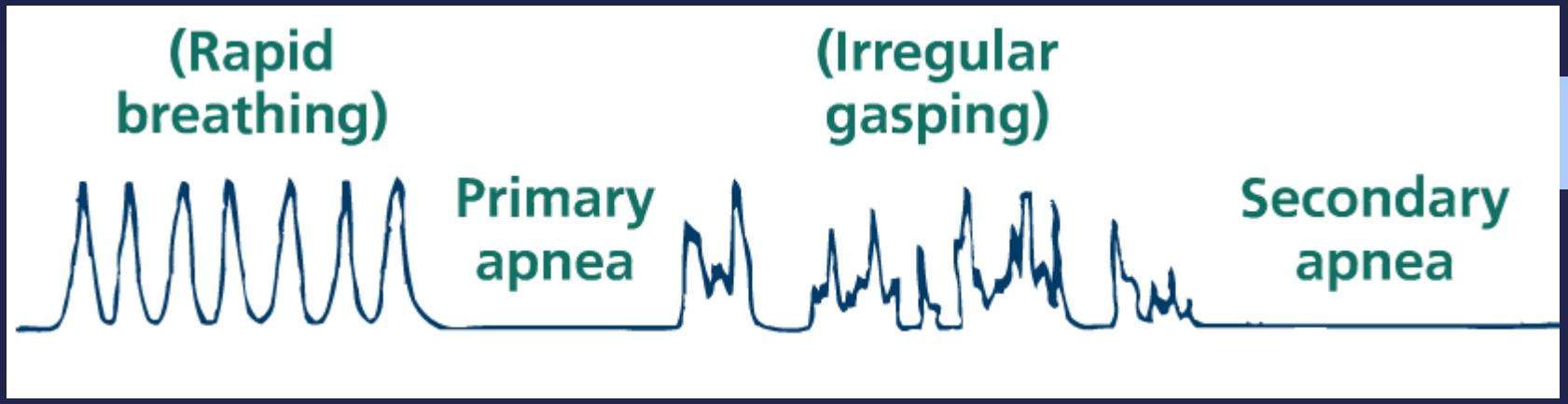
- Poor muscle tone
- Depressed respiratory drive
- Bradycardia
- Low blood pressure
- Tachypnea
- Cyanosis

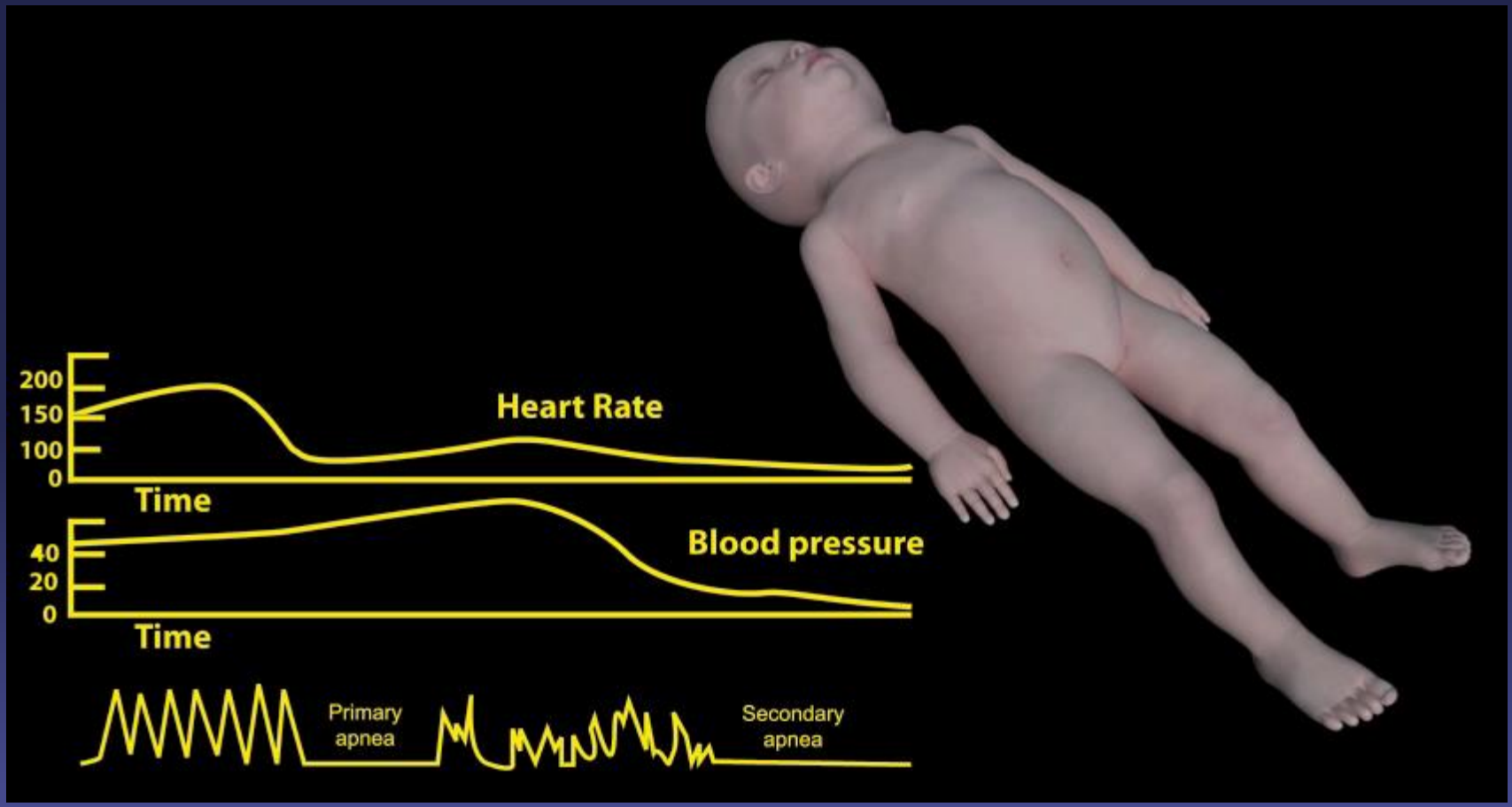
Primary Apnea

- When a fetus/newborn first becomes deprived of oxygen, an initial period of attempted rapid breathing is followed by primary apnea and dropping heart rate that will improve with tactile stimulation

Secondary Apnea

- If oxygen deprivation continues, secondary apnea ensues, accompanied by a continued fall in heart rate and blood pressure.
- Secondary apnea cannot be reversed with stimulation; assisted ventilation must be provided.


(Rapid breathing)
Primary apnea
(Irregular gasping)
Secondary apnea


200
150
100
0
Heart Rate
Time
40
20
0
Blood pressure
Time
Primary apnea
Secondary apnea

Preparation for Resuscitation

- EVERY delivery should be attended by at least one person whose only responsibility is the baby and who is capable of initiating resuscitation
- Prepare necessary equipment
  - Turn on radiant warmer
  - Check resuscitation equipment

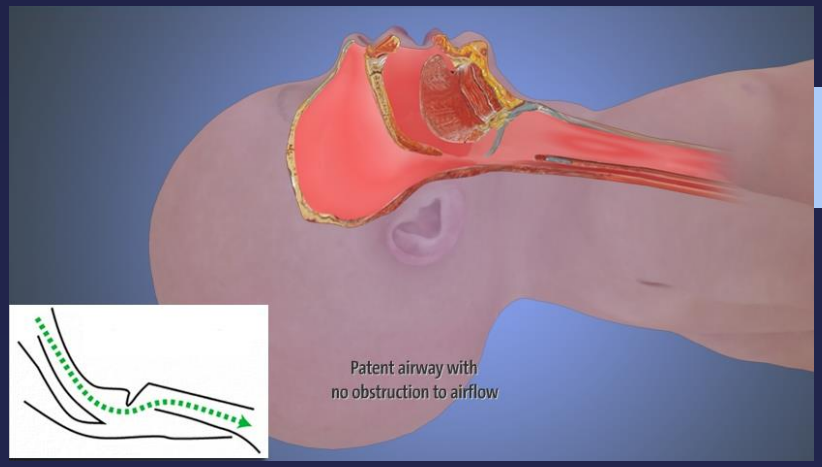
Remember your ABCs

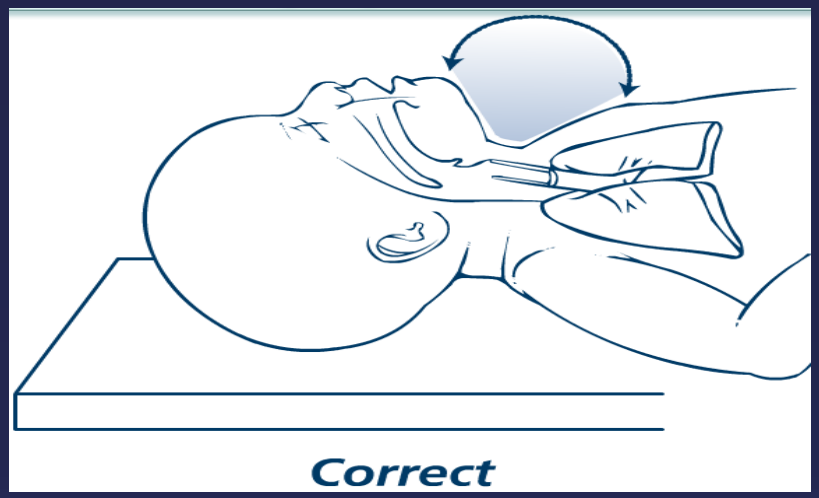
- A – Airways
- B – Breathing
- C – Circulation
- D – Drugs

A

Initial Steps

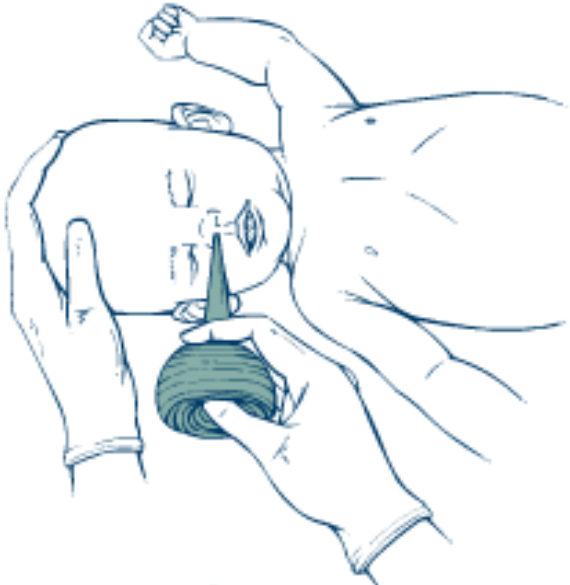
- Provide warmth
- Position; clear airway (as necessary)
- Dry, stimulate, reposition


Patent airway with
no obstruction to airflow


Correct

How do you clear the airway if no meconium is present?

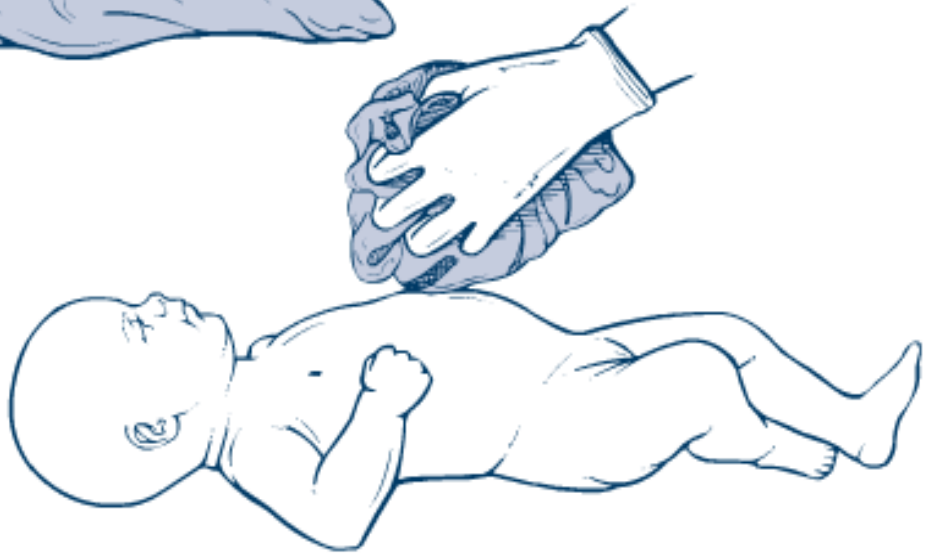
Mouth first…



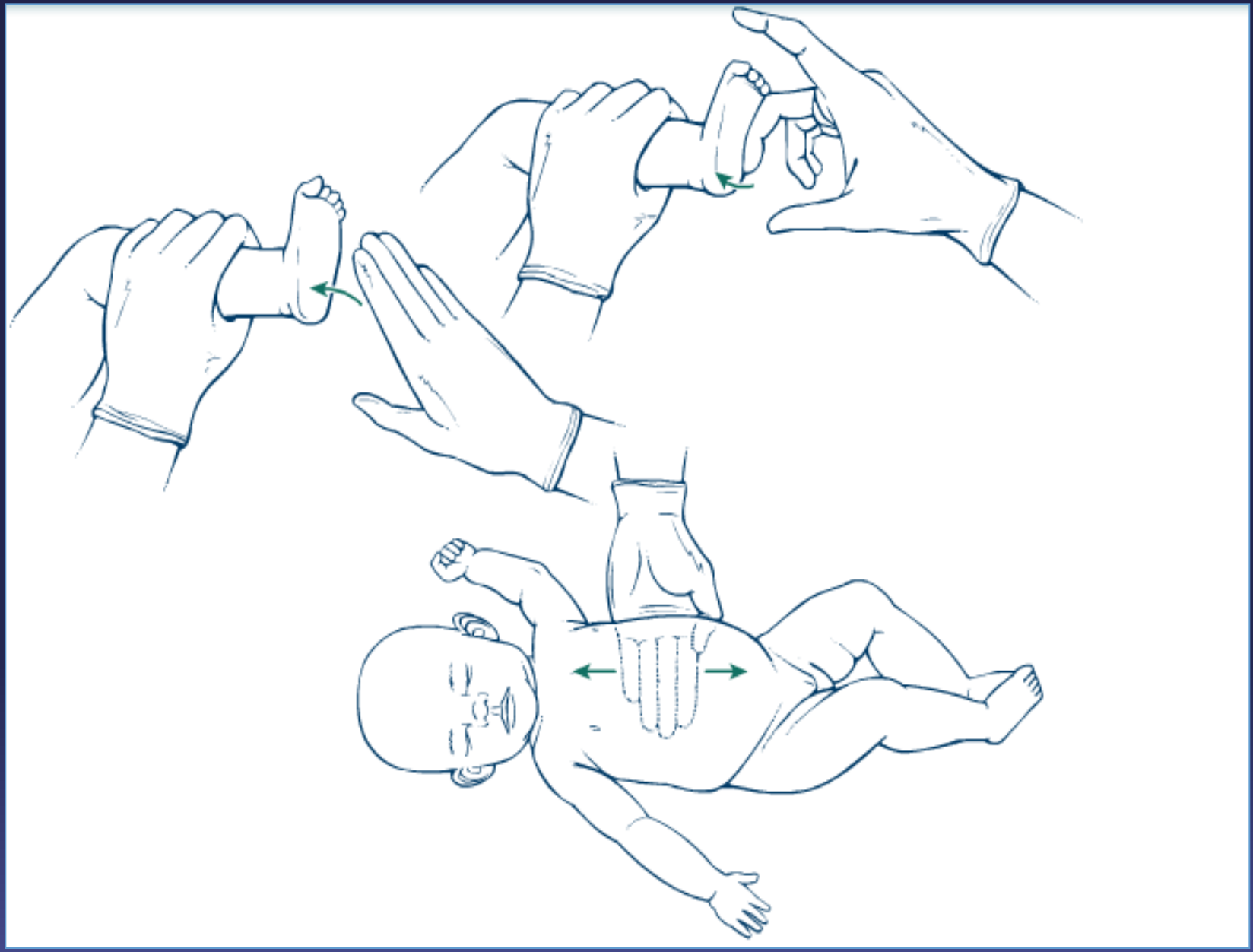
then nose

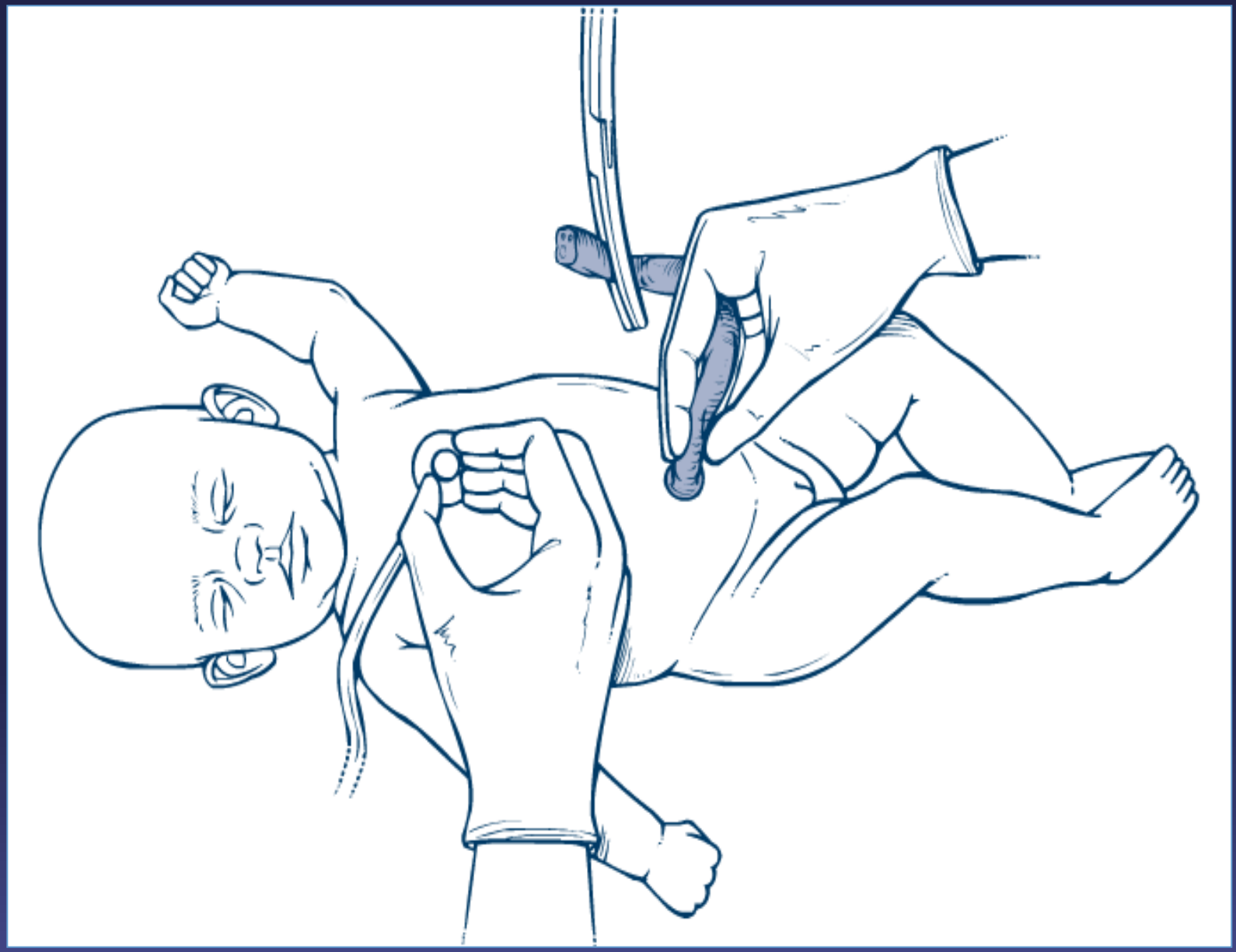
Dry thoroughly

Remove wet linen



Reposition the head



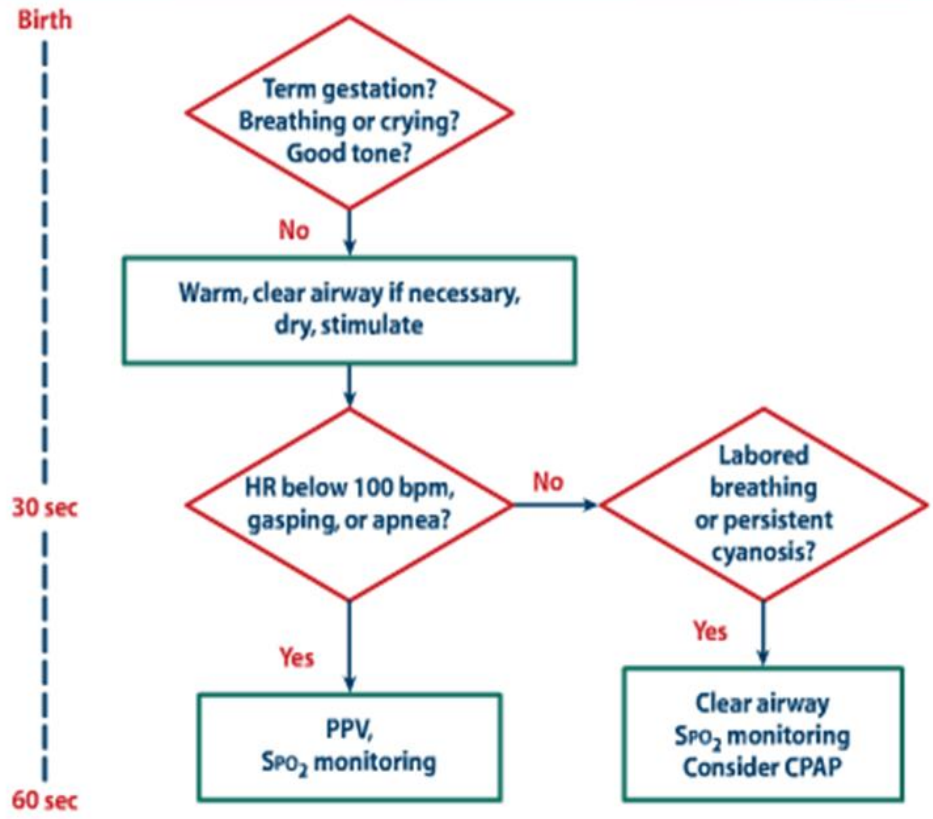


Evaluation

B

Breathing

What do you do if the heart rate or respirations are abnormal?



Targeted Pre-ductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

C

Circulation

- If heart rate <60 bpm despite adequate ventilation for 30 seconds:
  - Provide chest compressions as you continue assisted ventilation
  - Consider intubation of the trachea at this point
  - Evaluate again if heart rate <60 bpm proceed to the next step

D

Drugs

- If heart rate <60 bpm despite adequate ventilation and chest compressions:
  - Administer epinephrine as you continue assisted ventilation and chest compressions
  - Consider intubation of the trachea at this point if not intubated yet

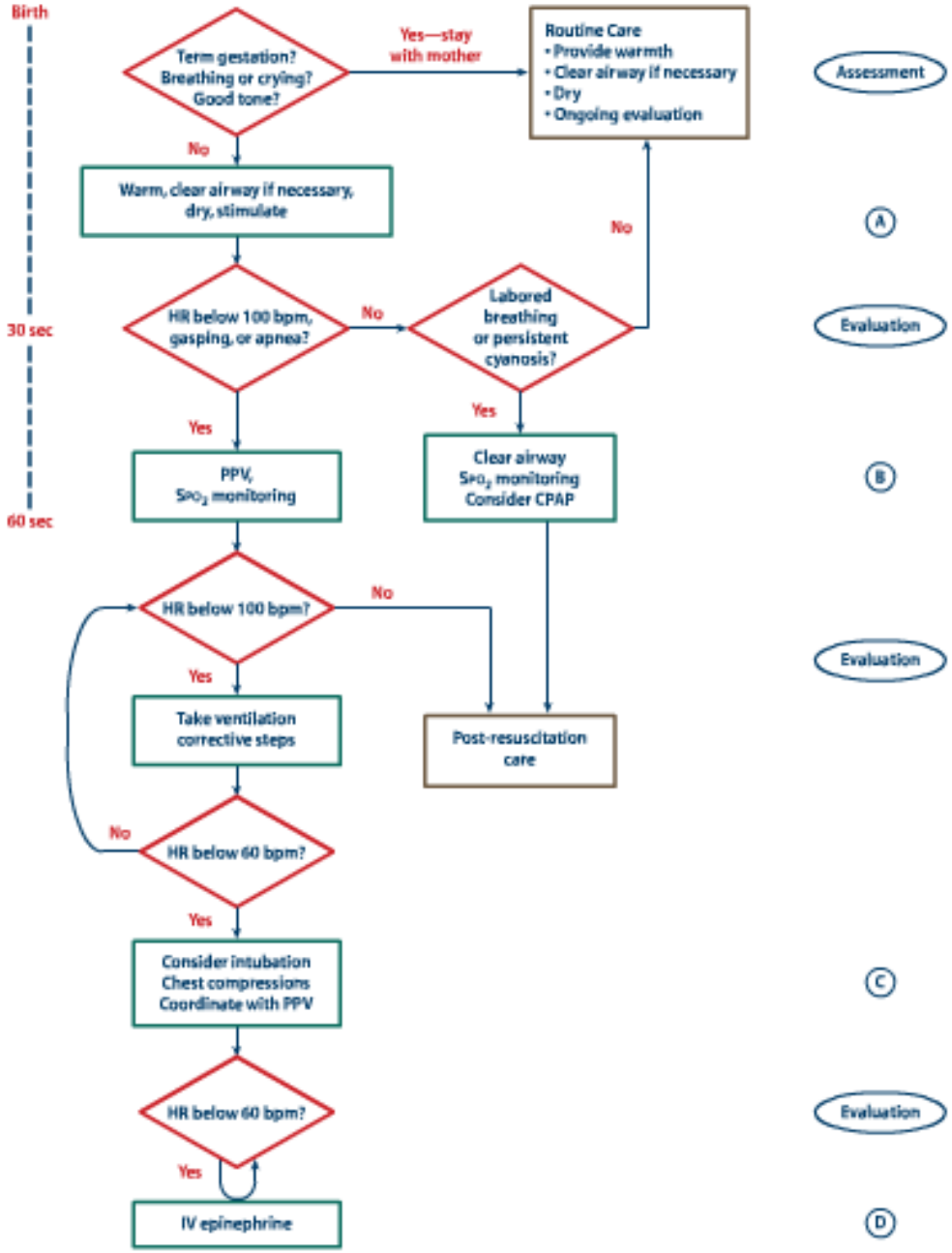
Points to remember

- The most important and effective action in neonatal resuscitation is to ventilate the lungs.
- Effective PPV in secondary apnea usually results in rapid improvement of heart rate.
- If heart rate does not increase, ventilation may be inadequate and/or chest compressions and epinephrine may be necessary.

Points to remember

- HR <60 bpm → Additional steps needed
- HR >60 bpm → Chest compressions can be stopped
- HR >100 bpm and breathing → PPV can be stopped
- Always proceed to the next step if no improvement after 30 seconds

The resuscitation flow diagram



APGAR's Score

Apgar's score

- In 1952, Dr Virginia Apgar devised a scoring system that was a rapid method of assessing the clinical status of the newborn infant and the need for prompt intervention to establish breathing.
- Parameters assessed:
  - Color, HR, RR, reflexes and muscular tone.

Apgar's score

Section 10 Why is the Apgar score *not* used to guide resuscitation?

APGAR SCORE

Gestational Age _____ weeks

SIGN	0	1	2	1 minute	5 minutes	10 minutes	15 minutes	20 minutes
Color	Blue or Pale	Acrocyanotic	Completely Pink					
Heart Rate	Absent	< 100 bpm	> 100 bpm					
Irritability	No Response	Grimace	Cry or Active Withdrawal					
Muscle Tone	Limp	Some Flexion	Active Motion					
Respiration	Absent	Weak Cry; Hypoventilation	Crying					
			TOTAL					

Comments:

Resuscitation					
Minutes	1	5	10	15	20
Oxygen					
PPV/NCPAP					
ETT					
Chest Compressions					
Epinephrine					

Limitations of Apgar's score

- Might be depressed due to
  - Maternal causes (anesthesia, drugs).
  - Neurological conditions.
- It is not always a good indicator for later outcomes.
- It does not correlate well with perinatal or intrapartum insults.

Infant of diabetic mother (IDM)

Why IDM infant is “big”

- Macrosomia:
  - Defined as:
    - Birth weight > 90th percentile for gestational age ***or***
    - Greater than 4,000 g
  - More in IDMs (15% - 45%) vs. normal infants (8% to 14%).

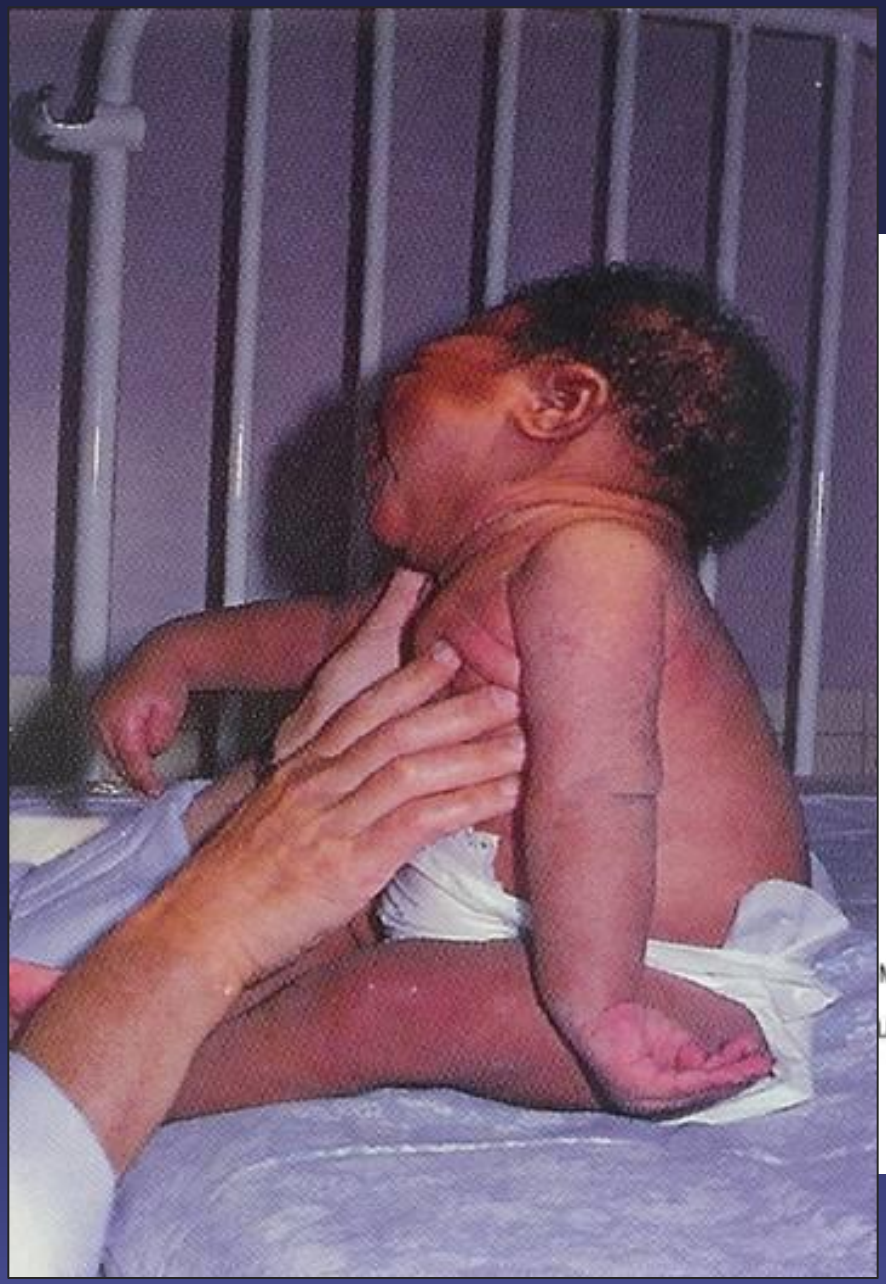
Why IDM infant is “big”

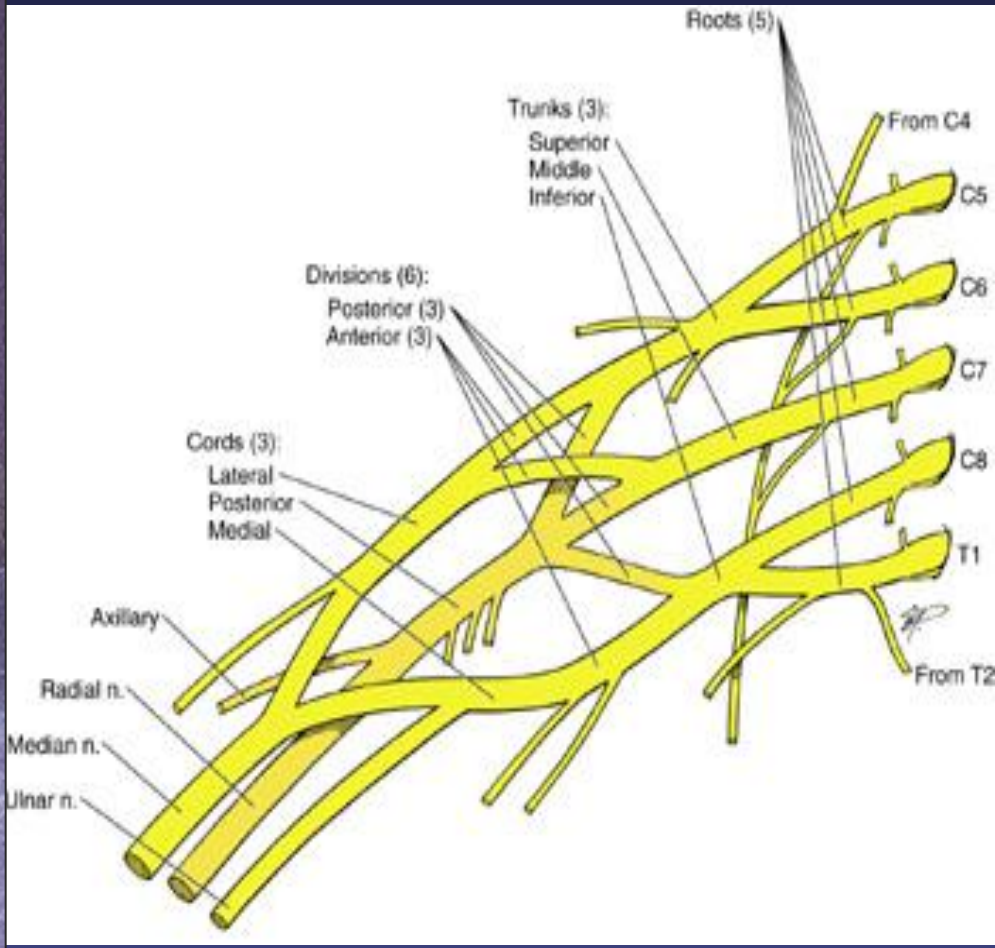
- Fetal hyperglycemia and hyperinsulinemia affect primarily insulin sensitive tissues such as fat.
- The risk of macrosomia is similar for all classes of diabetes (type 1, type 2, and gestational).
- Glycemic control in the 2nd and 3rd trimesters may reduce the macrosomia rate to near baseline.

Why IDM infant is “big”

- Macrosomia is a risk factor for intrapartum injury (shoulder dystocia and asphyxia) and for cesarean delivery.

Erb's Palsy




Roots (5)
Trunks (3):
Superior
Middle
Inferior
From C4
C5
C6
C7
C8
T1
From T2
Divisions (6):
Posterior (3)
Anterior (3)
Cords (3):
Lateral
Posterior
Medial
Axillary
Radial n.
Median n.
Ulnar n.

Preterm Infant

Prematurity

- By gestational age
  - Early preterm – 23 to 33 6/7
  - Late preterm – 34 to 36 6/7
- By weight
  - ELBW - less than 1000g
  - VLBW - less than 1500g
  - LBW -less than 2500g

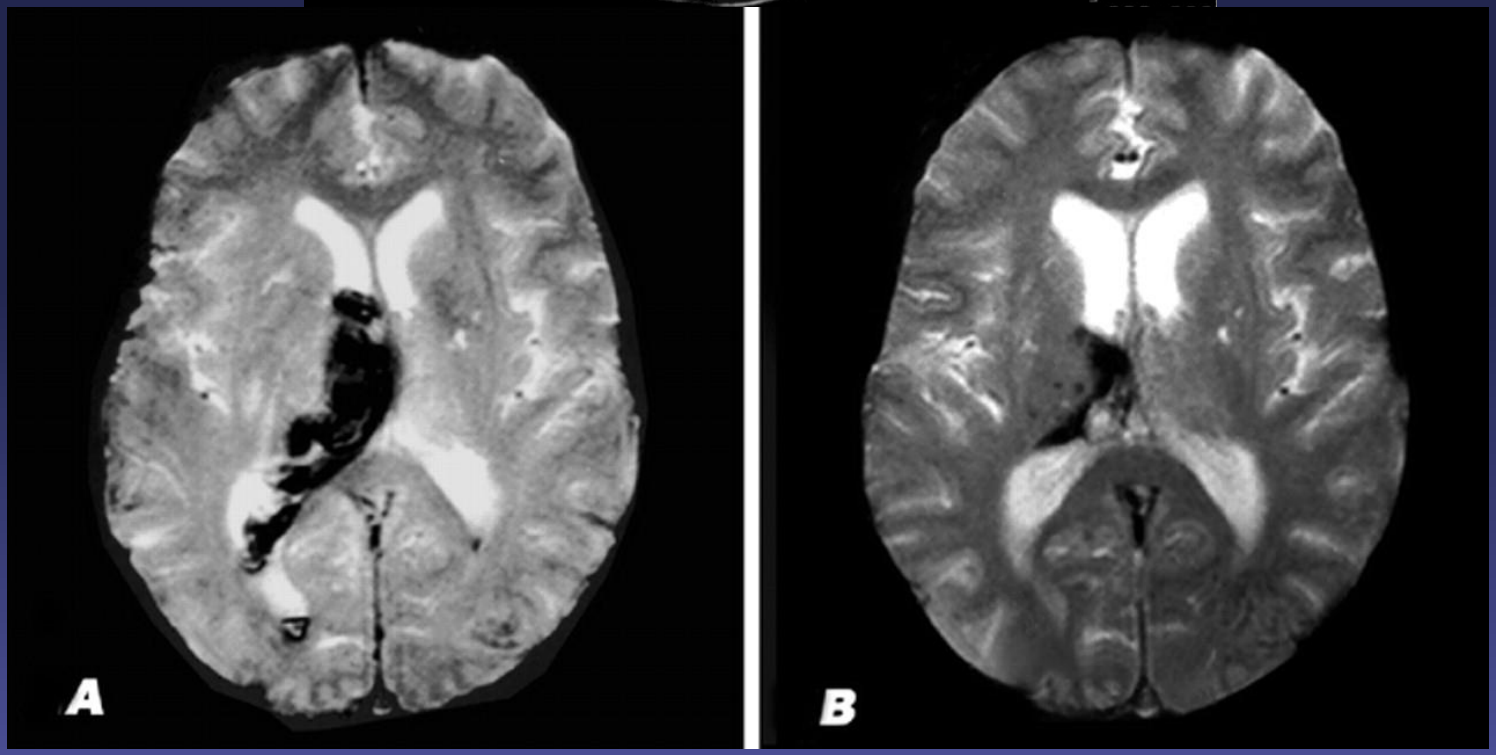
Prematurity Causes

- Maternal
  - Chronic illnesses
  - Uterine anomalies
  - Others
- Placental
  - Insufficiency
  - Hemmorhage
- Fetal
  - Infections
  - Genetic and chromosomal

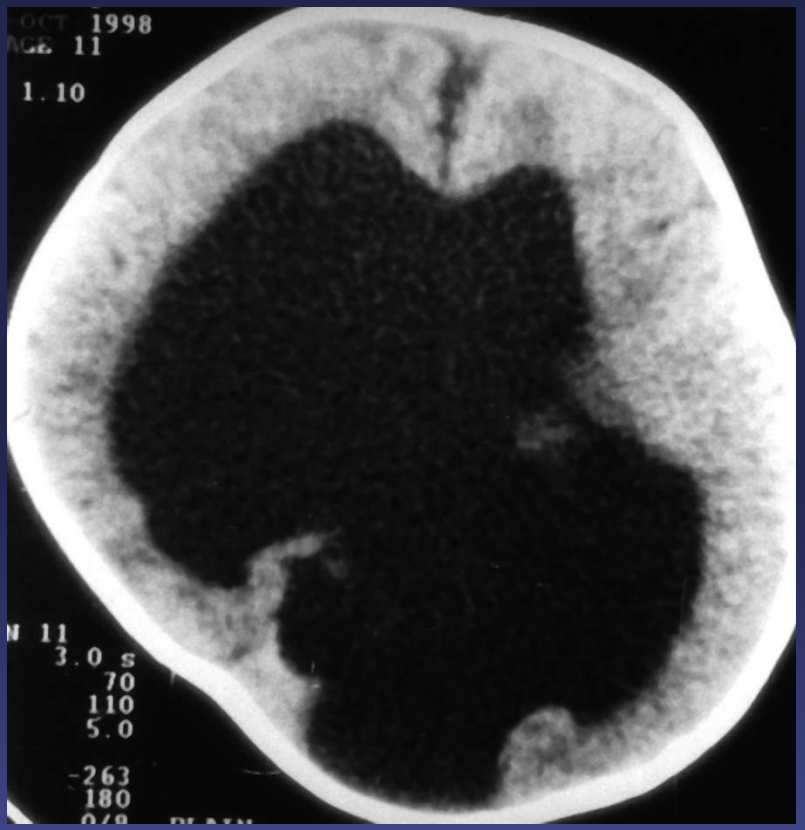
Why Are The Preterm At Risk?

- Surfactant deficiency.
- Poor temperature control.
- Decreased respiratory drive.
- Weak muscles make spontaneous breathing difficult.
- Oxygen toxicity.
- Possible infection.
- Susceptibility to IVH.
- Susceptibility to hypovolemia due to blood loss.

IVH



Hydrocephalus



Neonatal Mortality Associated with Prematurity, USA (2003-2005)

Gestational Age *(completed weeks)*	% Survival if admitted to NICU
23	38-66
24	43-81
25	85-92
26	86-93
27-32	86-98

The Morbidity of Extreme Prematurity

- Risk of all significant morbidities relate to degree of prematurity, At 23 weeks:
  - BPD 50-70%
  - White Matter Injury 32%
  - NEC 9%

Dysmaturity

vs.

Prematurity

Dysmaturity

- A complex of signs occurring in an infant, such as a relative absence of subcutaneous fat, skin wrinkling, prominent fingernails and toenails, and a meconium staining of the skin and the placental membranes, that is associated with postmaturity or placental insufficiency.

Post term infant

IUGR vs. SGA

- IUGR
  - Failure of normal fetal growth caused by multiple adverse effects on the fetus.
- SGA
  - When infant birth-weight is < population norms (lower than a predetermined cutoff weight.) or
  - Having a birth-weight <10th percentile for gestational age or >2 standard deviations below the mean for gestational age.

IUGR

- What is the cause of the IUGR?
- When was it detected?
- Are there signs of fetal compromise?

IUGR complications

- Increased risk of perinatal complications
  - Perinatal asphyxia.
  - Cold stress.
  - Hyperviscosity (polycythemia).
  - Hypoglycemia.

Outcomes of IUGR infants

- The most important determinant of IUGR outcome is its cause
  - Infants with chromosomal disorders or congenital infections (eg, CMV) experience early IUGR, and commonly have a disability.
  - Preterm IUGR infants have a risk of major disability (eg, CP or MR) that is similar to AGA preterm of the same size.

Congenital Malformations

Congenital Anomalies

- Congenital
  - The presence of the defect at birth
- Major (2% to 3% of live born infants)
  - Medical and social consequences (cleft palate and neural tube defects).
- Minor (Up to 15%)
  - No significant health or social burden (epicanthal folds and a single palmar crease).
- Normal phenotypic variants
  - Physical differences occurring in 4% or more individuals of a general population.

Major

Minor

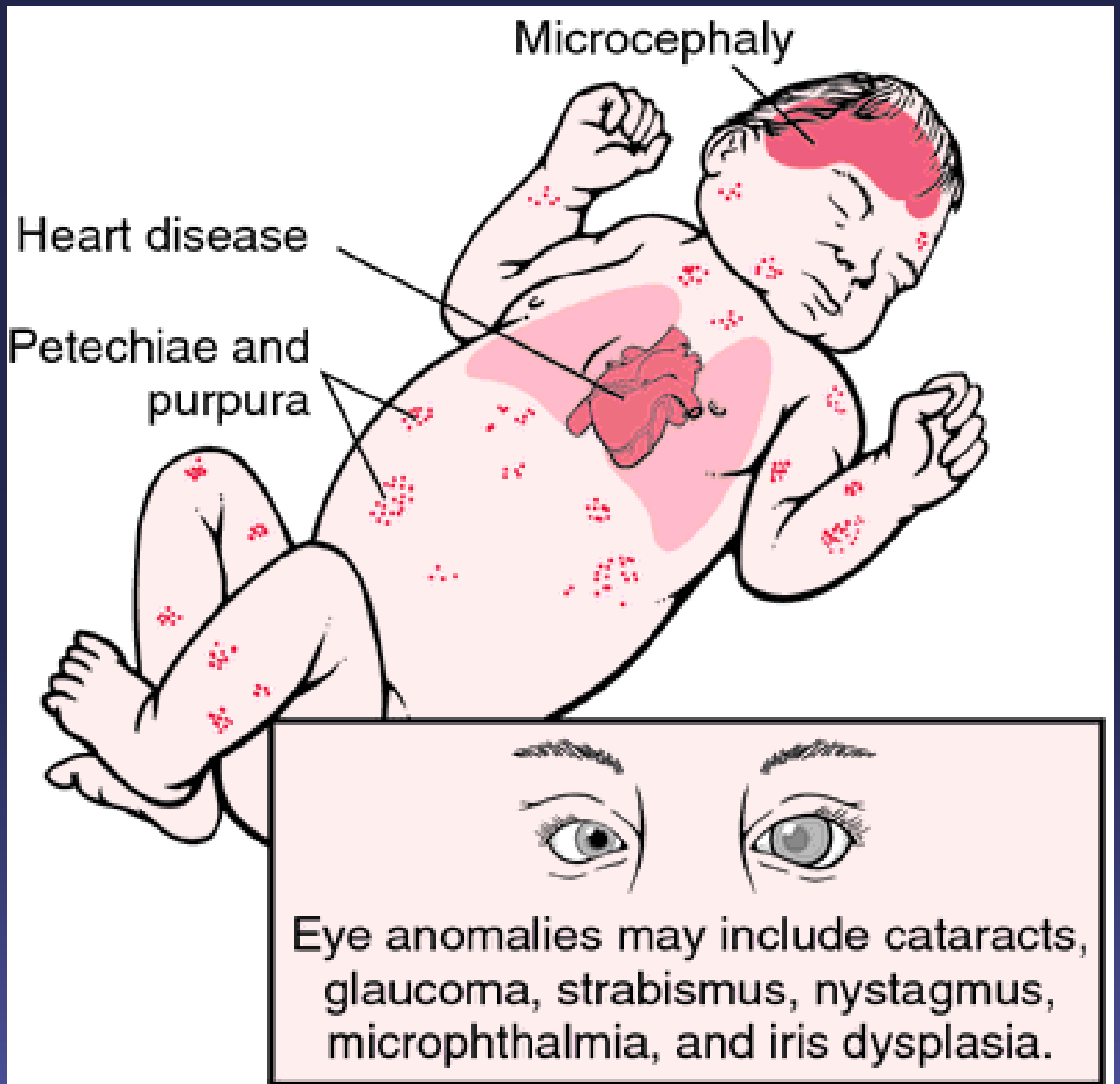
Normal variant

Simian crease

Malformations

- Abnormal processes during the initial formation of a structure
- May result in:
  - Faulty configuration (transposition of the great vessels).
  - Incomplete formation (cleft palate).
  - Agenesis (absence of radius).
- May be the result of:
  - Genetic - chromosomal (10%) and single gene defects (4%).
  - Environmental insults (teratogens).
    - Drugs - thalidomide .
    - Congenitally acquired viruses – Rubella .
- Multifactorial in 25%, unknown in 40%-45%

Congenital Rubella



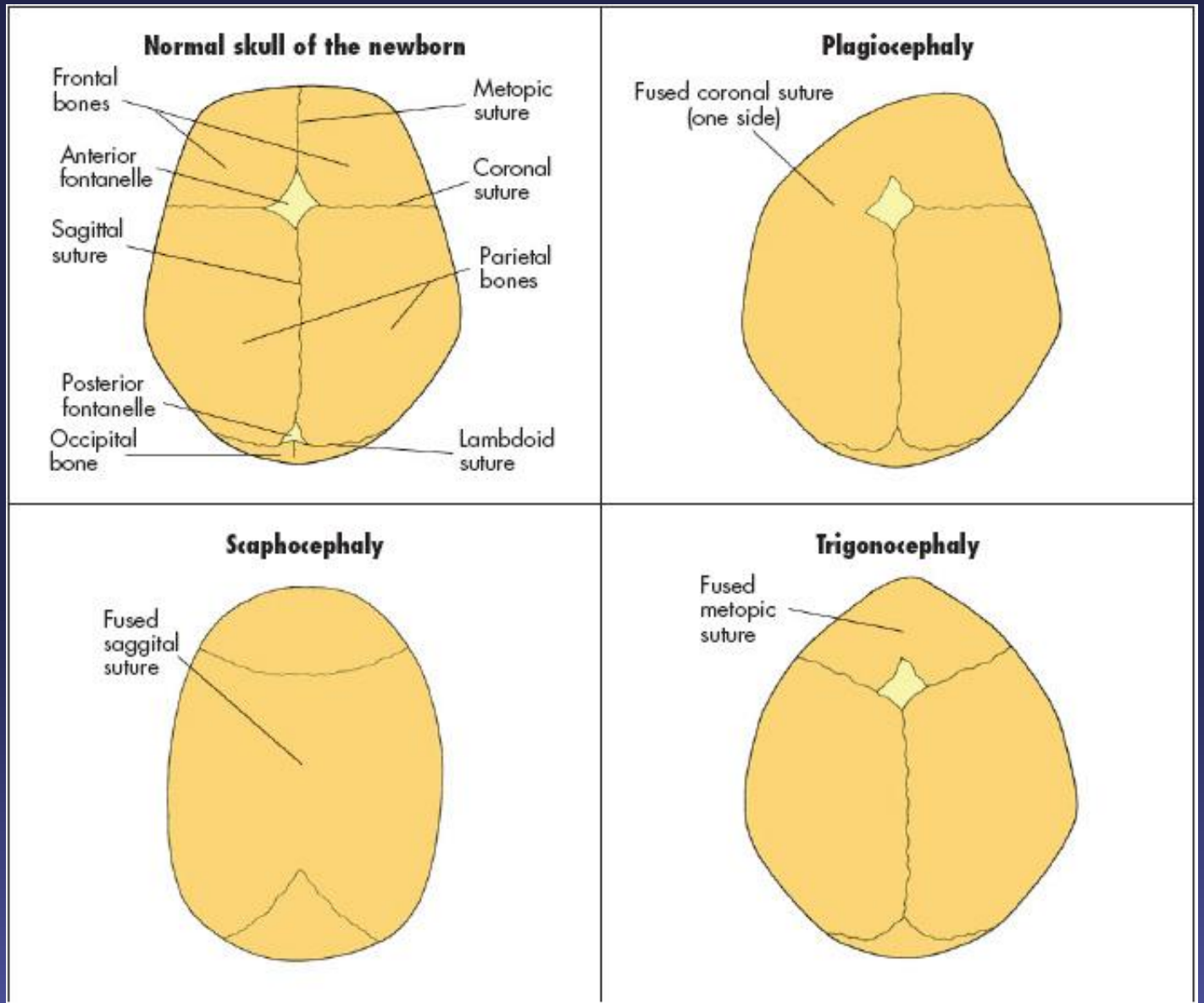
Malformations - Cleft lip and palate

Deformations

- Unusual and prolonged mechanical forces acting on normal tissue.
- External (uterine constraint) vs. intrinsic (edema).
- Mostly Musculoskeletal tissues
  - Tibial bowing and hip dislocation associated with breech presentation.
  - Webbing of the neck associated with the involution of a giant cystic hygroma).
  - Craniostenosis resulting from in utero constraint.
- Typically improve postnatally.
- Resolution depends on the duration of the abnormal forces and the extent of subsequent growth.

Deformations

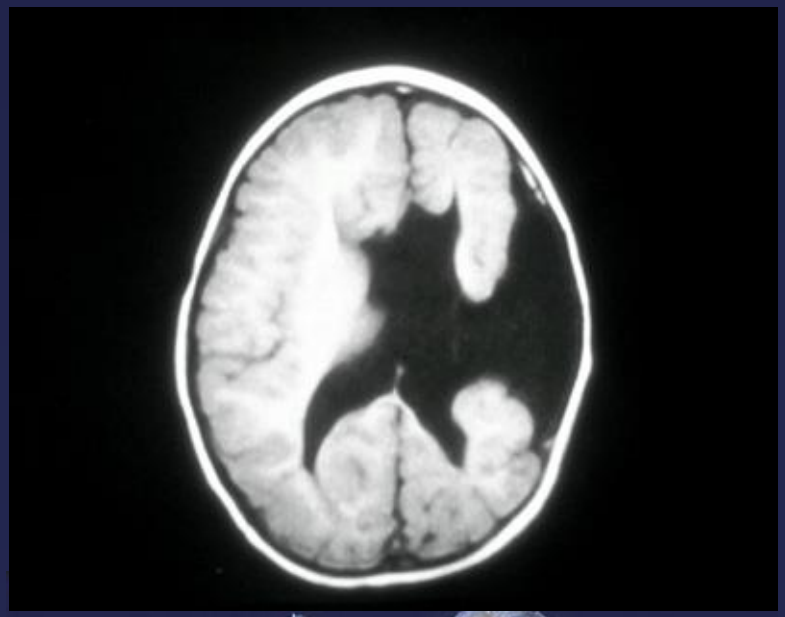
Deformations



Disruptions

- Breakdown of normal tissue after formation
- Causes
  - Mechanical compressive forces, hemorrhage, thrombosis, and other vascular impairments.
- Manifestations
  - Alterations of configuration, division of parts not usually divided, fusion of parts not usually fused, and the loss of previously present parts.
- Examples
  - Porencephalic cyst secondary to a vascular accident.
  - Limb amputations caused by amniotic bands.

Disruptions



Dysplasia

- Abnormal cellular organization or function.
- Typically affects a single tissue type.
- Examples
  - Hamartomas, ectodermal dysplasia, and skeletal dysplasias.

Ectodermal dysplasia

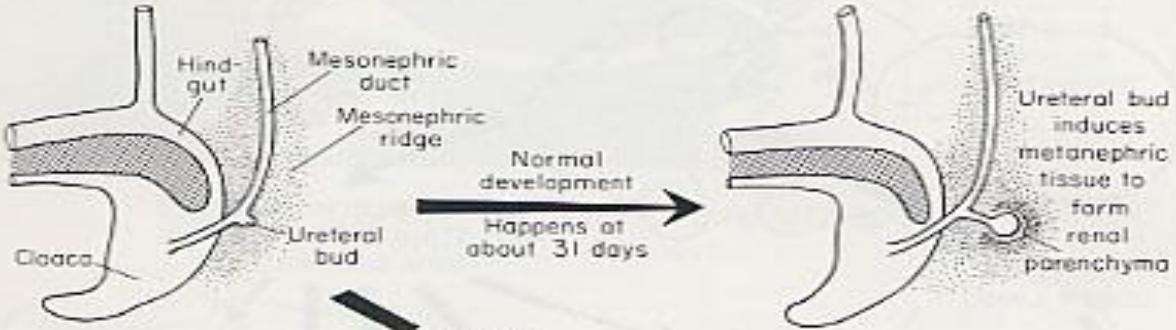
Multiple malformations

- 0.7% of live births
- Sequence vs. Syndrome

A malformation *sequence*

- All of the anomalies can be explained on the basis of a single problem
- Examples
  - Oligohydramnios sequence
  - Pierre Robin sequence

POTTER'S SYNDROME
The Consequences of Renal Agenesis



Defective development

RENAL AGENESIS

LACK OF URINE into amniotic cavity

Relative lack of amniotic fluid during fetal life

Amnion nodosum

Pulmonary hypoplasia

Death from respiratory insufficiency

Fetal compression

Breech presentation

Altered facies

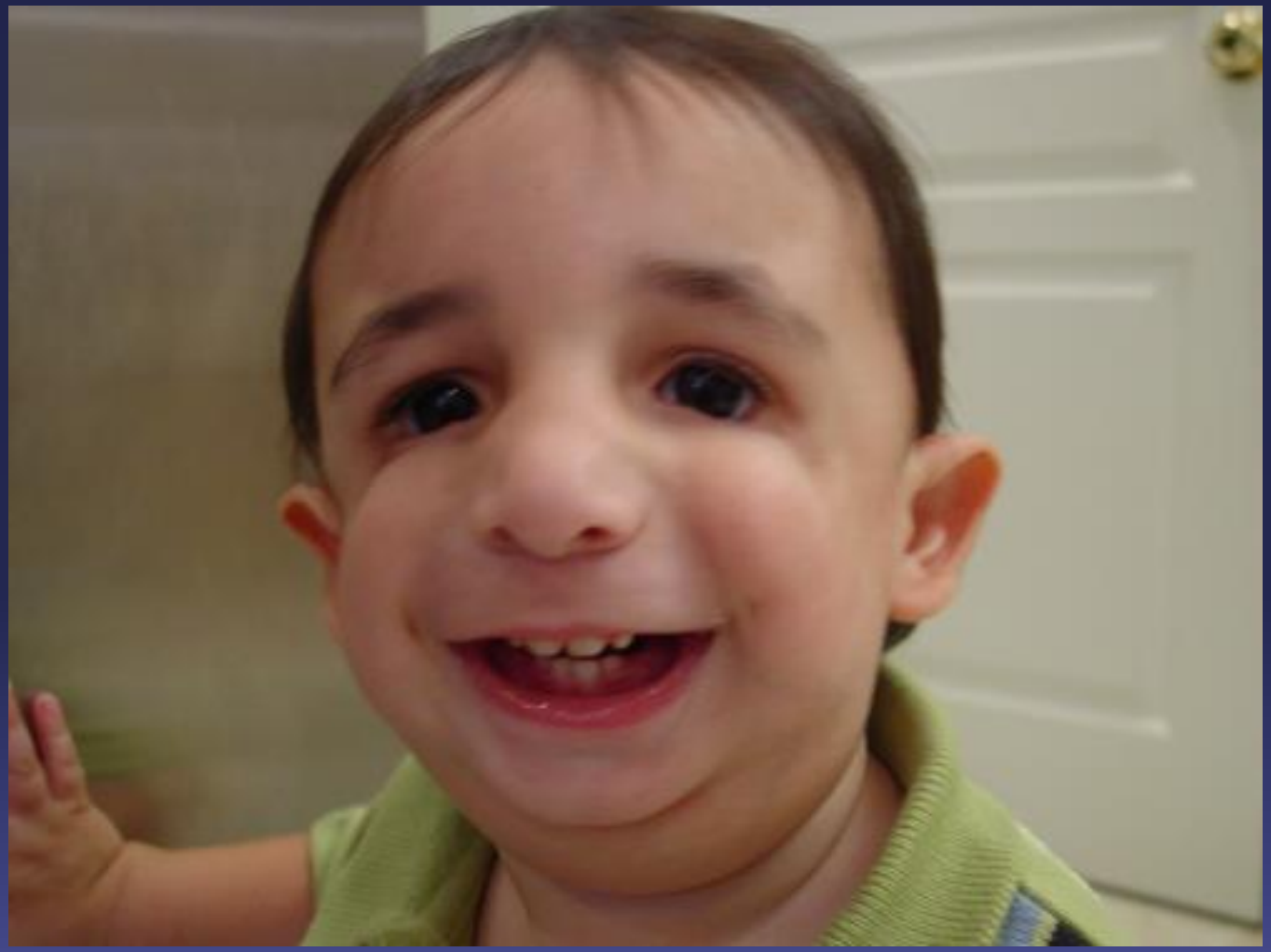
Abnormal positioning hands and feet

A malformation *syndrome*

- Multiple structural defects that are NOT explained on the basis of a single initiating defect but share a cause (chromosomal abnormalities, mutant gene disorders, or environmental teratogens)

Trisomy 13 and Trisomy 18

Tracher collins syndrome



Thank You