Pediatric Rounds

A newborn with Cyanosis

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Please refer to Cardiology lectures 1 & 2
Please Use the Slide Show view to benefit from step wise animation of the case presentation and to have a chance to think in the case

The chief complaint inquiry

A full term 12 hour male neonate was in his mothers room at the hospital.

You were called to her room because he was noted to be cyanotic.

What else do you need to know? ……

- When did it start
- Where is the cyanosis (face, mouth and mucous membranes, fingers and toes??)
- How severe is it (is there pulse oxymeter reading at the time)
- Was it transient or still persistent
- Was it aggravated by anything (feeding, crying, post vomiting)
- Was it relieved by anything (stimulation, spontaneous, oxygen)

The chief complaint Story

The mother says she had noticed bluish discoloration of the baby's face few minutes ago, it involved the face, the mouth, the tongue, and the finger tips. She thought he looked very blue, but no measurement was done yet. It lasted for a minute but now he is better. The baby was crying when that was first noted. He had his feed 2 hours ago and he fed well and he was not cyanotic during feeding. The mother believes that he is now better after he stopped crying, no oxygen was given.

How would you proceed with history taking?.....

HPI inquiry

Think about the other important questions that you need to ask

Hint:

Make a short list of possible etiologies

Example of your short list of etiologies for an episode of cyanosis in a neonate:

- Respiratory (apnea episode, bronchospasm due to aspiration, infection..)
- Cyanotic CHD
- CNS (seizure)
- Sepsis

Note: The list of differential may not be completely inclusive of all the possible etiologies, it should include common ones. This will guide you for your HPI inquiry

Ask about the following

Respiratory symptoms inquiry

- Was the baby breathing during episode (was the chest moving)
- was there noisy breathing (wheeze, stridor, grunting)
- Is the nose blocked?
- Was there any preceding vomiting, chocking, regurgitation?

Cardiac symptoms

- Cold extremities
- Easily fatigued, or poor feeding, diaphoretic
- Any urine output?

CNS symptoms

- Any abnormal movements? (eyes, mouth)
- Was he conscious?
- Was he floppy?

Sepsis symptoms

- Was he noted to be warm, or cold?
- Did he feed well
- Any rash noted?

Other important things to inquire about

- Gestational age, mode of delivery, APGAR score, any oxygen needed immediately after birth..
- Prenatal issues: maternal fever/ infections, maternal diabetes, any suspected malformations if fetal detailed ultrasound was done, normal fetal movements… etc
- Family history of malformations, seizure disorders, developmental delay, genetic disorders… etc

The HPI Story

The mother says that she was asleep when she heard the baby crying, but during the crying his chest was moving normally. There was no noisy breathing, and his nose was not blocked. There was no evidence that the baby had vomited or regurgitated during his sleep. Now the baby is breathing normally according to her.

She had fed him two hours ago, and he fed well with no fatigue, sweating, or chocking. He slept after feeding. She changed his diaper 3 hours ago, and he had urine output.

She did not note abnormal movement of his eyes or mouth, he was consolable and conscious. She did not know what is “floppy”. He did not feel him warm or cold, and had no rash.

Other important data

Gestational age is 39 week, born by normal delivery

No oxygen required, APGAR 7/9

No maternal fever or infections

Mother is diabetic, was on insulin, well controlled as she said

No detailed scan done for the fetus

Normal fetal movement during pregnancy

No family history of malformations, or other genetic or CNS disorders

How does the story help you in differential diagnosis? The following is example of critical thinking

- **Respiratory?** Not likely obstructive apnea since there was no nasal blockage or noisy breathing. Also not likely respiratory infection or respiratory distress (full term, no rapid breathing)
- **Cyanotic heart disease?** A possibility since there is central cyanosis that increases with crying, and with absence of respiratory symptoms. Also cyanotic heart disease typically don't cause heart failure symptoms.
- **CNS?** Seizure that preceded the crying is still a possibility because there was no witness. Neonatal seizure can cause cyanosis due to impaired breathing or apnea. Also hypoglycemic seizure is a possibility in infants of diabetic mothers (last feed was 2 hours ago)
- **Sepsis:** Although there is no risk factors for sepsis, it should be considered in the differential diagnosis

Now, we should complete the assessment of this baby by physical exam

What is the importance of the physical examination?

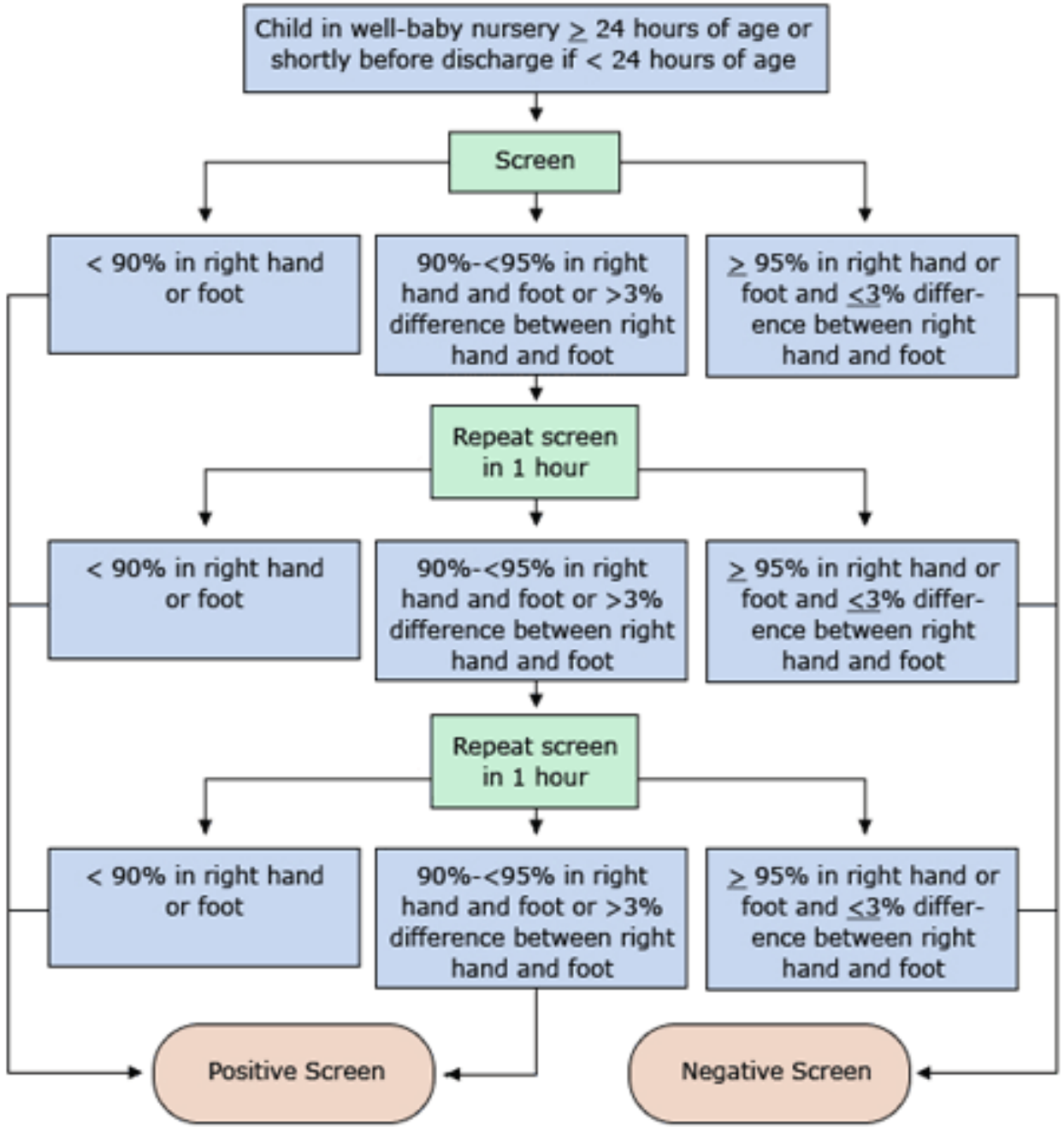
Think of the physical examination, how would every step help you to:

1) Confirm the presence of cyanosis
2) Quick screening for life threatening conditions (hypoglycemic sz)
3) Re-order the list of differential diagnoses based on the more likely vs the less likely

Proceed for guidance

Vital signs

Sign	Importance
Respiratory rate	Know the normal value in the neonate. Respiratory infections or aspiration results in tachypnea. Low breath rate may indicate CNS depression (apnea or hypopnea)
Heart rate	Know the normal value in this age Tachycardia is a non specific sign, in this scenario it may be an early sign of sepsis
Blood pressure	Know how to find out the normal value in this age Low blood pressure in this scenario may be a late sign of sepsis (septic shock), which is not likely based on the story
Temperature	Both hypothermia and hyperthermia (fever) are important to detect. They both may be signs of sepsis in this scenario
Pulse oximetry	Even if the baby does not look cyanotic at the moment, measuring pulse oximetry is of extreme importance because it is more sensitive in detecting hypoxemia. Note: pulse ox should be measured in right arm (preductal), and in lower limbs (post-ductal) **IMPORTANT: In the next slide you will find the pulse ox screening guide for neonates**
Glucocheck	Bedside glucose measurement should be done immediately to RO hypoglycemia (life threatening condition)


Child in well-baby nursery ≥ 24 hours of age or shortly before discharge if < 24 hours of age
Screen
< 90% in right hand or foot
90%-<95% in right hand and foot or >3% difference between right hand and foot
≥ 95% in right hand or foot and ≤3% difference between right hand and foot
Repeat screen in 1 hour
< 90% in right hand or foot
90%-<95% in right hand and foot or >3% difference between right hand and foot
≥ 95% in right hand or foot and ≤3% difference between right hand and foot
Repeat screen in 1 hour
< 90% in right hand or foot
90%-<95% in right hand and foot or >3% difference between right hand and foot
≥ 95% in right hand or foot and ≤3% difference between right hand and foot
Positive Screen
Negative Screen

General exam and Growth parameters

Sign	Importance
Weight	Large for gestational age is associated with infant of diabetic mother Cyanotic heart disease usually is associated with normal birth weight unless associated with severe genetic or chromosomal disorders
Height	Know the normal length for neonates
Head circumference	Know the normal values for neonates Microcephaly may be present in some syndromes (e.g. Down syndrome). Syndromes may be associated with CHD
Dysmorphism	Features of dysmorphism may indicate syndromes, which may be associated with congenital anomalies (CHD), CNS anomalies and seizures.
General appearance	Color: Cyanosis, central or peripheral? Signs of respiratory distress (retractions, flaring, grunting..) Posture of the baby (normal babies are in flexed position) You should know the normal posture, and the signs of hypotonic posture in neonates (extended upper limbs, frog like position of lower limbs) Activity of the baby: hypoactivity may indicate sepsis Skin rash, Mottling of skin (indicate sepsis)

Systematic exam

	Sign	Importance
Respiratory System	**Signs of respiratory distress, pattern of breathing, is there apnea or hypopnea**	Indicates increased respiratory effort, points to respiratory disease, such as aspiration, infection Hypopnea may be related to CNS depression
	Check for added sounds on auscultation	May indicate respiratory infection (not likely in this scenario)
Cardiovascular system	**Checking peripheral perfusion, capillary refill, quality of pulse**	Prolonged capillary refill and poor peripheral pulses indicate poor perfusion (not likely for cyanotic heart disease) Bounding pulses indicates that the ductus is patent
	Auscultation: looking for abnormal sounds and murmurs	If murmur present, it indicates CHD, however absence of murmur does not rule out CHD
Neurological exam	**Hypotonia, diminished primitive reflexes, Hyperpigmented or hypopigmented skin lesions**	Indication of CNS anomalies which my indicate seizures as a cause of cyanosis

Physical examination findings

- Vital signs: RR 42, HR 135, BP 68/38 in right arm, Temp 37.2, Oxygen saturation **84%**. Warm extremities. Glucose 85 mg/dL (normal)
- Wt 3.4 Kg, Height 50 cm, HC 35 cm
- Not dysmorphic
- Pink, **does not appear cyanotic**
- No respiratory distress.

- **Question: How do you explain that the baby does not appear cyanotic but the saturation is 84%?**

Click for Answer

Systemic exam findings

- Normal respiratory effort, normal breath sounds
- Normal S1 S2, with no murmurs detected, normal pulses and normal perfusion
- Normal tone, normal spontaneous movements, normal primitive reflexes
- No skin rash or skin lesions

(NORMAL EXAMINATION)

What is your impression?

Based on the history of physical findings, the clinical scenario is consistent with

Cyanotic heart disease

Explanations:

No respiratory signs, no apnea or tachypnea

Low saturation cannot be attributed to seizure because the baby is active and conscious with persistent desaturation

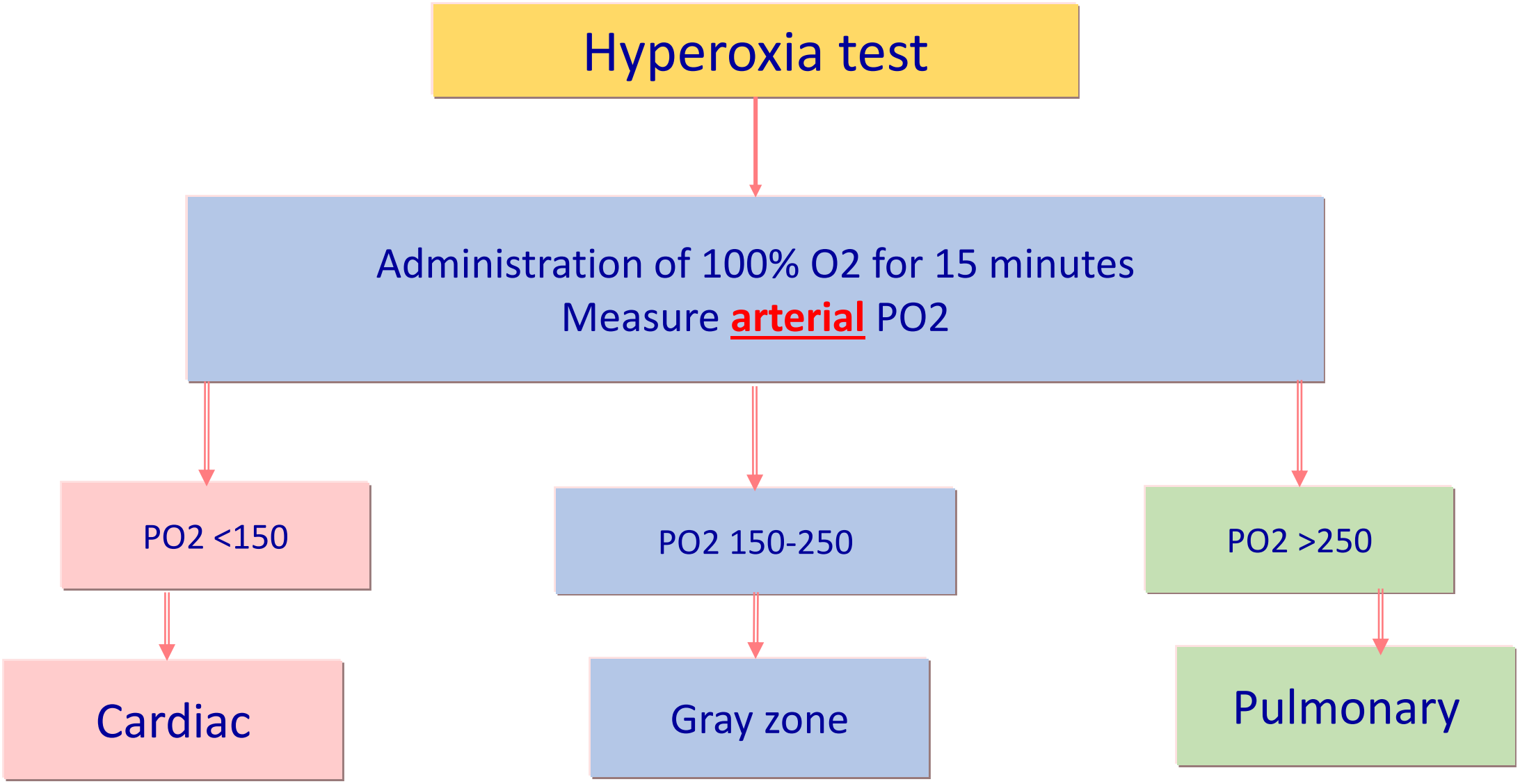
No signs of sepsis

Name specific congenital heart diseases that result in cyanosis?

Tetralogy of Fallot, Transposition of great arteries, Tricuspid atresia, Truncus arteriosus, Total anomalous pulmonary venous return, Ebstein anomaly, Pulmonary atresia with or without ventricular septal defects, Single ventricle with Pulmonary stenosis (MANY EXAMPLES)

What is your next step in management

- Does the baby need admission to intensive care Unit?
  - Yes
- Does the baby need endotracheal intubation at this point?
  - No
- What do you expect if you give oxygen?
  - For intracardiac shunting that happen in cyanotic CHD, oxygen may not have significant effect on the pulse ox.
  - Check what is called “HYPEROXIA TEST”
- Can a chest radiograph help you in diagnosis?
  - Yes, some cyanotic congenital heart disease have specific CXR findings


Hyperoxia test
Administration of 100% O2 for 15 minutes
Measure arterial PO2
PO2 <150
PO2 150-250
PO2 >250
Cardiac
Gray zone
Pulmonary

How can a radiograph help you in the diagnosis?

<u>Normal CXR in a neonate:</u>

Look for:

- Heart size
- Heart shape
- Mediastinal width, thymus
- Lung fields (plethoric or oligemic indicating increased or decreased blood flow)

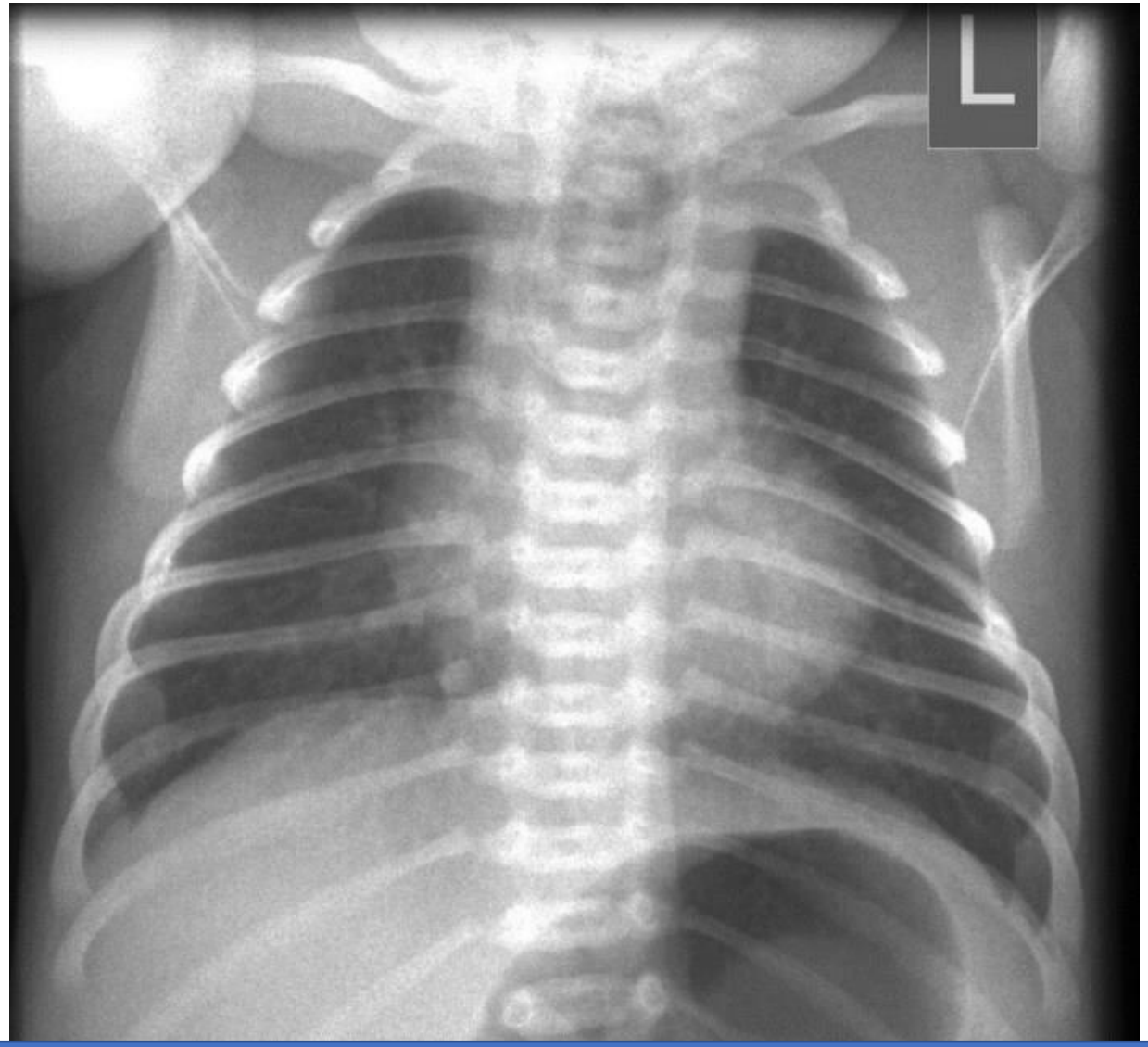
You obtained an X- ray for this baby
What are the findings?

- Cardiomegally
- Abnormal heart shape
  (like an egg on its side)
- Narrow mediastinum
- Plethoric lung fields

These findings are suggestive of TGA

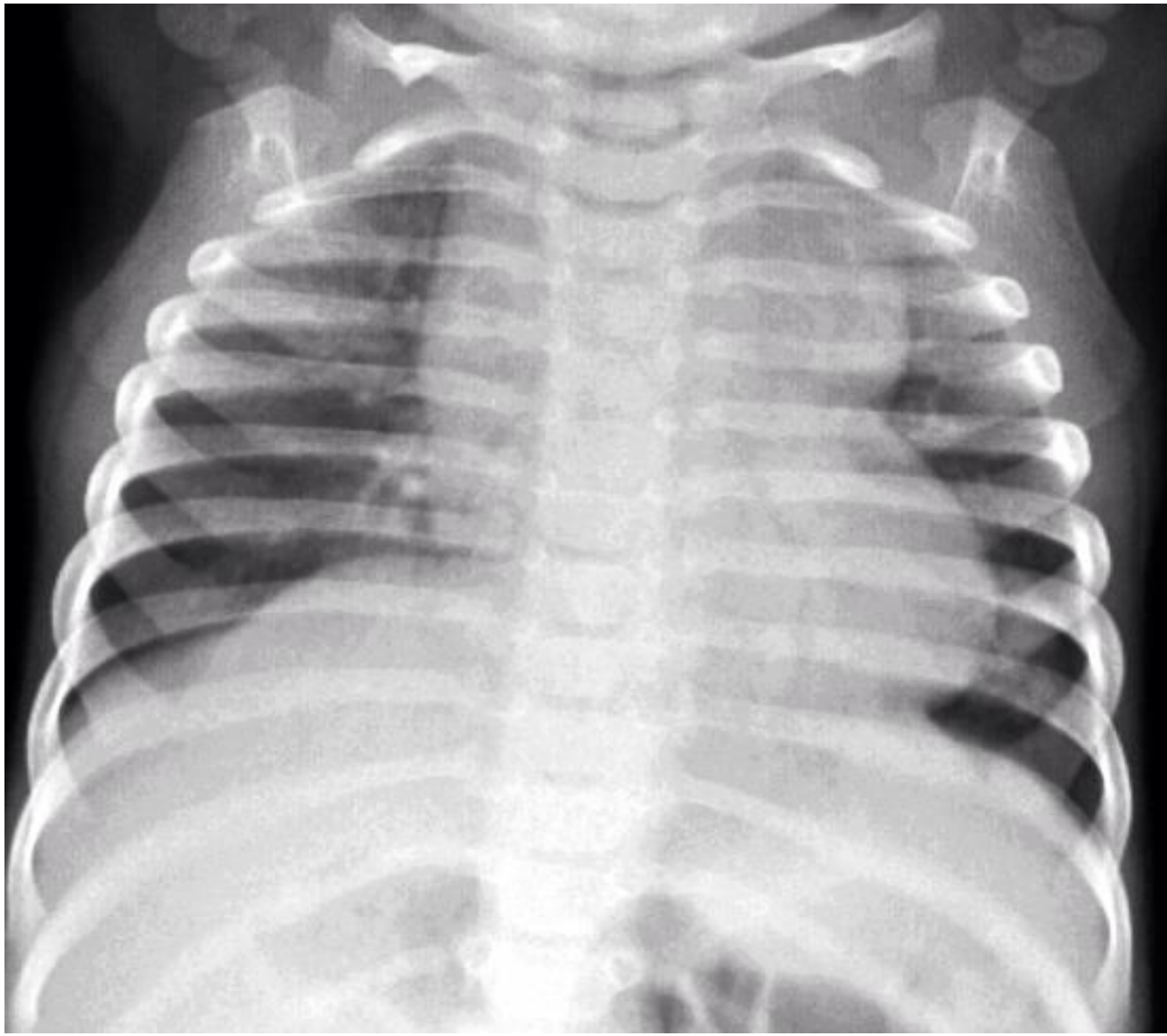
Other examples of X- ray findings

Boot shape heart- TOF



Dark lung fields, indicates decreased pulmonary blood flow
Examples (TOF with severe PS, Pulmonary atresia)

Severely dilated right atrium, dark (oligemic lungs), Ebstein anomaly of the tricuspid valve



Prominent mediastinum, (snow man appearance), may indicate total anomalous pulmonary venous return

Management of the neonate with TGA?

- **You admitted this baby to the NICU**
- **Initial saturation was 84%, but within a few hours it started to drop gradually, what is your explanation?**

  Answer is: The ductus arteriosus is starting to constrict, resulting in decreased saturation.
- **What would you do at this point?**

  Answer is: Start Prostaglandin infusion to keep the ductus arteriosus patent
- **How does the PDA help in these patients?**

  The PDA will result in blue blood crossing from the aorta to the pulmonary artery, resulting in increased red blood returning to the left atrium, and increased red blood crossing from the left atrium to the right atrium, that will go to the right ventricle then to aorta.
- **What is the definitive management?**

  Answer is: surgical repair (arterial switch operation) within the first 1-2 weeks of life

END