

# Common Neonatal Problems

A primer In Neonatal Medicine



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# Disclaimer

This presentation is to help medical students upon the start of their rotation in Pediatrics. It is NOT to replace the recommended textbook.

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# Objectives

By the end of this presentation the student should:

- Know the uniqueness of neonatal pathophysiology affecting illness presentation
- Know some of the most common neonatal problems and their management
- Know the impact of prematurity on neonatal health

# Introduction

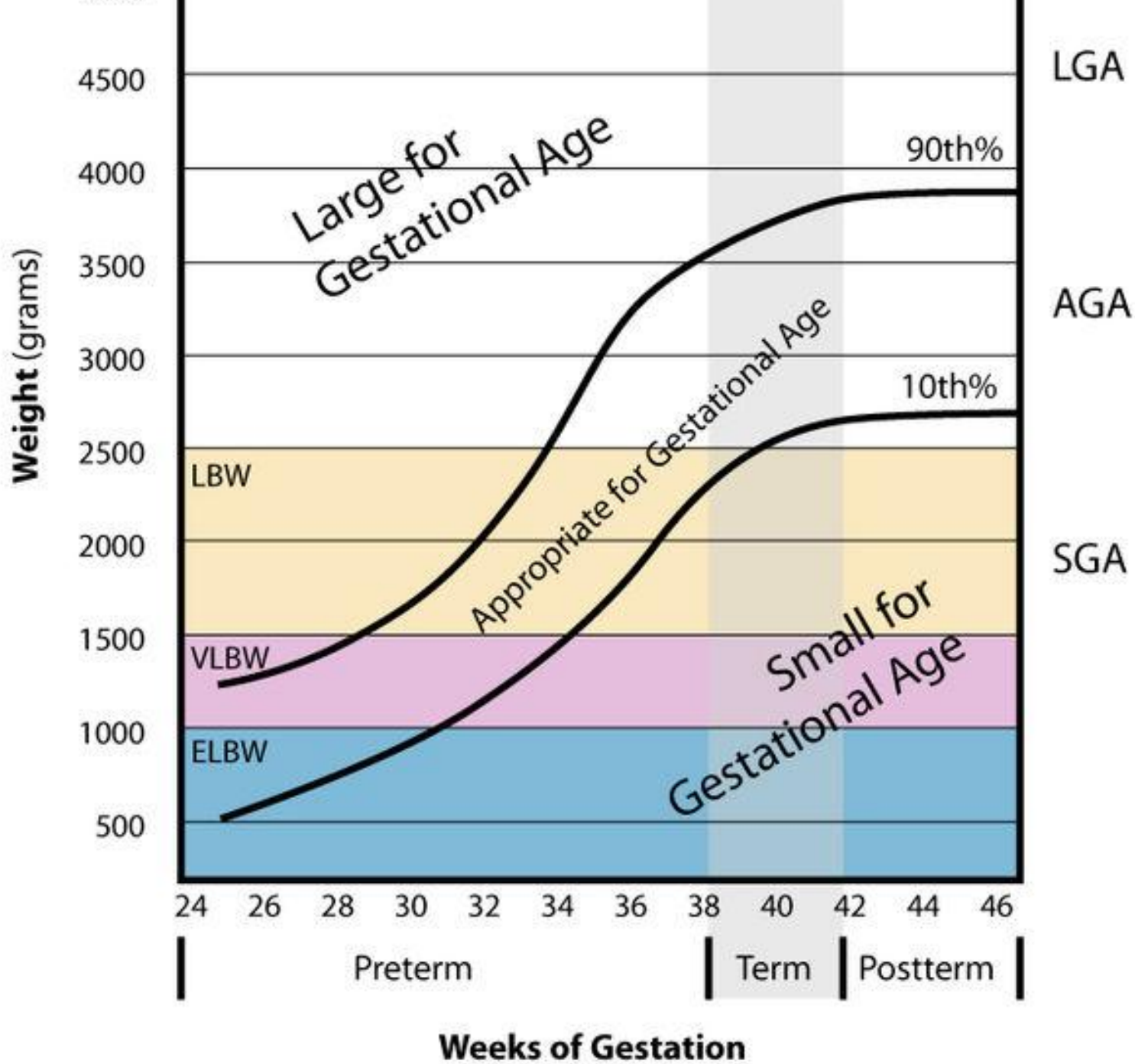
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# Age

- Gestational age (GA)
  - CGA = corrected gestational age
  - PCA = post conceptional age
  - PMA = post menstrual age
- Chronologic age
  - Postnatal day of life = start at 1 on birthday
  - Postnatal age = start at 0 on birthday

# Birthweight

- LBW = low birthweight <2500 g
- VLBW = very low birthweight <1500 g
- ELBW = extremely low birthweight <1000 g



# Signs and Symptoms

- Hypothermia
- Fever
- Cyanosis
- Pallor
- Jaundice
- Apnea
- Tachypnea
- Convulsions
- Jitteriness
- Irritability
- Lethargy
- Pseudo-paralysis
- Poor feeding
- Vomiting
- Diarrhea
- Abdominal distension



# Thermal regulation abnormalities

- Hypothermia: *(more common)*
  - Sepsis
  - Environmental
- Hyperthermia:
  - Environmental
  - Over clothing
  - Dehydration
  - Infection

# Cyanosis

- Central cyanosis :
  - Respiratory insufficiency
  - CNS depression
  - Cyanotic heart disease
  - PPHN
  - Hypoglycemia
  - Sepsis



# Peripheral Cyanosis



# Pallor

- Anemia
- Acute hemorrhage
- Hypoxia
- Hypoglycemia
- Shock
- Adrenal failure
- Sepsis

# Convulsions

- Electrolyte abnormalities : Ca, Na.
- Hypoglycemia
- Inborn error of metabolism
- Drug withdrawal
- Pyridoxine deficiency
- Cerebral anomalies
- Cerebral Infarction
- Intracranial hemorrhage
- Birth Asphyxia
- Meningitis
- Familial

# Convulsions

- Type of convulsions
  - Subtle, focal or generalized
- Needs to be distinguished from:
  - Jitteriness
  - Apnea

# Lethargy

- Asphyxia
- Hypoglycemia
- Sedation
- Cerebral defect
- Inborn error of metabolism
- Sepsis

# Irritability

- Intra-abdominal conditions
- Meningeal irritation
- Drug withdrawal
- Congenital glaucoma
- Sepsis



# Poor Feeding

- Prematurity
- Sick newborn infants:

- Especially Sepsis

# Jaundice

- First 24 hours: *(almost always pathologic)*
  - Erythroblastosis fetalis
  - Sepsis
  - CMV
  - Congenital rubella
  - Toxoplasmosis

# Jaundice

- After 24 hours:
  - Physiologic
  - Hemolytic anemia
  - Inborn Errors of Metabolism (e.g. Galactosemia)
  - Hepatitis
  - Congenital infections
  - Sepsis

# Vomiting

- GI obstruction
- Pyloric stenosis
- Over-feeding
- Milk allergy
- Increased ICP
- Sepsis

# Abdominal Distention

- GI obstruction
- Abdominal mass
- NEC
- Ileus
  - Hypokalemia
  - Sepsis

# Pseudo-paralysis

- Fracture
- Dislocation
- Nerve injury
- Osteomyelitis

# Selected Neonatal Disorders

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# Respiratory Distress Syndrome (RDS)

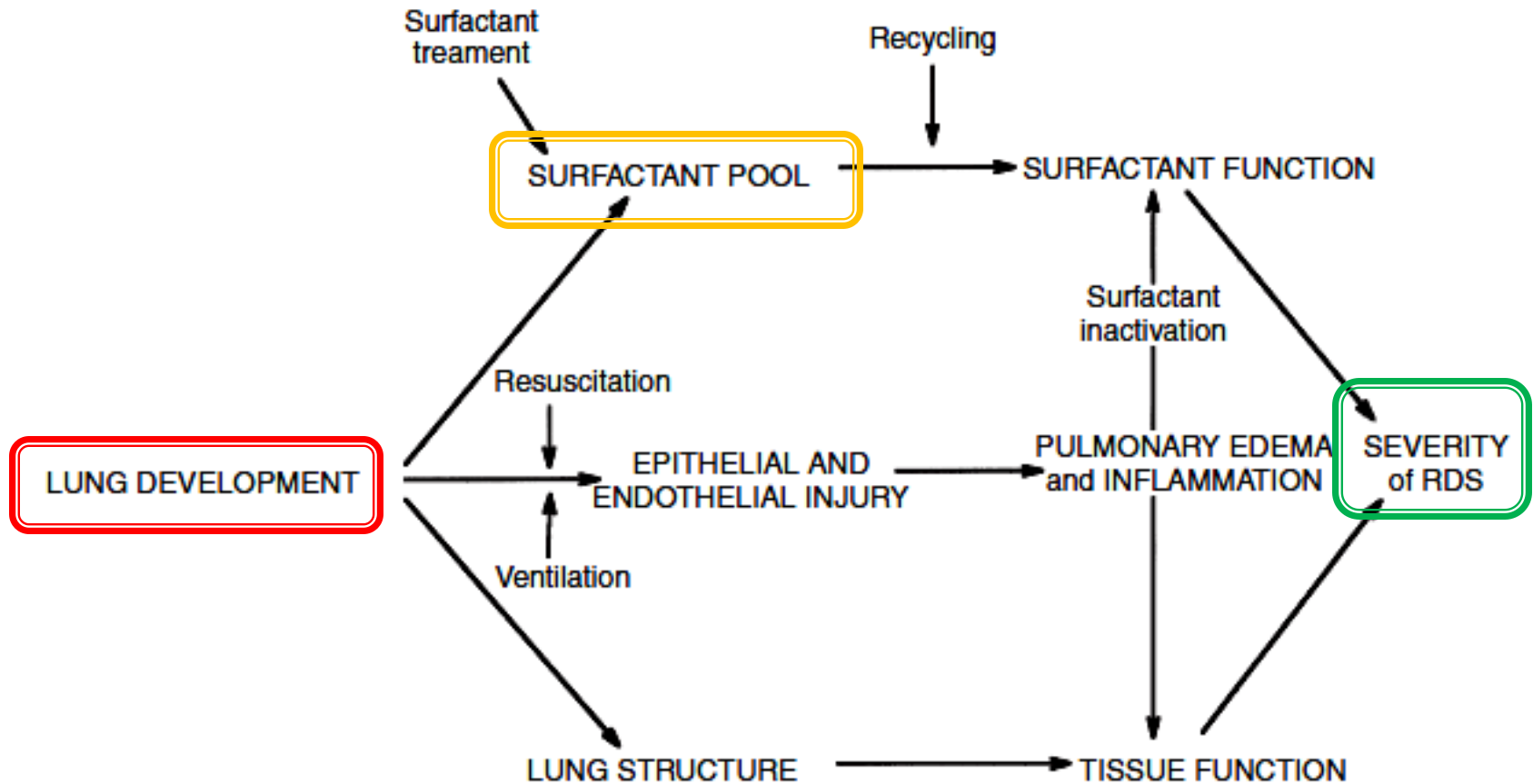
Hyaline membrane disease (HMD)



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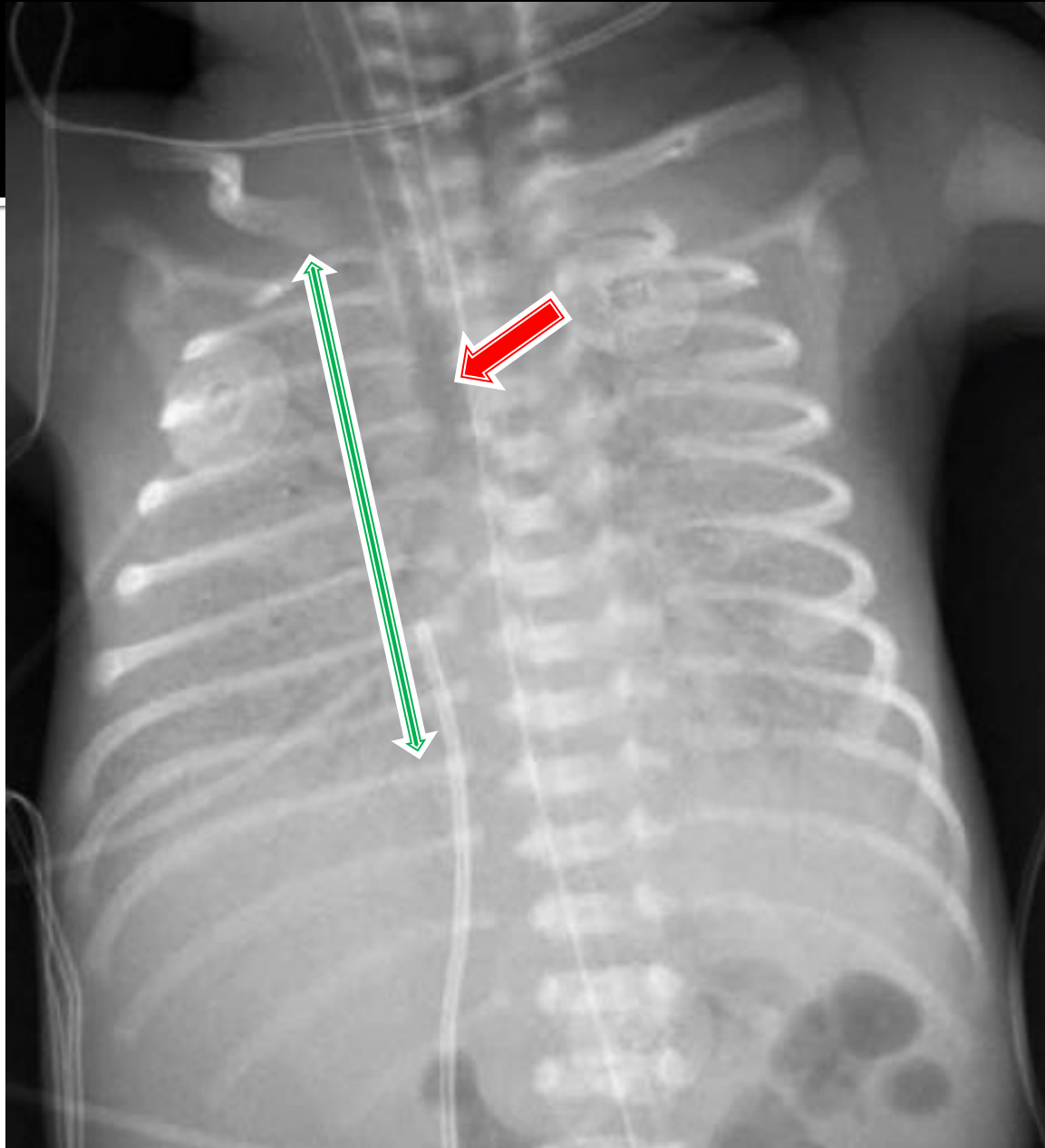
# RDS etiology



# RDS

- Course: 3-4 days
- Prevention:
  - Antenatal steroids, control of maternal diabetes
- Diagnosis:
  - *Clinical signs*: Cyanosis and Distress (Grunting, Retractions, Nasal flaring)
  - *Radiographic signs*: Ground-glass opacities, Air bronchogram, Low lung volumes

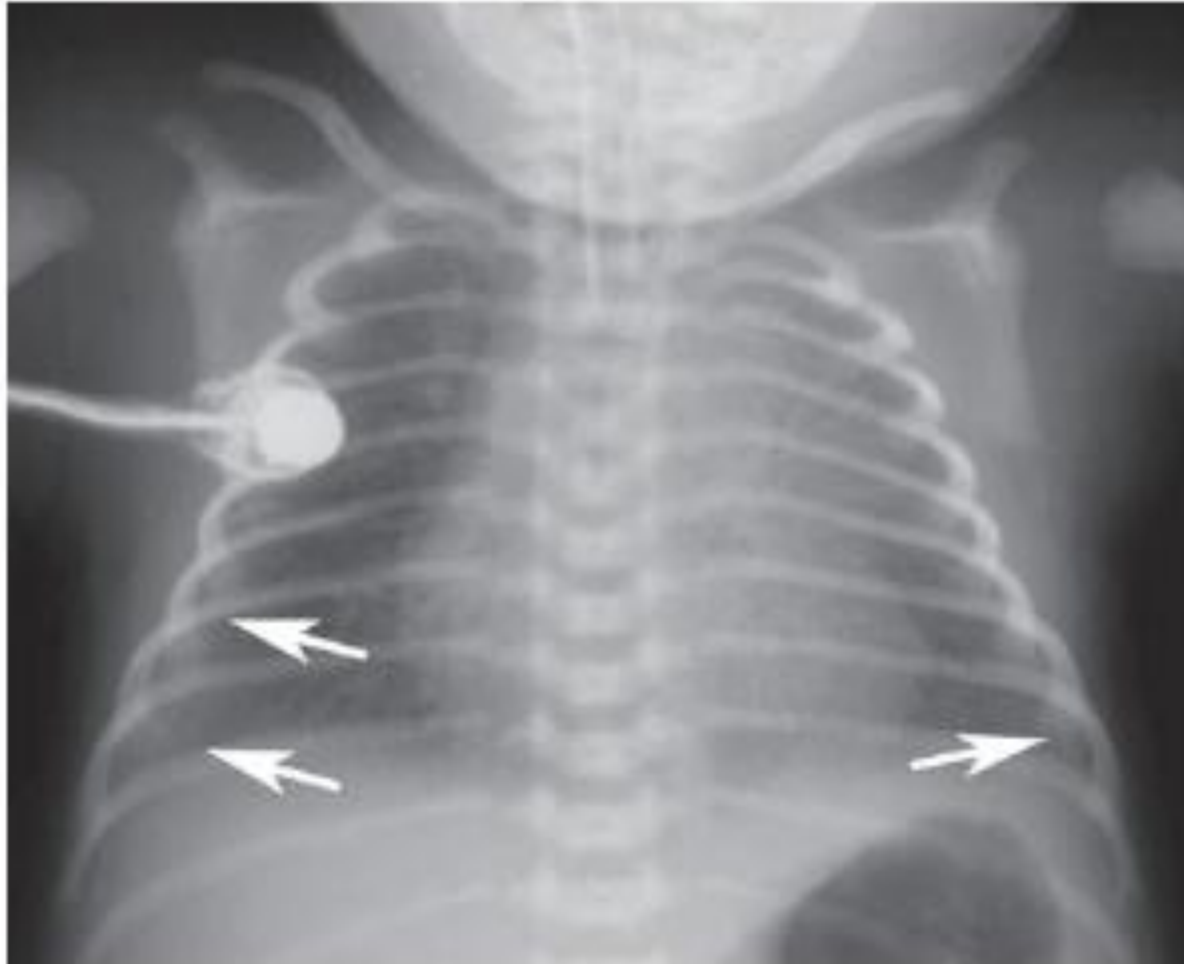
**RDS**

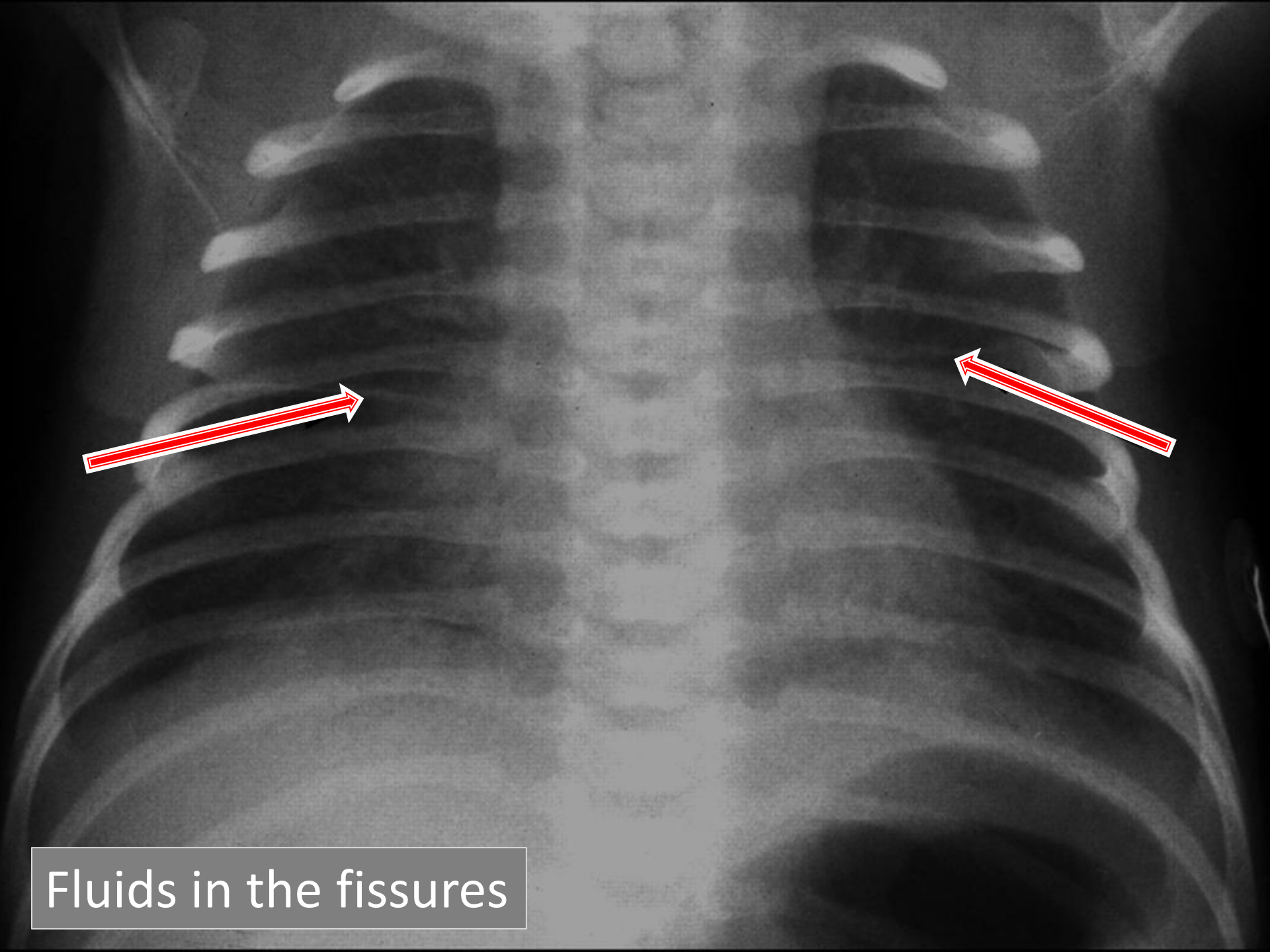


# RDS management

- Exogenous intratracheal surfactant
  - Lowers surface tension at air-fluid interface
  - Within minutes, improved oxygenation and increased FRC at lower airway pressures
  - Single treatment is enough for most newborns because type II pneumocytes recycle surfactant
  - Second dose may be needed in >6 hours if surfactant inhibition occurs (e.g. in MAS)

# GBS pneumonia





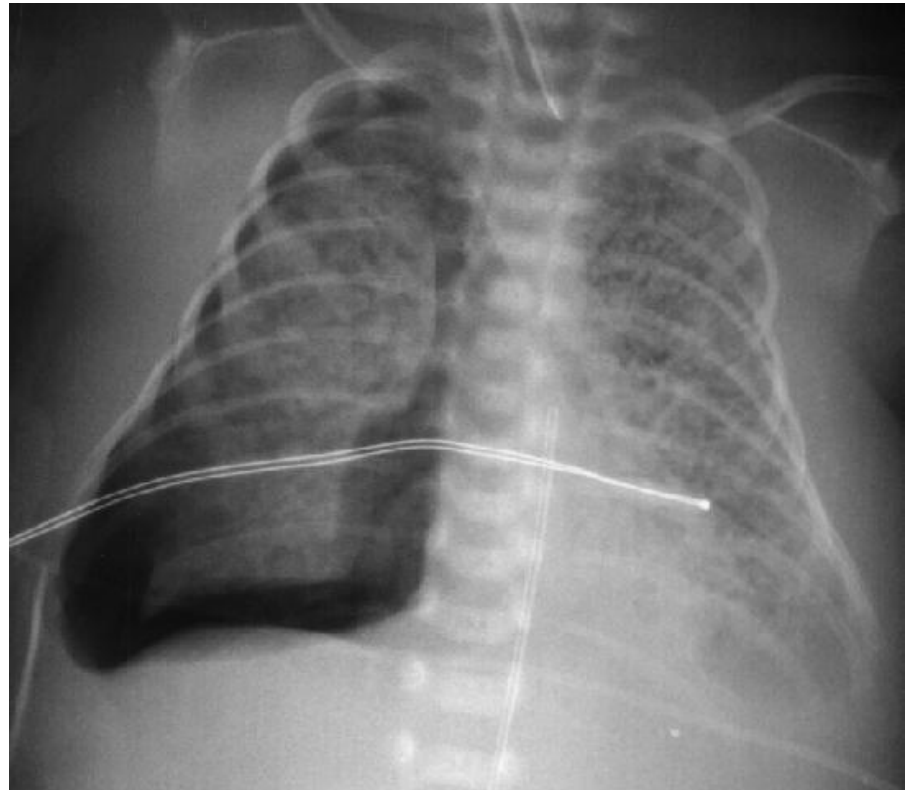
Fluids in the fissures

# Meconium Aspiration Syndrome



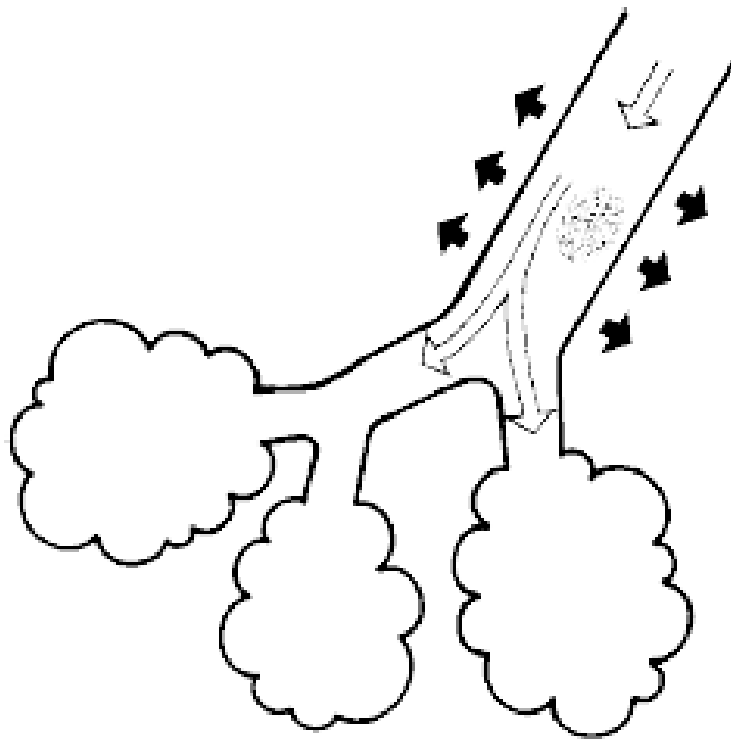
# Pneumothorax

- Aymptomatic  
(1-2% of all newborn)
- Spontaneous vs.  
secondary
- Clinical  
manifestations
- Diagnosis
- Management

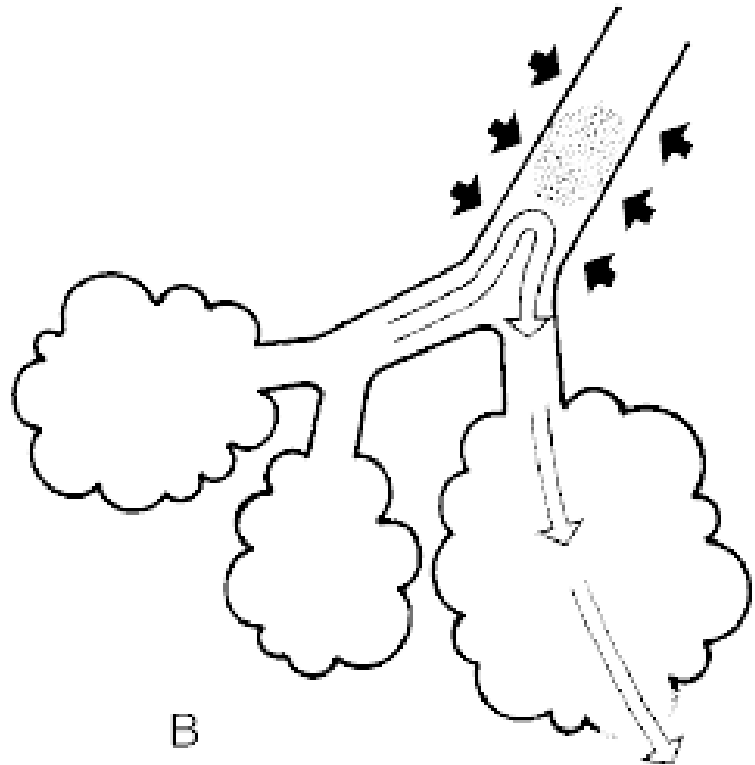




# One-way valve Mechanism



A



B

# Diaphragmatic Hernia

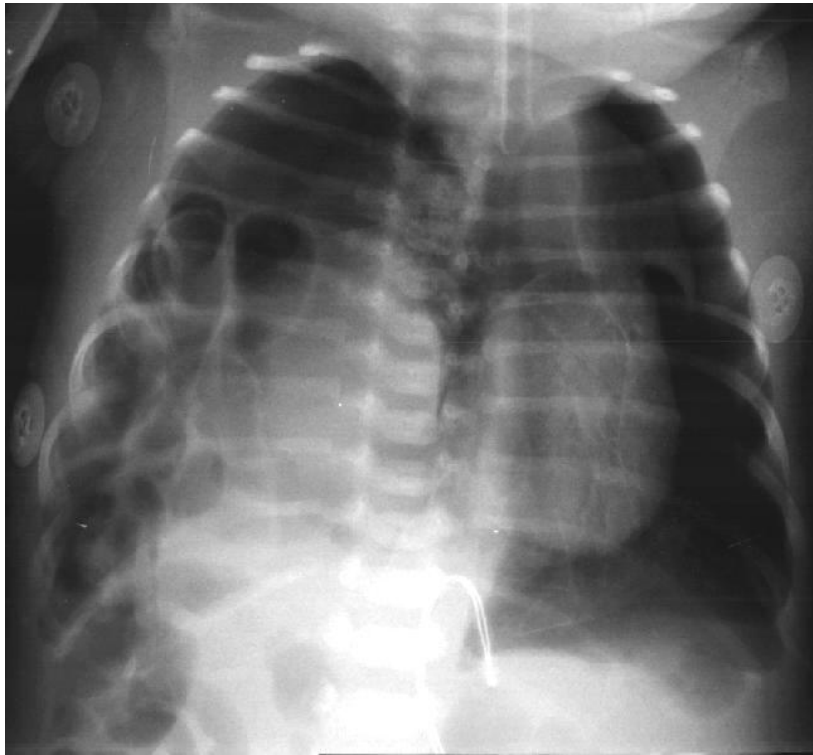


# Diaphragmatic Hernia

- Congenital vs. acquired
- Most often left, and through the poster-lateral segment of diaphragm.
- Respiratory Distress (usually severe), cyanosis, bradycardia, scaphoid abdomen
- Diagnosis: signs and imaging
- Management : stabilization then surgery

# Diaphragmatic Hernia

RIGHT



LEFT



# Broncho-pulmonary Dysplasia (BPD)

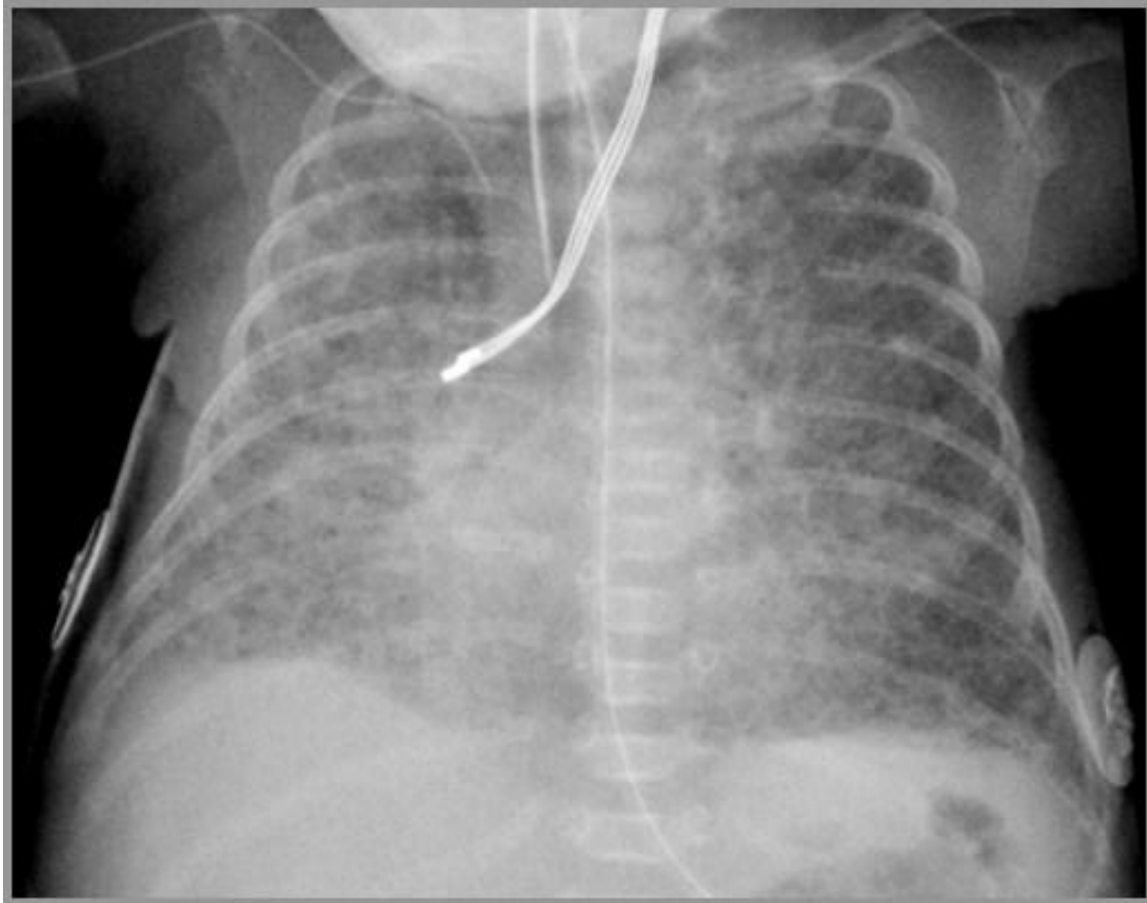
Chronic lung disease (CLD)



# BPD

- Lung injury due to:
  - Barotrauma
  - Volutrauma
  - Oxygen toxicity
- Defined by the need for oxygen therapy or respiratory support at 36 weeks post-menstrual age (PMA)
- Management options ???

# BPD



# Apnea of prematurity (AOP)





# AOP

- Cessation of respiration for 20 seconds, or for 15 seconds associated with cyanosis, pallor or bradycardia
- Respiratory drive in preterm infants is
  - Less developed in response to hypercarbia
  - Transiently increased then decreased by hypoxia
- Preterm infants are at 3-4 increased risk of SIDS than term infants

# AOP

- More common during sleep
- Uncommon if birth after 34 weeks of gestation
- May persist in VLBW infants until 44 weeks postmenstrual age.
- May recur following general anesthesia (GA):
  - Preterm < 44 weeks PMA who receive GA requires 24 hour monitoring

# Types of AOP

- Central apnea
  - Lack of respiratory drive and effort, Typically brief
- Obstructive apnea
  - Presence of central drive and respiratory efforts
  - Cessation of respiratory airflow due to airway obstruction
- Mixed apnea
  - Central apnea in response to hypoxia of obstructive apnea
  - Most common, Can be quite prolonged

# Identifiable Causes of Apnea

*Not all apnea in the preterm is due to AOP*

- Prematurity/immaturity
- Hypoglycemia
- Drugs
- Seizures
- CNS injury
- Sepsis!!!

# Treatment of severe AOP

- Methylxanthine drugs (e.g. Caffeine)
  - Central stimulation
- Nasal CPAP
  - Splints upper airway obstruction
  - Maintains FRC → stabilized oxygenation
- Low flow nasal oxygen
  - Stabilizes oxygenation

***Be careful not to hyper-oxygenate!***

# Periodic breathing

- Recurrent sequences of pauses in respiration lasting 5 to 10 seconds followed by 10-15 seconds of rapid respiration
- Evaluation and Treatment are NOT indicated

# Patent Ductus Arteriosus (PDA)



# PDA

- Persistence of fetal ductus arteriosus
- Blood flow determined by relative pressures
- Volume overload once pulmonary vascular resistance decreases



# PDA

- Diagnosis:
  - Clinical Signs:
    - Continuous **murmur**:
      - Best heard at upper left sternal border
      - Diastolic component is difficult to hear
    - Decreased systemic diastolic **blood pressure**
      - “bounding” pulse
    - Increased **O<sub>2</sub>** and ventilatory requirements
  - Echocardiography is the gold standard

# PDA

- Treatment:
  - Symptomatic
    - Indomethacin if < 14 (to 28) days chronologic age
    - Surgical ligation if two courses of Indomethacin were unsuccessful or contraindicated
  - Asymptomatic
    - closure after 6 months
      - Coil embolization or
      - Video-assisted thoracoscopic surgery (VATS)

**Intra-ventricular hemorrhage  
(IVH)**

*and*

**Peri-ventricular hemorrhagic  
infarction (PVHI)**



# IVH & PVHI

<b>Grade I (Mild)</b>	Germinal matrix bleeding
<b>Grade II (Moderate)</b>	IVH filling 10-50% of the ventricles
<b>Grade III (Severe)</b>	ventricles >50% filled with blood, typically distending ventricle
<b>Grade IV</b>	Periventricular hemorrhagic infarction

# Grade I



# Grade II



# Grade III



# Grade IV





# Necrotizing Enterocolitis (NEC)



# NEC

- Acute multifactorial intestinal necrosis syndrome
  - Ischemia
  - Infection and Inflammation
  - Poor host protective responses

# Clinical Presentation

## SYSTEMIC SIGNS

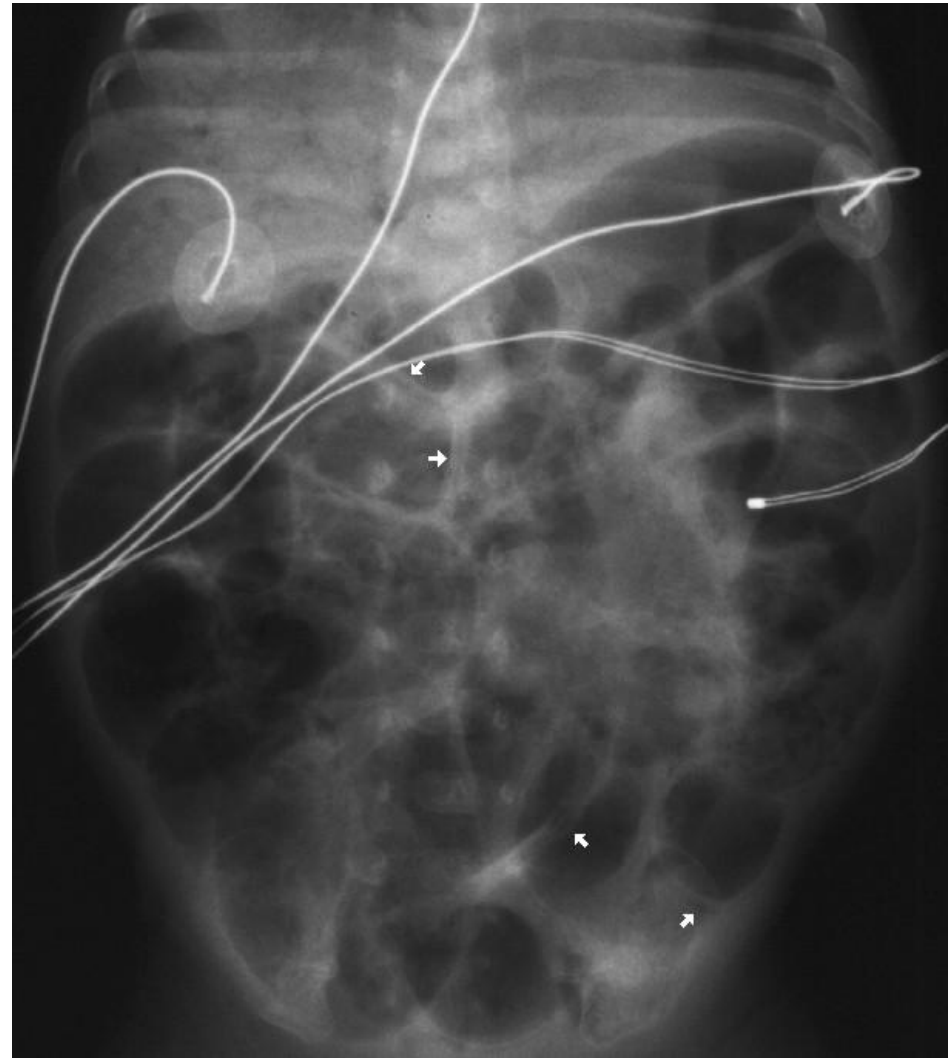
- Respiratory distress or apnea
- Lethargy
- Temperature instability
- Irritability or poor feeding
- Shock
- Acidosis
- Oliguria
- Bleeding

## ABDOMINAL SIGNS

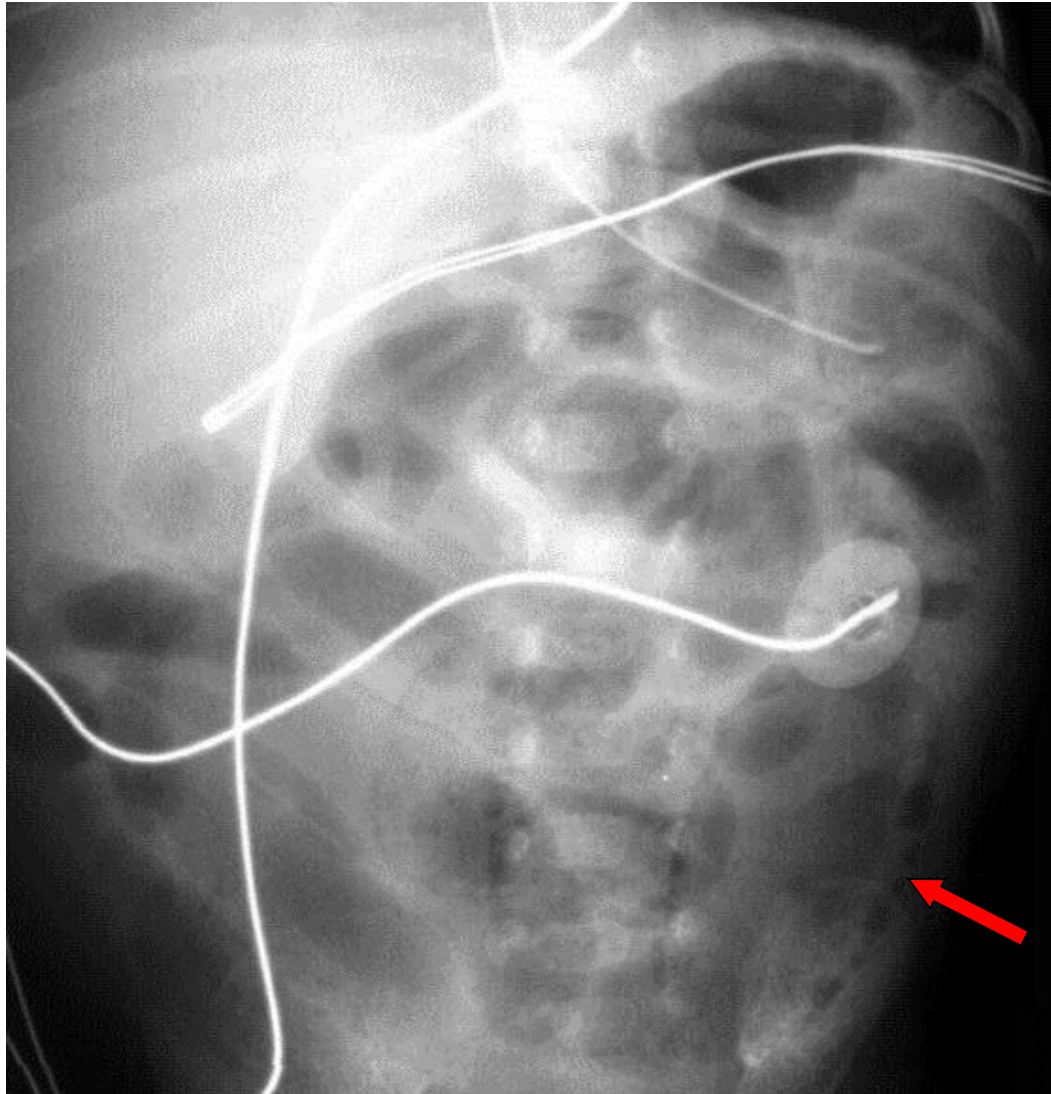
- Distention
- Tenderness
- Feeding residuals/Ileus
- Emesis
- Abdominal wall erythema
- Persistent localized abdominal mass
- Ascites
- Bloody stools

# Radiographic features

- Ileus
- Bowel wall edema
- Fixed-position loop
- Pneumatosis (arrows) or portal venous air
- Pneumoperitoneum

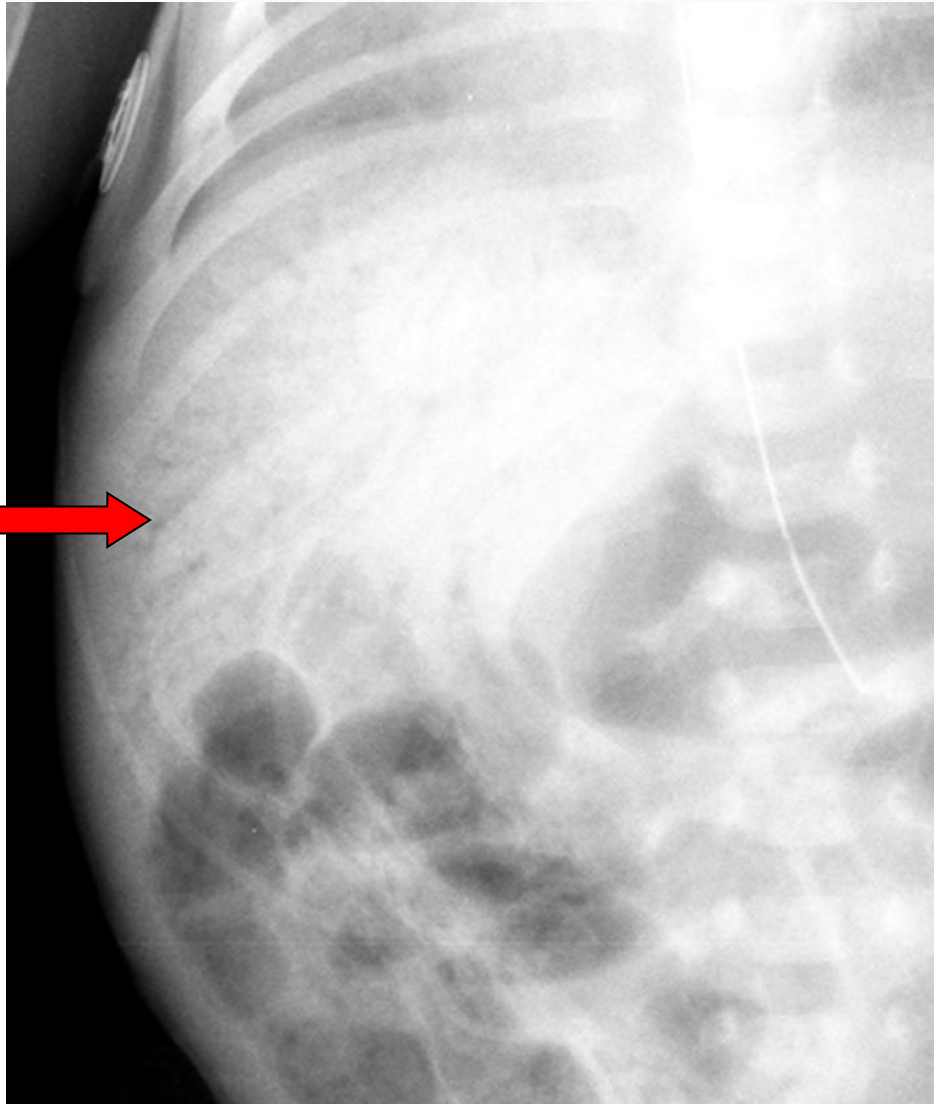


# Pneumatosis intestinalis



# Portal Venous Air

Portal venous air →



# Pneumoperitoneum



In decubitus position, air rises to space between liver and body wall



Hypodensity of peritoneal cavity due to anterior air

# NEC Evaluation

- CBC, Blood gas every 6-8 hrs until stable
- AP and decub KUB every 6-8 hrs until stable



# Management

- Medical treatment
  - NPO for 7-10 days after normal KUB
  - Antibiotics
    - (Ampicillin, Gentamicin) for 14 days
    - Clindamycin or Flagyl if actual or impending perforation

# Surgical Management

- Indications for surgical intervention:
  - Worsening clinical picture despite medical management
  - Persistent fixed loop on KUB
  - Abdominal mass
  - GI perforation
  - Signs of full thickness necrosis
    - Peritonitis: Ascites, Abdominal wall erythema
    - Persistent thrombocytopenia
    - Refractory metabolic acidosis

# Retinopathy of prematurity (ROP)

formerly known as  
Retrolental Fibroplasia (RLF)

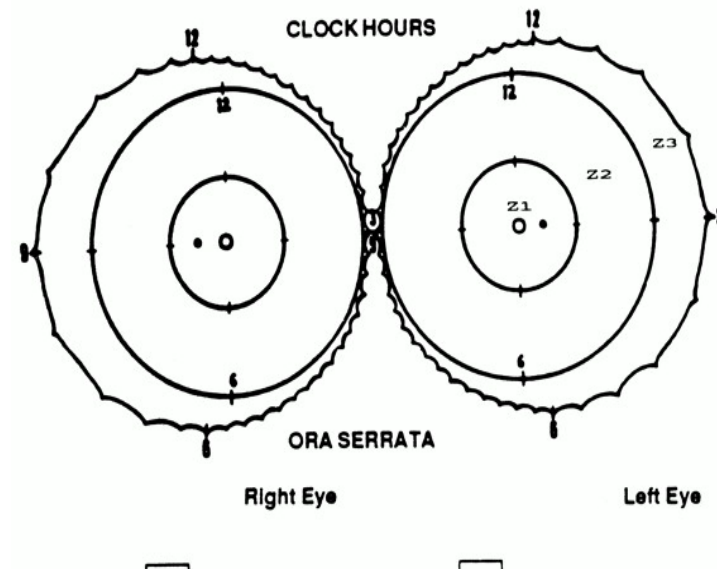


# ROP

- Develops only in incompletely vascularized retinas of premature infants
- Correlated with illness and hyperoxia
  - Acidosis, Hypothermia, Shock, and Asphyxia arrest vessel growth
- Abnormal growth in recovery phase results in “pile up” of vessels
  - Ridge without forward growth
  - Peaks ~40 weeks PMA

# International Classification of ROP (ICROP)

- Zones (I, II, III)
- Stages:
  - I = line of demarcation
  - II = elevated ridge of vessels
  - III = extraretinal neovascularization (ERNV) into vitreous
  - IV = partial retinal detachment
  - V = complete retinal detachment
- Plus disease
  - Inflammation and vessels engorgement
  - Higher risk of scarring and retinal detachment



# ROP Screening

- Dilated retinal exam at  $\geq 31$  weeks PMA (or 4 weeks chronologic age if born after 27 weeks of gestation)
- Whom to screen?
  - Who were born prior to 31 weeks of gestation OR
  - Who were born prior to 33 weeks of gestation AND had unstable course

# ROP Treatment

- Indications
  - Zone 1 any plus disease
  - Zone 1 stage III disease
  - Zone 2 stage II or III *and* plus disease
- Laser ablation of peripheral retina
- Intravitreal bevacizumab (anti-VEGF agents)

# Finally!

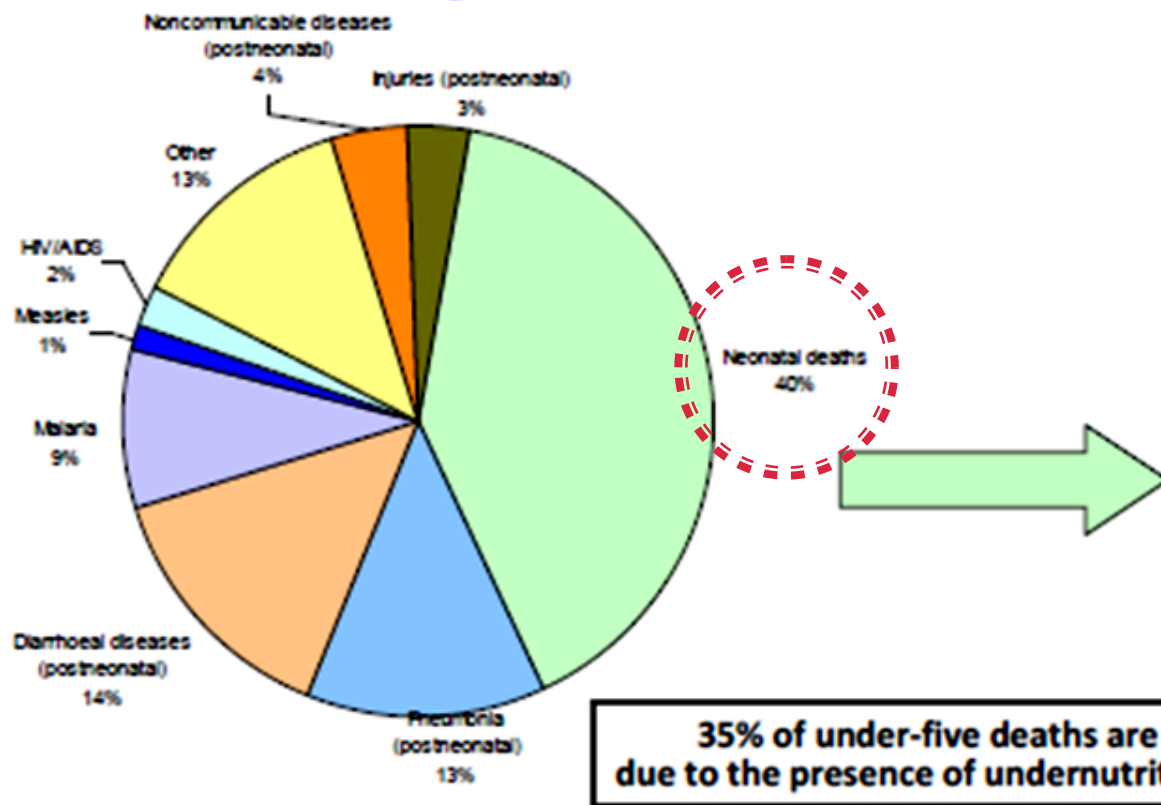
# The cost of prematurity



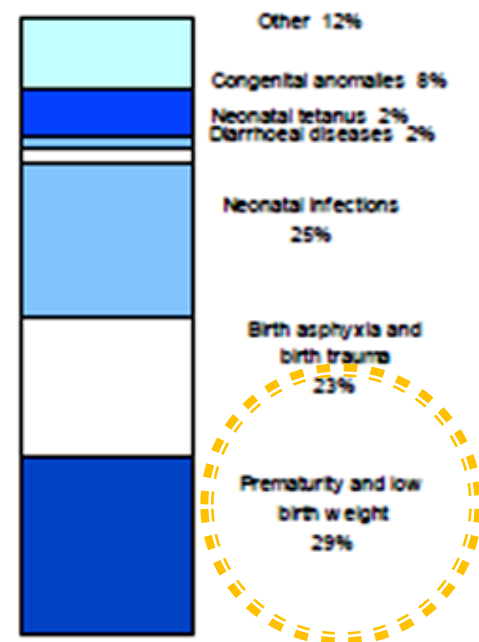


# Major causes of death in neonates and children under five – WHO 2008

## Deaths among children under five



## Neonatal deaths



Sources: (1) WHO. The World Health Statistics 2011; (2) \*For undernutrition: Black et al. Lancet, 2008

# Neonatal Mortality Associated with Prematurity, USA, 2005

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

# Neonatal Mortality Associated with Prematurity

**Table III.** Mortality rates by major group, epoch, and gestational cohort

Epoch	Cohort (weeks gestational age)	Live births (deaths)	Rate of death/1000 live born infants at that gestation (95% CI)				
			Respiratory	Malformation	Other	Infection	NEC
1988-1994	24-27	991 (415)	319 (283-354)	10.09 (3.84-16.34)	55.5 (40.83-70.16)	19.17 (10.55-27.79)	15.14 (7.48-22.79)
	28-31	2412 (256)	48.51 (39-57.29)	15.34 (10.39-20.28)	26.95 (20.42-33.53)	11.19 (6.98-15.43)	4.15 (1.58-6.72)
	Total	3403 (671)	127 (115-139)	13.81 (9.87-17.77)	35.26 (28.97-41.59)	13.52 (9.62-17.43)	7.35 (4.47-10.23)
1995-2001	24-27	821 (305)	291 (254-328)*	7.31 (1.46-13.18)	31.67 (19.53-43.91)*	17.05 (8.14-26.02)	24.36 (13.71-35.08)
	28-31	1997 (168)	26.54 (19.4-33.7)*	14.52 (14.22-19.77)	29.04 (21.55-36.45)	8.01 (4.08-12.92)	6.01 (2.60-9.39)
	Total	2818 (473)	104 (91.8-116)	12.42 (8.31-16.54)	29.81 (23.45-36.19)	10.65 (6.84-14.46)	11.36 (7.43- 15.29)
2002-2008	24-27	782 (360)	194 (163-225)*	16.62 (7.59-26.45)*	38.36 (24.67-52.13)	31.97 (19.46-44.54)*	39.64 (25.71-53.64)*
	28-31	1897 (109)	12.65 (7.59-17.71)*	17.92 (11.89-23.94)	15.81 (10.21-21.59)	5.79 (2.37-9.22)	5.27 (2.02-8.58)
	Total	2679 (360)	65.7 (55.99-75.41)*	17.54 (12.52-22.54)	22.39 (16.72-28.04)	13.44 (9.04-17.81)	15.3 (10.61-19.97)

THANK YOU



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