Disease specific ventilation in newborn

Disease specific ventilation

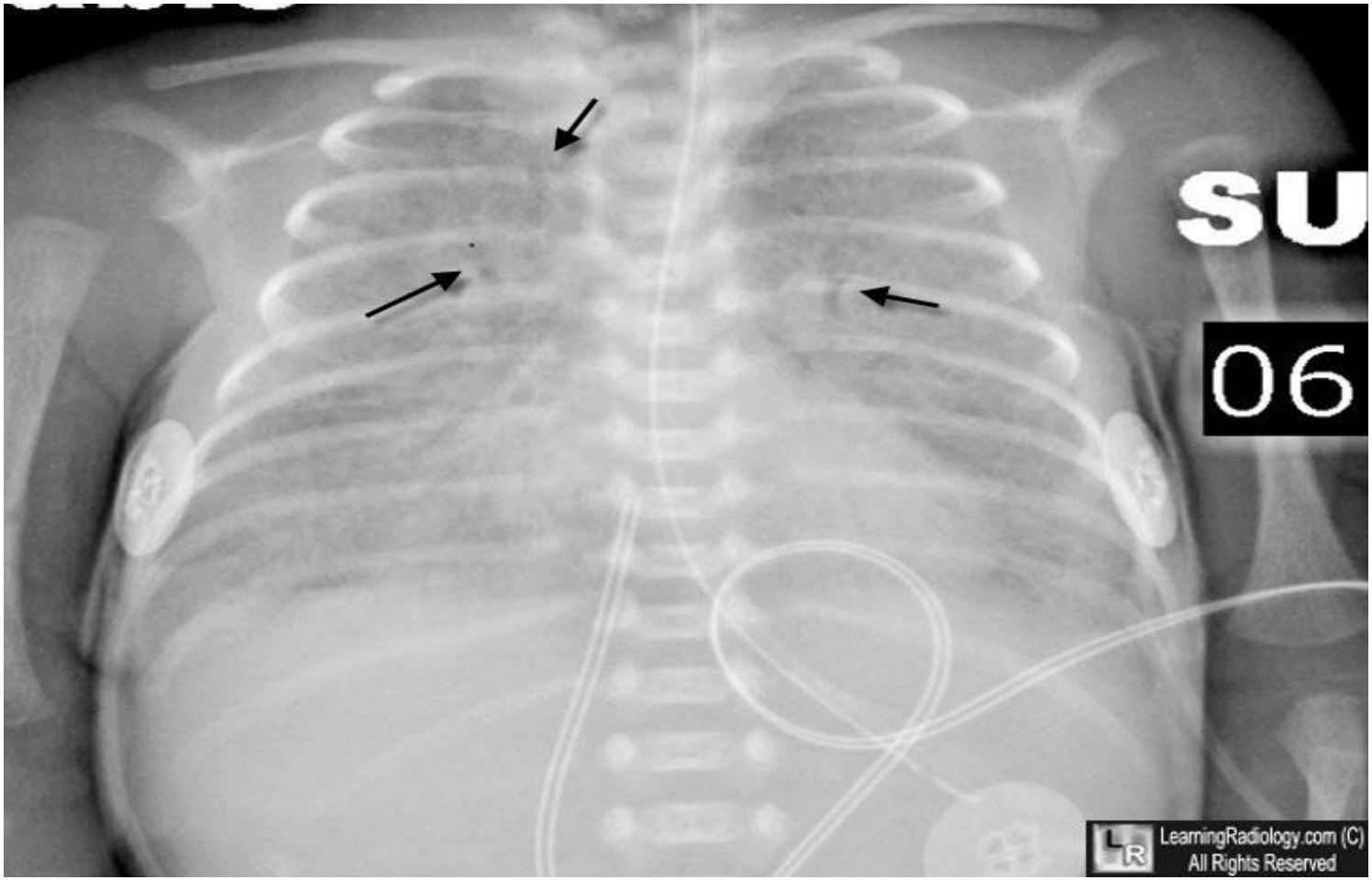
- Case 1

Preterm (30 wk)/1200gms/ Vaginal delivery

CIAB/Respiratory distress at birth/ANS uncovered

Delivery room CPAP given

Shifted to NICU



RDS

RDS- Key Pathophysiologic Features

1. **Lung Surfactant-** Quantitative, qualitative, and metabolic disturbances in lung surfactant.

Decreased compliance of distal airspaces- lead to atelectasis, ventilation:perfusion mismatch, and intrapulmonary shunt.

RDS- Key Pathophysiologic Features

2. **Lung Liquid-** Reduced clearance

Sustained production

3. Development- Canalicular-saccular stage

Thickened mesenchyme

Immature capillary development

Relevant Principles of Ventilation

1) Minimize the initial use and/or duration of exposure to any form of invasive mechanical ventilation.

2) Promote weaning and extubation from mechanical ventilation

Relevant Principles of Ventilation

- RDS lung have low compliance and low resistance - short time constant

- Low resistance and short time constant results in quick emptying and collapse of lung in expiration- Managed by adequate PEEP.

- Because of short time constant, a higher ventilator rate is used

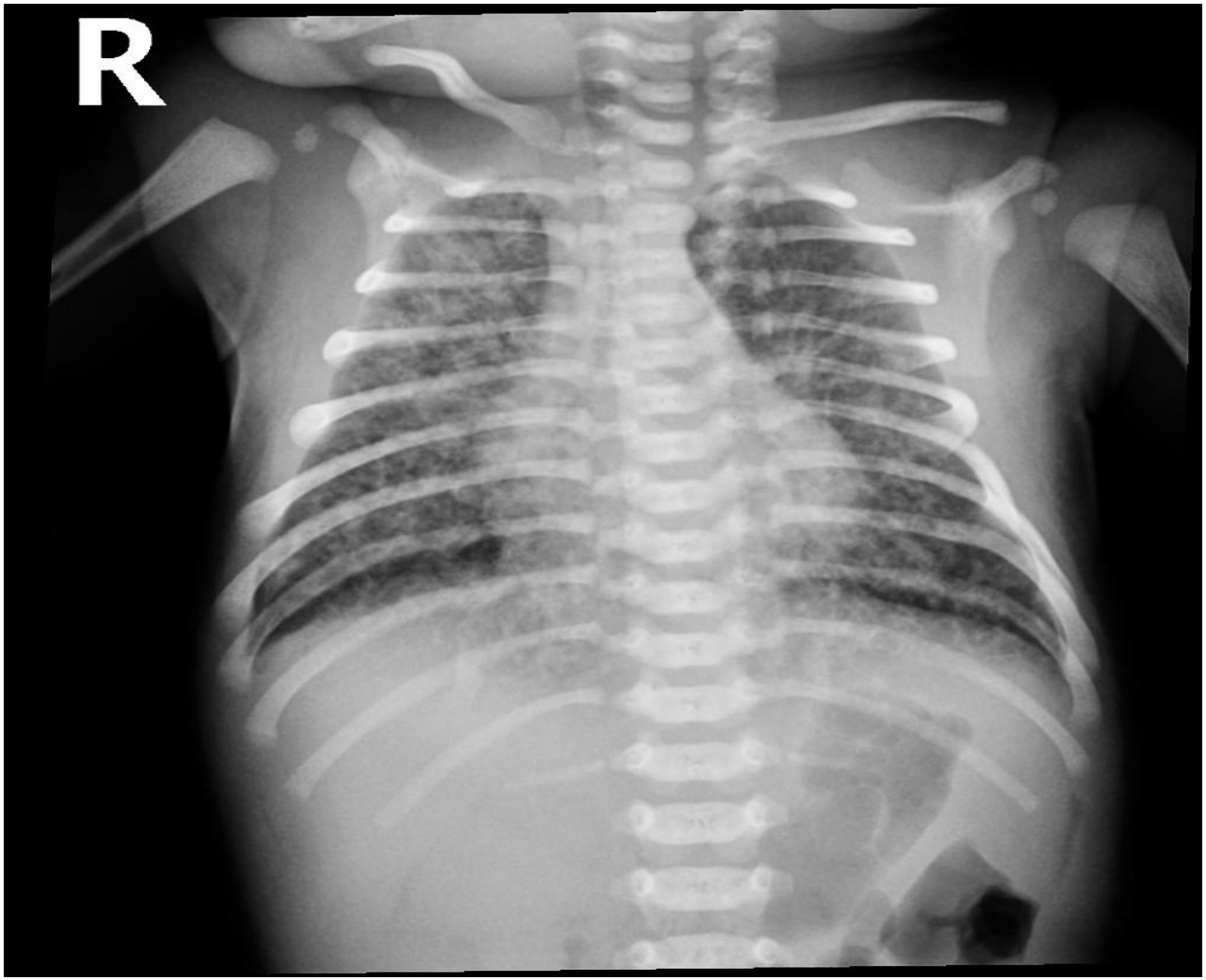
Ventilator settings in RDS

- Target tidal volume- 4-5 ml/kg
- PEEP – 5-6 cm H2O
- Respiratory rate- 50-60 /min
- Inspiratory time- 0.25-0.35 seconds
- PIP- guided by visual appreciation of a just adequate chest rise, audible breath sounds and target tidal volume of 4-5 ml/kg.

Case-2

- Term(38 wk)/3000 gms delivered to primigravida mother via LSCS (↓ FHR)

- Baby did not cry after birth- delivery room resuscitation



MAS

MAS-Key Pathophysiologic Features

- MAS has a complex, multifactorial pathophysiology.

1. **Surfactant Dysfunction-**Disturbances in surfactant metabolism and function lead to decreased compliance of distal airspaces leading to atelectasis and intrapulmonary shunt.

MAS-Key Pathophysiologic Features

2. **Airway Resistance-** elevated airway resistance because of obstruction from inhaled/aspirated meconium.

3. **Pulmonary Hypertension-** Fetal hypoxemia and inflammation are thought to be primary contributors to underlying pulmonary hypertension.

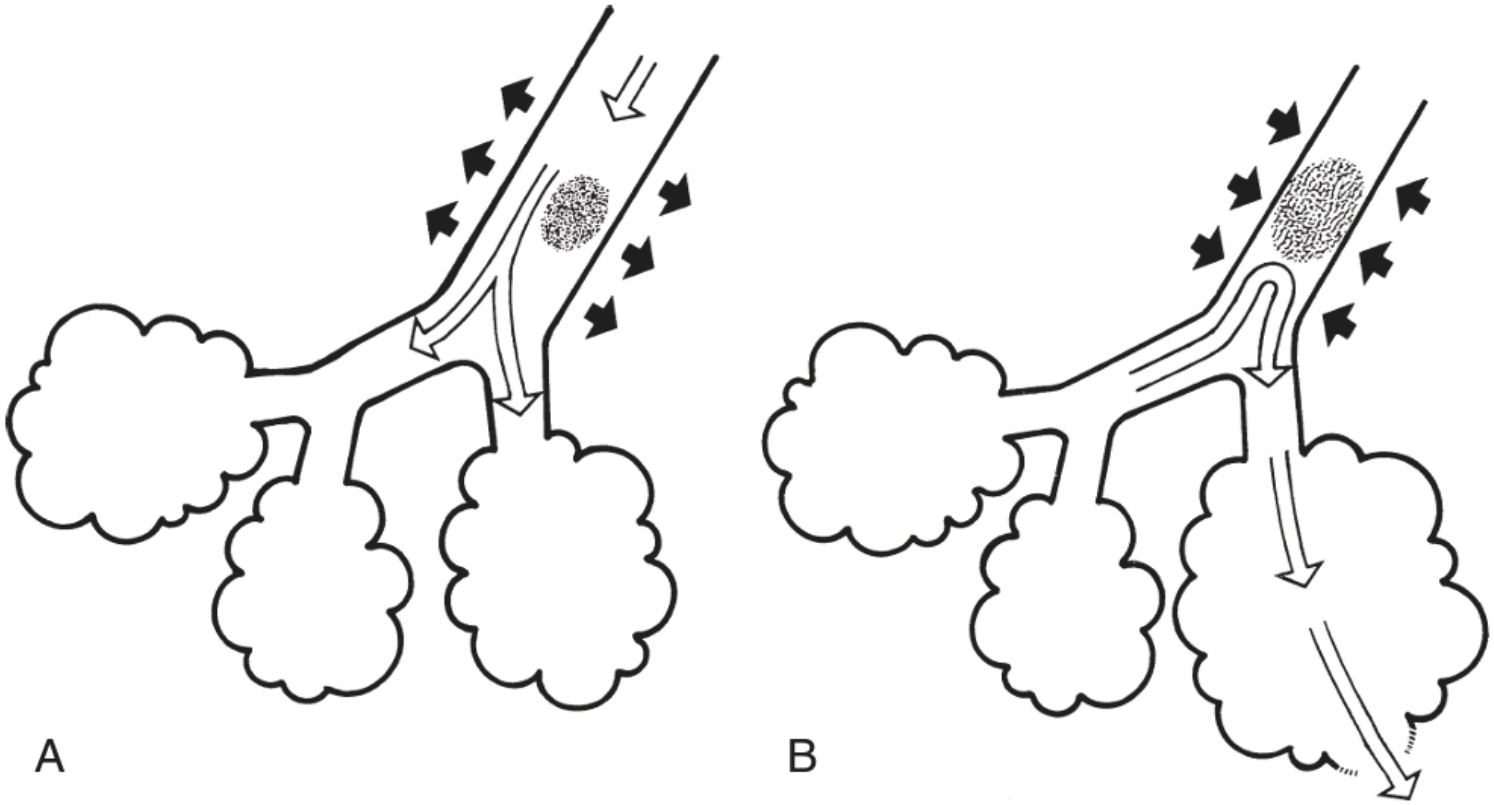


Fig. 25.2 Partial "ball-valve" air trapping behind particulate matter (i.e., meconium) in an airway, which leads to alveolar overexpansion and rupture. **(A)** Tidal gas passes beyond the meconium on inspiration when the airway dilates but **(B)** cannot exit on expiration when airways constrict. (From Goldsmith JP: Continuous positive airway pressure and conventional mechanical ventilation in the treatment of meconium aspiration syndrome. J Perinatol 28(suppl 3):S49–S55, 2008; used with permission.)

Relevant Principles of Ventilation

- **Airway Obstruction with Gas Trapping-** ↑Resistance, ↑Time constant and Lung hyperexpansion

- **Alveolar Disease w/ Low Lung Volume-** ↓Surfactant function , ↓ Lung compliance

  ↑ V/Q mismatch

Relevant Principles of Ventilation

- Air trapping (caused by dynamic PEEP) because of long expiratory time constant - Thus, set PEEP should be limited

- Ventilator rate should be kept relatively low to ensure adequate expiratory time to minimize gas trapping.

Relevant Principles of Ventilation

- As inspiratory time constants can also be prolonged- ensure I-time is long enough to complete VT delivery.

Relevant Principles of Ventilation

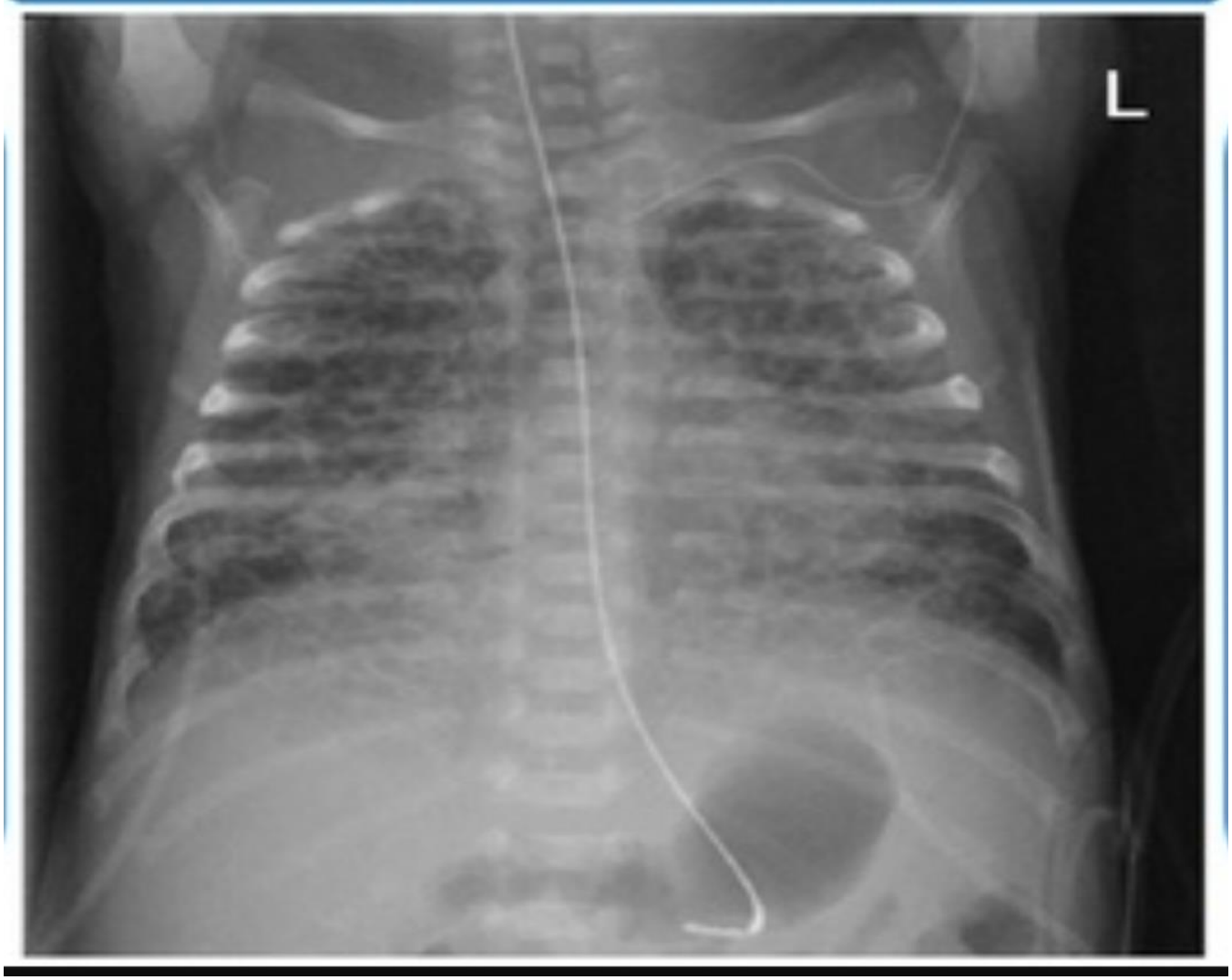
- Because the pathophysiology of MAS includes increased alveolar dead space, these infants require slightly larger VT/kg than similar infants with more homogenous lung disease.

Ventilator settings in MAS

- Target tidal volume- 5-6 ml/kg
- PEEP – 4-5 cm H2O
- Respiratory rate- 30-40 /min
- Inspiratory time- 0.35-0.5 seconds
- PIP- guided by visual appreciation of a just adequate chest rise, audible breath sounds and target tidal volume of 5-6 ml/kg.

Case 3

- Day of life-60 (PMA- 34+5 wk)
- Birth History- PT 26 wk/800 gm/ VD
- Required surfactant
- Baby admitted in NICU since birth
- Failure to extubate



BPD

BPD-Key Pathophysiologic Features

Lung Pathology

- Abnormalities in both the airways and the gas exchange areas of the lungs.
- interrupted alveolarization with reduced number and increased size of the remaining saccular-alveolar structures
- thickened mesenchymal/septal tissues
- disrupted growth and development of the pulmonary microvasculature
- fibrosis

TABLE 25.14 Abnormalities of Lung Function among Infants With Bronchopulmonary Dysplasia[161–168]

Parameter	Abnormality
Lung Volume	
Overall lung volume	Decreased
Functional residual volume	Decreased
Compliance	Reduced
Gas exchange	Impaired diffusion
Airway Function	
Expiratory flow velocity	Decreased
Resistance	Increased

Relevant Principles of Mechanical Ventilation in BPD

- Increased anatomical and functional dead space - increases in delivered VT may be necessary.
- In the developing stages of BPD - the optimal approach to ventilator support is similar to that recommended for the management of RDS.

Relevant Principles of Mechanical Ventilation in BPD

- With more chronic, severe forms of BPD- higher VT may be needed sometimes as high as 10 to 12 mL/kg

Reasons-

1. Interrupted/impaired alveolarization with reduced gas exchange surface area
2. increasing nonfunctional lung volume because of increased areas of atelectasis coupled with areas of overinflation(increased alveolar dead space)
3. dilatation of large airways owing to exposure to cyclic stretch from positive-pressure ventilation (acquired tracheomegaly)

Relevant Principles of Mechanical Ventilation in BPD

- Tracheal and bronchomalacia in chronic-severe BPD - increased PEEP levels are required

Relevant Principles of Mechanical Ventilation in BPD

- Increased airway resistance - managed via longer inspiratory times to allow for more complete distribution of VT.

- A longer expiratory time is also needed for the lung to effectively empty during the exhalation phase.

Relevant Principles of Mechanical Ventilation in BPD

- Thus, the combination of higher VT, longer inspiratory times, and low respiratory rates (allowing for increased exhalation time) is indicated for infants who remain ventilator dependent with more chronic-severe forms of BPD.

Ventilator settings in BPD

- Target tidal volume- 6-10 ml/kg
- Respiratory rate- 20-30 /min
- Inspiratory time- 0.5-0.7 seconds
- PEEP – variable, may need 6-8 cm H2O

Ventilation in lung hypolasia disorders

Lung hypoplasia disorders- **Key Pathophysiologic Features**

- Most obvious pathophysiologic problem is impaired lung growth.
- Severity of impact on airways, terminal respiratory units, and the pulmonary vascular bed depends on how early in gestation lung growth is affected

- Impaired vascular development accompanies the altered lung growth

1. Impaired growth and development of pulmonary arteries and arterioles
2. increased arteriolar medial muscle thickness
3. altered expression of angiogenic factors including vascular endothelial growth factor.
4. decreased endothelial NO synthase expression

Relevant Principles of Ventilation

- Lung is small, with a functional residual capacity that may be considerably less than normal.
- Gentle approach to ventilation- to minimize lung injury from excessive aggressive ventilator strategies to achieve oxygenation.
- Ventilate with adequate PEEP and lowest possible PIP (i.e smaller than usual tidal volume) to achieve oxygenation.

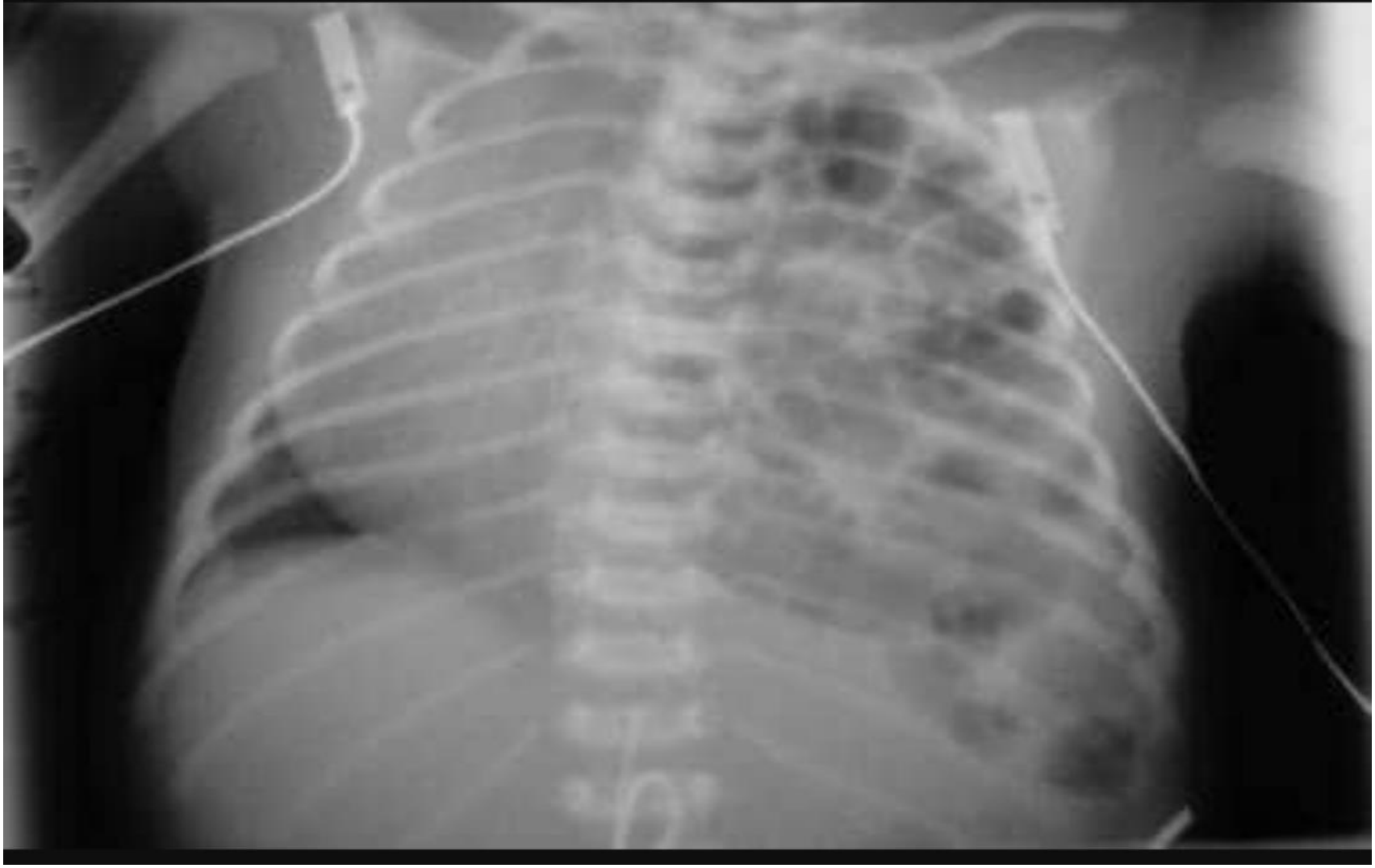
Ventiltor settings in Lung hypoplasia disorders

- Lowest possible PIP (less than 25 cm H2O)
- TV- 4 ml/kg
- Respiratory rate- 50-60/min
- Inspiratory time- 0.25-0.35 seconds
- PEEP – 4-5 cm H2O

THANK YOU

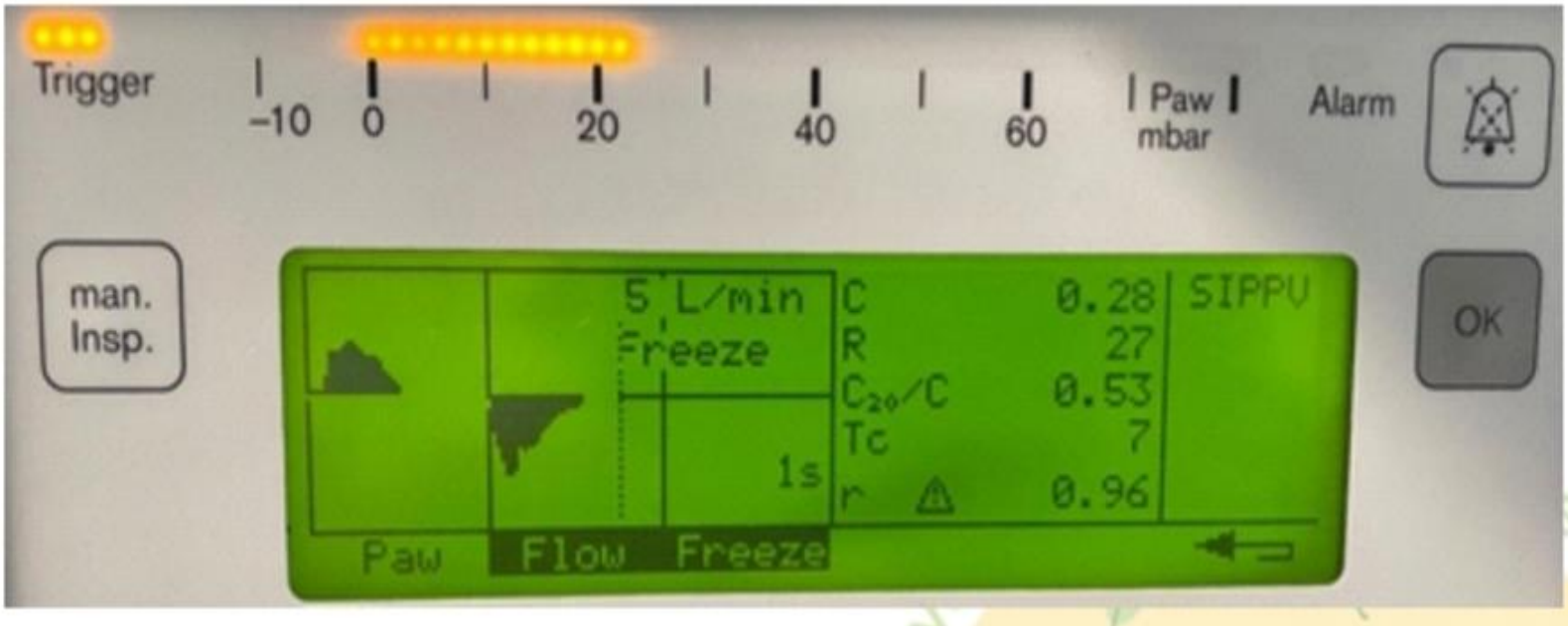
OSCE 1

- A term baby boy is born limp and gets intubated in LR. Baby put on SIMV mode PIP 17, PEEP 6 FiO2 40% rate of 40/min. His Initial CXR..



- Diagnosis?
- Formula for calculating LHR?

. What value of LHR indicates a good prognosis?



- What kind of waveform is this? And parametes on Y and X aaxis?
- Identify the problem in given waveform?

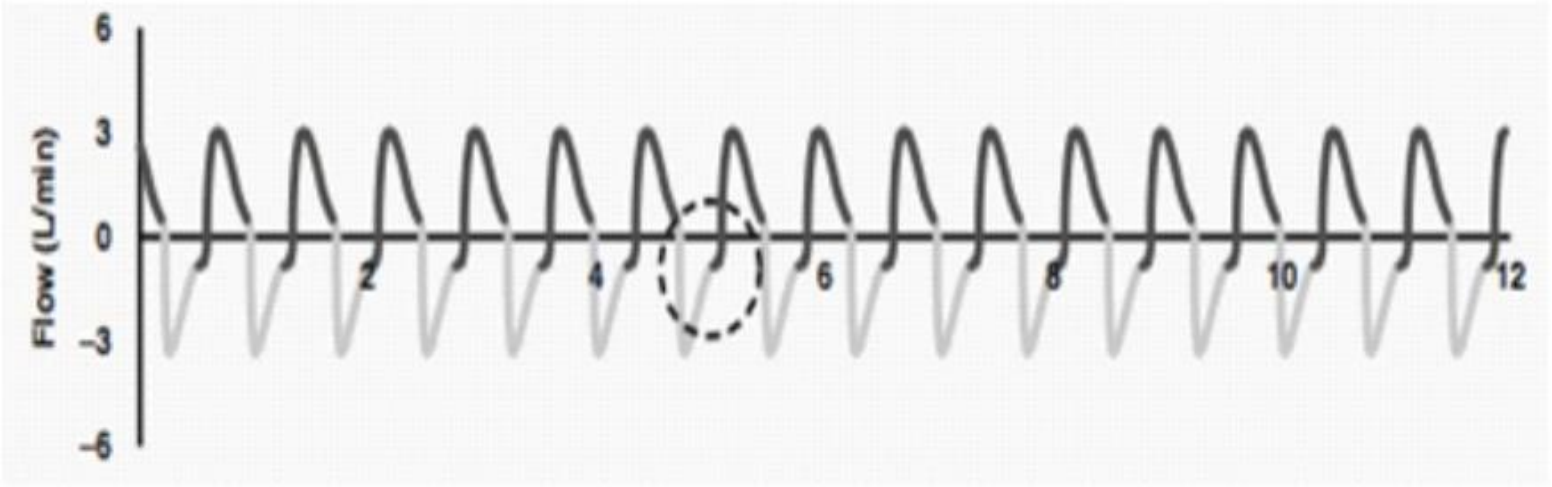
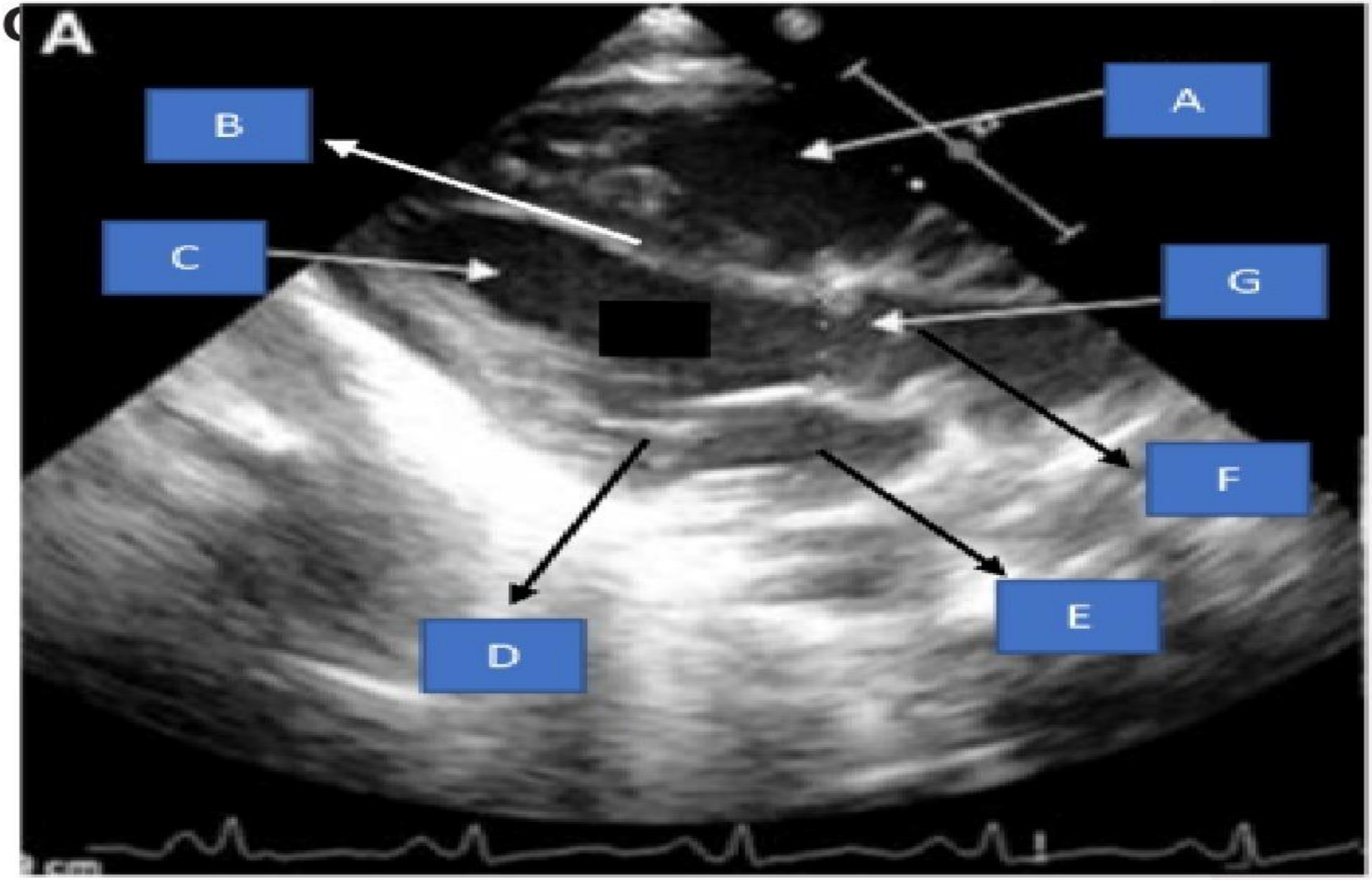


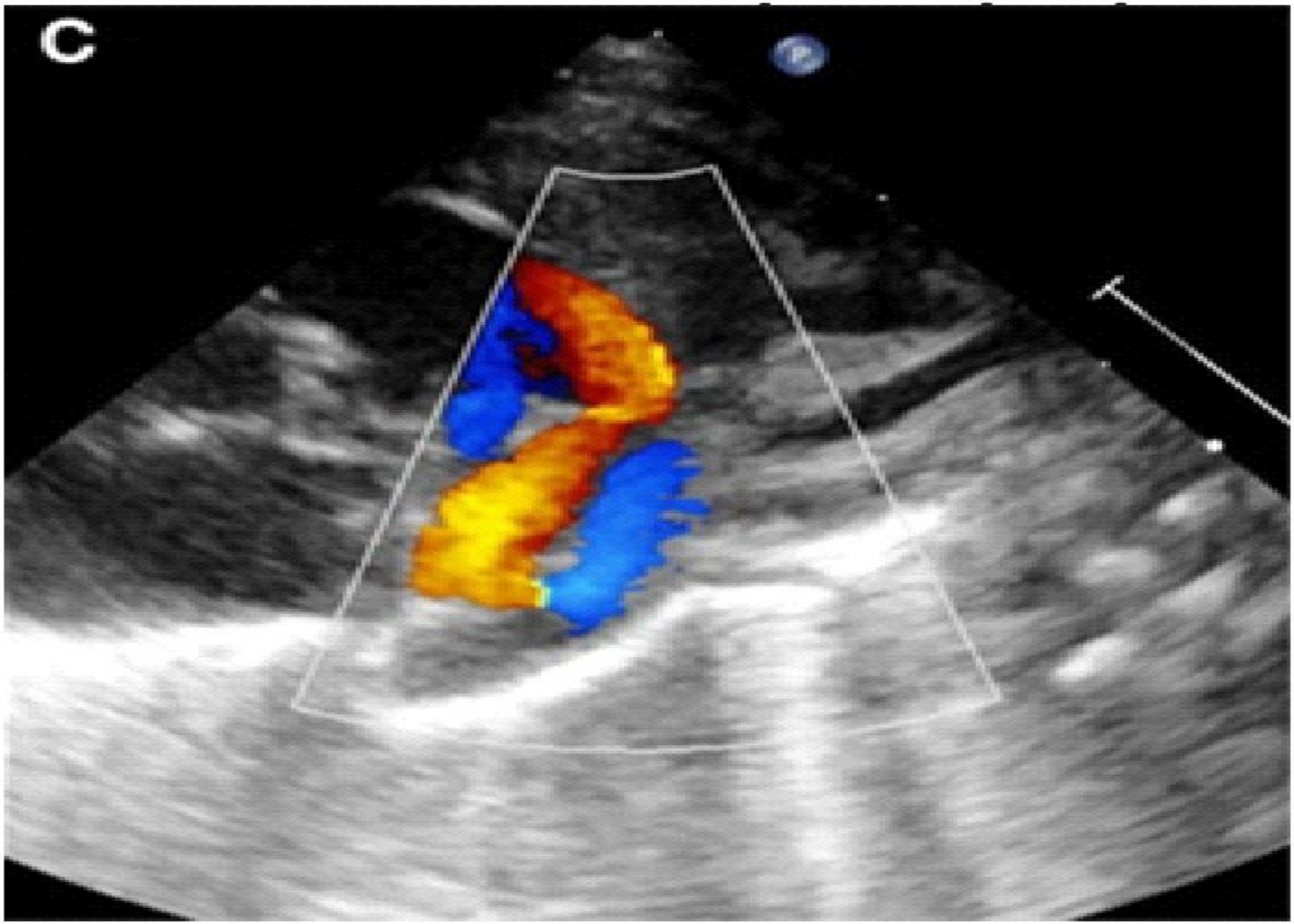
Fig. 10

- Identify the abnormality in given waveform?
- What complication can occur due to this abnormality?

- A 27 wk 980 gm baby on SIMV mode of ventiltion has worsening clinical conditionon day 5 of life. Baby has increasing FiO2 and pressure requirement. Sepsis screen is negative. ECHO was done.



- Identify the view?
- Identify the strucutres?



- Identify the abnormality?

THANK YOU