RESPIRATORY REFERENCE

Neonatal Diseases

Respiratory Distress Syndrome

RDS is a respiratory condition that mainly affects premature newborns due to deficiency of surfactant, a substance that prevents collapse of the alveoli in the lungs.

Causes

- Caused by surfactant deficiency and immature lungs.
- Primarily affects preterm infants.

Pathophysiology

1. ↓ Surfactant
2. Alveolar collapse (Atelectasis)
3. ↓ Lung compliance & FRC
4. ↑ Work of breathing
5. Hypoxemia + Hypercapnia + Respiratory acidosis
6. Pulmonary hypertension (R→L shunt)

Clinical Features

- Onset at birth or within the first 6 hours.
- Tachypnea
- Grunting
- Nasal flaring
- Chest retractions
- Cyanosis
- Decreased breath sounds

During surfactant administration, switch to PC mode without VG/VC to reduce risk of pneumothorax due to rapid change in lung compliance. After stabilization, VG/VC can be resumed if needed.

Investigation

- ABG: ↓ PaO_2, ↑ $PaCO_2$, and mixed acidosis.
- Chest X-ray: ground-glass appearance, air bronchograms, and low lung volumes.
- Clinical presentation

Prevention

- Antenatal corticosteroids (Betamethasone or Dexamethasone) for mothers at risk of preterm delivery.
- Delivery at a center with neonatal intensive care facilities.

Treatment

1- Maintain adequate oxygenation.

Oxygen therapy CPAP Mechanical ventilator

2- Surfactant Therapy

- Prophylaxis: Surfactant is given immediately after birth before symptoms develop, usually in high-risk premature infants who are intubated.
- Rescue: Surfactant is given after signs of respiratory distress appear, once NRDS is diagnosed or strongly suspected.

3- Fluid Support

Bronchopulmonary Dysplasia (BPD)

chronic lung disease of prematurity that develops in preterm infants who require prolonged oxygen therapy and mechanical ventilation, leading to impaired lung development and long-term respiratory dysfunction.

Causes

- Prematurity (immature lungs)
- Prolonged oxygen therapy
- Mechanical ventilation (positive pressure)
- Respiratory distress syndrome (NRDS) in early life
- Lung injury from inflammation or infection

Pathophysiology

Lung immaturity → leads to → respiratory failure → needs → oxygen therapy + positive pressure ventilation → results in → chronic lung injury (BPD).

Clinical Presentation & Diagnosis

- Occurs after prolonged mechanical ventilation in early life
- Suspect if oxygen + ventilation dependence > 10–14 days
- Affects very low birth weight infants (400–1000 g)

Prevention

- Lung-protective ventilation (gentle ventilation + permissive hypercapnia)
- Minimal oxygen therapy
- Antioxidants
- Inhaled nitric oxide (selected cases)
- Good nutrition
- Methylxanthines
- Corticosteroids (carefully selected cases)

Treatment

- Maintain oxygen saturation: 92–95%
- Respiratory support: NCPAP or high-flow nasal cannula
- Mechanical ventilation: only if severe respiratory failure and non-invasive support fails

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Transient Tachypnea of the Newborn

A self-limiting respiratory condition in newborns caused by delayed clearance of fetal lung fluid, leading to mild respiratory distress shortly after birth, usually resolving within 24–72 hours.

Clinical Presentation

- Tachypnea (60–150 breaths/min) within the first hours after birth
- Grunting, retractions, nasal flaring, ± cyanosis

Diagnosis

- ABG: Mild hypoxemia, hypercapnia, respiratory acidosis
- CXR: Hyperinflation, prominent pulmonary vascular markings (vascular congestion), flattened diaphragm, ± pleural effusion

- Benign and self-limiting (resolves within 24–72 hours)
- Also called Wet Lung Syndrome or RDS Type II
- More common in term infants and after elective cesarean section

Neonatal Pneumonia

Neonatal Pneumonia is a lung infection in newborn infants caused by bacteria, viruses, or fungi, resulting in inflammation of the lungs and respiratory distress.

Clinical Presentation & Diagnosis

- Early-onset: Before 72 hours (acquired before or during delivery)
- Late-onset: After 7 days (hospital- or community-acquired)

Signs & Symptoms

- Poor feeding, lethargy, irritability
- Temperature instability, cyanosis
- Grunting, tachypnea, retractions, nasal flaring
- Apnea and progressive respiratory failure

Treatment

- Antibiotics (pharmacotherapy)
- Respiratory support
- ECMO for severe cases

Persistent Pulmonary Hypertension of the Newborn

PPHN is a condition in which pulmonary vascular resistance (PVR) remains abnormally high after birth, causing right-to-left shunting and severe hypoxemia.

Clinical Presentation

- Presents within the first 12 hours of life
- Cyanosis
- Tachypnea
- Severe hypoxemia not responding to oxygen
- Respiratory distress: grunting, retractions, nasal flaring

Diagnosis

- Echocardiography (gold standard): confirms normal heart anatomy and pulmonary hypertension.
- ABG: severe hypoxemia.
- Chest X-ray: depends on underlying lung disease.
- Difference between pre- and post-ductal oxygen saturation.

Treatment

- Mechanical ventilation (maintain normal FRC, avoid overdistension)
- HFOV if needed
- Inhaled Nitric Oxide (iNO) if OI ≥25 (first-line pulmonary vasodilator.)
- IV Magnesium sulfate ($MgSO_4$)
- ECMO for severe refractory cases

Pathophysiology

- Failure of pulmonary vessels to dilate after birth.
- Persistent high PVR.
- Right-to-left shunt through the Patent Ductus Arteriosus (PDA) and/or Patent Foramen Ovale (PFO).
- ↓ Pulmonary blood flow → ↓ Oxygenation.

Causes

- Meconium Aspiration Syndrome (MAS) (most common)
- Respiratory Distress Syndrome (RDS)
- Pneumonia/Sepsis
- Birth asphyxia
- Congenital diaphragmatic hernia (CDH)
- Pulmonary hypoplasia

Measure pre-ductal SpO_2 from the right hand (before PDA) and post-ductal SpO_2 from either foot (after PDA). A pre-/post-ductal SpO_2 difference ≥5–10% suggests a right-to-left shunt and is highly suggestive of PPHN.

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Persistent Pulmonary Hypertension of the Newborn

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease, characterized by four congenital cardiac defects that reduce pulmonary blood flow and may cause right-to-left shunting and cyanosis.

consisting of four defects (PROVe):

- Pulmonary stenosis
- Right ventricular hypertrophy
- Overriding aorta
- Ventricular septal defect (VSD)

Clinical Features

- Cyanosis (severity depends on the degree of pulmonary stenosis).
- Pink Tet: Mild pulmonary stenosis → Left-to-right shunt → little or no cyanosis.
- Severe TOF → Right-to-left shunt → marked cyanosis.

Right-to-left shunt causes central cyanosis as deoxygenated blood bypasses the lungs and enters the systemic circulation, whereas left-to-right shunt mixes oxygenated with deoxygenated blood and is usually acyanotic (pink). In some congenital heart diseases, shunting is essential for survival, and a patent ductus arteriosus (PDA) provides lifesaving pulmonary or systemic blood flow until definitive treatment.

Managment

- Knee-chest position → ↑ SVR → ↓ Right-to-left shunt.
- 100% Oxygen → ↓ PVR and improves oxygenation.
- Morphine → Reduces agitation and oxygen consumption.
- Phenylephrine → ↑ SVR.
- Sodium bicarbonate → Corrects acidosis → ↓ PVR.

RT Ventilator Consideration

- Avoid high mean airway pressure (MAP) because it decreases venous return and cardiac output.
- Aim for early extubation when possible, especially after Glenn or Fontan procedures.
- Mild hypercapnia may increase PVR; maintain $PaCO_2$ around ≤45 mmHg if possible.
- Avoid hypoxia, acidosis, and high intrathoracic pressures, as they worsen pulmonary blood flow.

Hypoplastic Left Heart Syndrome (HLHS)

Hypoplastic Left Heart Syndrome (HLHS) is a critical congenital heart defect where the left side of the heart is severely underdeveloped, making systemic circulation dependent on a patent ductus arteriosus (PDA). Closure of the PDA can rapidly cause shock, severe hypoperfusion, metabolic acidosis, and death. Immediate management includes Prostaglandin E_1 (PGE_1) to keep the PDA open, followed by staged surgical palliation (Norwood → Glenn → Fontan) or heart transplantation.

Meconium Aspiration Syndrome (MAS)

A respiratory disorder caused by aspiration of meconium-stained amniotic fluid before or during birth, leading to airway obstruction, inflammation, surfactant inactivation, and pulmonary hypertension (PPHN).

Clinical Features

- Respiratory distress at birth
- Tachypnea
- Grunting
- Retractions
- Cyanosis
- Meconium-stained skin or amniotic fluid

Diagnosis

- Chest X-ray: Patchy infiltrates with hyperinflation.
- ABG: Hypoxemia ± hypercapnia.

High-Risk Factors

- Term or post-term infant (>41–42 weeks)
- Meconium-stained amniotic fluid (MSAF)
- Fetal distress / Perinatal asphyxia

Managment

- Oxygen therapy.
- CPAP or mechanical ventilation if needed.
- HFOV for severe disease.
- Inhaled Nitric Oxide (iNO) if associated with PPHN.
- Surfactant therapy in severe cases.
- ECMO for refractory hypoxemia.

RESPIRATORY REFERENCE

Neonatal Diseases

Choanal Atresia

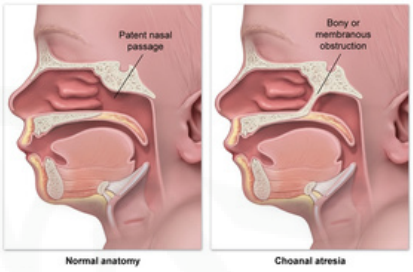
Choanal atresia is a congenital blockage of the posterior nasal passages, causing partial or complete nasal obstruction.

Key Factors

- Neonates are obligate nasal breathers.
- Can be unilateral or bilateral.
- Bilateral choanal atresia is a neonatal emergency due to airway obstruction.
- Pink when crying, cyanotic when quiet/feeding (classic finding).
- Commonly associated with CHARGE syndrome.

Diagnosis

- No. 8 French catheter is the bedside diagnostic test.
- Failure to pass the catheter from the nostril into the oropharynx suggests choanal atresia.
- CT scan confirms the diagnosis before surgery.



Management

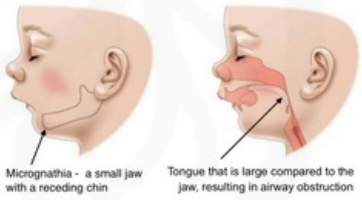
- Stabilize the airway with an oral airway, endotracheal tube (ETT), or tracheostomy if needed.
- Definitive treatment: Surgical repair.
- After surgery, a nasal stent (ETT) is placed to keep the choanae patent.

Pierre Robin Syndrome

A congenital syndrome characterized by micrognathia, glossoptosis (posterior displacement of the tongue), and cleft palate, leading to upper airway obstruction.

Clinical Features

- Airway obstruction
- Respiratory distress
- Feeding difficulties
- Episodes of desaturation, especially when supine



Management

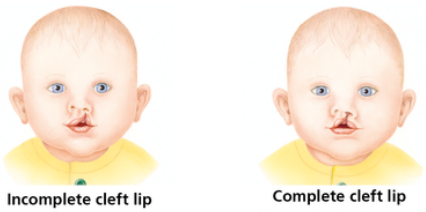
- Prone positioning (first-line to relieve airway obstruction)
- Nasopharyngeal or intraoral airway
- Endotracheal intubation if severe airway obstruction
- Surgical intervention (e.g., mandibular distraction or tracheostomy) in severe cases

Cleft Palate

A congenital defect in which there is an opening in the palate, with or without an associated cleft lip.

Clinical Features

- Feeding difficulties
- Poor suction
- Risk of aspiration
- Recurrent ear infections
- Speech problems later in life



Management

- Specialized feeding techniques/bottles.
- Cleft lip repair: Usually performed within the first 12 months of life (often in the first few months).
- Cleft palate repair: Recommended within the first 18 months of life, or earlier if possible.

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Neonatal Diseases

Air Leak Syndrome

Air leak syndromes occur when air escapes from the alveoli into extra-alveolar spaces due to alveolar rupture, usually from positive pressure ventilation or underlying lung disease.

Types

- Pulmonary Interstitial Emphysema (PIE)
- Pneumothorax
- Pneumomediastinum
- Pneumopericardium
- Pneumoperitoneum
- Subcutaneous Emphysema
- Systemic Air Embolism

Diagnosis

- Chest X-ray (Gold Standard)
- Transillumination (rapid bedside screening in neonates)
- Clinical signs: sudden desaturation, asymmetric chest movement, decreased breath sounds, hypotension (especially in tension pneumothorax).

Management

- Small, asymptomatic pneumothorax: Close observation ± supplemental oxygen.
- Tension pneumothorax: Immediate needle aspiration followed by chest tube drainage if required.
- Generalized PIE: Reduce ventilator settings (↓PIP, ↓PEEP, ↓Ti) and use a lung-protective strategy; permissive hypercapnia may be accepted.
- Unilateral PIE: Position the infant with the affected lung down; consider selective mainstem bronchial intubation of the unaffected lung if severe.
- HFOV/HFV: Preferred when conventional ventilation fails or persistent air leak is present.
- Surgical lobectomy: Reserved for severe, refractory unilateral PIE.

Congenital Diaphragmatic Hernia (CDH)

A congenital defect of the diaphragm allows abdominal organs to herniate into the thoracic cavity, causing lung compression and pulmonary hypoplasia.

Management

- Immediate endotracheal intubation if respiratory distress is present.
- Insert a large orogastric tube for continuous gastric decompression.
- Avoid bag-mask ventilation to prevent bowel distension.
- Use gentle ventilation with low airway pressures.
- Permissive hypercapnia is acceptable.
- HFOV if conventional ventilation is inadequate.
- Treat associated PPHN if present (e.g., iNO when indicated).
- Surgical repair after cardiopulmonary stabilization (not an emergency immediately after birth).

Diagnosis

- Prenatal ultrasound (most cases diagnosed antenatally).
- Chest X-ray confirms the diagnosis.

C□linical findings:

- Severe respiratory distress after birth.
- Scaphoid abdomen (sunken abdomen).
- Decreased/absent breath sounds on the affected side.
- Mediastinal shift and displaced heart sounds.

- Never use bag-mask ventilation in suspected CDH—it can inflate the bowel and worsen lung compression.
- Leads to **pulmonary hypoplasia** and **persistent pulmonary hypertension (PPHN).**
- **90% occur on the left side.**