Hyaline Membrane Disease

Objectives

- Introduction
- Risk Factors
- Etiopathogenesis
- Clinical Features
- Diagnosis
- Treatment
- Complication
- Differential Diagnosis



Introduction

- Also known as respiratory distress syndrome in newborns
- A common problem in preterm infants (<34 weeks).
- Defined as difficulty in respiration starting shortly after birth due to primarily deficiency of pulmonary surfactant in the lungs.



Risk Factors

Prematurity and low birth weight

Caesarean section without labour

Infant of diabetic mother

Hypothermia

Early cord clamping (<1 minute)

Chorioamnionitis

Precipitous delivery (extremely fast labour and delivery)

Others e.g. boys>girls, genetic conditions, second twin

Etiopathogenesis

Respiratory distress syndrome (RDS) is caused by pulmonary surfactant deficiency.

Surfactant is a lipoprotein containing phospholipids and proteins.

It is produced by type II alveolar cells (type II pneumocytes) and reduces surface tension in the alveoli.

Without surfactant, surface tension increases, leading to alveolar collapse during expiration.

More negative pressure is needed during inspiration to keep alveoli open.

Etiopathogenesis

This leads to inadequate oxygenation and increased work of breathing.

Hypoxemia and acidosis result, causing pulmonary vasoconstriction and right-to-left shunting across the foramen ovale.

This worsens hypoxemia, eventually leading to respiratory failure.

Ischemic damage to the alveoli causes the transudation of proteins, forming a hyaline membrane.

Surfactant production starts around 20 weeks of life and peaks at 35 weeks gestation.

Therefore, neonates less than 35 weeks are prone to developing RDS.

Clinical Features

Respiratory distress

- Fast breathing (>60 breaths/min)
- Retraction of intercostal and subcostal space
- Nasal flaring
- Chest indrawing
- Grunting (partial closure of the glottis during the forceful expiration to maintain functional residual capacity)

Cyanosis

Falling Oxygen saturation (SpO2<90%)

Hypotension

Decreased air entry on auscultation

Diagnosis

- 1. Chest X-ray:
 - 1. Homogenous ground glass appearance
 - 2. Complete white out of lungs (loss of demarcation of heart borders) in severe disease
 - 3. Air bronchogram
 - 4. Reticulogranular pattern
 - 5. Low lung volume
 - 6. Air leaks (e.g. pneumomediastinum and pneumothorax)



- Oxygen therapy
- Lungs show a dense reticulonodular pattern with air bronchogram
- Homogenous ground glass appearance



Diagnosis

Lecithin/Sphingomyelin ratio: 2:1 denotes fetal maturity

Shake test of gastric aspiration (Helps to determine lung maturity)

Blood (Sepsis screen)

Treatment

- A. Supportive management
 - Keep the baby warm e.g. Baby covered with warm clothes, Keeping under radiant warmer.
 - Nil per oral and appropriate IV fluids (10 % dextrose
 - Respiratory support: Clearing the airway, giving O2 through the headbox, until the lungs start producing enough surfactant. If a baby does not improve and develops difficulty in breathing with falling SpO2, then keep the baby on continuous positive airway pressure (CPAP)
 - Regular bedside monitoring of respiratory status (cyanosis, respiratory rate, rhythm and pattern, SpO2, air entry), circulatory status (Capillary refill time, Heart rate, Blood pressure), body temperature, capillary glucose status
 - ABG analysis
 - If sepsis, IV antibiotics (Ampicillin + gentamicin)





Respiratory support with CPAP



Newborn in mechanical ventilation

Treatment

Specific Management

Maintain oxygenation:

InSurE: Intubation-surfactants- extubate rapidly to CPAP



Ų

Ċ

Extracorporeal membrane oxygenation (ECMO) may be done in some cases.



Apnea management: physical stimulation, aminophylline, caffeine, mechanical ventilation



Complications

Pulmonary: collapse, pulmonary haemorrhage, pneumothorax, Bronchopulmonary Dysplasia (BPD)

CNS complications: Intraventricular haemorrhage, Retinopathy of prematurity

Cardiac complications: Patent ductus arteriosus (PDA)

GIT complications: Necrotizing enterocolitis

Renal: Acute Kidney Injury

Septicemia

Prevention

Antenatal glucocorticoids to mother <34 weeks of gestation:

- Injection of Betamethasone 12 mg doses, IM 24 hours apart (2 doses)
- Injection of Dexamethasone 6 mg doses, IM 12 hourly for 2 days (4 doses)

Prophylactic surfactants via ET tube in gestation <28 weeks or weight<1000 gram

Basic neonatal care

Differential Diagnosis

Transient tachypnea of the newborn

Pulmonary air leak disorders (pneumothorax, pneumomediastinum)

Neonatal pneumonia

Meconium aspiration

Persistent pulmonary hypertension of the newborn

The end

