Neonatal Jaundice: Physiological and Pathological Jaundice

Neonatal jaundice refers to the yellow discoloration of a newborn's skin and sclera due to elevated levels of **bilirubin** in the blood (hyperbilirubinemia). Bilirubin is a yellowish pigment produced from the breakdown of red blood cells.

- **Clinical jaundice manifests in neonates when bilirubin > 85 µmol/L (5 mg/dL)**.
- In adults, visible jaundice appears at lower bilirubin levels (~34 µmol/L or 2 mg/dL).

Pathophysiology & Basic Concepts

- **Hemoglobin Breakdown**:
  Red blood cells (RBCs) contain hemoglobin (Hb), which carries oxygen. When RBCs age (~120 days lifespan), they are removed by the reticuloendothelial system (liver and spleen). Hb breaks down into:
  - **Globin** (reused by the body as protein)
  - **Heme** (iron compound broken down into bilirubin)
- **Bilirubin** is produced from heme and normally processed by the liver to be excreted. Accumulation causes yellow staining (jaundice).
- **Newborns have high Hb (18-19 g/dL)** to meet fetal oxygen needs. After birth, Hb drops to ~11 g/dL in the first week, causing increased RBC breakdown and bilirubin production, often exceeding the newborn liver's processing capacity — leading to **physiological jaundice**.

Types of Neonatal Jaundice

1. Physiological Jaundice

- Occurs typically after the first 24 hours of life.
- Peaks by day 3-5 and resolves by day 10.
- Due to immature liver enzymes and high RBC turnover.
- Commonly seen in normal newborns; usually harmless.
- **Risk factors:** prematurity, bruising, polycythemia, breastfeeding.

2. Pathological Jaundice

- Appears within the first 24 hours or persists beyond 2 weeks.
- Caused by factors disrupting bilirubin metabolism or causing excessive RBC destruction.
- May cause muddy or generalized jaundice.
- **Causes include:**
  - Hemolytic diseases (Rhesus or ABO incompatibility)
  - Hypoxemia
  - Sepsis
  - Endocrine/metabolic disorders
  - Bile duct obstruction
  - Hypoglycemia

Clinical Significance and Risks

- **Bilirubin toxicity**: High unconjugated bilirubin crosses the blood-brain barrier ? deposits in brain nuclei (basal ganglia, hippocampus, etc.) causing **kernicterus** (permanent brain damage).
- High serum bilirubin is an emergency to prevent neurological injury.

Diagnosis and Investigations

- **Serum Bilirubin (SBR)** measurement is key.
- Assess mother's and baby's blood group and Rh factor.
- Coombs test to detect immune hemolysis.
- Check Hb for anemia and signs of hemolysis.
- Screen for infection if suspected.

Indications to investigate further:

- Jaundice within 24 hours of life.
- Jaundice persisting beyond 10 days.
- SBR above treatment thresholds (e.g., >250 µmol/L in term infants).
- Jaundice in a sick newborn.

Management

Goals:

- Prevent bilirubin encephalopathy.
- Treat underlying cause.
- Maintain hydration and nutrition.

Phototherapy

- Converts unconjugated bilirubin into water-soluble forms (biliverdin) that can be excreted.
- Uses blue light wavelength (400-500 nm).
- Indicated for:
    - Jaundice in first 24 hours
    - Deep jaundice (palms and soles)
    - Premature infants with jaundice
    - Hemolytic jaundice

Adverse effects:

- Dehydration and increased water loss
- Loose stools
- Irritability or lethargy
- Skin rash
- Overheating
- Retinal injury (protect eyes)
- Tanning/bronze baby syndrome

- Potential nutritional deficiencies (vitamins, calcium)

Exchange Transfusion

- Considered if phototherapy fails or bilirubin rises rapidly.
- Removes bilirubin and antibody-coated RBCs.
- Thresholds vary but often around 400-430 µmol/L bilirubin.

Adjunctive Treatments

- **Phenobarbital:** Accelerates bilirubin clearance.
- **Tin-mesoporphyrin:** Inhibits heme oxygenase enzyme (bilirubin production).
- **IV immunoglobulin (IVIG):** Reduces hemolysis in immune-mediated jaundice.
- **Activated charcoal:** Binds bilirubin in the gut (experimental).

Nursing and Supportive Care

- Ensure adequate feeding and hydration.
- Monitor bilirubin levels regularly during treatment.
- Educate parents on signs of worsening jaundice.
- Protect baby's eyes during phototherapy.
- Monitor for adverse effects of treatment.

Summary

Aspect	Physiological Jaundice	Pathological Jaundice
Onset	After 24 hours	Within 24 hours or prolonged jaundice
Duration	Resolves by day 10	>2 weeks, may be persistent
Cause	Immature liver, high RBC turnover	Hemolysis, infection, metabolic disorders
Severity	Mild	Often severe, may cause kernicterus
Treatment	Usually none or phototherapy	Phototherapy, exchange transfusion, treat cause