Condition: Neonatal jaundice ; when to treat

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Pathophysiology: **Neonatal jaundice** occurs because bilirubin production exceeds the liver's ability to conjugate and excrete it, leading to the buildup of unconjugated bilirubin in the blood.

Brief Report : **Neonatal jaundice** refers to the yellow discoloration of the skin, sclera, and mucous membranes caused by **elevated bilirubin levels** in the newborn. It is one of the most common conditions requiring evaluation and treatment in neonates.

Clinical Features :

- Yellow discoloration
- Lethargy
- Poor feeding
- Hypotonia or hypertonia
- High-pitched cry
- Irritability
- Vomiting

- ## Risk Factors :

1. Increased Bilirubin Production

- **Hemolytic Disease of the Newborn**
- **ABO incompatibility:** Most common, occurs when mother is Type O and baby is Type A or B.
- **Rh incompatibility:** When mother is Rh-negative and baby is Rh-positive.
- **Other blood group incompatibilities** (e.g., Kell, Duffy).
- **Enzyme deficiencies:** Such as Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency or pyruvate kinase deficiency.
- **Hereditary spherocytosis** or other RBC membrane defects.
- **Hematoma or Bruising:** Blood collected under the skin (e.g., cephalohematoma, extensive bruising) is broken down, releasing bilirubin.
- **Polycythemia:** High red blood cell count, often seen in infants of diabetic mothers or delayed cord clamping

2. Decreased Bilirubin Clearance (Impaired Hepatic Function)

- **Prematurity:** Infants born before 37 weeks gestation have immature liver enzymes (UDP-glucuronyl transferase) and reduced ability to conjugate bilirubin.
- **Asphyxia or Hypoxia:** Lack of oxygen can impair liver function.
- **Infection (Sepsis):** Sepsis can lead to liver dysfunction.
- **Maternal Diabetes:** Infants can be macrosomic and have higher risk.
- **Certain Medications:** Some drugs given to the mother during pregnancy or to the infant can interfere with bilirubin metabolism (e.g., sulfonamides, certain traditional medicines)
- **Hypothyroidism:** Can be associated with prolonged jaundice.

3. Increased Enterohepatic Circulation

- **Delayed or Infrequent Feeding:** This is a significant factor, especially in the first few days of life. Insufficient milk intake leads to slower gut motility and more time for bilirubin reabsorption.
- **Gastrointestinal Obstruction or Motility Disorders:** Conditions like intestinal atresia, stenosis, or Hirschsprung disease can impair bilirubin excretion.
- **Breastfeeding:** While generally beneficial, **breastfeeding jaundice** can occur.
- **Insufficient milk intake** in the early days.

4. Genetic and Ethnic Factors

- **East Asian and Native American infants** have a higher incidence of G6PD deficiency and may have higher rates of jaundice

5. Other Factors

- **Previous sibling with neonatal jaundice** requiring phototherapy.
- **Male gender**
- **Weight loss >7-8%** in the first 24 hours.

- ## Investigations :
- **Bilirubin Measurement (Core Test)**
  - **Total serum bilirubin (TSB)** and often **direct (conjugated) bilirubin**
  - **Transcutaneous bilirubin (TcB)** may be used for screening
- **Blood type / Hemolysis Screening**
  - **Maternal and infant blood group**
  - **Direct antiglobulin test (DAT / Coombs test)** on the infant (detects immune hemolysis)
  - **Hemoglobin/hematocrit (CBC)** to look for **anemia**
  - Sometimes **reticulocyte count** (evidence of hemolysis/erythropoiesis)
  - **Peripheral smear** if indicated
- **Evaluate for Infection**
  - **Clinical assessment** plus vitals
  - **Sepsis evaluation** (Blood culture , CBC , Lumbar puncture)
- **Check for Prematurity/Physiologic Explanations**
  - **Gestational age** assessment (preterm = higher risk, affects thresholds)

    - **Feeding history** and weight loss (screen for dehydration / poor intake)
    - **Weight check** (excess weight loss suggests inadequate feeding)
- **Assess Conjugated (Cholestatic) Jaundice Causes**
    - Repeat fractionated bilirubin
    - Liver panel (ALT/AST , ALP , GGT , Albumin)
    - Stool/urine evaluation
    - Abdominal ultrasound
- **Other Targeted Tests (Depending on Context)**
    - **G6PD level** if ethnicity/history suggests risk or if hemolysis suspected without clear cause
    - **Thyroid function tests** (e.g., TSH ± free T4) if prolonged jaundice/concern for hypothyroidism
    - **Urinalysis/urine culture** if infection suspected
    - **Coagulation profile** or further metabolic tests if severely ill or cholestasis

- # Management:

Treatment is indicated when the TSB level crosses specific thresholds, which vary based on the infant's age and risk factors. These thresholds are typically represented on **nomograms** (charts).

General Factors for Treatment:

1. **Age in Hours:** This is the most critical factor. Bilirubin levels that might be acceptable at 48 hours could be dangerous at 12 hours.
2. **TSB Level:** Higher levels necessitate intervention.
3. **Rate of Rise:** A rapidly rising bilirubin level (e.g., > 0.5 mg/dL per hour) is more concerning.
4. **Risk Factors:** Prematurity, G6PD deficiency, sepsis, asphyxia, hypoalbuminemia, and signs of hemolysis all lower the threshold for treatment.
5. **Clinical Signs:**

- **Signs of Acute Bilirubin Encephalopathy (ABE):** Lethargy, poor feeding, hypotonia, irritability, high-pitched cry, arching of the back (opisthotonos), fever, seizures. **If these signs are present, immediate intervention (often exchange transfusion) is required, regardless of the TSB level.**
- **Chronic Bilirubin Encephalopathy (Kernicterus):** Symptoms include auditory neuropathy (hearing loss), choreoathetoid cerebral palsy, gaze abnormalities, and developmental delay. This is the condition we aim to prevent.

There are two primary methods for managing hyperbilirubinemia:

1. Phototherapy

- **Mechanism:** Light breaks down bilirubin in the skin into less toxic, water-soluble byproducts that can be excreted more easily by the body.
- **When it's used:**

- For TSB levels above the threshold for phototherapy but below the threshold for exchange transfusion on the nomogram.
- For infants with significant risk factors, phototherapy may be started at a lower TSB level.
- **Types:**
- **Standard phototherapy:** Using special blue fluorescent lamps or white lights.
- **Intensive phototherapy:** Using specialized units (e.g., LED lights) that deliver higher irradiance (light energy), which is more effective and can lower bilirubin levels faster. This is often preferred.
- **Administration:**
- Infant should be **undressed** (except for eye patches and diaper) to maximize skin exposure.
- Eyes must be **covered** to prevent retinal damage.
- Maintain **adequate hydration and nutrition** (frequent feeds are essential).
- Monitor **temperature**.
- **Regular TSB monitoring** is crucial to assess response. Phototherapy can be stopped when TSB levels drop to safe levels, but close monitoring is still needed.

2. Exchange Transfusion

- **Mechanism:** This is a more aggressive treatment where the infant's blood is gradually replaced with donor blood. This removes bilirubin and antibodies, and can also correct severe anemia if present.
- **When it's used:**
- When TSB levels reach a critical threshold (often around 20-25 mg/dL or higher, depending on age and risk factors) where phototherapy is unlikely to be sufficient.
- In infants with signs of **acute bilirubin encephalopathy**, even if TSB is not at the critical level.
- In cases of severe anemia due to hemolysis.
- **Procedure:** Performed by trained medical personnel in a Neonatal Intensive Care Unit (NICU). It's a relatively risky procedure and is reserved for severe cases.

Pharmacological Treatment (Less Common for Jaundice Itself)

- **Phenobarbital:** May be used in specific cases of **prolonged jaundice** or certain inherited conditions where it can induce liver enzymes to help conjugate bilirubin. It's not a first-line treatment for acute hyperbilirubinemia.
- **Intravenous Immunoglobulin (IVIG):** Can be used in isoimmune hemolytic disease (e.g., Rh or ABO incompatibility) to reduce the need for exchange transfusion by inhibiting hemolysis.

Management of Underlying Cause

- **Treating Infection:** Prompt antibiotic therapy for sepsis.
- **Correcting Metabolic Disorders:** Specific management for inborn errors of metabolism.
- **Improving Feeding:** Encouraging frequent breastfeeding or formula feeds, or supplementing if necessary, to increase gut motility and bilirubin excretion.

Key Points:

- **Physiologic jaundice** is common and usually harmless.
- **Treat** when bilirubin levels exceed safe thresholds or if there are risk factors.
- **Phototherapy** is first-line; **exchange transfusion** for severe or refractory cases.
- Early detection and management prevent **kernicterus** and **neurologic damage**.