JAUNDICE IN NEW BORN
WHAT THE MBBS STUDENT SHOULD KNOW

- **Purpose:** Prevention of BIND
- **Detailed – Skill to be acquired**
  - Early recognition of encephalopathy and urgent referral for ET
  - Phototherapy, how to use, precautions, types,
  - Clinical assessment of skin color and limitations
  - Recognize at risk groups, clinical and PDSB, use of AAP charts to decide
- **Basic knowledge**
  - Importance of feeding
  - Prematurity (late preterm)
  - Blood group incompatibility / IVIG
  - Cephalhematoma (other collections of blood)
DEFINITION

- Jaundice = visible manifestation in skin and sclera of elevated serum bilirubin
- Visible in adults at STB > 2mg/dl
- In neonates if STB > 5 mg/dl
INCIDENCE

Chemical hyperbilirubinemia

• (> 2mg/dl) universal in newborns during 1\textsuperscript{st} week

Some degree of Jaundice

• 60-70\% of term newborns and
• 80\% of preterm newborns

7 April 2016
METABOLISM OF HAEMOGLOBIN

Red cells → Hemolysis → Hemoglobin → Turnover → Hemoproteins

- Myoglobin
- Catalase
- Peroxidase
- Cytochromes
- Nitric oxide synthase

Heme

- Heme oxygenase
- Metalloporphyrins

NADPH
Oxygen

Cytochrome c (P-450) reductase

- NADP
- Water
- Fe^{2+}

Biliverdin

- Biliverdin reductase
- NADPH
- NADP

Bilirubin

- Glucuronosyltransferases
- Enterohepatic circulation
- BDG
- BMG

Excretion in intestines and gallbladder

Carbon monoxide

- GC
- GMP

Oxyhemoglobin
- Oxygen

Carboxyhemoglobin
- Oxygen

Exhaled carbon monoxide

Oxyhemoglobin
BILIRUBIN PHYSIOLOGY

Bilirubin → Ligandin (Y-acceptor) → Bilirubin MG, Bilirubin DG → Bile → Small Bowel → Stercobilin (gut bacteria) → Excreted

EH circulation → β-glucuronidase → Deconjugated
PHYSIOLOGICAL MECHANISMS OF NEONATAL JAUNDICE

- Increased bilirubin synthesis
- Less efficient binding and transport of bilirubin
- Less efficient hepatic conjugation and excretion
- Enhanced absorption of bilirubin via enterohepatic circulation
CHARACTERISTICS OF PHYSIOLOGICAL JAUNDICE

- Appears between 24-72 hrs. of life
- Peak STB levels are seen between 3rd – 5th days of life in term and 3rd – 7th day in preterm
- Usually does not exceed 15 mg/dl
- Does not persist for more than 2 weeks in a full term infant
- No treatment usually required
CLINICAL CRITERIA TO ASSESS JAUNDICE
(KRAMER’S RULE)

- Head & Neck : 4-8 mg/dl
- Upper trunk : 5-12 mg/dl
- Lower trunk and thighs : 8-16 mg/dl
- Arms and lower legs : 11-18 mg/dl
- Palms and soles : >15 mg/dl
PATHOLOGICAL JAUNDICE: CLINICAL CRITERIA

- Clinical jaundice in the first 24 hours of life.
- STB > 17 mg/dl.
- Rate of STB increase > 0.2 mg/dl/h or 5mg/dl/d.
- Direct serum bilirubin > 2 mg/dl.
- Clinical jaundice persisting for > 2 weeks in a full term infant.
CAUSES OF PATHOLOGICAL JAUNDICE IN NEWBORN

- Appearing within 24 hours of birth
- Rh and ABO incompatibility
- G6PD and PK enzyme deficiency
- Infections: TORCH, Bacterial, Malaria
CAUSES OF JAUNDICE IN NEWBORN – CONTD..

- Appearing within 24-72 hours after birth
  I. Physiological jaundice
  II. Neonatal jaundice
  III. Polycythemia
  IV. Extra vascular blood
    • Cephalohematoma
    • Sub-galeal hematoma
    • Intraventricular bleed
    • Subarachnoid bleed
  V. Increased enterohepatic circulation
    • Intestinal obstruction
CAUSES OF JAUNDICE IN NEWBORN – CONTD..

- Appearing after 72 hours after birth:
  - Neonatal Sepsis
  - Cephalhematoma
  - Neonatal hepatitis
  - EHBA
  - Breast milk jaundice
  - Metabolic causes:
    - Hypothyroidism
    - Hypopituitarism
    - Crigler-Najjar syndrome
    - Gilbert disease
BREAST MILK JAUNDICE

- May persist as a prolonged physiological jaundice or appear de-novo after 1st week
- Common in exclusively breast fed babies
- Maximum intensity is between 10-14 days
- If STB > 15 mg/dl, temporary cessation of breast feeding for 48 hours leads to dramatic fall and does not rise thereafter, but such a practice can defeat breast feeding and must be avoided
- For higher levels, phototherapy may be needed
- The exact cause is still not understood

7 April 2016
APPRAOCH TO A JAUNDICED BABY

- Ascertain birth weight, gestation and post-natal age in hours.
- Assess clinical condition (well or ill).
- Decide whether jaundice is physiological or pathological.
- If physiological and baby well, only observation is required.
- If deeply jaundiced, look for Kernicterus (lethargy, poor feeding, poor/absent Moro, hypertonia, opisthotonus or convulsions).
KERNICTERUS

- **Acute**
  - Stage 1 (1st few days): Lethargy, poor sucking, hypotonia,
  - Stage 2 (Mid-1st week): Rigid extension of extremities, seizures, high pitched cry, opisthotonus, retrocollis
  - Stage 3 (after 1st week): Stupor/coma, marked opisthotonus

- **Chronic**
  - Movement disorders
  - Gaze anomalies
  - Auditory abnormalities
WORK UP OF JAUNDICED NEWBORN

- Maternal and perinatal history
- Physical examination
- Lab Studies:
  - Total, direct and indirect serum bilirubin
  - Blood grouping and Rh typing
  - Hematocrit, Reticulocyte count, PBS
  - Direct Coomb’s test of baby
  - Sepsis screen
  - Liver function and Thyroid tests
  - Torch assay

7 April 2016
Aims:

1. To prevent STB from rising
2. To reduce STB level
3. To prevent neurotoxicity
PREVENTION OF HYPERBILIRUBINEMIA

- Early and frequent breast feeding
- Adequate hydration
- Administration of Anti-D injection to Rh negative mother (when the baby is Rh positive)
REDUCTION OF STB LEVELS AND PREVENTION OF NEUROTOXICITY

• Phototherapy

• Exchange blood transfusion
PHOTOTHERAPY

• Phototherapy results in production of photoproducts which are excreted in the bile and subsequently removed in stool.
• It uses blue light in spectrum of 450-460nm wavelength and irradiance of 6-12µW/cm²/nm.
• The maximal surface area of naked baby is exposed to this light at a distance of 45 cm.
• The eyes and genitalia of baby should be covered during phototherapy.
• Feeding every 2 hours and frequent change of posture are
PHOTOTHERAPY - CONT..

• The first type of reaction is formation of configurational isomers of bilirubin 4Z15E.

• Native bilirubin is 4Z15Z.

• The photo isomer 4Z15E becomes more polar and therefore more water soluble and can be excreted through bile.

• However, this reaction is potentially reversible, after which they can be reabsorbed by enterohepatic circulation.
PHOTOTHERAPY - CONT.

• The second type of photoreaction leads to formation of structural isomer Lumirubin.

• This is an irreversible reaction and hence cannot be reconverted to native bilirubin and reabsorbed.

• Hence formation of this isomer produces more rapid and efficient decline in STB levels.

• However, formation of lumirubin efficiently requires high intensity phototherapy (irradiance of 25-40 µW/cm²/nm) at a distance of 15-20 cm.
PHOTOTHERAPY - CONT.

- Temp is monitored every 2-4 hrs.
- Weight is taken daily.
- More frequent breast feeds or 10-20% extra IV fluids are provided.
- STB is measured every 12 hrs.
- Phototherapy is discontinued if 2 STB values are < 10 mg/dl.

7 April 2016
PHOTOTHERAPY: ADVERSE EFFECTS

- Increased insensible water loss.
- Loose green stools.
- Hyperthermia / Hypothermia.
- Rashes (erythema).
- Oxidative injury.
- UV light irradiation.
- Bronze baby syndrome.
EXCHANGE TRANSFUSION

• The most effective and reliable method to reduce STB.

• It decreases the risk of bilirubin encephalopathy by:
  ▪ Reducing total bilirubin load.
  ▪ Increasing the binding sites of plasma albumin.
  ▪ Shifting bilirubin out of plasma.
  ▪ Providing erythrocytes less apt to haemolyse.
  ▪ Removes sensitized RBC.
EXCHANGE TRANSFUSION - CONTD..

• Umbilical venous catheterization is done

• 5-10 ml aliquots are removed and replaced sequentially until about twice the blood volume of neonate has been replaced

• Choice of blood:
  
  • ABO Incompatibility: use O\(^+\)ve blood. Ideal is O\(^+\)ve cells suspended in AB plasma
  
  • Rh Isoimmunization: in emergency use O\(^-\)ve blood. Ideal is O\(^-\)ve blood suspended in AB plasma
## MAISEL’S CHART

<table>
<thead>
<tr>
<th>STB (mg/dl)</th>
<th>Birth Wt.</th>
<th>&lt;24 hrs.</th>
<th>24-48 hrs.</th>
<th>49-72 hrs.</th>
<th>&gt;72 hrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5`</td>
<td>All</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>All</td>
<td>Phototherapy if hemolysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14</td>
<td>&lt;2500G</td>
<td>Exchange if hemolysis</td>
<td>Phototherapy</td>
<td>Investigate if STB &gt; 12 mg/dl</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;2500 G</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-19</td>
<td>&lt;2500 g</td>
<td>Exchange Transfusion</td>
<td>Consider exchange</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;2500 g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 and More</td>
<td>All</td>
<td>Exchange Transfusion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*7 April 2016*
MAISEL’S CHART

• For decision making based on Maisel’s chart, in the presence of following, treat as in next higher bilirubin category:

  • Perinatal asphyxia
  • Respiratory distress
  • Metabolic acidosis
  • Hypothermia
  • Low serum protein
  • Birth weight < 1500 g
  • Signs of clinical or CNS deterioration
CONJUGATED HYPERBILIRUBINEMIA

• Defined as direct serum bilirubin > 2mg/dl

• Clues to suspect conjugated hyperbilirubinemia:
  • High colored urine
  • White / clay colored stool
  • Persistence of jaundice beyond 2 weeks
  • Hepato-splenomegaly
CAUSES OF UNCONJUGATED HYPERBILIRUBINEMIA

• Idiopathic neonatal hepatitis
• Inspissated bile syndrome
• Infections: Hepatitis B, TORCH, Sepsis
• Biliary tract malformations: EHBA, annular pancreas, choledochal cyst, bile duct stenosis
• Metabolic disorders: Galactosemia, hereditary fructose intolerance, alpha-1AT deficiency, tyrosinemia, glycogen storage disease IV, hypothyroidism
• TPN

7 April 2016
THANK YOU