Neonatal jaundice

Clinical Guideline Presentation v3.0
References:
Queensland Clinical Guideline: Neonatal jaundice is the primary reference for this package.

Recommended citation:

Disclaimer:
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Feedback and contact details:
Funding:
Queensland Clinical Guidelines is supported by the Queensland Health, Healthcare Improvement Unit.

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Objectives

• Understand common causes of jaundice
• Identify babies at risk of jaundice (hyperbilirubinaemia)
• Understand investigations required and management of jaundice
• Identify complications of conjugated and unconjugated hyperbilirubinaemia
• Consider discharge planning strategies
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>CF</td>
<td>Cystic fibrosis</td>
</tr>
<tr>
<td>CMV</td>
<td>Cytomegalovirus</td>
</tr>
<tr>
<td>DAT</td>
<td>Direct antiglobulin test (also known as Coombs test)</td>
</tr>
<tr>
<td>FBC</td>
<td>Full blood count</td>
</tr>
<tr>
<td>G6PD</td>
<td>Glucose-6-phosphate dehydrogenase deficiency</td>
</tr>
<tr>
<td>LFT</td>
<td>Liver function tests</td>
</tr>
<tr>
<td>RBC</td>
<td>Red blood cell</td>
</tr>
<tr>
<td>Rh D</td>
<td>Rhesus type D</td>
</tr>
<tr>
<td>TFT</td>
<td>Thyroid function tests</td>
</tr>
<tr>
<td>TcB</td>
<td>Transcutaneous bilirubin</td>
</tr>
<tr>
<td>TSB</td>
<td>Total serum bilirubin</td>
</tr>
<tr>
<td>USS</td>
<td>Ultrasound scan</td>
</tr>
</tbody>
</table>
Incidence

- One of the most common conditions requiring medical attention in newborn babies
- Occurs in approximately 60% of term and 80% of preterm babies in the first week of life
- 3.6% of all babies born in Queensland (2020) had phototherapy
Pathogenesis of hyperbilirubinaemia

- Occurs due to an imbalance between bilirubin production, conjugation and elimination

- Unconjugated bilirubin:
  - Accumulates in the blood due to red cell destruction
  - Binds to albumin and is converted to conjugated bilirubin in the liver

- Conjugated bilirubin is water soluble and eliminated in urine and stools
## Risk factors

<table>
<thead>
<tr>
<th>Maternal risk factors</th>
<th>Neonatal risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ABO and Rh D type</td>
<td>• Feeding: breastmilk, delayed gut colonisation, inadequate breastmilk or formula intake</td>
</tr>
<tr>
<td>• Genetic</td>
<td>• Haematological: haemolysis, polycythaemia, haematoma</td>
</tr>
<tr>
<td>• Diabetes</td>
<td>• Gastroenterological: bowel obstruction</td>
</tr>
<tr>
<td>• Previous baby with jaundice</td>
<td>• Infection</td>
</tr>
<tr>
<td></td>
<td>• Male</td>
</tr>
<tr>
<td></td>
<td>• Prematurity</td>
</tr>
</tbody>
</table>
Pathological jaundice

Early presentation (before 24 hours of age) or high peak level

<table>
<thead>
<tr>
<th>Context</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Level of free bilirubin (unbound to albumin) increases risk of</td>
<td>• Haemolysis: (e.g. bruising, haemorrhage,</td>
</tr>
<tr>
<td>developing acute and chronic encephalopathy</td>
<td>isoimmunisation)</td>
</tr>
<tr>
<td>• Exacerbated by acidosis/hypoxia, hypothermia, hypo-albuminaemia,</td>
<td>• Decreased conjugation of bilirubin: (e.g.</td>
</tr>
<tr>
<td>infection, some medications</td>
<td>congenital hypothyroidism)</td>
</tr>
<tr>
<td></td>
<td>• Decreased excretion of bilirubin: (e.g.</td>
</tr>
<tr>
<td></td>
<td>biliary atresia, cystic fibrosis (CF))</td>
</tr>
</tbody>
</table>
## Physiological jaundice

Jaundice onset after 24 hours and resolving early

<table>
<thead>
<tr>
<th>Context</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Transient—resolves in first week to 10 days (term baby) or 3 weeks (preterm baby)</td>
<td>• Physiological due to increased volume and decreased life span of RBC</td>
</tr>
<tr>
<td>• Mostly benign</td>
<td>• Common in breastfeeding babies</td>
</tr>
<tr>
<td>• Investigate and treat unwell, jaundiced baby for underlying disease</td>
<td></td>
</tr>
</tbody>
</table>

Queensland Clinical Guidelines: Neonatal jaundice
# Prolonged jaundice

## Jaundice onset after day 14

<table>
<thead>
<tr>
<th>Context</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Jaundice after day 14 in term babies and day 21 in preterm babies</td>
<td>• Unconjugated: (e.g. inadequate nutrition and hydration, breast milk)</td>
</tr>
<tr>
<td>• Usually harmless but may be indicative of more serious disease</td>
<td>• Conjugated: (e.g. congenital hypothyroidism)</td>
</tr>
<tr>
<td></td>
<td>• Unconjugated and/or conjugated: (e.g. haemolytic disease, G6PD)</td>
</tr>
</tbody>
</table>
Assessment of jaundice

• Examine all babies for jaundice:
  o Every 8 to 12 hours in the first 72 hours of life
  o Before discharge
• Do not rely on visual examination to assess level of jaundice
  o Use TcB or measure TSB

Jaundice appears cephalocaudal and regresses in reverse order
Signs of jaundice

- Lethargy
- Feeding: poor intake, breastmilk
- Weight loss greater than 10%
- Urine: output and colour
- Stools: colour
- Pale stools and dark urine:
  - Investigate for biliary atresia

**OKAY:** Yellow (breast feeding) or bright yellow/green (formula feeding) stools

**NOT OKAY:** If stools are pale or urine is dark coloured further investigations required
Total serum bilirubin (TSB)

Measure total, conjugated and unconjugated bilirubin

- Measure if jaundiced baby:
  - Less than 24 hours of age
  - Less than 35 weeks gestation
- Plot on nomogram
- Repeat TSB according to nomogram
Transcutaneous bilirubin (TcB)

- Reduces the number of invasive blood tests
- Suitable for babies:
  - Greater than 35 weeks gestational age
  - Older than 24 hours of age

Not recommended

- During phototherapy
- After phototherapy
- After exchange transfusion
- Prolonged jaundice
- Conjugated bilirubinaemia
Initial investigations

• Check maternal antenatal screening:
  ◦ Blood group, Rh D type, red cell antibodies
• Total serum bilirubin
• FBC
• Blood group compatibility:
  ◦ ABO and Rh D type, DAT
Additional investigations

Consider as indicated:

Electrolytes/urea

• Infection C-reactive protein
  • Blood culture and sensitivity
  • Urine microscopy and culture
  • Congenital infections—signs suggestive of history, severe jaundice, elevated conjugated bilirubin, thrombocytopenia

• Inborn errors of metabolism—unwell with severe jaundice

• Albumin/LFT
# Investigations for prolonged jaundice

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progression of early jaundice</td>
<td>History, weight gain, feeding, bilirubin level (total/conjugated/unconjugated), FBC, LFT, TFT</td>
</tr>
<tr>
<td>Recurrent or new presentation of jaundice</td>
<td>Urine microscopy and culture, CMV, reducing substances, FBC and reticulocytes, consider G6PD, repeat neonatal screening test</td>
</tr>
<tr>
<td>Unwell baby</td>
<td>Urine microscopy and culture, CMV, reducing substances, colour of stools, abdominal USS, sweat test and genetic markers for CF, inborn errors of metabolism (e.g. CF, hypothyroidism, galactosaemia)</td>
</tr>
<tr>
<td>Genetic</td>
<td>Family history, investigate as indicated for RBC metabolism disorders, glucuronyl transferase deficiency disorders, red cell membrane disorders</td>
</tr>
</tbody>
</table>
Nomogram

- Hour-specific graph based on TSB
- Monitors trend of TSB or TcB
- Use nomogram appropriate for baby’s age in hours, gestational age and birth weight
- Re-check TSB as per nomogram
  - Cease phototherapy when TSB greater than 50 micromol/L below phototherapy treatment line
Nutrition - newborn

Breastfeeding
- Encourage 8–12 feeds/day initially
- Supplementary feed not recommended
- Offer expressed breastmilk if extra fluids required

Formula feeding
- Educate parents about adequate intake

Intravenous fluids
- Only if clinically indicated
Phototherapy

- Commence as indicated by nomogram
- Spectral power increases with increased skin exposure
- Irradiance maximised by minimising the distance between the baby and the light source
- Use additional light sources for intensive phototherapy
Phototherapy continued

• Clinical response depends on:
  o Efficiency of the phototherapy unit
  o Rate of bilirubin production and bilirubin excretion

• Blue-green light in 460–490 nanometres emission spectrum is most effective

• Measure spectral output of light source
  • Maximise spectral power by increasing skin exposure
  • Maximise irradiance by reducing distance between baby and light source
How does phototherapy work

Causes a chemical reaction

Bilirubin in the skin absorbs light and converts bilirubin molecules to photoisomers

Photoisomers are excreted in bile or urine
Efficacy of phototherapy

Spectrum of light
Blue light most effective at 460–490 nm

Distance
Maximise irradiance by minimising baby-to-light-source distance

Irradiance (430-490 nm)
Standard Phototherapy: about 25-30 µW/cm²/nm
Intensive Phototherapy: ≥ 30 µW/cm²/nm

Skin area exposed
Maximise for intensive phototherapy with additional light source below infant
Care during phototherapy

- Nurse baby in nappy only
- Use eye protection
- Check baby’s temperature
- Interrupt phototherapy for feeding/parental attachment when bilirubin decreasing
Exchange transfusion

Medical emergency

Indications
• TSB continues to rise despite phototherapy
• Baby shows signs of acute bilirubin encephalopathy

Transfusion
• Use plasma that is O Rh D negative or relevant antigen negative, CMV negative (if available), irradiated
• Exchange double the baby’s blood volume

Risks
• Fluid overload, metabolic imbalance, necrotising enterocolitis, infection, thrombocytopenia, coagulopathy, air embolism, thrombosis
Hyperbilirubinaemia complications

• Bilirubin encephalopathy due to lipid soluble bilirubin crossing blood brain barrier

• Bilirubin induced neurological disorder (BIND)—severe and irreversible; diagnosis based clinical observation and history

• Bilirubin induced auditory toxicity due to effect on neural cells of auditory pathway
Bilirubin encephalopathy

- Complication of unconjugated hyperbilirubinaemia
- Lipid soluble and can cross the blood-brain barrier
- Results in:
  - Acute and then chronic bilirubin encephalopathy
  - Kernicterus
- Australian incidence is 9.4/100,000 live births
Discharge planning

• Identify at risk babies
  ◦ Consider pre-discharge measurement of TcB
• Provide written and verbal information to parents
• Review:
  ◦ Baby less than 72 hours of age at discharge within 2 days of going home
    ◦ Jaundice increasing or presents after 10 days
    ◦ Poor feeding or losing weight
    ◦ Pale stools, dark urine