**Purpose**

To identify and treat neonates greater than 35 weeks gestation at risk for hyperbilirubinemia.

To prevent and reduce the incidence of neonatal hyperbilirubinemia encephalopathy and kernicterus.

**Policy Statement**

- All newborns greater than 35 weeks gestation will have Serum Bilirubin (SB) or Transcutaneous Bilirubin (TcB) measured within the first 72 hours of life.

- Newborns with visible jaundice in the first 24 hours of life will have SB or TcB done immediately and physician will be notified.

- Decisions for further screening or treatment will be made based on Canadian Pediatric Society Algorithms and nomograms and in consultation with the Neonatologist/Designate.

- Parents will be given verbal and written information regarding jaundice, screening for jaundice, and about treatments provided to their newborn.

- Sites where TcB testing is done will develop appropriate point-of-care criteria and competency to support use of their transcutaneous device.

**Applicability**

This policy applies to Covenant Health employees, members of the medical and midwifery staff, students, volunteers and other persons acting on behalf of or in conjunction with Covenant Health (including contracted services providers as necessary).

**Policy Elements**

1. **Anticipatory Testing**

   1.1. If mother was not tested for ABO and Rh(D) blood types and screened for red cell antibodies during pregnancy, or has a high risk blood type (e.g. O positive), newborn cord blood will be tested for blood group and DAT (Coombs test).

   1.2. Some mothers may present with additional antibodies. Blood group and DAT (either from a cord blood sample and/or a newborn blood sample) are usually required along with earlier therapy, closer follow-up, and pediatric hematologist or neonatologist consultation.

   1.3. It is recommended that newborns at risk for G6PD (Mediterranean, Middle Eastern, African or Southeast Asian origin) be screened for G6PD deficiency.
2. **Required Newborn Assessment**

2.1. The Nursing Assessment and Interventions Algorithm (Appendix IV) provides an overview of management.

2.2. For all newborns, with each physical exam after birth, an assessment for jaundice will be made. This ensures repeated assessments during the first 24 hours and throughout the hospital stay. Additional jaundice assessment is recommended at 48 and 36 hours of age and until feeding is established (usually on Day 3 to 4 of life).

2.3. Assessment will include:
   a) DAT results and blood groups, when available.
   b) Identification of Risk Factors. Heightened vigilance will be used for infants at risk as per the table below:

<table>
<thead>
<tr>
<th>Risk Factors for development of Severe Hyperbilirubinemia:</th>
<th>Conditions which increase susceptibility to acute encephalopathy in the presence of severe hyperbilirubinemia (CPS 2011):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible jaundice &lt; 24 hrs old</td>
<td>Respiratory distress</td>
</tr>
<tr>
<td>Visible jaundice before discharge from hospital at any age</td>
<td>Hydrops</td>
</tr>
<tr>
<td>Less than 38 weeks gestation</td>
<td>Prematurity</td>
</tr>
<tr>
<td>Previous sibling with hyperbilirubinemia</td>
<td>Acidosis</td>
</tr>
<tr>
<td>Visible bruising</td>
<td>Hypoalbuminemia</td>
</tr>
<tr>
<td>Cephalhematoma</td>
<td>Hypoxia</td>
</tr>
<tr>
<td>Male sex</td>
<td>Seizures</td>
</tr>
<tr>
<td>Maternal age greater than 25 years of age</td>
<td>Sepsis</td>
</tr>
<tr>
<td>Asian or European background</td>
<td></td>
</tr>
<tr>
<td>Dehydration</td>
<td></td>
</tr>
<tr>
<td>Exclusive and partial breastfeeding</td>
<td></td>
</tr>
</tbody>
</table>

c) Presence or absence of jaundice. Visual assessment of jaundice is **inaccurate and can lead to errors particularly in darkly pigmented** infants.
   - Jaundice is usually seen in the face first and progresses downward to the trunk and extremities.
   - Observe in a well-lit room preferably in daylight by a window
   - Blanch skin with digital pressure over forehead or nose, revealing underlying colour
   - In dark skinned infants, check oral mucosa, posterior portion of hard palate, and conjunctiva.

d) Frequency of feeding, adequacy of intake and evidence of milk transfer.
e) Patterns of stooling and voiding
f) Infant’s weight and percent change from birth weight
g) Neurological signs such as level of alertness, lethargy, hypo or hypertonia, high pitched cry
3. **Required Bilirubin Screening**

3.1. All newborns greater than 35 weeks gestation will have SB or TcB measured during the first 72 hours of life.
   a) If not required earlier due to visible jaundice, a SB may be obtained at the same time as the metabolic screen.
   b) Alternatively, TcB may be done at discharge or 72 hours of age, whichever is first.
   c) SB or TcB shall be done before discharge, even if less than 12 hours of age. Follow up will be arranged within 24 hours, if discharged prior to 24 hours of age.

3.2. Plot SB or TcB vs. Age (hours) on the Predictive Nomogram in Appendix I to determine the Risk Zone (Low, Low Intermediate, High Intermediate, High). If both SB and TcB are available, plot the SB result.

3.3. Match the Risk Zone to the appropriate category on the Action Table (Category 1, 2 or 3) to determine the action required (Appendix I). Actions required may include:
   a) Routine Care – continue assessments for jaundice as per Section 2
   b) Repeat Bilirubin within 24 – 48 h
   c) Possible Phototherapy - SB required now if this assessment is based on TcB
      - Neonatologist/Designate notified
      - SB repeated within 24 hours
   d) Phototherapy Required - Start phototherapy now
      - SB required now if this assessment is based on TcB
      - Neonatologist/Designate notified
      - SB repeated within 24 hours

3.4. All newborns who are visibly jaundiced within the first 24 hours of life will have SB or TcB done immediately and Neonatologist/Designate will be notified.

3.5. SB will be ordered by Neonatologist/Designate when indicated by TcB results and when clinical assessment indicates.

3.6. For newborns requiring phototherapy, SB will be ordered as outlined in Phototherapy Section 4.

3.7. Newborns with severe or prolonged hyperbilirubinemia will be investigated further, including measurement of conjugated bilirubin and G6PD screening.

3.8. Sites where TcB testing is done will develop appropriate point-of-care criteria and competency to support use of their transcutaneous device.
4. **Phototherapy**

4.1. TcB readings are less reliable after initiation of phototherapy. SB is recommended during and following phototherapy treatment.

4.2. Different phototherapy devices deliver a variety of irradiance levels. Irradiance levels of at least 30 µW/cm²/nm, confirmed with an appropriate spectral radiometer over the waveband of approximately 460 to 490 nm are desirable.

4.3. Biomedical support for ensuring adequate light intensity and/or measuring of light intensity with a bilimeter per manufacturer's recommendations will be in place.

4.4. **Intensive Phototherapy** is recommended for infants with, or with risk factors for, severe hyperbilirubinemia. Intensive phototherapy provides irradiance of at least 30 µW/cm²/nm over as much body surface as possible. Guidelines for Intensive Phototherapy (Appendix II) will be utilized.

- More than one spot phototherapy light may be used if the light area does not cover the surface area of the patient.
- Intensity is increased by bringing lights closer to the patient, as close as 10 cm, however manufacturer's instructions must be followed.
- If SB is approaching Exchange Transfusion level, skin surface area receiving phototherapy should be maximized by using a fibre-optic phototherapy blanket under the patient and removing the diaper.

4.5. If phototherapy is started within 24 hours of birth, a follow-up SB will be ordered 2 to 6 hours after treatment is started in order to detect a rapidly rising bilirubin level. An anticipated decrease of more than 34 µmol/L should be evident within 4 to 6 hours.

4.6. If phototherapy is started after 24 hours of age, a follow-up SB will be obtained within 24 hours to determine effectiveness of therapy.

4.7. Phototherapy will be discontinued when SB falls below the threshold for phototherapy. A SB within 24 hours after phototherapy is discontinued is done to detect rebound level.

4.8. Nursing care during phototherapy will be provided as per Table 1.
## Table 1: Nursing Care of the Newborn under Phototherapy

<table>
<thead>
<tr>
<th>Principle</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expose maximum amount of skin to phototherapy light.</td>
<td>• Apply eye shields and diaper only</td>
</tr>
<tr>
<td></td>
<td>• Continuous Positive Airway Pressure (CPAP) hats remain in place</td>
</tr>
<tr>
<td>If bilirubin level is rising quickly or approaching exchange transfusion level.</td>
<td>• Add a fibre optic phototherapy blanket underneath baby and use device(s) to ensure maximum of skin is exposed to light, e.g. two spotlights (upper body/lower body) or bank of lights instead of spotlight.</td>
</tr>
<tr>
<td></td>
<td>• Remove diaper.</td>
</tr>
<tr>
<td></td>
<td>• Changing infant's posture from supine to prone every 2 to 4 hours may maximize the area exposed to light if fibre optic blanket is not available.</td>
</tr>
<tr>
<td>Provide maximum intensity from phototherapy lights while preventing thermal injury.</td>
<td>• Apply lights close to baby following manufacturer's recommendations.</td>
</tr>
<tr>
<td></td>
<td>• Ensure Biomedical Department or Bilimeter monitoring of light intensity.</td>
</tr>
<tr>
<td></td>
<td>• Avoid humidity greater than 90% as this may decrease irradiance by 15% with blue LED lights.</td>
</tr>
<tr>
<td>Eye Protection and Care</td>
<td>• Use eye shields unless phototherapy is by fibre optic blanket only and baby is swaddled.</td>
</tr>
<tr>
<td></td>
<td>• Ensure eyes are closed when applying shields. Avoid pressure to eyelids and nostrils.</td>
</tr>
<tr>
<td></td>
<td>• Every hour: Confirm eye shields are covering eyes.</td>
</tr>
<tr>
<td></td>
<td>• Every 4 hours: Assess for signs of conjunctivitis or irritation, provide eye care with sterile water and cotton ball or clean moist cloth, and apply lubricating drops or ointment.</td>
</tr>
<tr>
<td></td>
<td>• Every 24 hours: Consider replacing shields.</td>
</tr>
<tr>
<td>Thermoregulation</td>
<td>• Check temperature every 30 minutes until stable, then every 3 to 4 hours with routine assessments and vital signs.</td>
</tr>
<tr>
<td>Establish and support effective breastfeeding</td>
<td>• Encourage frequent feeding while interrupting therapy as little as possible Eye Shields are removed during feeding.</td>
</tr>
<tr>
<td>Dehydration may be associated with increased serum bilirubin and may be exacerbated by phototherapy.</td>
<td>• Consider using a fibre optic blanket and swaddling during feeding.</td>
</tr>
<tr>
<td></td>
<td>• If it is not desirable to interrupt intensive phototherapy for feeding, consider: a fibre optic blanket positioned over baby.</td>
</tr>
<tr>
<td></td>
<td>• Supplements of water or dextrose water are not recommended.</td>
</tr>
<tr>
<td>Hydration</td>
<td>• Supplemental fluids will be administered, orally or by intravenous infusion to newborns under phototherapy who are at elevated risk of requiring exchange transfusion.</td>
</tr>
<tr>
<td>Intravenous Therapy – Phototherapy can cause degradation of TPN and hemolysis of RBCs.</td>
<td>• Wrap administration sets and bags of parenteral nutrition or blood with light occlusive material.</td>
</tr>
<tr>
<td>Blue Lights make assessment of skin color more difficult.</td>
<td>• Monitor O2 saturations continuously if using blue lights. Cover pulse oximetry probe with an occlusive wrap.</td>
</tr>
<tr>
<td>Lab Testing</td>
<td>• Turn off phototherapy lights while lab samples are drawn.</td>
</tr>
</tbody>
</table>
### Table 1: Nursing Care of the Newborn under Phototherapy

<table>
<thead>
<tr>
<th>Principle</th>
<th>Intervention</th>
</tr>
</thead>
</table>
| Complications      | • Monitor for temperature instability, intestinal hypermotility, diarrhea, and skin changes such as:  
• Erythema which may occur and will resolve when phototherapy stops.  
• Rarely, bronze discoloration of the skin is seen in infants with cholestatic jaundice.  
• Purpura or bullae may develop in infants with cholestatic jaundice or congenital erythropoietic porphyria. |
| Contraindications  | • Phototherapy is contraindicated in newborns with conjugated hyperbilirubinemia, porphyria or those with a positive family history for this disorder or those treated with photosensitizing drugs. |

### Policy Elements

#### 5. Intravenous Immunoglobulin (IVIG)

5.1. Newborns with a positive DAT who have predicted severe disease based on antenatal investigation or an elevated risk of progressing to exchange transfusion based on the postnatal progression of SB concentration should receive IVIG at a dose of 1 gm/kg.

#### 6. Exchange Transfusion

6.1. Exchange transfusion will be performed when SB levels reach those on the Guidelines for Exchange Transfusion in infants of 35 or more weeks gestation (Appendix III) or if signs of acute bilirubin encephalopathy are present (hypertonia, arching, retrocollis, opisthotonus, fever, high pitched cry).

6.2. Preparation of blood for exchange transfusion may take several hours, during which time intensive phototherapy, supplemental fluids and IVIG should be used.

6.3. Repeat measurement of SB just before the exchange is reasonable, (as long as it does not delay the procedure), and may result in the exchange transfusion not being required if SB has fallen with treatment.

6.4. Exchange transfusion is a procedure with substantial morbidity that should only be performed by trained personnel in neonatal intensive care units with full monitoring and resuscitation capabilities in consultation with a neonatologist.

6.5. Double volume exchange transfusions are preferred over single volume.

6.6. Arterial-venous exchange transfusions are preferred over venous exchange transfusions.

6.7. Do not routinely administer calcium during exchange transfusion.

6.8. Continue intensive phototherapy during exchange transfusion except when SB is being drawn.

6.9. TcB measurements are not accurate, and should not be used, following exchange transfusion. SB should be used instead.
Policy Elements

7. Required Parent Education

7.1. Parents will be given verbal and written information regarding jaundice, screening for jaundice, and about treatments provided to their newborn.

   a) Jaundice Information Sheet including topics:
      • What jaundice is
      • Management of mild physiologic jaundice
      • Risks of severe hyperbilirubinemia
      • When to return to hospital or see the doctor
      • Importance of, and how to recognize, adequate feeding and hydration
      • Monitoring output (wet & dirty diapers)

8. Discharge and Post Discharge

8.1. In hospital screening results, phototherapy and subsequent SB results, and any concerns regarding jaundice will be communicated to Public Health Unit/Wellness Services through documentation on the Notice of Live Birth and other site specific Liaison Sheets.

8.2. It is recognized that public health visits may only be made with the consent of the parent. If there is jaundice follow-up the physician considers essential post discharge and there are concerns regarding parental compliance with follow-up, the physician will be made aware and continuation of in hospital treatment will be considered.

8.3. Any newborn requiring exchange transfusion or with neurologic abnormalities will be referred to a multi-disciplinary follow-up program which will include brainstem auditory evoked potential hearing testing.

Policy Elements

9. Documentation

9.1. Assessments for jaundice as outlined in Required Newborn Assessment will be documented in the Newborn Chart.

9.2. SB and TcB screening will be documented on the Predictive Nomogram and it will placed on the Newborn Chart.

9.3. Lab results such a DAT, Blood Group, or Serum Bilirubin (SB) will be placed in the newborn chart.

9.4. Nursing care during phototherapy will be documented in the newborn chart, including checks of phototherapy irradiance and eye care provided. Visual checks to ensure eyepatches are in correct placement are done hourly.

9.5. Any referrals to physician or arrangements for post discharge SB testing with follow-up required will be documented on the Discharge Care Plan.
9.6. Screening results or most recent SB results, along with any concerns, discharge instructions to parents regarding follow-up, and any follow-up bilirubin testing required will be documented on the Notice of Live Birth and any site specific Liaison sheets used to communicate with Public Health/Wellness.

10. Definitions

Physiologic Jaundice - A transient, benign condition that occurs during the first week of life in up to 60% of term newborns. It usually appears the 2nd or 3rd day after birth, peaking at day 3 or 5. The peak may be later, day 5, in the preterm and infants in some racial groups, e.g., Asians. Physiologic jaundice will typically resolve by day 7 in the term newborn, and by day 10 to 21 in the preterm newborn. (Riordan 2004, CPS 2011)

Breastmilk Jaundice - An extension of physiologic jaundice. Onset is after the 5th day of life, in association with the appearance of transitional and mature milk. The mechanism of breastmilk jaundice has been shown to be due to an increase in the intestinal absorption of bilirubin, not to an inhibitor of the conjugating enzyme. The levels rarely become dangerously high; careful evaluation for other causes of jaundice is essential since this is a diagnosis of exclusion. (Riordan 2004)

Pathological Jaundice - Bilirubin levels that deviate from the normal range and require intervention.

Severe Hyperbilirubinemia - A total serum bilirubin concentration greater than 340 μmol/L at any time during the first 28 days of life. (CPS 2011)

Critical Hyperbilirubinemia - A total serum bilirubin concentration greater than 425 μmol/L at any time during the first 28 days of life. (CPS 2011)

Acute Bilirubin Encephalopathy - A clinical syndrome, in the presence of severe hyperbilirubinemia, of lethargy, hypotonia and poor suck, which may progress to hypertonia with high-pitched cry and fever and eventually to seizures and coma. Acute encephalopathy does not occur in full-term infants if the peak SB concentration remains below 340 μmol/L and is very rare unless the peak SB concentration exceeds 425 μmol/L. (CPS 2011)

Chronic Bilirubin Encephalopathy - the sequelae of acute encephalopathy with athetoid cerebral palsy with or without seizures, developmental delay, hearing deficit, occulomotor disturbances, dental dysplasia and mental deficiency. (CPS 2011)

Kernicterus - the pathological finding of deep yellow staining of neurons and neuronal necrosis of the basal ganglia and brainstem nuclei. (CPS 2011)

Total Serum Bilirubin (TSB) - The total serum bilirubin concentration in a capillary or venous blood sample, analysed in the lab.

Transcutaneous Bilirubin (TcB) - A non-invasive, point-of-care estimate of total serum bilirubin concentration, based on the amount of bilirubin deposited in the skin, performed with a meter that uses multi-wavelength spectral analysis.
Direct Antiglobulin Test (DAT) - Detects the presence of antibodies bound to Red Blood Cells.

Phototherapy - Phototherapy lights come in fluorescent, high intensity fluorescent, fibre optic or halogen. A µW/cm²/nm measurement describes the intensity of the light. Desired waveband interval is 460 to 490 nm. Different technologies provide different light intensities. Devices that emit lower irradiance may be supplemented with additional devices. Much higher doses (65 µW/cm²/nm) might have as yet unidentified adverse effects.

Intensive Phototherapy - An irradiance of greater than 30 µW/cm²/nm over as much body surface as possible
Conventional Phototherapy - Irradiance less than 30 µW/cm²/nm.
Predictive Nomogram

Plot bilirubin on graph and then refer to the **Action Table** below.

### Action Table

<table>
<thead>
<tr>
<th>Risk Zone</th>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>37 or more weeks gestation AND DAT Negative</td>
<td>35 – 37 6/7 weeks gestation OR DAT Positive</td>
<td>35 – 37 6/7 weeks gestation AND DAT Positive</td>
</tr>
<tr>
<td>High</td>
<td>Possible Phototherapy SB now and repeat within 24 h Notify physician</td>
<td>Possible Phototherapy SB now and repeat within 24 h Notify physician</td>
<td>Start Phototherapy now SB now and repeat within 24 h Notify physician</td>
</tr>
<tr>
<td>High Intermediate</td>
<td>Routine Care</td>
<td>Repeat SB or TcB within 24 – 48 h</td>
<td>Possible Phototherapy SB now and repeat within 24 h Notify physician</td>
</tr>
<tr>
<td>Low Intermediate</td>
<td>Routine Care</td>
<td>Routine Care</td>
<td>Possible Phototherapy SB now and repeat within 24 h Notify physician</td>
</tr>
<tr>
<td>Low</td>
<td>Routine Care</td>
<td>Routine Care</td>
<td>Routine Care</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Guidelines for Intensive Phototherapy

Guidelines for **intensive** phototherapy, in newborns of 35 or more weeks gestation. Intensive phototherapy should be used when the Serum Bilirubin (SB) concentration exceeds the line corresponding to the appropriate Risk Category.

**Risk Categories**

- **High Risk**: 35 – 37 6/7 weeks and risk factors
- **Medium Risk**: Either 38 or more weeks and risk factors or 35 – 37 6/7 weeks and well (no risk factors)
- **Low Risk**: 38 or more weeks and well (no risk factors)

**Notes**

1. These guidelines are applicable only to Serum Bilirubin (SB)
2. For newborns 35 – 36 6/7 weeks and well (no risk factors): Adjust the threshold line lower for newborns closer to 35 weeks (phototherapy indicated at lower bilirubin levels), and higher for those closer to 37 6/7 weeks (phototherapy indicated at higher bilirubin levels).
Figure 3) Guidelines for exchange transfusion in infants of 35 or more weeks’ (wk) gestation. These guidelines are based on limited evidence and the levels shown are approximations. Exchange transfusions should be used when the total serum bilirubin (TSB) concentration exceeds the line indicated for each category. G6PD Glucose-6-phosphate dehydrogenase...
Nursing Assessment and Interventions Algorithm for > 35 Weeks

Assess all infants for:
- Risk Factors for hyperbilirubinemia; DAT and Blood Group if available
- Visible signs of jaundice
- Effective feeding; evidence of milk transfer, frequency
- Adequate output: stooling and voiding
- Weight and percent change from birth weight
- Level of alertness, lethargy, hypo or hypertonia, high pitched cry
- Bilirubin (SB or TcB) at discharge or at 72h of age, whichever is first

Jaundice present at less than 24 hours of age: *
- Measure bilirubin immediately
- Notify Neonatologist/Designate
- Document assessment findings

* Infants who become jaundiced in the first 24 hours of life need immediate medical assessment. This may be pathological jaundice.

Jaundice present between 2-4 days of life:
- Check or repeat bilirubin (SB or TcB)
- Evaluate milk-transfer process
- Assess behaviour and effect on feeding
- Notify Neonatologist/Designate
- Document assessment findings
- Inform Public Health Nurse upon discharge

Severe or prolonged hyperbilirubinemia
- Investigate further, including conjugated bilirubin and G6PD screening

Required Parent Teaching:
- Provide verbal and written teaching about the following:
  - What Jaundice is
  - Management of mild physiologic jaundice
  - Risks of Severe Hyperbilirubinemia
  - When to return to hospital or see the Doctor
  - Importance of, and how to recognize adequate feeding and hydration in the newborn
  - Monitoring output (wet & dirty diapers)

Phototherapy (if required)
- Purpose of phototherapy
  - Application and removal of eye patches, eye care

Exchange Transfusion (if required)

Phototherapy ?
- Nursing Interventions while on Phototherapy
  - Phototherapy set-up – place lights close as per manufacturer, ensure irradiance checks, monitor temperature of incubator
  - Thermoregulation – Baby temperature q30min until stable then q3 to q4h
  - Eye Care – use eye shields, check hourly, remove only for feedings or if swaddled with biliblanket. Eye care q8h: cleaning, lubrication
  - Hydration Status – encourage frequent feeding, note intake/frequency of feeds, output, and any signs of dehydration
  - Integument – ensure maximum amount of skin is exposed to phototherapy light
  - Neurological Status – monitor, may be lethargic or irritable affecting feeding
  - SB – if photo starts at less than 24h, check SB 2 to 6h after starting and as ordered. If photo starts at greater than 24h, check SB within 24h and as ordered.
  - Other – cover oxygen saturation probes (use with blue lights) and bags/tubing for blood or TPN with light occlusive wraps if in use
  - If bilirubin is rising quickly or approaching exchange transfusion level: A) Ensure intensive phototherapy, B) Expose more skin to lights (add biliblanket under baby or q3h position change from prone to supine, remove diaper), C) Provide Supplement Fluids, D) Give IVIG dose 1 gm/kg as per Neonatologist/Designates order

YES
Related Documents
Adapted with permission from Stollery Children’s Policy and Procedure/Guideline Manual:

RELATED POLICIES AND PROCEDURES
IVIG
Phototherapy

References


Revisions
December, 2012
September, 2015