PSBC Provincial Perinatal Guidelines Committee
Sample Guideline Template

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Development Committee Members:
Thayanthi Tharmaratnam, Sarika Rama, Chelsea MacAulay
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1.0 Introduction

Hyperbilirubinemia (jaundice) is a common condition occurring in newborns. Jaundice occurs in 60% of term infants and nearly all preterm infants (Watson, 2009). Jaundice has potential devastating effects such as progression to kernicterus. Kernicterus is a rare condition but cases are continuing to occur as a result of imprecise assessments, insufficient screening protocols and early discharge from hospitals (Newman, 2009; Watson, 2009). Nurses must be vigilant when identifying and monitoring infants at risk and implementing treatments when needed, to help reduce the potential negative impacts of untreated jaundice (Watson, 2009).

2.0 Risk Factors

RISK FACTORS OF PHYSIOLOGICAL JAUNDICE

- Major Clinical Risk Factors:
  - Rh isoimmunization, ABO or other blood incompatibles (Watson, 2009).
  - Previous sibling with neonatal jaundice requiring phototherapy (Ives, 2011).
  - Exclusive and insufficient breast milk transfer (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - Heavy bruising from delivery: old RBC's underneath the skin resulting in increased bilirubin production (Ives, 2011).
  - Repeated attempts at vacuum extraction (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - Cephal-hematoma/significant bruising (Ives, 2011).
  - Ethnicity (East Asian) (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - Jaundice prior to 24 hours (Ives, 2011).

- Minor Clinical Risk Factors:
  - Male gender (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - Macrosomic babe with GD mother (Ives, 2011).
  - Maternal age >25 (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - GA 37-38 weeks (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - Jaundice observation prior to discharge.
  - Pre-discharge TSB/tcb in high zone.

RISK FACTORS OF PATHOLOGICAL JAUNDICE

- General Risk Factors:
  - Jaundice appearing in the first 24 hrs of life jaundice in a sick neonate (Bhutani, Vilms & Hamerman-Johnson, 2010).
  - Rapidly rising serum bilirubin.
  - Increased production of bilirubin load on the liver.
  - Immune-mediated hemolytic anemia.
  - Prolonged jaundice more than 14 days in term infant; more than 21 days in preterm infants ("National institute for," 2010).
  - Conjugated serum bilirubin more than 25 umol/litre ("National institute for," 2010).
  - Pale, chalky stools and dark urine (Bhutani, Vilms & Hamerman-Johnson, 2010).

- Hemolytic Risk Factors:
  - Red cell enzyme defects: glucose-6-phosphate dehydrogenase deficiency, pyruvate kinase deficiency, other erythrocyte enzyme deficiencies (Watson, 2009).
  - Red cell membrane defects (Watson, 2009).
  - Hemolytic disease (Watson, 2009).
  - Hemoglobinopathies (Watson, 2009).
  - Unstable hemoglobin levels (Watson, 2009).
  - Disseminated intravascular coagulation (DIC) (Watson, 2009).
  - Extravasation of blood, hematomas and pulmonary/abdominal/cerebral/other occult hemorrhage (Watson, 2009).
  - Increased enterohepatic circulation (Watson, 2009).
  - Polycythemia (Ives, 2011).

- Heritable/Genetic Risk Factors:
  - Hereditary spherocytosis, elliptocytosis, pyropoikiloctosis, stomatocytosis (Watson, 2009).
  - Congenital heinz body hemolytic anemia (Watson, 2009).
  - Pyloric stenosis (Watson, 2009).
Metabolic Risk Factors:
- Inborn errors of metabolism:
  - Crigler-Najjar syndrome, types I and II (Watson, 2009).
  - Gilbert syndrome (Watson, 2009).
  - Galactosemia (Watson, 2009).
  - Tyrosinemia (Watson, 2009).
  - Hypothyroidism (Ives, 2011).
  - Hypopituitarism (Ives, 2011).
- Increased absorption of bilirubin from the GI tract:
  - Small or large bowel obstruction or ileum.
  - Decreased clearance.

Breastfeeding Jaundice

- Early Breastfeeding Jaundice:
  - Usually begins within 2-4 days of life (Watson, 2009).
  - Peaks between day 3 and 6 of life (Watson, 2009).
  - Related to the process/pattern of breastfeeding (Watson, 2009).
  - Causes: dehydration, poor caloric intake and increased enterohepatic circulation (Watson, 2009).

- Late Breast Milk Jaundice:
  - Appears around 4-7 days of life (Watson, 2009).
  - Peaks between day 5 and 15 of life (Watson, 2009).
  - No confirmed theories to explain this pattern of jaundice; speculated that substances in breast milk may block proteins in the liver responsible for breakdown of bilirubin (Watson, 2009).

3.0 Assessment

Colour

Kramer’s 5-point scale is commonly used by nurses to describe the extent of infant jaundice (Keren, Tremont, & Luan, 2009). The scale’s score is based on cephalocaudal progression of an infant’s jaundice, with facial jaundice being a score of 1 and increasing numerically as jaundice extends toward the feet. This score should not be the used as a primary means of assessing for jaundice, as research shows poor correlation between assessments based on the Kramer Scale and measured bilirubin values. Extra caution should be taken with the examination of late preterm infants, as they are at an increased risk of developing hyperbilirubinemia and the Kramer Scale is particularly limited with this population (Keren et al., 2009). The TSB range associated with progression through the 5 zones is as follows:

<table>
<thead>
<tr>
<th>Zone</th>
<th>SBR (umol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
</tr>
<tr>
<td>4</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>&gt;250</td>
</tr>
</tbody>
</table>

To assess the colour of the skin, observe after blanching by pressure from the thumb. This should be performed in a well-lit room, or in natural light if performed in the home. It should be noted that prolonged exposure to direct or indirect sunlight can bleach a newborn’s skin, making it more difficult to assess for jaundice (Lease & Whalen, 2010).
AGE

Jaundice before 24 hours or after 10 days of life is always pathological, and the cause should be investigated prior to initiating any treatment. Jaundice that occurs between 24 hours to 10 days of life is determined to be pathological or physiological by plotting the age of the infant against their total bilirubin levels on the Bhutani Risk Graph. Knowing an infant’s risk zone can be beneficial when deciding to initiate treatment (Lease & Whalen, 2010).

FEEDING

Feeding helps newborns pass bilirubin in their stools. After the first 1-2 days of life, newborns should be breastfed 8 or more times in a 24 hour period. As the bilirubin levels increase, the newborn may become more lethargic and have a decreased desire to feed. If the newborn is sleepy during feeds, utilize waking techniques to keep them active (eg, removing a layer of clothes, tickling feet, talking to baby) (Perinatal Services BC, 2013).

HYDRATION/INTAKE

Adequate intake during feeds can be determined by assessing the following (Perinatal Services BC, 2013):

- Signs and symptoms of dehydration (eg: skin turgor, moistness of mouth/mucous membranes).
- Newborn weight loss
- Energy levels.
- Feeding pattern/behaviors.
- Elimination (see guide below, based on breastfed infant). A newborn suffering from jaundice typically experiences increased frequency of stools, which may be loose, greenish in colour, and explosive (Perinatal Services BC, 2013).

<table>
<thead>
<tr>
<th>Day 1 (0-24hr)</th>
<th>Day 2 (24-48hr)</th>
<th>Day 3 (48-72hr)</th>
<th>Day 4 (72-96hr)</th>
<th>Day 5 (96-120hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Stools/Day</td>
<td>at least 1 meconium</td>
<td>at least 1 meconium or 1 transitional stool</td>
<td>3-4 transitional stools</td>
<td>3-4 transitional stools</td>
</tr>
<tr>
<td># of Wet Diapers/Day</td>
<td>at least 1</td>
<td>1-2</td>
<td>2-3</td>
<td>3-5</td>
</tr>
</tbody>
</table>

4.0 Clinical Management

Clinical management is aimed at avoiding bilirubin encephalopathy and its long term neurological complications. Adequate hydration is an important consideration in the infant with moderate to high bilirubin levels. Fundamental to management is a good history and physical examination, together with appropriate investigations including:

- Unconjugated and conjugated bilirubin.
- Blood group determination with a direct antibody test (coomb’s test).
- Hemoglobin and hematocrit.
- Other lab investigations (eg. T4, g6pd) may be required depending on the patient assessment.

Once the serum bilirubin reaches “risk” levels, the standard treatment is the use of phototherapy and/or exchange transfusion. Several expert bodies have developed guidelines to assist care providers determine the appropriate time to implement each therapy as well as how to provide the therapy most effectively. The most common guidelines utilized in risk identification and management of hyperbilirubinemia are listed in the appendices.
5.0 Other Issues in the Management of Jaundice

BREASTFEEDING AND PHOTOTHERAPY

Interruption of breastfeeding is not indicated; the latest research emphasizes family-centred approach to have the infant breastfeeding while phototherapy is being delivered (Szucs & Rosenman, 2013; Willis, Hannon, Scrimshaw, 2002). An adequate intake of milk minimizes the bilirubin level by stimulating bowel emptying. Encourage frequent and effective breastfeeding (at least 8X in 24 hours) (Stokowski, 2011; American Academy of Pediatrics, 2004). Breastfeeding may be interrupted for diagnostic or therapeutic purposes when the bilirubin levels are high and there is a risk of an exchange transfusion. Should this occur, the following is advised:

- Continue phototherapy.
- Consider discontinuing breastfeeding for 24 hours or alternate breastfeeding with formula feeding if fluid intake is a concern.
- Offer positive support for breastfeeding by encouraging the maintenance of lactations by using a breast pump or manual expression during the period of interrupted breastfeeding.
- Family centre approaches encourages kangaroo care where care provider offers skin-to-skin and breastfeeds while phototherapy treatment is given (Szucs & Rosenman, 2013).
- Routine supplementation of breastfed infants with water or dextrose water is not recommended (Canadian Paediatric Society, 2007).

![Figure 3: Kangaroo care where the mother is placed skin to skin with her baby during phototherapy treatment and 'biliblankets'. Eyeshields are worn by both. (Szucs & Rosenman, 2013).](image)

DAYLIGHT TREATMENT

Exposing infants to indirect or direct sunlight via a window has been a long standing practice. (Stokowski, 2011) Controlled studies on this treatment have not been done in Western countries. Mild jaundice requires no sunlight exposure, as it sends a false note to parents that their baby has a significant problem when in fact the infant does not. Changes in the beliefs of sunlight exposure need to change to avoid long term risk of skin cancer. (Harrison, Nikles, & Nowak, 2013) If an infant has jaundice that needs treatment according to accepted guidelines then it should be investigated further.

FIBROPTIC TREATMENT

Use of fibroptic or “bili blankets” are commonly used as a “double” phototherapy treatment in addition to the conventional treatment (. Studies have found that fibroptic and conventional phototherapy are more effective than conventional phototherapy alone. No conclusion could be made on the superiority of one fibroptic device over another. Studies have found that fibroptic devices do not interfere more with infant care or on parent-child bonding. At this time, “bili blankets” are still recommended not to be used alone to treat non-physiologic causes of jaundice or those infants at risk of requiring an exchange transfusion.

HOME PHOTOTHERAPY

There are few articles in the literature that address this issue in the North American context especially pertaining to Canada. One Cochrane review compared home versus hospital phototherapy treatment found that home treatment is the same in efficacy within the first 24 hours, but treatment requiring more duration were not as effective and required longer duration compare to hospital based treatment Malwade & Jardine, 2012). On the other hand, home treatment provided more parent-infant bonding time (Malwade & Jardine, 2012). With increase use of conventional hospital treatments there have been few implementation of this method in communities in Canada. To date there are no published evidence-based guidelines on the use of home phototherapy in Canada.
PHOTOTHERAPY AND EYE SHIELDS
Eye shields have been recommended for use to protect the infant’s eye from phototherapy damage. If using eye shields, they should be removed for short periods to encourage interactions with care providers, should not be put on too tightly as the pressure can damage the newborn’s eyelids (Szucs & Rosenman, 2013; Stokowski, 2011).

PROPHYLACTIC PHOTOTHERAPY FOR PREMATURE/VERY LOW-WEIGHT INFANT
A recent Cochrane review has looked at prophylactic phototherapy treatment that has found prophylactic treatment prevents serum bilirubin levels from increasing when treatment is given within 36 hours of birth for preterm and/or very low weight infant, but further research is required to understand long term outcomes on the brain and central nervous system development and other areas by using prophylactic phototherapy treatment. (Okwundu, Okoromah, & Shah, 2013)

Clinical Evaluation:
- Serum bilirubin levels at which phototherapy is initiated.
- Bilirubin levels at which the infant is readmitted.
- Numbers of readmissions for jaundice.

6.0 Strategies for Decreasing Incidence

LABOUR AND DELIVERY
- Avoid trauma during labor and delivery.
- Blood typing: all pregnant women should be tested for ABO and Rh blood types and have a serum screen for unusual isoimmune antibodies (ECRI Institute, 2010).

BREASTFEEDING
- Provide early assistance education and support for breastfeeding.
- Encourage mothers to breastfeed 8-12 times a day (ECRI Institute, 2010).
- Assess adequate intake of newborn.
- Do not supplement with water or dextrose because that may result in bilirubin levels rising. If supplementation is necessary due to inadequate intake, the mother should pump her breasts and give expressed breast milk, donor milk and/or formula.

ASSESSMENTS
- Visual inspection includes checking naked baby in bright and natural light (unreliable under artificial light and once phototherapy has started). Be aware that visual inspections are not accurate and may often lead to errors especially in darker babies (Ives, 2011).
- Visual assessment should be done whenever vital signs are taken but no less than every 8-12 hours for at risk babies (Bhutani, Vilms & Hamerman-Johnson, 2010).

PARENTAL EDUCATION
- Teach parents how to recognize clinical jaundice. Education regarding factors that influence the development of jaundice, how to check baby for jaundice, what to do if they suspect jaundice, importance of checking baby's diaper for dark urine or chalky stools.("National institute for," 2010).
- Ensure parental education regarding signs of adequate hydration and feeding.

DISCHARGE/ FOLLOW-UP
- Perform risk assessment before discharge by recognizing major risk factors (ECRI Institute, 2010)
- Referral for postpartum follow up in community after discharge if risk factors exist.
- Initiate early postpartum follow-up once discharged from hospital. All infants discharged prior to 48 hours of age should be evaluated by a health care professional within 48 hours after discharge (if concerned with babe) or risk factor identified (ECRI Institute, 2010).
- Consider referral to lactation consultant or community health clinics if mother needs additional breastfeeding support ("National institute for," 2010).

SCREENING
- Serum bilirubin levels must be measured for appropriate clinical management.
- Measure TSB or TCB if jaundice occurs in the first 24 hours (Academy of Pediatrics, 2004)
- Interpret bilirubin levels according to infant age in hours (ECRI Institute, 2010)
- TCB levels can be unreliable during phototherapy or with exposure to sunlight because of the bleaching effect of light on the skin (Academy of Pediatrics, 2004).
• Accuracy is not enhanced by the use of icoerometeres (ECRI Institute, 2010).

7.0 Universal Screening

In 2007, the Canadian Pediatric Society made the recommendation that all infants receive a TSB or TcB measurement either at 72 hours of age or at time of discharge. TcB measurements are non-evasive, and reduce the opportunity for infant skin infections. TcB results are available to nurses instantly, without having to wait for laboratory results. Despite these advantages, TcB measurements often need to be verified by a TSB measurement, especially if an infant TcB value is high or if multiple risk factors exist. A TSB measurement is considered to be the gold standard in assessing jaundice and determining the course of treatment, especially when considering either the initiation or discontinuation of phototherapy. Universal TSB screening could be beneficial as the trend of early postpartum discharge progresses; allowing for quicker turn around in lab results and follow-up care as they become more routine in care provision, and limiting the need for later interventions such as readmission for phototherapy treatments.

8.0 Glossary

• Full-Term Infant: An infant born after the completion of the 36th week of gestation (ie: minimum gestational age of 37+0 at birth) (Engle, 2006).

• Hyperbilirubinemia: Elevated amounts of bile pigment, or bilirubin, in the blood (Canadian Pediatric Society, 2007).

• Immune-Mediated Hemolytic Anemia: an immune mediated destruction of red blood cells, indirectly resulting in hyperbilirubinemia (Makadia, Siddaiahgari & Latha, 2013).

• Kernicterus: an accumulation of bilirubin in the gray matter of CNS causing neurological damage.

• Late Pre-Term Infant: An infant born after the completion of the 34th week of gestation (ie: minimal gestational age of 35+0 at birth) and before the commencement of the 37th week of gestation (ie: maximum gestational age of 36+6 at birth) (Engle, 2006).

• Pathological Jaundice: Jaundice that begins in infants before 24 hours of life, or after 10 days of life, or severe jaundice that occurs between 24 hours to 10 days of life (Lease & Whalen, 2010).

• Physiological Jaundice: A common and normally self-limiting condition seen in infants that occurs after 24 hours of age and can last as long as two weeks (Lease & Whalen, 2010).
References


Development committee members

- Chelsea MacAulay
- Sarika Rama
- Thayanthish Tharmaratnam
Appendices

**APPENDIX 1:**

*Potential Algorithm for management and follow-up according to predischarge bilirubin measurement*  
(Lease & Whalen, 2010)

*Figure 4. Sample algorithm for management and follow-up according to predischarge bilirubin measurement*

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*Significant risk factors include exclusive breastfeeding (especially if breastfeeding is not going well), weight loss in excessive (10% or higher), or both; is immune or other hemolytic disease (e.g., G6PD deficiency, hereditary spherocytosis); previous sibling with jaundice; cephalhematoma or significant bruising; and East Asian race. *Refer to hour-specific serum bilirubin nomogram.* Refer to AAP* phototherapy guidelines in Fig. 2.*
APPENDIX 2:
Guidelines for detection, management, and prevention of hyperbilirubinemia in term and late preterm newborn infants (Canadian Paediatrics Society’s Community Paediatrics Committee and the College of Family Physicians of Canada)

APPENDIX 3:
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