1.0 PURPOSE AND INTENT:

1.1 To promote optimal assessment, diagnosis, management and follow-up of the newborn with the potential for and/or hyperbilirubinemia.

1.2 To provide a rapid non-invasive method of obtaining neonatal bilirubin levels.

Note: All recommendations are approximate guidelines only and practitioners must take into account individual patient characteristics and situation. Concerns regarding appropriate treatment must be discussed with the attending neonatologist.

2.0 PRACTICE OUTCOME:

2.1 Approximately 60% of normal newborns become clinically jaundiced in the first week of life. While the majority of these newborns have physiologic jaundice, vigilant assessment and follow-up is important to prevent severe hyperbilirubinemia and kernicterus. The Canadian Paediatric Society recommends universal screening for hyperbilirubinemia for all newborns in the early post birth period.

3.0 DEFINITIONS:

3.1 Hyperbilirubinemia in the newborn: Excess serum bilirubin in the newborn due either to overproduction of bilirubin, as in excessive destruction of erythrocytes, or to reduction in glucuronide conjugation in the liver. If a high level of bilirubinemia is left untreated, kernicterus may occur as a result of free unconjugated bilirubin entering the brain tissue and causing neurotoxic damage.

3.2 Standard Phototherapy: Light therapy with a single light source that can deliver a minimum of 30 µW/cm²/nm (refer to information provided by light manufacturer). Note: In the current Canadian Paediatric Society (CPS) guidelines, this is referred to as intensive phototherapy.

3.3 Intensive Phototherapy: Light therapy that covers a minimum of 80% of the infant's skin surface area using one or more light sources that can deliver a minimum of 30 µW/cm²/nm. This usually requires two light sources.

3.4 Transcutaneous bilirubin (TcB) meter: A hand held meter that provides an estimate of circulating bilirubin, obtained by making calculations which measure the difference between bilirubin in the skin and subcutaneous tissue and minimizes the impact of melanin (skin color) on the transcutaneous assessment. The result is expressed as the "TcB". The measurement range is 0 to 340 µmol/L. An average of three measurements are used. For meter operation, see the Standard Operating Procedures (HSC) for Draeger Jaundice Meter or the Specialty Nursing Procedure Draeger Jaundice Meter (SBH).

3.5 Total Serum Bilirubin (TSB): Total amount of bilirubin in the blood determined by sending a blood sample to the laboratory.

3.6 Direct Bilirubin (DBIL): In the liver, bilirubin is conjugated with glucuronic acid by the enzyme glucuronyltransferase, making it soluble in water. The conjugated version is also often called "direct" bilirubin. Elevation in conjugated (direct) bilirubin level is pathologic. Prompt evaluation is necessary for neonatal cholestasis including biliary atresia.

• Only a total bilirubin will be reported unless a direct bilirubin is specifically requested.
3.7 **Direct Antiglobulin Test (DAT):** A blood sample result that may be used to diagnose hemolytic disease of the newborn due to incompatibility between the blood type of a mother and infant (previously referred to as Direct Coombs Test).

4.0 **GUIDELINES:**

**Universal Screening of All Newborns**

4.1 Screen all newborns of any gestational age, who have not received phototherapy or an exchange transfusion, for the development of hyperbilirubinemia using the TcB monitor, initially between 24-30 hours and every am thereafter until discharged from hospital. If admitted to a neonatal intensive care unit, continue for the first 7 days unless otherwise ordered by infant’s prescribing practitioner.

4.2 Use infant’s forehead as primary site for TcB reading unless extensively bruised and discolored; use infant’s sternum as secondary site if required, or if infant has been discharged and exposed to ambient sunlight.

4.3 If TcB reading appears inconsistent with clinical assessment, use clinical judgment to order TSB and/or request care provider assessment.

4.4 When the TcB meter display shows “__ __”, the estimated bilirubin exceeds 340 μmol/L. Record such results as > 340 and notify care provider immediately for direction related to TSB and/or phototherapy.

4.5 If baby appears jaundiced < 24 hours of age, screen using TcB. Notify infant’s care provider of result if TcB reading plots in high risk zone of Nomogram for Designation of Risk Based on Hour Specific Serum Bilirubin or Transcutaneous Value (Appendix B) and obtain order for TSB and DAT.

4.6 For infants 35 weeks gestational age or more and on the well-newborn mother baby unit, plot TcB reading on the Nomogram for Designation of Risk Based on Hour Specific Serum Bilirubin or Transcutaneous Value (Appendix B or found at website: http://bilitool.org). Determine next steps based on the risk zone as follows, if the infant has not previously been on phototherapy.

- **High Risk Zone:**
  - Do TSB and Direct Antiglobulin Test (Coombs) immediately (if DAT not previously done).
  - Plot the TSB result on Appendix C (Phototherapy Implementation Threshold Graph) to determine need for phototherapy or refer to Bilitool.org.
  - Notify infant care provider of results, including the risk threshold line used on the graph on Appendix C, to determine if phototherapy is required and when a repeat bilirubin measurement should be obtained. A TcB can be done for repeat testing if baby is NOT on phototherapy.

- **High Intermediate Risk Zone:**
  - **≥ 38 weeks gestational age:**
    - Notify infant’s care provider.
    - Repeat TcB in 24 hours while in hospital.
    - When preparing for discharge, contact infant’s care provider for direction regarding follow-up based on other jaundice risk factors.
    - If a bilirubin trajectory needs to be established, use TcB for repeat measurement.
  - **< 38 weeks gestational age:**
    - Notify infant’s care provider if TcB plots within phototherapy range (per Appendix C using the appropriate risk threshold line or per Bilitool.org).
    - Care provider may order a TSB and DAT (if DAT not already done) and/or CBC, reticulocyte count, and/or G6PD level to determine whether hemolysis is likely and whether to initiate phototherapy.
    - Alternatively, care provider may choose to monitor TcB more frequently to evaluate whether the rise in TcB may be indicative of hemolysis.
    - If the TcB is not within phototherapy range, repeat TcB in 24 hours.
    - When preparing for discharge, contact infant’s care provider for direction regarding follow-up based on other jaundice risk factors.
If preparing for discharge for infants between 37-37+6 weeks gestation, and a bilirubin trajectory needs to be established prior to discharge, use TcB for repeat measurements at intervals requested by provider (typically every 10-24 hrs)

- **Low Intermediate Risk Zone:**
  - Ongoing clinical assessment.
  - Repeat TcB q 24 hrs in am while in hospital
  - Repeat TcB/TSB if clinically indicated post-discharge.

- **Low Risk Zone:**
  - Ongoing clinical assessment.
  - Repeat TcB q 24 hrs in am while in hospital
  - Repeat TcB/TSB if clinically indicated post-discharge.

4.7 For infants less than 35 weeks gestational age, plot the TcB result on the graph in Appendix D specific to their birthweight. If the value plots in the phototherapy range, inform care provider to obtain an order for a TSB.

4.8 Make decisions regarding neonatal bilirubin therapy (phototherapy, exchange transfusion) only on TSB results. Note: If TcB level is close to treatment / phototherapy levels, do a TSB. Refer to Appendixes C, D and E.

4.9 Ensure all information regarding TSB and TcB levels is communicated appropriately to the most responsible care provider. Refer to Appendix F (Communication re High Intermediate or High Risk Zone) and Appendix G (Communication re Phototherapy).

**Assessment and Management**

4.10 If breastfeeding, assist mothers to breastfeed at least 8 times per day. If extra fluids are required for dehydration or weight loss, expressed breast milk or infant formula should be given as outlined in the WRHA Breastfeeding Guidelines for the Healthy Term Infant.

4.10.1. Provide intravenous fluid supplementation to infants under phototherapy who are approaching Total Serum Bilirubin (TSB) exchange transfusion levels (see Appendix E for TSB Exchange Transfusion Levels Graph). Continue breastfeeding. Consult lactation support nurses if required.

4.11 Visually assess the newborn for clinical features of jaundice by blanching the infant's skin on their forehead with a thumb to determine the degree of yellow discoloration that is present after the pressure is released. Inspect palms and soles of feet, oral mucosa and conjunctiva. Note: Since visual assessment in a non-Caucasian infant can be difficult, a second opinion may be required. If jaundice is seen prior to 24 hours of age, then TcB should be done at this time and communication with care provider regarding result of TcB / need for TSB (see 4.5).

4.12 For infants born at ≥35+ weeks gestation, consider the following investigations for hemolysis if TSB levels reach phototherapy levels as identified using the graph in Appendix C or bilitool.org:
  - Total and direct bilirubin
  - CBC, reticulocyte count and peripheral smear
  - ABO/Rh blood typing and direct antiglobulin test (DAT) if the maternal blood type is Rh negative or potential ABO mismatch between mother and infant.
  - G6PD level if suggested by ethnic or geographic origin, especially if poor response to phototherapy.

4.13 For infants of all gestational ages, initiate **standard** phototherapy on physician’s order when the infant’s TSB reaches the threshold based on the graph in Appendix C. Please note that in the Canadian Paediatric Society guidelines, as well as Appendix C, intensive phototherapy is equivalent to standard phototherapy as defined in this practice guideline. After discontinuing phototherapy, use TSB for assessments within the first 16 hours and TcB after that time.

4.14 If the TSB result is within phototherapy range, and nursing is unable to obtain a physician’s order to initiate phototherapy within 60 minutes, consult Neonatology for order, to initiate standard phototherapy.
4.15 Consider consultation to Neonatology in infants who:
- Fail to respond to standard phototherapy (bilirubin continues to rise or does not decrease)
- Are approaching exchange transfusion levels as per Appendix E
- Have a documented bilirubin level greater than 400µmol/l

These infants may require intensive phototherapy, which can only be provided in the IMCN or NICU at this time.

4.16 As ordered by the primary care provider, monitor TSB levels at least once daily until they remain below phototherapy levels after phototherapy has been discontinued. Anticipate an approximate 10% rebound after discontinuation of phototherapy. If the levels while on phototherapy do not drop or continue to rise, consider need for consult to Neonatology for intensive phototherapy utilizing 2 light sources or exchange transfusion based on the indications and TSB levels as outlined in the practice guideline: Newborn Exchange Transfusion.

4.17 Consider intravenous immune globulin (IVIG) administration to reduce need for exchange transfusions in infants with Rh, ABO and other iso-immunization conditions. Administer IVIG to these infants if the bilirubin is rising despite intensive phototherapy or is within 34 to 51µmol/L of exchange transfusion level. Refer to IVIG drug monograph in Pediatric Parenteral Drug Manual. These infants are to be cared for in the NICU.

4.18 Measure total and direct serum bilirubin levels in any infant who is still jaundiced at 2 to 3 weeks of age.

4.19 If a patient presents in labor with clinically significant antibodies, notify neonatology while the patient is in labor, and notify the infant care provider at time of notification of birth. Ensure appropriate bloodwork is taken from mom (ABO Rh typing and antibody screen) and baby’s cord (ABO Rh typing and antibody screen, TSB, and Hgb / Hct) at time of birth. Refer to Specialty Procedure Mothers with Clinically Significant Red Cell Antibodies (SBH).

### Proving Phototherapy

4.20 Standard Phototherapy:
Expose as much of the baby’s skin and buttocks to the light as possible (lying on diaper if under radiant warmer, very low slung diaper if not). Provide continuous phototherapy even during provision of care until there is a documented decrease in bilirubin level. Once a decrease in bilirubin level has occurred, interrupt phototherapy for care provision only for brief periods of time. Provide standard phototherapy using one of the following methods:

4.20.1 A fiber-optic blanket that provides at least 30 µW/cm²/nm underneath the infant’s back and head and wrapped up the infant’s sides to ensure that maximum amount of skin is exposed to the light. Ensure that the cable is placed towards the infant’s feet.

4.20.2 An over bed spot light, ensuring that the appropriate distance is maintained between the light and the skin. Spot light phototherapy (i.e. Giraffe SpotLite) is used predominantly for preterm infants; the most effective distance between the infant and the spot light is 15 inches. Remove infant positioning aids to maximize skin exposure.

4.20.3 Note: These methods provide more effective phototherapy than previous methods referred to as ‘single’ phototherapy and should be the starting point when phototherapy is indicated. Phototherapy Bed (Medela Bilibed) does not permit the provision of continuous phototherapy during feedings.

4.21 Intensive phototherapy:
Aim to expose 80% of the skin surface to light. Use both a phototherapy blanket or phototherapy bed under the infant and one over bed light above, maximizing the effectiveness of each as outlined above. Each light source must be able to deliver a minimum of 30 µW/cm²/nm. More than 2 phototherapy light sources do not provide additional benefit. If using a light source that has multiple settings (such as the Biliblanket Plus), ensure that it is set at maximum.

**Note:** This method provides equivalent or more effective phototherapy than previous methods referred to as ‘double’ phototherapy.
4.22 When using overhead lights, keep eyes covered with appropriate-sized eye covers at all times. When using fiber-optic light sources that allow the infant to be dressed and/or bundled, cover the eyes whenever the infant is not under direct observation (either being held or in the infant bed with adult sitting close by) as eyes may inadvertently be exposed to light. Use equipment according to manufacturer’s instructions.

4.23 Avoid using oil-based topical preparations (medicinal ointments, petroleum jelly) on areas of skin exposed to phototherapy. Preparations used on the diaper area (if a diaper is worn) during phototherapy is acceptable.

4.24 Oxygen saturation measurements can be hindered by phototherapy. If an oximeter is not consistently picking up readings, cover the oxygen saturation probe with a cloth to see if this remedies the problem.

4.25 For the well-baby areas, newborns undergoing phototherapy should have VS (HR, RR and temp) q 4 hrs.

**Discharge Planning For Newborns Not Admitted to NICU**

4.26 Plot all pre-discharge TcB and/or TSB levels on Nomogram in Newborn Jaundice Discharge Information form as well as any phototherapy administered. Discuss potential risk for hyperbilirubinemia after discharge with infant’s care provider and prepare a follow-up plan as indicated. It is suggested that for those in the high risk category to arrange TSB within 24 hours after discharge. For those in the high intermediate risk zone, it will depend on gestational age and previous trajectory. For those infants who have been on phototherapy, a follow-up bilirubin measurement is usually suggested at 24 hours post discontinuation.

4.27 Obtain consent for public health nurse contact and communicate plan with public health nurse on the Postpartum Referral Form and/or Infant Referral Form. Plan may include arrangements for repeat TcB or TSB level, or follow-up with a health care provider at 24-48 hour intervals where bilirubin testing is available if necessary. Include the following information on the Postpartum Referral Form:
   - Most recent TcB / TSB
   - Risk zone as per Nomogram
   - Follow-up arrangements as required
   - Need for early follow-up / priority visit for late preterm infants with a note: “Late preterm infant – at risk for jaundice”.

4.28 Provide all parents/infant caregivers with teaching information on jaundice and review it with them before discharge. Information can be found in the Baby’s Best Chance book.

4.29 Complete the “Newborn Jaundice Discharge Information Form (HSC#NS01822A, SBH#7102-8927-8) at time of patient discharge, ensuring all TcB / TSB results are plotted. Review it with the parent or alternate care provider and give them the yellow copy with instructions to pass it on to the follow-up care provider in the community. The white copy is faxed to the follow-up infant physician, and, at HSC only, the white copy is also faxed to public health central intake. Retain the white copy in the medical record.

**Readmission**

4.30 For infants with hyperbilirubinemia who are at home, re-admit to hospital if not eligible for Home Phototherapy. Refer to WRHA Community Home Phototherapy Guidelines for information on jaundice management in the community. Begin phototherapy as soon as possible while waiting to transfer to in-patient unit and follow the guidelines as outlined above.

4.31 Utilize a bassinet as it is the most appropriate sleeping surface for the newborn who is less than 4 weeks of age. This surface promotes a sense of normalcy for the mother and helps to minimize the negative impact of hospitalization on breastfeeding and bonding. Provide an appropriate bed for the mother who is still recovering from the delivery.
4.32 At re-admission, if TSB is approaching or at exchange transfusion level, reassess TSB every 4 hours and consider exchange transfusion if the level does not fall over 4 hours of maximized intensive phototherapy. At the time of presentation, send blood to Canadian Blood Services (CBS) for a group and match (or type and screen and crossmatch) for exchange transfusion blood. Phone CBS to alert them of the potential need.

**Discharge Planning From Children’s Hospital**

4.33 Provide family with discharge instruction sheet and instruct them to make a follow-up appointment with community pediatrician or family physician.

4.34 Obtain consent for public health nurse contact, then fax discharge instruction sheet to Public Health Central Intake. The appropriate public health nurse will then be notified of patients’ discharge from hospital and will arrange a follow-up home visit.

**5.0 DOCUMENTATION**

5.1 Record the following on the newborn care map or infant data record: Date and time of TcB or TSB reading in μmol/L, as well as initiation and discontinuation of phototherapy.

5.2 Document assessment and actions in Integrated Progress Notes as necessary.

5.3 Document the discharge TcB and/or TSB date, time, results and corresponding “Risk Zone” on Postpartum Referral Form/Infant Referral Form for information and follow-up by Public Health as required.

5.4 Fax the Newborn Jaundice Discharge Information Form to the follow-up care provider (if known) and, at HSC only, also fax to public health central intake. Retain the original in the infant’s chart.

**6.0 REFERENCES:**

- Canadian Pediatric Society (2011). Guidelines for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks’ gestation) POSITION STATEMENT (FN 2007-02). *Paediatrics and Child Health. 12* Suppl B. 1B-12B.


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APPENDIX A

Risk Factors for Development of Severe Hyperbilirubinemia in Infants of 35 or More Weeks’ Gestation

Risk Factors for Neurotoxicity:

- Risk or evidence of hemolysis:
  - DAT+,
  - G6PD deficiency (consider Mediterranean, Middle Eastern, South East Asian, Africa)
  - Other clinically significant maternal antibodies with confirmation of at risk antigen in infant / cord blood
  - Significant jaundice < 24 hours of age
- Gestational age (35-37+6 weeks GA)
- Asphyxia
- Acidosis
- Sepsis (respiratory distress, temperature instability, significant lethargy)

Risk Factors for Hyperbilirubinemia:

- Exclusive breastfeeding with poor feeding and MORE than expected weight loss (>95% on hour specific curves for weight loss)
- Cephalohematoma or significant bruising
- Sibling who needed phototherapy
- Macrosomic infant >90%
APPENDIX B

Nomogram for Designation of Risk Based on Hour-Specific Serum or Transcutaneous Bilirubin Value for Infants 35 or More Weeks Gestation

Nomogram for designation of risk based on hour-specific serum (TSB) or transcutaneous bilirubin (TcB) value

Note: If TcB or TSB value plots on line between risk zones, follow directions for follow up as per higher risk zone

Ref: Adapted from Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Subcommittee on Hyperbilirubinemia, Pediatrics 2004;114:297-316
APPENDIX C

Phototherapy Implementation Threshold Graph

For Gestational Age 35+ Weeks:

APPENDIX D

Phototherapy Implementation Threshold Graphs
For Gestational Ages 34 weeks, 6 days or less:

Birthweight 2001 - 2500 g

Birthweight 1500 - 2000 g

Birthweight < 1500 g
Birthweight < 1000 g (black zone)

2-4 Adapted from Cockinton, R.A.
"A guide to the use of phototherapy in the management of neonatal hyperbilirubinemia."

APPENDIX E

Total Serum Bilirubin Exchange Transfusion Levels Graph for Infants 35 or More Weeks Gestation

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
APPENDIX F

Communication Script Algorithm

**Script for communication with most responsible provider (MRP) for babies that fall into the High Intermediate or High Risk Zone on the Nomogram for designation of risk (TSB)**

**Neurotoxicity**
- Asphyxia/fetal distress
- Gestational age
- Hemolytic: Early jaundice <24 hours
  - Blood group incompatibilities (Rh / ABO / other significant Maternal antibodies)
  - DAT positive
  - Risk for G6PD deficiency - Mediterranean (Greek/Italian), SE Asian (SE China / Thailand), African, Middle Eastern
- Sepsis:
  - Respiratory Distress
  - Temperature Instability
  - Leukocythia

For Hyperbilirubinemia
- Exclusive breastfeeding with poor feeding
- Early jaundice <24 hours
- Cerebral haemorrhage/seizures
- Previous sibling with treated jaundice
- Macrosomia: infant >90%

**Determine the risk factors prior to calling the MRP**

**Determine the level(s) for treatment on the Phototherapy Implementation Threshold graph**

- >38 weeks and well
- ≥38 weeks and risk factors
  - 35 - 37 6/7 and risk factors

**Double check all plotting with another nurse prior to calling MRP**

This is (your name) calling from (unit) at HSC/SHH. I am calling regarding the TSB result on baby (name). This baby is (xx) weeks gestation, was born on (date) at (time). The serum bilirubin is (number) at (x) hours of age and that plots into the (high, high intermediate) risk zone on the "Nomogram for Designation of Risk".

Please repeat back to me the number and zone I have just stated.

Are you familiar with this baby or should I review the risk factors for hyperbilirubinemia? The risk factors for hyperbilirubinemia and neurotoxicity are xxx.

The DAT is xxx or unknown.

On the phototherapy implementation graph the treatment level for a ( >38 weeks and well, ≥38 weeks and risk factors or 35-37 6/7 and well, or 35-37 6/7 and risk factors) infant is xxx mmol. Would you like to plot that yourself? How would you like to proceed?

This may include:
- Phototherapy
- Physician order for DAT and blood type
- CBC
- Bill Direct and Total
- Repeat Bill in xx hours

- Monitor infant in hospital
- Repeat Bill in xx hours
- Physician may order DAT and blood type

- Discharge with follow up
- Specify where to get TSB done
- How to reach MRP with results
- Discharge with physician follow up
- Appointment in xx - xx hours

**To facilitate accurate transfer of information to the next care provider, please document the plan of care and all telephone conversations for the infant as discussed with the most responsible provider. Document on the Post Partum referral form and the iPN **

Feb 2017
APPENDIX G

Communication Script Algorithm

Script for communication with MRP for babies that are on or post phototherapy

The TsB is obtained and plotted to determine the levels for treatment on the Phototherapy Implementation Threshold graph

≥ 38 weeks and well

≥ 38 weeks and risk factors

35 - 37 6/7 and well

35 - 37 6/7 and risk factors

Double check all plotting with another nurse prior to calling MRP

Determine if any other lab results pending prior to calling MRP

Call MRP

This is [your name] calling from [unit] at HSC/SBH. I am calling regarding the TSB result on baby [name]. This baby is [xx] weeks gestation, was born on [date] at [time]. This baby has been on phototherapy since [xxx]. The last serum bilirubin at [xxx] hours was [xxx]. The TSB now is [xxx] at [xxx] hours of age.

Please repeat back to me the number.

Previous lab results that have been ordered are (i.e. DAT, CBC, etc.) On the phototherapy implementation graph the treatment level for (≥ 38 weeks and well, ≥ 38 weeks and risk factors OR 35-37 6/7 and well, 35-37 6/7 and risk factors) infant is [xxx] mmols.

Would you like to plot that yourself? How would you like to proceed?

This may include

Continue Phototherapy
Repeat Bili in xx hours

Discontinue Phototherapy
Repeat Bili in xx hours in hospital

Discharge Baby with follow up
Repeat Bili in xx hours – specify where and which MRP to follow up with

Discharge with no follow up bili required
Regular MRP visit in [x] weeks

** To facilitate accurate transfer of information to the next care provider please document the plan of care and all telephone conversations for the infant as discussed with the most responsible provider document on the Post Partum referral form and the IPN **