Phototherapy for Newborns

Site Applicability

St. Paul's Pregnancy, Birthing and Newborn Centre

SPH Neonatal Intensive Care Unit

Practice Level

Perinatal and NICU Registered Nurses

Need to Know

See **Definitions** for explanation of terms

- A provider order is required for:
  - Initiation and discontinuation of phototherapy
  - The use of the Bili Soft Phototherapy System adjunctive to Phototherapy treatment
  - Changes in total fluids given (in addition to regular breastfeeding) due to changes in insensible water loss with phototherapy
  - Frequency of serum bilirubin testing
- Hyperbilirubinemia is an abnormally high concentration of serum bilirubin resulting from the abnormal breakdown, processing and/or excretion of the heme (iron) component of red blood cells (RBC's) by a newborns immature liver
- Bilirubin levels usually peak between day 3 and 5 of life, but severe hyperbilirubinemia can occur after the first week and persist for more than 2 weeks (See Appendix A)
- The presence of jaundice within the first 24 hours of life is abnormal and requires immediate treatment (may indicate hemolysis)
- If not treated, severe hyperbilirubinemia can cause encephalopathy. Signs may include alteration in mental status, muscle tone and cry
- There is a direct correlation between irradiance output of phototherapy and the decline in bilirubin levels
- Turn phototherapy off during blood sampling for bilirubin

Equipment and Supplies

1. Incubator
2. Phototherapy light
3. Bili soft Phototherapy System (if used in adjunctive to phototherapy)
4. Eye shield
5. Bili meter
6. Disposable diapers

Procedure

Prior to Initiating Phototherapy

1. Assess infants colour for degree of jaundice and condition of skin (e.g. presence of rashes, burns). This should be assessed in a well lit room or in the presence of natural light.
2. Assess skin turgor, mucous membranes, percentage of weight loss (less than 10 % weight loss)
3. Assess infant's behaviour patterns for active and alert periods, feeding at least 8 times per day
4. Obtain baseline temperature

Initiating Phototherapy

Steps	Rationale
1. Collect equipment	
2. Explain procedure and purpose to the parents and answer any questions they may have	
3. Identify infant using two (2) patient identifiers	
4. Adjust the incubator NTE temperatures until infant temperature is within normal range (36.5 to 37.4°C) NOTE: A single temperature is not a full assessment of the thermal environment of the infant	Potential for infant to become hyperthermic (overheated). Phototherapy lights radiate heat and may contribute to overheating.
5. Set temperature on the incubator and **check infants temperature after initiation Q1H x 3 then at each feeding (Q3 to 4H) and PRN** Adjust temperature of incubator to maintain the infants temperature within the normal range of **36.5 to 37.4°C** Do not take the top (canopy) off the incubator or leave the door ports open. Do not turn off the incubator.	Leaving the top (canopy) off or ports open will cool incubator too fast and take longer to reheat. Risk of baby falling through open door ports
6. Place shield over infants closed eyes	Protects retina from possible UV damage
7. Place the infant in the incubator with only a diaper on	Allows for maximum skin exposure to phototherapy lights. Diaper protects genitals

8. Position phototherapy light over the top of the incubator at a minimum of 30 cm from the infant. Ensure the light is positioned so that the maximum amount of skin is exposed to the lights ****Position lights from the front or back of the incubator, not the sides**	Photo lights radiate heat. 30 cm protects the infant from overheating
9. Turn on phototherapy lights (blue lights) and the examination lights (white lights)	Both lights at the same time decreases the visual appearance of the blue lights. This in turn helps reduce the likelihood of parent/staff eye irritation or headaches from exposure to the blue lights
10. Verify irradiance (intensity) of light at torso skin level using bilimeter once per shift. Place meter below blue lights not the white lights. (Refer to Appendix A for instructions on how to use bilimeter) ****If irradiance level is less than 28 uW/cm2/nm, contact Biomedical Engineering to replace bulbs**.	Ensures optimal phototherapy irradiance. Reading should be greater than 28 uW/cm2/nm 
11. Wipe bilimeter with disinfecting towelettes (e.g. Cavi wipes)	Clean equipment between infants to avoid cross-contamination
12. Remove eye shield when the infant is taken out from under the lights	Allows socialization, attachment with parents
13. Minimize time away from phototherapy lights as much as possible (i.e. only for feeding) to a maximum of 30 minutes. Parents who wish to remain skin to skin with their child should be encouraged to do so during feeds	Separation can be emotionally traumatizing for parents. Be conscious of this effect and encourage bonding as much as possible
14. If ordered by a physician, utilize Bilisoft Phototherapy System as adjunctive therapy with Phototherapy lights (see Appendix B). The Bilisoft blanket can be utilized for skin to skin and feeds outside phototherapy lights	Allow for skin to skin bonding and soothing of baby while still receiving phototherapy treatment

Ongoing Care while on Phototherapy

1. Assess skin colour and condition twice per shift (minimum). Avoid use of creams and oils

2. Document all feeds/supplements including expressed breast milk (EBM), Human Donor milk or formula amount. Encourage birthing person to breastfeed every 2 to 3 hours and hand express after each feed and feed contents to infant via a cup/spoon.
   Formula is only to be used when medically indicated or at caregivers request after the birthing person has made an informed choice (See Appendix C for supplemental feeding)
3. Record wet and soiled diapers to evaluate hydration status
4. Calculate and document percentage of weight loss/gain daily
5. Remove eye shield when infant out of incubator for feedings to check eyes for secretions or discharges, to provide visual stimulation and eye care (Q4H). Change eye shield Q24H or as necessary.
6. Report bilirubin tests to physician
7. Check irradiance with bilimeter once per shift (See Appendix A for instructions)
8. Encourage parent involvement in infant care as separation is stressful for the family
9. Monitor infant axilla temperature 1 hour after discontinuation of phototherapy lights

Reference Tools

- Hyperbilirubinemia Treatment Graphs:
  - INFANTS AT LOWER RISK (>38 WEEKS AND WELL)
  - INFANTS AT MEDIUM RISK (>38 WEEKS WITH RISK FACTORS OR 35-37 +6/7 WEEKS AND WELL)
  - INFANTS AT HIGH RISK (35-37+6/7 WITH RISK FACTORS)

- NICU Hyperbilirubinemia Treatment Graphs:
  - INFANTS OF GESTATIONAL AGES 34 – 34 +6/7 WEEKS
  - INFANTS OF GESTATIONAL AGES 32 – 33 +6/7 WEEKS

Documentation

Prescriber's Orders

PED Newborn Phototherapy Module

In the NICU:

- Power Chart → Interactive View and I&O→ NICU Quick View → Newborn Phototherapy

On birthing units:

- Power Chart → Interactive View and I&O→ Newborn Lines-Devices-Procedures → Newborn Phototherapy

Patient and Family Education

- Explain the etiology and significance of jaundice to family
- Explain the purpose of phototherapy
- Explain the benefits of frequent feeding

References

1. Barrington, K. J., Sankaran, K., Canadian Pediatric Society, Fetus and Newborn Committee. (2007). Guideline for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks' gestation). *Pediatric Child Health. 12 Suppl B. 1B-12B.* Reaffirmed: February 2018. Accessed: May 2, 2022 at: http://www.cps.ca/
2. Dysart, K. (2021). Neonatal Hyperbilirubinemia. Merck Manual Professional Edition Merck & Co., Inc., Kenilworth, NJ. http://www.merck.com/
3. Phototherapy (Maternal Newborn) Elsevier Nursing Skills (2021). St. Louis, MO. Elsevier. Published December 2021. from www.elsevierresources.com
4. Wong, R.J., Bhutani, V.K., Unconjugated hyperbilirubinemia in the newborn: Pathogenesis and etiology (2021). Update 2021. http://www.uptodate.com

Definitions

- **Hyperbilirubinemia** – an elevated serum bilirubin concentration; the threshold for an abnormal value varies by age, and in pre-term infants by health status.
- **Severe hyperbilirubinemia** – a total serum bilirubin (TBS) concentration greater than 340μmol/L at any time during the first 28 days of life
- **Jaundice** – yellowing of the skin, sclera, and other tissues caused by excess circulating bilirubin.
- **Acute bilirubin encephalopathy** – clinical syndrome, in the presence of severe hyperbilirubinemia, of lethargy, hypotonia, and poor suck, which may progress to hypertonia (with opisthotonos and retrocollis) with high-pitched cry and fever, and eventually to seizures and coma.
- **Pathological jaundice** – Jaundice that appears in the first 24 hours of life or beyond the first week of life or is caused by an abnormal process such as hemolytic anemia (blood type incompatibility, polycythemia, hematomas), or genetic disorders that impair bilirubin conjugation.
- **Physiologic jaundice -** Jaundice usually appears after the first 24 hours of life and peaks on day 2 to 4, then decreases by day 5 to 7.
- **Breast Milk Jaundice** - Bilirubin is a yellow pigment that is created as the body gets rid of old red blood cells. The liver helps break down bilirubin so that it can be removed from the body in the stool. If jaundice occurs or persists past the first week of life in an otherwise healthy and thriving breast-fed infant, the condition may be called "breast milk jaundice." It is probably caused by factors in the breast milk, which block certain proteins in the liver that break down bilirubin. Breast milk jaundice tends to run in families. It occurs equally often in males and females and affects approximately 0.5% to 2.4% of all newborns.
- **NTE – Neural Thermal Environment**. Temperature Guidelines. Age and Weight. Range of Temperature ◦C Age and Weight Range of Temperature ◦C.

Appendix A: Olympic Bilimeter Type B-22

- The Olympic Bili-Meter is a spectroradiometer that measures the therapeutic irradiance (radiant power) of phototherapy lights. The only way to ascertain the actual dose of phototherapy received is to measure the radiant energy (irradiance) at the skin with a bilimeter. Bilimeter measure irradiance as uW/cm^2/nm.
- The Olympic Bili-Meter has a sensor to measure the irradiance of phototherapy lights placed over the infant. The sensor remains connected to the main body, please do not remove.
- Position phototherapy lights as close to top of the incubator as possible. Place the incubator mattress flat, this will ensure that infant is at a minimum 30 cm (12 inches) from the phototherapy light. Phototherapy is the most effective delivered directly above infant at this distance.
- NICU / Perinatal use the Draeger PT 4000 high irradiance phototherapy light. A bank of blue therapy lights delivers a measured irradiance of 28 to 30 micro-watts. The 2 outer white lights do not have therapy value. The PT 4000 is "recommended as a highly effective piece of equipment for use in the breakdown of high concentration of bilirubin"

How to use Olympic Bili Meter:

- **POSITION** white sensor inside the incubator and place sensor flat on the incubator mattress, beside the umbilical region. Aim the sensor at the center of the photo therapy light (always hold the sensor on the same place for accurate measurements) & not near the white light (non therapy light)
- **PRESS AND HOLD** the grey button, **"ON"** briefly displays, then the irradiance measurement displays. Continue to **PRESS** the grey button and adjust the aim of the sensor to obtain the most accurate reading. (take an average of 2 to 3 readings)
- **RELEASE** the grey button. The irradiance measurement locks on the display for 30 seconds, then **AUTOMATICALLY** shuts off to preserve battery life.
- If irradiance level is less than 25 microwatts, the bank of blue therapy lights may need to be replaced (good for 1000 hours) Please refer to the PT 4000 laminate on each photo light)
- **CONFIRM** that Bili-meter is **OFF** prior to cleaning. Bili-meter should be cleaned with Cavi wipes between infants to avoid cross contamination.
- Battery failure or repairs, please call BIOMED.
- **CHECK** irradiance level every shift and document on Cerner.

References

Olympic Instruction Manual

Draeger PT 4000 Instruction Manual

Appendix B: Bili soft Phototherapy System

Provides light therapy for the treatment of indirect hyperbilirubinemia, commonly known as neonatal jaundice, in a hospital or home setting.

Bilisoft LED Phototherapy System consists of a light box and a detachable fiberoptic light pad with a long, flexible fiberoptic cable. The fiberoptic cable delivers light from a high intensity LED module in the light box to the fiberoptic light pad. The flexible fiberoptic light pad is placed in a soft Bilisoft Pad cover or Bilisoft Nest that is then brought into contact with the patient's skin. The patient is exposed to light in the wavelength of 430 to 490 nanometer range (peak 440 to 460 nanometer)

When to use the Bilisoft Phototherapy System:

When ordered by a physician, used as an adjunctive therapy to phototherapy lights. This will accommodate skin to skin and feeds outside the phototherapy lights system.

How to use the Bilisoft Phototherapy System:

- **INSERT** the Bilisoft fiberoptic pad into a Bilisoft Pad Cover or Bilisoft Nest. The illuminated side should face up and should be against the padded side of the cover.
- **PLACE** the baby on the padded side of the Bilisoft cover or Bilisoft Nest with eye protection such as the eye mask.
- **TURN** the Bilisoft box on and insert the fiberoptic cable into the box.

For hygienic reasons, never place the infant directly on the bare fiberoptic light pad. The light pad must be covered with the Bilisoft Pad Cover or Bilisoft Nest. The Bilisoft Pad Cover or Bilisoft Nest must be changed between patients and whenever it is soiled.

How to clean the Bilisoft Phototherapy System:

The preferred method of cleaning the Bilisoft Phototherapy System is to wipe the box, cable and pad with soap and water, using a dry cloth to dry it right away. If disinfection is required, it may be used sparingly, applying the cleaning solution with a cloth and not saturating the device. Remove any residue with a clean damp cloth. Do not spray cleaner directly on the fiberoptic cable connector.

Appendix C: Supplementation Guidelines

Supplementation of Breastfeeding Newborns & Infants to 6 months

- Provide the birthing person/ caregiver with information about human donor milk (HDM) and formula.
- Provide the birthing person/ caregiver information and support about establishing and maintaining milk production.
- When breastfeeding is temporarily delayed or interrupted, assist the birthing person/ caregiver to initiate or maintain breastfeeding by effective expression of milk by hand or breast pump.
- Give the birthing person's own milk (unless unavailable or contraindicated due to perinatal or infant factors) either directly from the breast or expressed to the baby.

Prior to feeding supplements to the newborn & infants

- Assess the birthing person/ caregiver and newborn for medical indications (see below)
- The birthing person/ caregiver makes an informed choice of supplementing with either human donor milk (HDM) when available or formula
- Determine the method of providing the supplementation
- **NOTE**: Feeding the newborn/infant from a cup is preferred
- Supplementation in the first 48 hours begins with small amounts and increases as indicated by ongoing assessment.
- Supplements are provided to healthy term breastfed newborns/infants when medically indicated or by birthing person/ caregiver informed request.

Definition of Supplements: Supplements are any food or liquid other than birthing person's own breast milk given to a newborn/infant whose birthing person/ caregiver plans to breastfeed. Appropriate supplements are pasteurized human donor milk or formula.

Medical Indications for Supplementation

Infants with:

- Acute water loss - for example, during phototherapy if increased breastfeeding does not provide adequate hydration.
- Hypoglycemia or other clinical condition indicating a need for additional calories not met by additional breastfeeding.
- Errors of metabolism - such as phenylketonuria.
- Weight loss - has sufficient weight loss to raise clinical concerns. A weight loss of greater than 10% raises concerns and mandates clinical assessment and consideration for supplementation.

Birthing person with:

- Severe acute illness resulting in separation of birthing person/ caregiver and infant - for example, psychosis, eclampsia, or shock.

- Severe chronic illness where breastfeeding is temporarily contraindicated.
- Temporary administration of medication contraindicated for breastfeeding.
- Active substance use.

Special Considerations for Newborns in Neonatal Intensive Care Unit (NICU):

Feeding of infants in NICU depends on particular nutritional requirements and functional capabilities, though breast milk is recommended whenever possible. Supplementation is often required in severely ill or compromised newborn/infants as in the following:

- Infants with very low birth weight
- Preterm infants
- Infants with potentially severe hypoglycemia, or who require therapy for hypoglycemia, and who do not improve through increased breastfeeding or by being given breast milk

Document the assessment, informed choice, medical indication for supplementation and instructions given to the family.

Persons/Groups Consulted

Maternity Safety and Quality Council

Nurse Educator Maternity

Revised by

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