

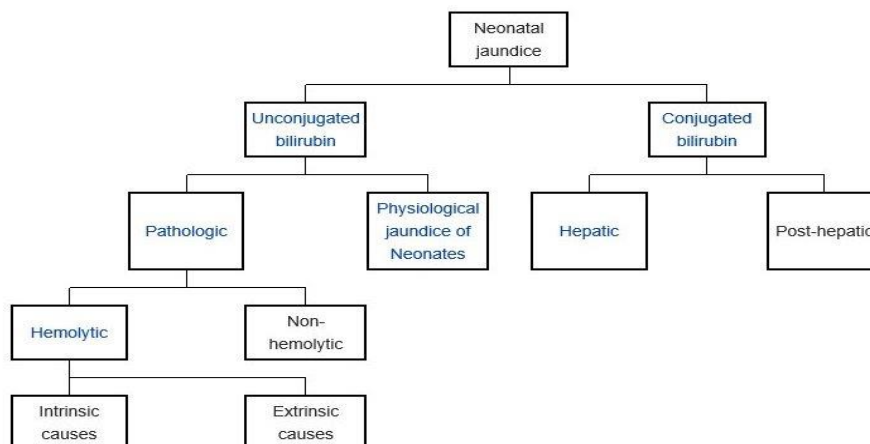
# PHOTOTHERAPY

## Indications

- To reduce serum levels of bilirubin (hyperbilirubinemia)
- To prevent hyperbilirubinemia and severe morbidity such as kernicterus in at risk infants

## Definitions

- **PHOTOTHERAPY:** Exposing infant to light with wavelengths ranging from 400 to 500 nm. These wavelengths chemically change the unconjugated (indirect) bilirubin near the skin into a water soluble compound and can then be excreted through bile, urine and stools.
- **RADIANCE:** The measure of “dose” of phototherapy – how many photons are reaching the baby. The goal is to reach a radiance of 30-60 mw/cm<sup>2</sup>/nm. Exceeding this dose can mutate DNA, and has been suggested to be linked to an increased risk of cancer in adulthood.
- Types of bilirubin:
  - **Direct (or conjugated) bilirubin.** Direct bilirubin dissolves in water (it is soluble) and is made by the liver from indirect bilirubin.
  - **Total bilirubin** (combination of direct and indirect bilirubin)
  - **Indirect (or unconjugated) bilirubin.** This form of bilirubin does not dissolve in water (it is insoluble). Indirect bilirubin travels through the bloodstream to the liver, where it is changed into a soluble form
- Total and direct bilirubin levels are measured directly in the blood, whereas indirect bilirubin levels are derived from the total and direct bilirubin measurements



## Materials

- Phototherapy lamps (3 types exist at MCH)
  - Big Drager lamps (can give x2)
  - Giraffe photo light (can give x1)
  - Biliblankets (can give x1)

○ Biliblanket

- Requires disposable single patient use cover
- Useful for holding baby, for feeding and for kangaroo care
- Contraindicated in extreme premature babies (GA<25w for the first 72h of life) -> higher risk of burns

○ Eye protector

- Needed to protect baby's eyes from light
- NOTE: Hats (bCPAP hats, knitted hats, etc) pulled over the eyes are **NOT** adequate protection for the eyes. You **MUST** use special eye protectors

○ Ohmeda Biliblanket meter

- Needed to ensure safe dose of phototherapy
- Located in "Cooling Room" in Tupperware box
- Should be wiped down after each use with disinfecting wipes



## Procedure

○ When?

- Start phototherapy when ordered by physician (see reference charts in Appendix)

○ How? With phototherapy lamps

1. Make sure baby is **in an isolette**
  - Use of ISC mode is recommended to avoid hyperthermia or hypothermia
2. Ensure baby is **naked** with **smallest size of diaper** possible & **avoid bundling** baby
  - The largest amount of skin should be exposed to optimize the treatment
3. Place phototherapy lights at **30 cm above baby (directly on top of isolette dome)**. Lights should be positioned so that they are shining at a 90° to the baby to ensure maximum radiance absorption. However, in the case of phototherapy using anything above 3 lights, it will not be possible to position all lights directly above the baby. In this case, the set-up in the photo below is suggested:

Giraffe phototherapy lamp, angled as close as possible to the side of the dome of the isolette

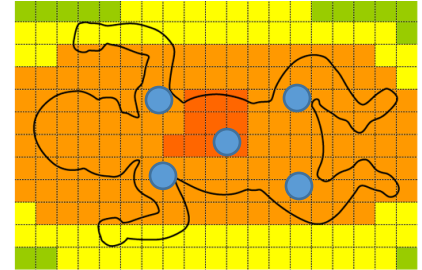


One bank of Drager lights, directly above baby

One bank of Drager lights, angled to side of dome of isolette

4. **Protect baby's eyes** at all times with phototherapy glasses (DO NOT USE HAT; does not block enough light)
  - Phototherapy lights can cause retinal damage
  - Stop phototherapy when providing eye care

5. **Turn on** lamps and ensure baby positioned so that **entire body is under light**. Allow 10 minutes for lamps to “warm up”.
6. **Measure radiance** of light to ensure dose of phototherapy is appropriate (after lamps have warmed up).
  - Follow instructions to **zero the unit** on the back of the Ohmeda Biliblanket Meter
    - Extend *HOLD /RUN* button on side of unit
    - Install cap, then set *ON/OFF* switch to *ON*
    - Allow display to zero
  - Position meter at the **5 key points** of the baby and note 5 radiance measurements: both shoulders, belly button, and both thighs (see picture beside).
  - **Radiance should be measured once per shift, and each time lights are added or removed.** Measurements should be documented in the Nursing Flowsheet.
  - **Goal radiance** is between 30-60 mw/cm<sup>2</sup>/nm. Exceeding this radiance has been shown to mutate DNA. **If radiance exceeded, discuss with MD. To decrease radiance, lamps can be placed further away from baby, or one can be turned off. Radiance should always be re-measured once lamp position has been changed.**
7. **Change the position** of the baby at every check
  - Maintain skin integrity



#### ○ How? With biliblanket

1. Make sure baby is **in an isolette**
  - Use of ISC mode is recommended to avoid hyperthermia or hypothermia
2. Ensure baby is **naked** with **smallest size of diaper** possible
  - The largest amount of skin should be exposed to optimize the treatment
3. Turn the power **switch on** and allow it to **run for 5 minutes before** inserting fiberoptic cable in the box
4. Insert the fiberoptic pad into a **new disposable single-patient use cover**. Change in between patient and if soiled.
5. The **illuminated side** should be **face up** and against the padded side of the cover
6. **Place the infant** directly on the padded side with baby's shoulder at the tip of the pad and baby's feet at the cable
7. **Positioning aids can be used underneath** the biliblanket to bring more lights to the side to ensure greater skin surface exposure and to provide comfort for the baby
8. Radiance with biliblanket alone **does not need to be measured.**

## General Care - What to look for?

- Assess **skin integrity**
  - **Creams, oils and ointments on baby's skin are contraindicated.** They can localize heat and result in skin burns
  - Skin irritation can be caused by frequent stools. Clean buttocks gently with water. Do not wipe. Dry gently
- Bronze baby syndrome
  - Abnormal skin color (grey-brown or bronze)
  - High direct bilirubin
- Monitor for **dehydration**
  - Total fluid should be increase by 10% to 20 % to compensate fluid loss via stools and insensible water loss through skin
  - Weigh baby at least q 24h
  - Monitor in and out
  - Monitor electrolytes
- Monitor **baby's temperature** at every check & ensure baby has an ISC probe in place
  - Skin exposure can cause hypothermia
  - Heat from lights can cause hyperthermia
- Monitor **bilirubin levels** as ordered by physician (should be monitored q 12 to 24 hrs when on phototherapy)

- Turn phototherapy lights or BiliBlanket off when taking sample and cover sample in brown paper before sending to the lab
- Rotate blood drawing site as much as possible to avoid bruised heels
- Consider arterial insertion if blood sampling becomes too frequent
- **Assess family concerns** as they might not be able to hold baby during phototherapy
  - Explain equipment and rationale of treatment
  - If medically acceptable, turn phototherapy off and remove eye cover for family visits if possible and encourage feeding. Biliblanket may be used to promote breastfeeding.

## APPENDIX: REFERENCE CHARTS FOR SERUM BILIRUBIN & PHOTOTHERAPY THRESHOLD

Gestational age (weeks)	Phototherapy in preterm infants Total serum bilirubin ( $\mu\text{mol/L}$ )
< 28 0/7	85-102
28 0/7 - 29 6/7	102-136
30 0/7 - 31 6/7	136-170
32 0/7 - 33 6/7	170-204
34 0/7 - 34 6/7	204-238

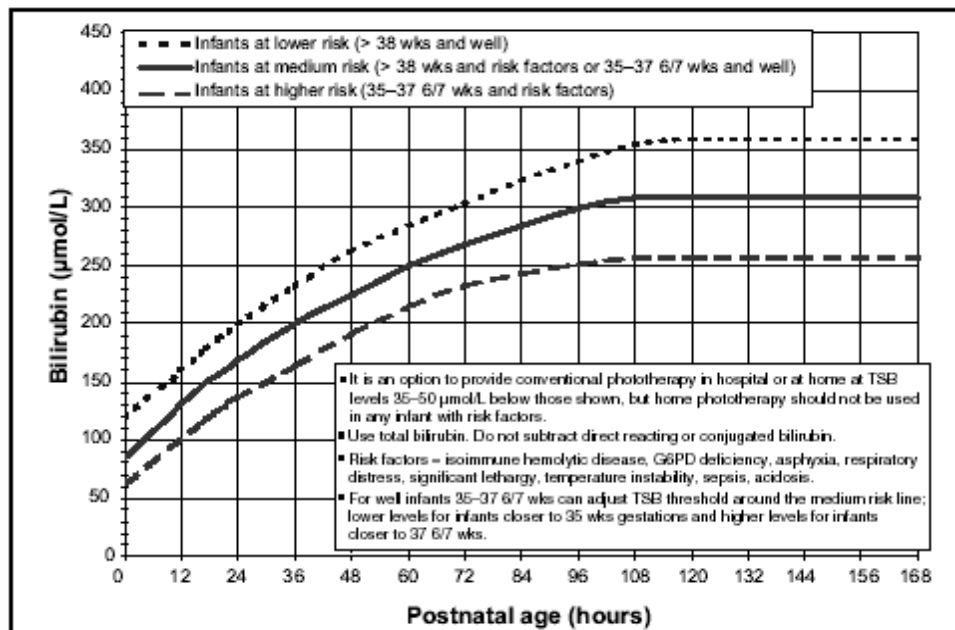


Figure 2) Guidelines for intensive phototherapy in infants of 35 or more weeks' (wk) gestation. These guidelines are based on limited evidence and the levels shown are approximations. Intensive phototherapy should be used when the total serum bilirubin (TSB) concentration exceeds the line indicated for each category. G6PD Glucose-6-phosphate dehydrogenase