## Phototherapy in NICU and the postnatal wards, JHH

### Sites where Local Guideline applies

- Neonatal Intensive Care Unit & Post-natal wards, JHH

### This Local Guideline applies to:

1. **Adults**
   - No
2. **Children up to 16 years**
   - No
3. **Neonates – less than 29 days**
   - Yes

Approval gained from the Children Young People and Families Network on 27/06/2017

### Target audience

All clinical staff, who provide care to infants requiring phototherapy

### Description

Information for clinicians about phototherapy devices available and management of an infant requiring phototherapy

### Keywords

Bilirubin, Hyperbilirubinaemia, jaundice, photoisomerisation, phototherapy, JHCH, NICU

### Document registration number

JHCH_NICU_16.04

### Replaces existing document?

Yes

### Registration number and dates of superseded documents

JHCH_NICU_16.04

November 2015

### Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:

- NSW Health Policy Directive 2014_036 Clinical Procedure Safety
- NSW Health GL2016_027 Neonatal-Jaundice Identification and Management in Neonates≥32 Weeks Gestation

### Prerequisites (if required)

N/A

### Local Guideline note

This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s require mandatory compliance. If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients health record.

### Position responsible for the Local Guideline and authorised by

Pat Marks. General Manager / Director of Nursing

CYPFS

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### Date authorised

27/06/2017

### This document contains advice on therapeutics

No

### Issue date

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### Review date

27/06/2020

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PURPOSE AND RISKS

This local clinical procedure has been developed to provide instruction to the health clinician and to ensure that the risks of harm to the child associated with management & treatment of jaundice are prevented, identified and managed.

The risks are:

- Kernicterus
- Weight loss due to poor feeding
- Temperature instability

The risks are minimised when:

- Clinicians having knowledge of the diagnosis and management of jaundice
- Clinicians understand the importance of accurate plotting of SBR on the gestational age appropriate chart
- Clinicians seek assistance if caring for infants with jaundice and under phototherapy lights and it is outside their scope of practice
- Following the instructions set out in the clinical procedure

Risk Category: Clinical Care & Patient Safety

GLOSSARY

<table>
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<tr>
<th>Acronym or Term</th>
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<tr>
<td>LED</td>
<td>Light emitting diode</td>
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<tr>
<td>SBR</td>
<td>Serum Bilirubin</td>
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<td>TcB</td>
<td>Transcutaneous bilirubinometer</td>
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OUTCOMES

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<td>1</td>
<td>Timely treatment with phototherapy lights of a raised bilirubin level in infants</td>
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<td>Correct phototherapy treatment used according to the bilirubin level to reduce bilirubin levels to safe level</td>
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Phototherapy in NICU and the postnatal wards, JHH- One Page Summary and Checklist

(Ctrl+Click on Coloured words to jump to that section)

**Phototherapy**

**Equipment**
- Natus Neo blue LED light
- Natus Neo blue Mini
- Giraffe Spot phototherapy light
- Bilisoft Unit

**Phototherapy in the Post Natal Ward**
- Medela Bilibed
- Guidelines for SBR levels
- Using the Medela bed

**Appendix 1: Measuring Light irradiance from Phototherapy lights**

**Appendix 2: Warning: neoBLUE LED Phototherapy System for preterm infants≤1000g**
GUIDELINE
This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

Phototherapy
Phototherapy is the first line treatment for neonatal jaundice and is effective in most babies in reducing the SBR level. Its efficacy depends on wavelength and luminance of the light source and the skin surface area illuminated by the light.

Phototherapy was introduced for the treatment of neonatal hyperbilirubinaemia in 1958. It is used to lower the concentration of circulating bilirubin and to prevent toxic accumulation in the brain. Blue light has been proven to be most effective in providing a phototherapeutic effect while achieving wavelengths of at least 458nm that is needed to change the structure of bilirubin.

Bilirubin is converted to enable it to be excreted when normal conjugation is deficient. Two mechanisms used are photo-oxidation and photoisomerisation. Photo-oxidation involves oxidation of the pigmented bilirubin allowing conversion to a water soluble product; this is excreted through urine. It accounts for about 15% of bilirubin depletion. Photoisomerisation involves the fat soluble form of bilirubin, using the wavelengths to convert the bilirubin polymers within the skin structures into excretable isomers. This process permits bilirubin excretion without the liver catabolism involvement. When administering phototherapy there are four key points to consider achieving effective treatment and decreasing the time of treatment.

These are:
- Intensity of the light
- Spectral qualities of the light source
- Distance between the light and the infant’s skin
- Body surface area exposed

Before commencing phototherapy it is important for staff to be aware that phototherapy can cause side effects to the infant, these include:
- Loose stools
- Dehydration
- Hyperthermia
- Lethargy
- Skin rashes
- Eye damage
- Bronze baby syndrome

Equipment
JHH NICU uses four types of phototherapy lights which include the Natus Neoblue LED, Natus Neoblue mini LED, The BiliSoft and the Giraffe phototherapy light.

Natus Neoblue LED Phototherapy can be used for infants nursed in incubators and open cares. This is a freestanding unit; it can be adjusted horizontally and vertically and can also be tilted to approximately 40 degrees. Light is to be positioned 30cm above the infant. It can be set on low or high intensity. Wavelength measurements are: low 12uW/cm2/nm, high 30uW/cm2/nm (Natus, 2012).
Natus Neoblue LED lights

Natus Neoblue Mini LED Phototherapy can be used for infants nursed in incubators or open care cots. This unit needs to be attached to poles measuring 1.91 to 3.81cms in diameter. It can be tilted to achieve direct light of the infant, and it is not to be placed directly under radiant heaters. Light needs to be positioned 30cm above the infant. Wavelength measurement is 30μW/cm²/nm (Natus, 2012).

Giraffe Phototherapy Light : This light is attached to giraffe incubators, which are the most effective phototherapy lights measuring a light reading of 55Lux. Infants need to have a distance of 25 to 30cms between them and the light source. This phototherapy light is a heat source.

Infants using this light need to have a temperature probe attached and servo temperature set to baby to prevent the infant from over-heating.

WARNING for preterm infants ≤ 1000g

NeoBLUE LED Phototherapy systems, comprising of Natus Neoblue LED lights and Natus Neo blue mini lights can deliver an irradiance of >30 μW/cm²/nm which may not be appropriate for all infants.

See Appendix 2 Field safety notice neoBLUE LED Phototherapy System labelling change for more details.
The BiliSoft™ unit consists of a light box attached to a pole and a detachable fiber optic light pad with a long, flexible fiber optic cable. The cable delivers light from a high intensity LED module in the light box to the fiber optic light pad. It is used when additional lights are needed to treat extreme hyperbilirubinemia. The pad is covered with a soft biliSoft pad cover and placed directly under the infant, either back or chest, ensuring the light emitting side is facing up.
Procedure

- Explain procedure and proposed treatment to mother/parents (give parent information sheet)
- Encourage parents to continue with the same care plan including cares and feeding.
- Provide emotional support to the family.
- Choose appropriate light source for the infant depending on the SBR level and medical orders.
- Prepare incubator in the infant’s neutral thermal zone due to being undressed.
- When babies are admitted from home for phototherapy, place on an open care bed with a servo probe insitu.
- Remove the infant’s clothes.
- Infants may lie on a nappy that is undone or partially secured to increase light exposure. AVOID the use of a “bluey” as plastic lining may interfere with skin integrity.
- Place infant into incubator or onto open care.
- Apply monitor leads (may need cardio-respiratory or saturation monitor or both depending on infants history).
- Record baseline observations and time of commencement of phototherapy.
- Place small tabs of Mepitac™ on either side of the infant’s head, near the temple and then stick DuoDERM™ over the top.
- Neoshades™ eye patches are available in 3 sizes-Micro, small & large. There is also a wrap-around eye patch, Eyemax in micro, preemie and regular sizes.

- No eye care is required unless visible problems noted. Eye patch is removed when feeding from breast/bottle.
- Ensure infant has appropriate hydration ordered, or has their total fluid volume increased appropriately to prevent dehydration.
- Carefully observe the infant for signs of hypo or hyperthermia.
- Assess skin integrity regularly due to an increase in urine output and bowel movements needed to excrete bilirubin. Refer to ‘Skincare guidelines for babies in NICU’ CPG for nappy rash flow diagram.
- Observe infant for side effects related to receiving phototherapy as listed above.
Phototherapy in NICU and the postnatal wards, JHH

Phototherapy in the postnatal ward

**Medela Bilibed**

A blue fluorescent tube is fitted into a plastic crib with a stretched plastic cover over the top for the baby to lie on. The baby is dressed in the Bilicombi baby suit and nursed on the soft plastic cover. The suit attaches to the crib by Velcro attachments. The irradiance delivered is up to $40 \text{ mW/cm}^2/\text{nm}$.

The Medela Bilibed® is the preferred method of delivering phototherapy on the postnatal wards. They are used on infants who are:

- Well infants with physiological jaundice (i.e. jaundice appears after 24 to 48 hours of age). This is caused by increased production, increased enterohepatic circulation and decreased excretion of bilirubin in a normal baby.
- Infants with birth trauma – caput succedaneum, cephalohaematoma, bruising.
- Initial mode of therapy whilst further investigations are awaited.
- Infants that have been in the nursery for overhead phototherapy and the jaundice has been controlled.

Any baby with jaundice in the first 24 hours needs investigation and management and referral immediately to NICU staff. A serum bilirubin (SBR) level 50 micromol/L above the phototherapy line, or rapidly rising jaundice may need more intensive phototherapy in the NICU.

When blood is collected in the postnatal Ward for an SBR it is sent to the laboratory and not tested in the NICU gas machine.

**Guidelines for SBR levels at which physiological jaundice should be treated.**

The NICU team will manage infants requiring phototherapy: contact Level 2 nursery on phone numbers 14412 or 14411.
The following chart provides guidelines for SBR levels that require treatment with phototherapy.

**Risk Factors for Kernicterus**
- Rapidly rising bilirubin level (>8 micromol/L/hour)
- Isimmune haemolytic disease
- G6PD deficiency
- Acidosis (pH<7.2)
- Proven sepsis
- Asphyxia (Sarnat stage 2 or more)
- A generally unwell neonate - temperature instability, significant lethargy

**Bilirubin Results in the first 24 hours**
If a SBR in the first 24 hours is over 80 micromol/L then a repeat bilirubin should be done in 4 to 6 hours and the jaundice guideline consulted for further advice. If still in doubt consult the neonatologist.

**Bilirubin Results from Gas Machine and Laboratory**
If concurrent samples have been obtained, action according to the laboratory result (regarded as the gold standard)
If concurrent results are widely discrepant repeat the test on a venous sample
Infants with signs of dehydration, poor feeding or lethargy should be considered for investigation and treatment at lower levels (HNEAH, 2001). Any of the following signs make physiological jaundice less likely:

- Jaundice appearing in the first 24 hours;
- Bilirubin rising faster than 80 micromol/Litre per day; and,
- Infant that appears unwell or is dehydrated.

**Goals of phototherapy in the post-natal ward:**

- To decrease the infant’s serum bilirubin levels
- To commence and maintain the infant on phototherapy treatment in a safe and effective manner
- To prevent maternal infant separation
- Facilitate demand breast feeding

**Phototherapy using the Medela Bilibed®**

There are 4 Medela Bilibeds® available for use, these are stored in NICU.

Phototherapy is not without side effects so a comprehensive plan of nursing care should be implemented to avoid any complications. Potential complications can include:

- dehydration
- peri-anal excoriation from increased bilirubin induced diarrhoea
- temperature instability
- possible maternal infant separation and disruption of breast feeding

**Equipment**

- Medela Bilibed®
- Bilicombi (towelling suit for baby to lie in). There are two bilicombis per Medela Bilibed®

**Procedure:**

Explain procedure and proposed treatment to mother/parents *(give parent information sheet).* Encourage parents to continue feeding, and caring for their infant.

- Remove the mattress from the perspex cot
- Carefully place Bilibed® in the perspex cot. Attach the Bilicombi to the infant support.
- Remove all the baby’s clothes (except nappy). Ensure the infant has at least six well soaked nappies a day
- Place the baby supine in the Bilicombi suit.
- Secure the Bilicombi suit to the Bilibed® with velcro *(ensure all pieces of equipment are aligned correctly keeping the ventilation slots clear).*
- Turn the Bilibed® on at the power source.
- Turn the light on by pressing the button on the end of the grey cable *(Reset the hour meter—hold the start/stop button down for 15 seconds).*
- The infant’s temperature is taken 4th hourly while receiving phototherapy.
- Maintain the infant’s skin integrity - loose stools that may cause peri-anal skin excoriation. Refer to ‘Skincare guidelines for babies in NICU’ CPG for nappy rash flow diagram.
A serum bilirubin level (SBR) should be collected 6 to 8 hours after commencement of phototherapy to ensure it is effective in reducing the infant’s bilirubin level.

Document serial SBRs on the phototherapy chart. Indicate sample type ie TcB, blood gas SBR or formal SBR next to result on graph. Also include the date and time of commencement and cessation of phototherapy. Please ensure all other details are completed.

Any concerns regarding hydration of the infant should be referred to NICU RMO, registrar or NNP.

Guidelines for breast-fed babies receiving phototherapy

- Infants should be fed regularly, with a maximum interval of four hours.
- Infants should be removed from phototherapy for feeds for no more than 40 minutes each feed.
- Lactation consultant / midwife to write 24 hour care plan if attachment and feeding is a problem
- Admission to NICU Level 2 should be considered in infants who require tube feeding

Additional Fluids

- Increase fluids if appropriate for example if insufficient wet nappies.
- If additional fluids are required:
  - The first choice is expressed breast milk (EBM), or formula if EBM is unavailable
  - Breast fed infants should be cup fed unless the mother consents to the use of a bottle and teat

Cleaning of equipment

- Unplug the Bilibed® unit from the power supply and clean with neutral detergent
- Return Bilibed® to NICU for cleaning
- Return the Bilicombi to NICU for washing by Volunteers

  - Volunteers will wash in standard machine cycle (minimum wash cycle of 10 minutes)
    - machine wash in hot water (minimum temp of 60°C and maximum of 95°C degrees)
    - standard washing detergent
    - do not use chlorine bleach
    - tumble dry on low heat

- Inspect velcro after each wash prior to use.

Follow up:

Infants may require follow up by NICU staff and a SBR level after cessation of treatment. If the mother is taking the infant home the day phototherapy ceases, she may need to have the infant reviewed the following day.

Outcomes:

- The infant was commenced and maintained on phototherapy treatment in a safe and effective manner
- The infant’s serum bilirubin levels were decreased
- Maternal infant separation was avoided and breast feeding maintained
APPENDIX 1

MEASURING LIGHT ENERGY/IRRADIANCE FROM BILIBLANKETS AND OVERHEAD PHOTOTHERAPY LIGHTS

DESCRIPTION

The Ohmeda BiliBlanket™ Meter measures the light energy that strikes its photo detector within a fixed spectral region. The total energy or irradiance (µW.cm²/nm) of the light source will be displayed on the LCD. It provides a quick and reliable measure of light from phototherapy systems used in the NICU/SCN. It is to be used to record the overall irradiance a baby is receiving whilst receiving phototherapy. The BiliBlanket™ Meter II can be used with all phototherapy systems such as LED, fluorescent, halogen, and fiberoptic phototherapy systems.

![Normalised Spectral Response of Ohmeda BiliBlanket Meter](image)

**Figure 1-1** Spectral response curve

OPERATING CONTROLS AND INDICATORS

Wipe Biliblanket™ meter with a detergent wipe and allow to dry (DO NOT use alcohol wipes)

Turn on the Biliblanket™ meter (by sliding No 5)

Ensure the Hold/run switch (No 4) is not pressed in
TO READ THE WAVELENGTH OF THE PHOTOTHERAPY LIGHT

Place the meter on the babies bed with the receptor dome (2) facing upwards. Leave for a few seconds and then press the hold/run button (4) down and read the displayed ‘µW.cm2/nm’ and write it down.

The three areas to be measured are at the level of the mattress and as close as possible to the following points

A. next to the baby’s head
B. next to the babies torso at the level of the xiphisternum
C. next to the babies legs near the knees

NOTE: If the baby is also receiving phototherapy using a bililanket pad, turn the meter over so that the receptor dome is facing down on the mattress and repeat the readings at the same areas as described above.

To calculate to average irradiance the baby is receiving add all the readings and then divide by the total number of readings. Thus, if the baby is on a biliblanket as well as overhead phototherapy lights you would take a measurement at 6 points and then calculate your average µW.cm2/nm. If the baby is only under overhead phototherapy lights then you calculate it by three readings.
Overhead phototherapy + BiliBlanket™

\[ \mu W.cm^2/nm = (A+B+C+D+E+F)/6 \]

Overhead phototherapy only

\[ \mu W.cm^2/nm = (A+B+C)/3 \]

**DOCUMENTATION**

Intensive phototherapy is defined as an irradiance of at least 25 \( \mu W.cm^2/nm \) to provide optimal benefit. Therefore the aim should be to provide phototherapy to achieve an average irradiance reading of 25 \( \mu W.cm^2/nm \).

Note that amount of skin surface exposed to phototherapy is also extremely important in achieving maximal benefit from phototherapy and efforts should be made to maximise this (by use of biliblanket pads, optimal positioning of phototherapy lights and by not having a nappy on where appropriate).

Addition of further phototherapy units to increase the irradiance level to >25 \( \mu W.cm^2/nm \) may not result in additional increased benefit in terms of rapidity of decreasing bilirubin levels.

When to Document the average irradiance on the bottom bilirubin chart

1. Once a shift
2. Or if you **add, remove or change** a phototherapy source

**REFERENCES FOR BILIBLANKET™**

3. RPA Newborn Care Guidelines Phototherapy
   
APPENDIX 2

Warning: neoBLUE LED Phototherapy System for preterm infants ≤1000g

Addendum
(June 2016)

NeoBLUE® LED Phototherapy System

The following warning is being added to the current neoBLUE LED Phototherapy System user manual. Please add this addendum to all existing neoBLUE LED Phototherapy System user manuals for devices still in use in your facility.

⚠️ Warning! Intensive phototherapy (>30 μW/cm²/nm) may not be appropriate for all infants (i.e. preterm infants ≤1000 g).

REFERENCES:


GE Healthcare Phototherapy 2014


RPA Newborn Care Guideline: Jaundice November 2011

IMPLEMENTATION, MONITORING COMPLIANCE AND AUDIT

The level of implementation, monitoring or compliance and audit will be based on the risk rating of the document. Owners/developers must detail how:

1. the document will be communicated via email notification on message board on the Neonatal Hub and implemented when approved by CQ&PCC;
2. education will be provided to staff at arranged in-service times as well as bedside teaching by Education staff
3. the document will be monitored for effectiveness and compliance by reviewing the SBR charts and irradiance levels

FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.