Newborn Guideline 4

JAUNDICE IN THE HEALTHY TERM NEWBORN

INTRODUCTION

During the first week of life, all newborns have increased bilirubin levels by adult standards, with approximately 50% of term infants having visible jaundice. Despite progress in neonatal care and the virtual absence of classic bilirubin encephalopathy, safe bilirubin levels have not been established with absolute certainty. There has been an increase in the number of term infants reported with kernicterus\textsuperscript{1,2} and the number of readmissions to hospital for jaundice has increased in recent years\textsuperscript{3}. This has been attributed to shorter length of postpartum hospital stays without comprehensive follow-up\textsuperscript{4,5}.

When carefully reviewed, the data from numerous studies of bilirubin toxicity are so complex that it is difficult to derive a single rational approach to jaundiced neonates\textsuperscript{6}. One principle is well accepted: if there is any evidence that a neonate’s jaundice is not physiologic, the cause should be investigated prior to the initiation of treatment\textsuperscript{6}.

SIGNIFICANCE

Neonatal Jaundice is of concern due to:

- The risk of bilirubin encephalopathy/kernicterus
- The possibility that the jaundice may be a sign of a serious underlying illness

RISK FACTORS\textsuperscript{7}

- family history of newborn jaundice (especially sibling), anemia, liver disease, or inborn errors of metabolism
- plethora, polycythemia, bruising, cephalhematoma
- poor feeding, vomiting, delayed passage of meconium
- excessive weight loss
- sepsis
- asphyxia
- relative prematurity or small for gestational age
- hypothyroidism, hypopituitarism
- certain ethnic groups i.e. East Asian, Native American
- infant of a diabetic mother
- maternal ingestion of sulfonamides or antimalarial drugs
**CAUSES**

I. PHYSIOLOGIC JAUNDICE

Increased bilirubin load due to:

- Increased red blood cell volume
- Immaturity of bilirubin conjugation in the liver at birth
- Increased enterohepatic circulation of bilirubin
- Decreased red blood cell survival
- Decreased uptake of bilirubin from the plasma by the liver

II. INCREASED BREAKDOWN OF RED BLOOD CELLS

- Blood group and Rh incompatibility
- Red blood cell defects (G6PD deficiency, spherocytosis)
- Rare blood group incompatibilities
- Polycythemia
- Sequestered blood (bruising, hematoma)
- Infection

III. DECREASED CONJUGATION OF BILIRUBIN

- Prematurity
- Rare inherited defects

IV. INCREASED REABSORPTION OF BILIRUBIN FROM THE GI TRACT

- Asphyxia
- Delayed feedings
- Bowel obstruction
- Delayed passage of meconium

V. IMPAIRMENT OF BILE EXCRETION

- Sepsis
- Intrauterine infections
- Hepatitis
- Cholestatic syndromes
- Biliary atresia
- Cystic fibrosis

VI. BREAST MILK JAUNDICE

The association between breastfeeding and higher bilirubin levels is well established, however the cause for this has not been determined with certainty⁶.
A. Early Breastfeeding Jaundice

- Develops within 2 to 4 days of birth
- Most likely related to infrequent breastfeeding with a limited fluid intake
- May be related to increased reabsorption of bilirubin from the bowel

B. Late Breast Milk Jaundice

- Much less common
- Develops 4 to 7 days after birth, peaks day 7 to 15
- Cause remains unknown despite numerous theories and studies.

STRATEGIES TO DECREASE INCIDENCE

I. LABOR AND DELIVERY

- avoid trauma during labor and delivery

II. BREASTFEEDING

- provide early assistance, education and support for breastfeeding
- ensure parental education regarding signs of adequate hydration, signs of jaundice and feeding
- initiate early and frequent feedings – at least 8 feeds in 24 hours. Avoid separation of mother and baby.
- encourage the ingestion of colostrum to increase stooling which prevents reabsorption of bilirubin
- supplementation with water does not affect bilirubin levels and is not recommended. If supplementation is necessary due to inadequate intake, the mother should pump her breasts and give expressed breastmilk and/or formula rather than water.

III. DISCHARGE/FOLLOW-UP

- ensure adherence to evidence-based and current postpartum discharge criteria
- 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
- ensure community mechanisms for follow-up and referral between health care providers (See example in Appendix 1: Management of Newborn Jaundice at Home Program)

SCREENING

I. TRANSCUTANEOUS

Use of an icterometer or transcutaneous jaundice meter is sometimes used as a screening device in healthy term infants. Accuracy may be limited by the changing pigmentation of the skin, the duration of jaundice and the effect of phototherapy.
II. BILIRUBIN MEASUREMENT

Several studies have looked at the predictive ability of predischarge serum bilirubin testing\textsuperscript{12,13,14}. To date, \textbf{routine bilirubin investigation for healthy term newborns is not indicated}. However, if the infant’s level of jaundice is a concern at discharge, it may be prudent and helpful to obtain a bilirubin level at the time that the PKU specimen is collected. Reference to the Bhutani Graph (Appendix 3, page 17) may then help to determine whether further bilirubin levels should be obtained.

\textbf{ASSESSMENT}

I. COLOUR

Kramer\textsuperscript{15} described the cephalocaudal progression of jaundice in term infants. He drew attention to the observation that jaundice starts on the head, and extends towards the feet as the level rises. This is useful in deciding whether or not a baby needs to have the serum bilirubin (SBR) measured. Kramer divided the infant into 5 zones. The SBR range associated with progression to the zones is as follows:

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

Adapted from the Department of Neonatal Medicine Protocol Book, Royal Prince Alfred Hospital, University of Sydney, Australia, 1999\textsuperscript{16}

The colour of the skin should be evaluated after the skin has been blanched by pressure from the thumb in a well lit room (or natural daylight if in the home).

II. AGE

Jaundice before 24 hours of age is always pathological.

III. FEEDING BEHAVIOUR

- as bilirubin levels rise, the baby may become more lethargic
- after the first 1-2 days of life, newborns should breastfeed at least 8 times in 24 hours
- if baby is sleepy during feeds, utilize waking techniques

IV. HYDRATION

Adequate intake can be determined by the baby’s:
- Skin turgor
- Moistness of mouth
- Weight
- Energy levels
- Feeding pattern/behavior
• Elimination (See guide below)

**Guide for Healthy Term Newborn Output**

<table>
<thead>
<tr>
<th>Day</th>
<th>Number of Stools/24 hours</th>
<th>Number of Wet diapers/24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>at least one meconium</td>
<td>at least 1</td>
</tr>
<tr>
<td>2</td>
<td>at least one meconium</td>
<td>at least 2</td>
</tr>
<tr>
<td>3</td>
<td>at least 1 transitional</td>
<td>at least 3</td>
</tr>
<tr>
<td>4</td>
<td>at least 2 + yellow/seedy</td>
<td>at least 4</td>
</tr>
<tr>
<td>5</td>
<td>at least 2 + yellow/seedy</td>
<td>5 - 6</td>
</tr>
</tbody>
</table>

See BCRCP British Columbia Newborn Care Path: Outcomes, Teaching & Interventions document for norms.

**V. OTHER ILLNESS**

In association with other findings, jaundice may be a sign of serious illness. Each jaundiced infant should be assessed to see whether the following danger signs are present:

• Family history of significant hemolytic disease
• Onset of jaundice within 24 hours
• Pallor, bruising, petechiae
• Lethargy
• Poor feeding
• Fever
• Vomiting
• Dark urine and light stools
• Hepatosplenomegaly
• High pitched cry

**CLINICAL MANAGEMENT**

Clinical management is aimed at avoiding bilirubin encephalopathy with 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 (e.g. 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.\textsuperscript{1,12,17}

The most common guidelines utilized in risk identification and management of hyperbilirubinemia are listed below.

\textbf{Appendix 2: Approach to the management of hyperbilirubinemia in term newborn infants\textsuperscript{1}. A Joint Statement: Canadian Paediatric Society & College of Family Physicians of Canada (February 2001)}


\textbf{Appendix 4: Management of hyperbilirubinemia in healthy term newborns\textsuperscript{17}. American Academy of Pediatrics (1994)}

\textbf{OTHER ISSUES IN THE MANAGEMENT OF JAUNDICE}

\textbf{I. BREASTFEEDING AND PHOTOTHERAPY}

- Interruption of breastfeeding is usually not indicated\textsuperscript{6}.
- An adequate intake of milk minimizes the bilirubin level by stimulating bowel emptying. Encourage frequent and effective breastfeeding (as least 8X in 24 hours)\textsuperscript{6,18}
- Breastfeeding may be interrupted for diagnostic or therapeutic purposes when the bilirubin is high and there is the risk of an exchange transfusion. Should this occur:
  - continue phototherapy
  - consider discontinuing breastfeeding for 24 hours, or
  - alternate breastfeeding with formula feeding if fluid intake is of concern
  - offer positive support for breastfeeding. Encourage maintenance of lactation by using a breast pump or manual expression during the period of interrupted breastfeeding\textsuperscript{6}.
- Glucose water will not reduce serum bilirubin levels and may interfere with breastfeeding\textsuperscript{6}.

\textbf{II. DAYLIGHT TREATMENT}

Exposing infants to indirect sunlight via a window to decrease bilirubin levels has been a long standing practice\textsuperscript{19}. Controlled studies on this treatment have not been done. Mild jaundice requires no sunlight exposure, as it sends a false note to parents that their baby has a significant problem when in fact (s)he has not. If an infant has jaundice that needs treatment according to accepted guidelines, then it should be investigated further.

\textbf{III. FIBROPTIC PHOTOTHERAPY}

Use of fibroptic or “bili blankets” is gaining increased interest. A Cochrane Database Review\textsuperscript{20} found that fibroptic phototherapy was more effective at lowering serum bilirubin than no treatment, but less
Jaundice in the Healthy Term Newborn

effective than conventional phototherapy. A combination of fibroptic and conventional phototherapy was more effective than conventional phototherapy alone. No conclusion could be made on the superiority of one fibroptic device over another. No trials have been identified which support the view that fibroptic devices interfere less with infant care or impact less on parent-child bonding.

At this time, “bili blankets” should **not** be used alone to treat non-physiologic causes of jaundice or those infants at risk of requiring an exchange transfusion.

**IV. HOME PHOTOTHERAPY**

There are few articles in the literature which address this issue. With the advent of fibroptic blankets and portable bilibeds, home phototherapy has been implemented in a few communities throughout Canada. To date, there are no published evidence-based guidelines on the use of home phototherapy.

**CLINICAL INDICATORS FOR EVALUATION**

- Serum bilirubin levels at which phototherapy is initiated (age specific in hours of life).
- Bilirubin levels at which the infant is readmitted.
- Numbers of readmissions for jaundice.

**REFERENCES**


WEB RESOURCES

http://www.aap.org/policy/hyperb.htm

www.cps.ca/english/statements/FN/fn98-02.htm

http://www.cps.ca/english/statements/FN/fn96-02.htm


http://www.umanitoba.ca/womens_health/hschomet.htm
APPENDIX 1 (Example)

Management of Newborn Jaundice at Home Program

Referral for the Healthy Term Infant

PHN Identifies jaundice in the newborn

1. Preterm Infant? Rh/ABO incompatibility?
2. Look or act ill (e.g. lethargic, apnea, tachycardia, temperature unstable, poor feeding, changed behavior, persistant vomiting, insufficient voiding/stooling)?

Yes → Refer to MD ASAP

No →

Family hx of early or severe jaundice? Ethnicity relevant (Mediterranean, SE Asian)

Yes → Refer to MD for investigation. eg. G6PD, Spherocytosis

No → Refer to MD for non – isoimmune hemolytic disease investigation

Infant less than 24 hrs

Yes → Refer to MD for follow-up with total serum bilirubin

No → Is jaundice clinically significant?

Yes → Refer to MD

No → Routine Clinical Supervision

Routine care and feeds

Jaundice persisted > 2 weeks?

Yes → Any abnormal physical findings? Dark urine, light stools?

Yes → Refer to MD

No → Jaundice >3 weeks?

Yes → Refer to MD

No → Routine care and feeds

Developed by the Coordinated Maternity Standards Committee, South Fraser Health Region and Dr. K. Danso, Pediatrician Surrey Memorial Hospital. Revised 1997. Copied with permission.
APPENDIX 2

Approach to the Management of Hyperbilirubinemia in Term Newborn Infants

A Joint Statement with the College of Family Physicians of Canada

*Paediatrics & Child Health* 1999;4(2):161-164
Reference No. FN98-02
Reaffirmed February 2001

Reprints of this position statement are available from the Canadian Paediatric Society, 100-2204 Walkley Road, Ottawa ON K1G 4G8; phone: (613) 526-9397; fax: (613) 526-3332.

Contents
- Background
- Phototherapy
- Clinical management of hyperbilirubinemia in infants
- Exchange transfusion
- Conclusions
- References

Conflicting reports have led to confusion about the optimal management of jaundice in otherwise healthy term infants (1-9). The ‘kinder gentler approach’ to neonatal hyperbilirubinemia proposed in 1992 by Newman and Maisels (8) resulted in a 1994 statement by the American Academy of Pediatrics (2) that addressed the management of healthy term infant without risk factors. Recently, there has been an increase in the number of term infants reported with kernicterus (10). It is important to note that while some of the infants reported with kernicterus had features that would place them in a high risk category, some presented with severe jaundice only and no identifiable risk factors (10). The infants reported were commonly breastfed and frequently discharged from hospital very soon after birth (10). Nonetheless, the current standards (2) for the management of hyperbilirubinemia in the healthy term infant have become controversial. This document updates information previously published by the Canadian Paediatric Society (1). It provides an overview of the proposed management of hyperbilirubinemia based on available evidence, even though randomized controlled trials are not available to allow a conclusive assessment of the risk associated with hyperbilirubinemia in the clinical situations encountered in practice. The objective of this overview is to establish a management plan that will minimize the risk of kernicterus in term infants both with and without risk factors. Although scientific evidence has not established a clear link between specific bilirubin concentrations and the development of kernicterus in healthy term babies, information to date has been incorporated into the following guidelines.

**Background**

Kernicterus is a neurological condition characterized by deep yellow staining of the basal nuclei. The accompanying clinical syndrome results from the destructive changes of these neuronal populations. Initially, the signs are lethargy, hypotonia and seizures; later, the infants may develop athetoid cerebral palsy, mental retardation and deafness. When neurological signs evident in the infant, permanent damage has already occurred, leading to death or long term disability. Therefore, management strategies are aimed at preventing kernicterus.
Jaundice in the Healthy Term Newborn

Until recently, these strategies suggested maintaining serum unconjugated bilirubin concentrations below 340 µmol/L (20 mg/dL) in healthy term infants through the use of phototherapy or exchange transfusion (11). While exchange transfusions had been a frequent occurrence from the 1950s to the 1970s and may sometimes still be required, phototherapy has become the mainstay of medical management of hyperbilirubinemia since that time.

The cases of kernicterus originally described occurred mainly in infants with hemolytic disease. Higher serum unconjugated bilirubin concentrations may be safe in healthy term infants without hemolytic disease. It is not possible to predict at what level an individual infant may develop kernicterus.

Several authors have expressed serious concerns over the approach of allowing higher serum unconjugated bilirubin concentrations to occur before investigating and treating these term infants (11-16). Brown and Johnson (10) have reported 23 cases of kernicterus occurring since 1989, 16 in term and seven in near term infants. In these infants, peak unconjugated bilirubin concentrations of 375 to 860 µmol/L (22 to 50 mg/dL) were seen. All but one infant was breastfed. Other associations found in these infants with kernicterus were dehydration (seven infants), glucose-6-phosphate dehydrogenase (G6PD) deficiency (five infants), ABO alloimmunization (one infant), hemolysis of unknown cause (five infants), familial etiology (one infant) and otherwise unexplained early jaundice clinically evident before 24 h of age (six infants). Similar cases have been reported by others (17,18). Although many of these babies were subsequently found to have additional risk factors, these factors were not often identified at the time the baby was noted to be jaundiced.

Since the introduction in the 1990s of the kinder, gentler approach to the management of hyperbilirubinemia, a great deal of confusion has arisen about approaches to the management of hyperbilirubinemia in healthy term infants. This confusion has extended to the care of borderline preterm infants who have often been treated as term infants. A recently published international survey reported considerable variability in the approach to hyperbilirubinemia and the use of phototherapy among neonatal units worldwide (3).

Phototherapy

The goal of hyperbilirubinemia treatment is to avoid bilirubin concentrations that may result in kernicterus. Phototherapy remains an effective therapeutic intervention that decreases bilirubin concentrations, thereby preventing elevated bilirubin levels associated with permanent sequelae.

The effectiveness of phototherapy is related to the area of skin exposed, and the radiant energy and the wavelength of the light (19-23). Phototherapy acts on unconjugated bilirubin to a depth of 2 mm from the epidermis. Phototherapy changes the bilirubin through structural photoisomerization into water-soluble lumirubin that is excreted in the urine (19). The fall in bilirubin level is proportionately greater in the skin than in the serum (20). Therefore, the infant receiving phototherapy should have as much skin as possible exposed to the lights. More intense phototherapy may be achieved by using multiple sources of phototherapy; double or triple phototherapy is recommended to optimize the skin surface exposed and, therefore, the efficacy of phototherapy. More detailed discussion of the physics of phototherapy has been published (1,24).

It is important to recognize the relationship between dehydration and hyperbilirubinemia. Dehydration may be associated with increased serum bilirubin concentrations and may be exacerbated by phototherapy. All jaundiced infants should be adequately hydrated before and during phototherapy. Breastfeeding is not contraindicated in the presence of hyperbilirubinemia and should be continued. More frequent breastfeedings may be beneficial (25).

The concentrations of bilirubin at which phototherapy might be initiated in healthy term infants and those with risk factors are shown in Figure 1. Guidelines for phototherapy in low birth weight infants remain as previously published (1). The bilirubin concentrations at which phototherapy is suggested by the Canadian Paediatric Society in the present statement are more conservative than the current recommendations of the American Academy of Pediatrics (2). If the infant is a healthy term newborn, phototherapy should be started as indicated
in the upper curve of Figure 1. If the infant has one or more risk factors, a clinical decision should be made to initiate phototherapy at the concentration indicated by the lower curve.

Figure 1: Guidelines for initiation of phototherapy for hyperbilirubinemia in term infants with and without risk factors. Some risk factors include gestational age younger than 37 weeks, birth weight less than 2500 g, hemolysis, jaundice at younger than 24 h of age, sepsis and the need for resuscitation at birth.

The timely recognition of risk factors is essential to minimize the danger of kernicterus. The risk factors are as follows:

- gestational age younger than 37 weeks and birth weight less than 2500 g;
- hemolysis due to maternal isoimmunization, G6PD deficiency, spherocytosis or other causes;
- jaundice at less than 24 h of age;
- sepsis; and
- the need for resuscitation at birth.
Clinical management of hyperbilirubinemia in infants

A bilirubin level that justifies consideration of phototherapy should mandate the investigation of the cause of hyperbilirubinemia. Investigation should include a clinically pertinent history of the mother, family history, description of labour and delivery, and infant’s clinical course (26). A physical examination should be supplemented by laboratory investigations (Table 1) including determination of unconjugated and conjugated serum bilirubin concentrations, and blood group with direct antibody test (Coombs’ test) and hemoglobin and hematocrit levels. A complete blood count, including differential white cell count and a blood smear for red cell morphology, may be indicated. Further tests (eg, reticulocyte count, G6PD screen) may be indicated based on initial results, ethnicity or clinical presentation. Testing for serum electrolytes and albumin or protein are indicated in some situations such as suspected dehydration or when bilirubin levels approach exchange values. In the absence of drugs or clinical states that alter the binding of bilirubin by albumin, the bilirubin to albumin or the bilirubin to protein ratio reflects the free bilirubin concentration and the binding capacity of the serum (27-29). At a bilirubin concentration close to exchange transfusion levels, some clinicians may wish to ensure that serum bilirubin binding is normal (albumin 25 g/L or greater, protein 54 g/L or greater). Values below these levels may be associated with low bilirubin binding and may be used by the clinician when deciding whether further intervention (eg, exchange transfusion) should take place (27).

<table>
<thead>
<tr>
<th>TABLE 1: Laboratory investigation for hyperbilirubinemia in term newborn infants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicated</strong> (if bilirubin concentrations reach phototherapy levels)</td>
</tr>
<tr>
<td>- Serum total or unconjugated bilirubin concentration</td>
</tr>
<tr>
<td>- Serum conjugated bilirubin concentration</td>
</tr>
<tr>
<td>- Blood group with direct antibody test (Coombs’ test)</td>
</tr>
<tr>
<td>- Hemoglobin and hematocrit determinations</td>
</tr>
<tr>
<td><strong>Optional</strong> (in specific clinical circumstances)</td>
</tr>
<tr>
<td>- Complete blood count including manual differential white cell count</td>
</tr>
<tr>
<td>- Blood smear for red cell morphology</td>
</tr>
<tr>
<td>- Reticulocyte count</td>
</tr>
<tr>
<td>- Glucose-6-phosphate dehydrogenase screen</td>
</tr>
<tr>
<td>- Serum electrolytes and albumin or protein concentrations</td>
</tr>
</tbody>
</table>

For infants with prolonged jaundice (lasting longer than seven days) or with conjugated hyperbilirubinemia (greater than 30 µmol/L), additional investigation and management may be required, and a consultation with a specialist may be needed (30).

During the past decade, most nurseries have shortened the time of hospital stay for term healthy newborn infants. Early discharge of neonates means that jaundice is not often recognized at discharge (31). The Canadian Paediatric Society reiterates the importance of allowing early discharge only if a healthy status is confirmed for each baby and appropriate follow-up is provided (32). Appropriate parental education about feeding, signs of dehydration and jaundice must be implemented in hospital nurseries. Testing for serum bilirubin concentrations must be readily available for newborns on an out-patient basis. Readmission to hospital (usually the hospital of birth) may be necessary for the investigation and management of hyperbilirubinemia.

**Exchange transfusion**

If phototherapy fails to control the rising bilirubin levels, exchange transfusion is indicated to lower serum bilirubin concentrations. For healthy term infants without risk factors, exchange transfusion should be considered at serum unconjugated bilirubin concentrations of 400 to 430 µmol/L. For term infants with risk factors, the level should be 340 µmol/L. For infants who initially present with serum bilirubin concentrations in
excess of exchange levels, intensive phototherapy should produce a decline of serum unconjugated bilirubin from 20 to 35 µmol/L within 4 to 6 h, and levels should continue to fall thereafter and remain below the threshold for exchange transfusion. If the bilirubin concentration does not decrease after adequate rehydration and 4 to 6 h of intensive phototherapy, exchange transfusion should be considered. Preparation for this, including ensuring availability of blood, should occur shortly after the admission of babies whose bilirubin concentrations exceed exchange levels. Appropriate consultation should be obtained if the etiology of hyperbilirubinemia is unclear, the infant is ill, and particularly if bilirubin concentrations are approaching exchange levels. Because the risks of exchange transfusion are significant, the best management may be reviewed with an expert opinion from a neonatologist.

Conclusions
Hyperbilirubinemia in apparently healthy term newborn infants continues to hold the potential threat of complications from bilirubin encephalopathy and kernicterus. Careful assessment of risk factors, judicious use of phototherapy, appropriate laboratory monitoring and specific treatment of other disorders (eg, sepsis) are essential for the optimal management of hyperbilirubinemia. Appropriate laboratory facilities must be available to measure bilirubin concentrations for out-patients in required clinical situations. Readmission to hospital may be required if phototherapy is necessary. Guidelines for phototherapy are presented for term babies with and without identifiable risk factors.

References

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Disclaimer: The recommendations in this position statement do not indicate an exclusive course of treatment or procedure to be followed. Variations, taking into account individual circumstances, may be appropriate.
APPENDIX 3
Hyperbilirubinemia Risk Designation for Term and Near-Term Well Newborns

This graph allows risk designation of term and near-term well newborns based on their hour-specific serum bilirubin values. Infants whose bilirubins fall in the high risk zone should be considered at risk for hyperbilirubinemia requiring treatment, and need closer followup and possible repeat bilirubin determinations. Bhutani et al, PEDIATRICS Vol 103, #1, pp6-12, January 1999.
APPENDIX 4


### Management of Hyperbilirubinemia in the Healthy, Term Newborn

<table>
<thead>
<tr>
<th>Total serum bilirubin level, mg/dL (μmol/L)</th>
<th>Consider Phototherapy</th>
<th>Phototherapy</th>
<th>Exchange Transfusion if Intensive Phototherapy Falls</th>
<th>Exchange Transfusion and Intensive Phototherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, in hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 24 Term infants who are clinically jaundiced at ≤ 24 hours old are not considered healthy and require further evaluation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-48</td>
<td>≥ 12(170)</td>
<td>≥ 15(260)</td>
<td>≥ 20(340)</td>
<td>≥ 25(430)</td>
</tr>
<tr>
<td>49-72</td>
<td>≥ 15(260)</td>
<td>≥ 18(310)</td>
<td>≥ 25(430)</td>
<td>≥ 30(510)</td>
</tr>
<tr>
<td>&gt; 72</td>
<td>≥ 17(290)</td>
<td>≥ 20(340)</td>
<td>≥ 25(430)</td>
<td>≥ 30(510)</td>
</tr>
</tbody>
</table>

Phototherapy at these TSB levels is a clinical option, meaning that the intervention is available and may be used on the basis of individual judgment.

Intensive phototherapy should produce a decline of TSB of 1 to 2 mg/dL within 4 to 6 hours and the TSB level should continue to fall and remain below the threshold level for exchange transfusion. If this does not occur, it is considered a failure of phototherapy.
Jaundice in the Healthy Term Newborn

Algorithm

1. Pediatric clinician evaluates term newborn with jaundice

2. Does the infant have signs of underlying serious illness (lethargy, apnea, tachypnea, temperature instability, behavior changes, hepatosplenomegaly, persistent vomiting, or persistent feeding difficulty)?

3. Exit this algorithm to individualized clinical evaluation, including assessment of jaundice and underlying disease

4. Is the infant < 37 weeks’ gestational age?

5. Exit this algorithm to individualized clinical evaluation, including assessment of jaundice in light of prematurity

6. Is the mother’s ABO and Rh blood typing and isoimmune antibody screen status known?

7. Is the mother’s blood Rh positive?

8. Does the mother’s blood have any immune antibodies?

9. Consider holding the infant’s cord blood in the blood bank in case future testing is necessary

10. Perform blood typing (ABO and Rh) and direct Coombs’ testing on the infant’s cord (preferably) or venous blood

11. Is the infant’s blood direct Coombs’ test positive?

12. Exit this algorithm to individualized clinical evaluation, including assessment of jaundice and isoimmune hemolytic disease

13. Are any of the following risk factors present to suggest that nonisoimmune hemolytic disease is possible in this infant?
   (1) Family history of hemolytic anemia;
   OR
   (2) Family history of early or severe jaundice;
   OR
   (3) Ethnicity or geographic origin associated with hemolytic anemia;
   OR
   (4) Early or severe jaundice

14. Perform appropriate laboratory assessment of infant including (but not limited to consideration of):
   (1) Complete blood count, differential, smear, reticulocyte count;
   (2) G6PD screen;
   (3) Hemoglobin electrophoresis

15. Does the evaluation suggest hemolytic disease?

16. (Go to Box 16)

17. (Go to Box 17)
Algorithm

Is the infant jaundiced and ≤ 24 hours of age?

No → Exit this algorithm to individualized clinical evaluation, including assessment of jaundice and nonisoimmune hemolytic disease

Yes → Is jaundice "clinically significant" by medical judgment?

No → Healthy term infant with jaundice not clinically significant by medical judgment

Yes → (1) Measure infant's total serum bilirubin

(2) Go to Box 27

Is jaundice persisting > 2 weeks?

No → Provide routine care, recommend routine feeding and follow-up

Yes → Does this infant have abnormal physical exam results, dark urine or light stools?

No → (Go to Box 22)

Yes → Perform appropriate physical and laboratory assessment of the infant, including possibility of cholestatic jaundice

Is jaundice persisting > 3 weeks?

No → Yes → (Go to Box 27)

Table 2. Management of Hyperbilirubinemia in the Healthy Term Newborn*

<table>
<thead>
<tr>
<th>Age, hours</th>
<th>TSB Level, mg/dL (umol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consider Phototherapy**</td>
</tr>
<tr>
<td>&lt;24***</td>
<td>.......</td>
</tr>
<tr>
<td>25-48</td>
<td>≥ 12 (170)</td>
</tr>
<tr>
<td>49-72</td>
<td>≥ 15 (260)</td>
</tr>
<tr>
<td>&gt; 72</td>
<td>≥ 17 (290)</td>
</tr>
</tbody>
</table>

*TSB indicates total serum bilirubin.
**Phototherapy at these TSB levels is a clinical option, meaning that the intervention is available and may be used on the basis of individual clinical judgment for a more detailed description of phototherapy, see the Appendix.
***Intensive phototherapy (Appendix) should produce a decline of TSB of 1 to 2 mg/dL within 4 to 6 hours and the TSB level should continue to fall and remain below the threshold level for exchange transfusion. If this does not occur, it is considered a failure of phototherapy.
****Term infants who are clinically jaundiced at ≤ 24 hours old are not considered healthy and require further evaluation (see text).