Management of neonatal jaundice

N Kevin Ives

Abstract
Jaundice is the most common clinical sign in neonatal medicine, but only rarely is it associated with bilirubin neurotoxicity or the harbinger of significant underlying disease. Cases of kernicterus, which should be a never event, are still occurring. Delays in the diagnosis of pathological causes of prolonged jaundice, such as biliary atresia are still resulting in life long morbidity. These are salutary reminders that healthcare professionals should never take neonatal jaundice for granted. Phototherapy remains the mainstay of treatment of significant unconjugated hyperbilirubinaemia, and its optimal use will usually prevent the need for exchange blood transfusion. In cases of antibody-mediated haemolysis high-dose immunoglobulin is indicated if the serum bilirubin is continuing to rise despite multiple phototherapy. For babies with prolonged jaundice investigation should be directed towards making a timely diagnosis and avoiding secondary complications.

Keywords conjugated hyperbilirubinaemia; exchange blood transfusion; kernicterus; phototherapy; prolonged jaundice; unconjugated hyperbilirubinaemia

Introduction
With relaxation of treatment thresholds for jaundice over the past two decades a ‘kinder, gentler approach’ to clinical management in healthy full-term newborns has evolved. Earlier postnatal discharge, shortcomings in community surveillance and translation of the more relaxed approach to therapy in the term baby to that in the late preterm or near term infant were all likely factors in a resurgence of kernicterus. There is a requirement to identify which babies are at greatest risk of developing levels of significant jaundice. The 2010 United Kingdom NICE Guideline on Neonatal Jaundice emphasized review within 48 hours of birth of babies with known risk factors, and mandates measurement rather than visual estimation of the bilirubin level in all babies presenting with clinical jaundice.

Premature infants are more prone to bilirubin encephalopathy and should be managed with thresholds adjusted accordingly. The baby with a serum bilirubin level approaching or above the exchange transfusion threshold is a neonatal emergency. The prompt use of multiple phototherapy and timely availability of blood for an urgent exchange transfusion will avoid chronic neurological sequelae in the majority of cases. Symptomatic bilirubin encephalopathy remains an absolute indication for exchange transfusion, irrespective of the bilirubin level. High-dose immunoglobulin is an accepted adjunct to therapy in cases of antibody-mediated haemolysis, but the use of metalloporphyrins to suppress haem catabolism and modify the pattern of neonatal jaundice has yet to enter clinical practice.

Up to one-third of breastfed babies remain clinically jaundiced beyond two weeks of age, and they represent the overwhelming majority presenting for a prolonged jaundice screen. The discovery of an underlying pathology in cases of conjugated jaundice involves a sequence of investigations that may need to be guided by supra-regional paediatric hepatology services. This article will review the current guidelines and make recommendations to enable adherence to best practice.

Prevention
Identifying the newborn at risk of bilirubin encephalopathy
The 2010 NICE Guidance in the UK has emphasized an additional clinical review within 48 hours of birth of babies with the following risk factors for significant hyperbilirubinaemia:
- gestational age under 38 weeks
- a previous sibling with neonatal jaundice requiring phototherapy
- mother’s intention to breastfeed exclusively
- visible jaundice in the first 24 hours of life

Clinical jaundice is more difficult to recognize in babies with dark skin tones and can be missed without close examination of the sclerae, gums and blanched skin. These babies fall into a heightened risk category if they are not examined properly. In cases of doubt a low threshold should be adopted for checking the transcutaneous or serum bilirubin.

The bilirubin/albumin ratio
The bilirubin/albumin ratio reflects the free unbound bilirubin level, and correlates with abnormal auditory brainstem responses in jaundiced infants. An exchange transfusion threshold has been proposed at a bilirubin/albumin ratio of 0.8 in the healthy term newborn, 0.72 in a sick term infant and as low as 0.4 for the sick premature infant of less than 1250 g. This ratio has not gained widespread clinical acceptance, but may help to inform the decision as to whether or not to perform an exchange transfusion in borderline cases. (Note that when calculating the bilirubin/albumin ratio, values for serum albumin concentration in g/litre need to be converted to SI Units of µmol/litre using the factor 15.15).

Assessing the level of serum bilirubin
Visual inspection
Clinical jaundice becomes apparent visually at serum bilirubin levels of 80–90 µmol/litres. It is more difficult to detect in preterm infants and can be missed without close inspection in babies with darker skin tones. Visual assessment can be unreliable under artificial light, and once phototherapy has started. Healthcare professionals and parents can be taught to recognize clinical jaundice, but studies show that they are unable to assess its severity. Accuracy is not enhanced by the use of icterometers or assessment of the cephalocaudal progression of dermal jaundice. For these reasons, whenever a baby is visibly jaundiced, the bilirubin level must be measured to inform appropriate clinical management.
Transcutaneous bilirubinometry

The use of non-invasive transcutaneous bilirubinometry is established in the USA and has increased in UK practice following NICE guidance. Transcutaneous bilirubinometers measure bilirubin in the skin of the forehead or overlying the sternum. They reduce the requirement for blood sampling, but accuracy decays at levels more than 250 μmol/litre. Validation of the use of transcutaneous bilirubinometry in preterm babies is limited. The current UK NICE guidance recommends that a serum sample should be obtained at transcutaneous bilirubinometer readings more than 250 μmol/litre.

Phototherapy removes bilirubin from the skin, which precludes the use of transcutaneous bilirubinometry to monitor the progress of treatment ‘under the lights’, but testing can resume accurately some 24 hours after ‘coming out of lights’. Researchers at the University of Washington are evaluating an ‘App’ known as the ‘BiliCam’, which it is hoped will enable primary healthcare workers and parents to screen a baby’s jaundice level using a smartphone.

Invasive blood sampling

A bilirubinometer employing direct spectrometry is used in many neonatal units to provide point of care testing of total serum bilirubin. Such instruments reflect the sum value of all species of bilirubin, conjugated and unconjugated, including photoisomers. Whole blood bilirubin assay is a facility on some blood gas analysers. Regular instrument quality control and calibration are necessary. Measurement should be accurate to within ±20–30 μmol/litre, and the limitations of any analyser should be known when measuring very high values.

Diagnostic approaches

Defining the severity of jaundice

The terms ‘physiological’ and ‘pathological jaundice’ lead to confusion and are best avoided; as are adjectives, such as extreme or hazardous, used by some to grade the severity of jaundice. Defined more simply ‘hyperbilirubinaemia’ denotes a raised level of bilirubin in the blood, ‘clinical jaundice’ describes visually detectable jaundice, and ‘significant hyperbilirubinaemia’ distinguishes a level of jaundice requiring treatment. Regardless of the level, jaundice in the first 24 hours of life and rates of rise in serum bilirubin consistent with haemolysis add urgency to investigation and treatment.

Jaundice with a pathological cause

Clinical features that suggest a pathological cause of jaundice and prompt further investigation are as follows:

- Jaundice appearing in the first 24 hours of life
- Jaundice in a sick neonate
- Rapidly rising serum bilirubin
- Prolonged jaundice more than 14 days in term infants; more than 21 days in preterm infants
- Conjugated serum bilirubin more than 25 μmol/litre
- Pale, chalky stools and dark urine

The more common causes of unconjugated and conjugated hyperbilirubinaemia arising from an underlying pathology are listed in Boxes 1 and 2. Unless there are diagnostic pointers to the more rarely encountered causes of neonatal jaundice, stepwise investigation should aim to identify the more common ones first (Box 3).

Early-onset jaundice

Jaundice within the first 24 hours of life is commonly the result of significant haemolysis. This is a neonatal emergency and a serum bilirubin measurement should be obtained within 2 hours. An urgent medical review should be conducted to establish the

Causes of unconjugated jaundice in the newborn

<table>
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<tr>
<th>Haemolysis</th>
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<tr>
<td>Isoimmunization</td>
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<td>Rhesus</td>
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<td>ABO</td>
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<td>Minor blood groups</td>
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<td>Other</td>
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<tr>
<td>Spherocytosis and other red cell abnormalities</td>
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<td>G-6PD deficiency</td>
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<td>Pyruvate kinase deficiency and other enzyme defects</td>
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<td>Sepsis*</td>
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<td>Disseminated intravascular coagulation</td>
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<td>Small for dates infant</td>
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<td>Twin–twin transfusion syndrome</td>
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<td>Delayed cord clamping</td>
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<td>Matemofetal transfusion</td>
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<td>Infant of diabetic mother</td>
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<th>Extravasated blood</th>
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<td>Bruising, e.g. cephalhaematoma</td>
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<td>Pulmonary haemorrhage</td>
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<td>Cerebral haemorrhage</td>
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<td>Intra-abdominal haemorrhage</td>
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<th>Increased enterohepatic circulation</th>
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<td>Pyloric stenosis</td>
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<td>Bowel obstruction</td>
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<td>Swallowed blood</td>
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<th>Endocrine/metabolic</th>
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<tr>
<td>Hypothyroidism*</td>
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<tr>
<td>Hypopituitarism*</td>
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<tr>
<td>Hypoadrenalism*</td>
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<tr>
<td>Glucuronosyl transferase deficiency</td>
</tr>
<tr>
<td>(Crigler–Najjar Syndrome)</td>
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<tr>
<td>Galactosaemia*</td>
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<tr>
<td>Tyrosinaemia*</td>
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<tr>
<td>Hypermethioninaemia*</td>
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*Conjugated jaundice often coexists
Causes of conjugated jaundice in the newborn

- Intrauterine infections
- Perinatal asphyxia
- Bacterial sepsis
- Severe haemolysis
- Prolonged parenteral nutrition
- α1-antitrypsin deficiency
- Cystic fibrosis
- Biliary atresia
- Choleodochal cyst
- Spontaneous bile duct perforation
- Ideopathic neonatal cholestasis
- Intrahepatic biliary hypoplasia (Alagille’s)
- Progressive familial intrahepatic cholestasis
- Galactosaemia
- Tyrosinaemia
- Hypermethioninaemia

Box 2

diagnosis. Maternal blood group and rhesus status should be checked. Antenatal anti-D prophylaxis in rhesus negative women can result in a weakly positive direct antiglobulin test (DAT) in the absence of haemolysis. The finding of a positive DAT is not predictive of the severity of jaundice, and nor does a negative result rule out significant haemolysis. Rhesus and other blood group incompatibilities will usually be known from the maternal history. Anti-c (little c), Anti-K (Kell) and high titres of Anti-E can cause severe haemolytic disease of the fetus and newborn (HDFN). Antenatal titres of these antibodies can help to predict likely disease severity as shown in Table 1. The combination of a haemolytic process and Gilbert’s Disease can result rapidly in a very high serum bilirubin. ABO incompatibility with maternal group O is present in 10–15% of pregnancies, but the number that progress to significant jaundice is small and unpredictable. In the absence of haemolysis, rare conditions affecting hepatic conjugation, such as Crigler–Najjar Syndrome should be considered.

Prolonged jaundice

Visibly detectable jaundice beyond 2 weeks of age in the term infant and beyond 3 weeks in the preterm is classified as ‘prolonged jaundice’. The majority of term infants presenting with prolonged jaundice have an unconjugated hyperbilirubinaemia and will be breastfeeding. Providing there are no features in the history or on clinical examination that suggest a pathological cause (in particular, the urine is not dark, stool colour is not pale and chalky, there is no hepatomegaly and the baby is thriving), screening investigations can be delayed until 3 weeks of age in the term infant. The total and conjugated serum bilirubin must be determined. The main purpose of the prolonged jaundice screen is to detect a conjugated hyperbilirubinaemia (more than 25 μmol/litre). Some of the following additional tests may be clinically indicated, but should not be considered routine:

- full blood count
- examination of blood film if haemolysis is suspected
- blood group and DAT (mother’s group and antibody status should be known)
- thyroid function tests if result of heel-prick TSH screen is not known
- urinalysis for reducing sugars (Clinistest)
- urinalysis for evidence of infection

Further tests will be indicated according to the outcome of this initial screen (see Box 3). A more comprehensive list can be sourced from textbooks or supplied by a tertiary paediatric hepatologist. In the absence of an abnormal conjugated serum bilirubin avoid random measurement of liver function tests, as this will generate uncertainty with borderline results from transient enzyme elevations. A greater index of suspicion should be observed in assessing an exclusively formula-fed infant with prolonged jaundice and in cases where there is parental consanguinity.

Box 3

Investigation of jaundice in the newborn

Early onset jaundice

- Blood group and DAT
- Haematocrit and FBC
- Blood film
- Infection screen if indicated
- Serology for congenital infections
- Urine for CMV culture
- Stool for virology
- G-6PD screen
- Red cell enzyme studies

Prolonged jaundice

- Total and conjugated serum bilirubin
- Thyroid function tests
- Urine culture
- Urine Clinitest for reducing substances
- Erythrocyte galactose-1-phosphate uridyl transferase (Gal-1-PUT) activity
- Liver function tests
- α1-antitrypsin assay and phenotype
- Cystic fibrosis DNA screen
- Immunoreactive trypsin
- Plasma cortisol level
- Serum aminoacid screen

Table 1

Red cell antibody level and risk of fetal anaemia and neonatal jaundice

<table>
<thead>
<tr>
<th>Risk of anaemia and jaundice</th>
<th>Anti-D IU/ml</th>
<th>Anti-c IU/ml</th>
<th>Anti-Kell</th>
<th>Other antibodies</th>
</tr>
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<tbody>
<tr>
<td>Low</td>
<td>0–4</td>
<td>0–7.5</td>
<td>&lt;1 in 8</td>
<td>&lt;1 in 32</td>
</tr>
<tr>
<td>Moderate</td>
<td>4–15</td>
<td>7.5–20</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>High</td>
<td>&gt;15</td>
<td>&gt;20</td>
<td>&gt;1 in 8</td>
<td>&gt;1 in 32</td>
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</table>
Cholestatic or conjugated jaundice

The definition of conjugated hyperbilirubinaemia adopted in this article is a serum level more than 25 μmol/litre. The use of variable threshold level definitions, such as up to 20% of the total serum bilirubin will provide false reassurance in the case of total levels more than 250 μmol/litres and should be avoided. Pale chalky stools and dark bile-stained urine are the clinical markers of established conjugated jaundice, but they may be absent in the first weeks of hepatic pathologies, including biliary atresia. Similarly, it is a fallacy to assume that all babies with biliary atresia have an early pattern of faltering growth.

Diagnosis of any associated clotting abnormality and its correction are urgent considerations in the infant with conjugated jaundice. Several conditions present with a mixture of raised unconjugated and conjugated bilirubin. Notable amongst these are the intrauterine infections, bacterial sepsis, galactosaemia, aminoacidemias and congenital hypopituitarism. Some of the causes of conjugated hyperbilirubinaemia are listed in Box 2 and the initial investigations are found in Box 3.

If an obstructive jaundice is suspected, liver ultrasound and a hepatobiliary excretion study will be indicated. Visualization of the gallbladder on ultrasound does not rule out biliary atresia. The importance of making an early diagnosis of biliary atresia and its prompt referral to a paediatric hepatology centre cannot be overstated.

Clinical management of the jaundiced infant

Management of neonatal jaundice starts with prevention. Adequate support should be provided to all mothers as they establish their baby’s early feeding pattern. The accepted treatments for unconjugated jaundice are phototherapy, exchange transfusion and high dose intravenous immunoglobulin (IVIG) used to suppress iso-immune haemolysis. The reader is referred to the ‘quick reference guide’ of the NICE clinical guideline on neonatal jaundice for easy to follow algorithms on investigation, phototherapy and exchange transfusion pathways (www.nice.org.uk/CG98). Unconjugated hyperbilirubinaemia that is judged to be above treatment thresholds, but below those that prompt immediate exchange transfusion, can usually be managed with phototherapy alone. A lack of response to optimal phototherapy may imply significant underlying haemolysis, necessitating exchange transfusion. Any infant undergoing treatment for jaundice should be investigated for the cause.

Phototherapy

Phototherapy remains the most convenient and safe means of lowering serum bilirubin. Most importantly, phototherapy reduces the need for the potentially more hazardous alternative, namely exchange transfusion. Phototherapy would only appear to be effective as bilirubin enters the skin at serum levels more than 80 μmol/litre. The maximal effect of phototherapy is during the first 24—48 hours of its use. It is to be anticipated that, in the absence of haemolysis, phototherapy will reduce the serum bilirubin level by 25%—50% during this initial phase. The enterohepatic circulation of ‘natural’ unconjugated bilirubin, reconstituted from configurational photoisomers in bile, causes the subsequent decay in response.

Phototherapy has a benign reputation but it is not without side effects. The more commonly encountered are:

- diarrhoea;
- increased fluid loss via the skin;
- temperature instability;
- erythematous rashes;
- tanning;
- bronze baby syndrome.

Diarrhoea and increased insensible water loss require attention to fluid balance. Close attention to thermoregulation is important. The eyes of an infant receiving lamp phototherapy should be shielded to prevent potential retinal damage. The bronze baby syndrome results from an interaction between cholestatic jaundice and phototherapy. The brown pigment produced (bilifuscin) stains the infant’s skin and lingers for some weeks after phototherapy has been discontinued.

Fibre-optic systems for delivering phototherapy via a body pad or wrap have made its application more versatile. Earlier trials with small ‘blankets’ have shown fibre-optic phototherapy to be as effective as conventional phototherapy in preterm infants, but less so in term infants. Larger fibre-optic pads designed for term infants are currently available and appear to be more effective. A new generation of phototherapy unit uses multiple light-emitting diodes (LEDs). These have the advantage of not emitting infrared or ultraviolet radiation, and so can be used closer to the infant’s skin for maximal efficacy.

The efficiency of treatment can be improved by using more than one phototherapy lamp or by combining conventional overhead lamps with a fibre-optic system beneath the baby. Multiple phototherapy, applied to a greater proportion of the body surface area, should be adopted in cases of jaundice if the serum bilirubin fails to respond to single phototherapy, is less than 50 μmol/litre below the threshold for exchange transfusion or is rising rapidly (more than 8.5 μmol/litre/hour). Whilst adding to a sense of drama, the use of white sheets or tinfoil to reflect light onto the baby is not of proven benefit.

Pharmacological agents

Administration of high-dose intravenous immunoglobulin (IVIG) has entered practice for newborns presenting with severe haemolytic disease of the fetus and newborn (HDFN) or ABO iso-immunisation. Treatment significantly reduces the need for exchange transfusion with a ‘number needed to treat’ as low as two in rhesus disease. Also reduced are the duration of phototherapy and the length of hospital stay, but recipients are more likely to require top-up red cell transfusions for late anaemia. To prevent over use it is recommended that IVIG (0.5 g/kg over 2—4 hours) is reserved for haemolysing babies with a serum bilirubin that continues to climb at a rate more than 8.5 μmol/litre/hour despite multiple phototherapy. The majority of cases of ABO incompatibility are amenable to optimally delivered multiple phototherapy. A more pre-emptive use of IVIG may be called for in cases of severe rhesus disease where there has been little or no in utero management, or cases of ABO incompatibility readMITTED with a serum bilirubin level approaching or above exchange threshold values.

Exchange transfusion

In severe rhesus disease previous guidelines for the timing of exchange blood transfusion based on cord blood values rarely
Most infants will have received in-utero transfusion, and many will respond to intensive phototherapy followed by a later top-up transfusion. If, despite multiple phototherapy, the serum bilirubin continues to rise by more than 8.5 μmol/litre/hour high-dose IVIG is indicated. Exchange transfusion will be necessary if these measures fail and cross-matched blood should have been requested in advance and made available for this eventuality. There is no clear evidence that the practice of giving albumin routinely before or during an exchange transfusion confers benefit. Similarly, with the current generation of transfusion packs there is no evidence to support the routine and potentially dangerous administration of intravenous calcium during an exchange transfusion.

Exchange transfusion carries a significant risk of morbidity and mortality from vascular accidents, cardiac complications, biochemical and haematological disturbance. The overall mortality rate from the procedure is quoted as being 0.3% and morbidity 5%. Exchange transfusion will remain necessary for infants who fail to respond to optimal phototherapy or who present late with bilirubin levels in excess of a given exchange value. In the latter case, the infant should be placed under multiple phototherapy, and cross-matched blood should be sought as a matter of urgency for an anticipated exchange transfusion. Should the serum bilirubin fall below the exchange transfusion level by the time the blood is available a decision as to whether to go ahead with the exchange or not has to be made. This may be informed by the peak serum bilirubin, the duration of jaundice, the bilirubin/albumin ratio and the clinical status of the baby. Signs and symptoms of acute bilirubin encephalopathy, such as seizures and opisthotonus are an absolute indication to proceed with an exchange transfusion.

**Guidelines for the use of phototherapy and exchange transfusion**

**Premature infants**

Recognition that preterm newborns are at higher risk of bilirubin toxicity has given rise to sliding scales prompting earlier intervention on the basis of lower birthweight or gestational age. The UK NICE guideline on Neonatal Jaundice recommends treatment thresholds that are specific by week of gestational age for babies of less than 38 weeks gestation. It provides an adjustable Excel spreadsheet graph (Figure 1) with thresholds for phototherapy and exchange transfusion for babies aged 72 hours or older, calculated using the formulae:

- for phototherapy: bilirubin in μmol/litre = (gestational age × 10) – 100
- for exchange transfusion: bilirubin in μmol/litre = (gestational age × 10)

The threshold levels for the first 72 hours of life start at 40 and 80 μmol/litres at birth, chosen to reflect the upper limit of normal umbilical cord bilirubin and a level likely to be associated with significant in utero haemolysis. If jaundice is prolonged it should be anticipated that a baby remains on the same gestation specific graph for the 14 days of the X-axis. Thereafter the plateau portion of a graph for a baby of two weeks added corrected gestation can be used. A common sense approach should be applied to a baby who straddles the 38-week gestation. For instance, they may have been born at 37 + weeks, but admitted from home with jaundice at several days of age in their 38th week. In such cases, if there were a recognized pathology, such as ABO incompatibility, the lower gestation graph would be the safer choice.

Additional risk factors are not taken into account. The results of a trial looking at the use of the bilirubin/albumin ratio as an adjunct
to decision making on thresholds for phototherapy and exchange transfusion in preterm infants are awaited. In the meantime this author recommends strict adherence to phototherapy thresholds in preterm infants with additional pathologies such as acidosis and hypoalbuminaemia. It should also be acknowledged that a postnatal deterioration, such as NEC, is not a contra-indication to exchange transfusion, which if necessary can be performed with a continuous ml for ml infusion/extraction technique.

**Term infants**

For babies born at 38 or more weeks gestation the UK NICE guideline on Neonatal Jaundice recommends thresholds for initiation of phototherapy from 96 hours of age of 350 μmol/litre and for exchange transfusion of 450 μmol/litre. For the period from birth to 96 hours of age a series of bilirubin levels with 6-hourly stepwise increases at which phototherapy and exchange transfusion are recommended has been tabulated. An extremely useful implementation tool the ‘BiliApp’, free to download to smartphones, has been developed to display graphically the trend in serum bilirubin results and prompts clinical management decisions relevant to the baby’s gestation and age in hours.

Current treatment guidelines use the total bilirubin level. The previous practice of subtracting the conjugated component should be avoided because conjugated bilirubin can affect the binding of unconjugated bilirubin to albumin, and kernicterus has been reported in such circumstances. The latest American guidelines recommend reducing the thresholds for phototherapy and exchange transfusion by between 40 and 50 μmol/litre in cases where there are additional risk factors, defined as iso-immune haemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis and hypoalbuminaemia (less than 30 g/L). NICE found no evidence base for such practice and has chosen to adopt pre-emptive intervention thresholds, which, as long as they are adhered to, should protect all babies in these risk groups.

After starting phototherapy the serum bilirubin should be checked 4–6 hourly until the bilirubin level is stable or falling and every 6–12 hours thereafter. Multiple phototherapy should be used if the serum bilirubin is within 50 μmol/litre below the threshold for which exchange transfusion is indicated, or if the serum bilirubin is rising rapidly (more than 8.5 μmol/litre/hour) despite single phototherapy. When the serum bilirubin has fallen to more than 5 μmol/litre below the exchange transfusion threshold a step down from multiple phototherapy to single phototherapy should be considered. This should be performed with caution in the presence of known or suspected haemolysis, and monitored with a repeat serum bilirubin within 4–6 hours. When the serum bilirubin has fallen to more than 50 μmol/litre below the phototherapy threshold single phototherapy can be stopped, and a serum bilirubin value checked for rebound after 12–18 hours.

**Future monitoring and adherence to best practice**

In the USA a case has been made for universal hour specific pre-discharge bilirubin screening to identify babies at risk of significant hyperbilirubinaemia. In the UK the responsibility for detecting significant post-discharge jaundice rests with the primary healthcare team and informed parents. The 2010 NICE guideline seeks to identify babies at heightened risk of significant hyperbilirubinaemia. These babies will have an additional assessment in the period leading up to 48 hours of age with inspection for signs of jaundice and attention to feeding support. A clear directive has been made to test the level, rather than guess the level, of bilirubin in all babies presenting with neonatal jaundice. This approach is reliant on our ability to better recognize clinical jaundice in babies with darker skin tone, who are currently over-represented in registries of kernicterus and surveys of significant hyperbilirubinaemia.

Clinical kernicterus is an irreversible personal and family tragedy that should be considered a preventable condition in the term and near term infant. In the UK in 2010 it was proposed that death or kernicterus associated with failure to identify and treat hyperbilirubinaemia in neonates be added to an expanded list of ‘never events’ generated by the Department of Health. Although this proposal was turned down in 2011, it should remain the responsibility of every health professional caring for the newborn to prevent a case of kernicterus occurring on their watch.

**FURTHER READING**


**Practice points**

- Do not ignore or guess the level of jaundice; measure it!
- First day jaundice is the result of haemolysis until proven otherwise
- Jaundice still present at 3 weeks must be investigated
- A confident diagnosis of breast-milk jaundice follows exclusion of pathology
- Conjugated jaundice requires prompt investigation to detect biliary atresia in a surgically favourable phase
- In cases of hepatic dysfunction coagulation disorders must be anticipated and treated