

Neonatal Jaundice

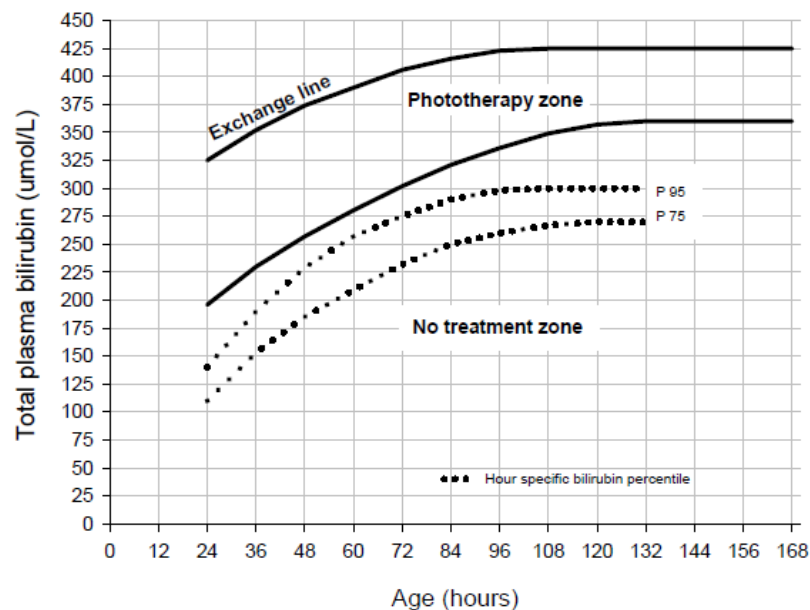
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Neonatal jaundice – management of lower risk babies $\geq 35^{+0}$ weeks gestation

(Community, postnatal ward and level 3 and 4 neonatal services)

LOW RISK: Baby $\geq 38^{+0}$ wks, well, no set-up for haemolysis, and with an acceptable weight loss ($< 10\%$ of BW)

- Early discharge and community follow-up are appropriate. Ensure lactation support for all breast feeding mothers



- Where jaundice is above the nipple line at discharge in pale skinned babies, monitor clinically in the community every 2-3 days until visibly improved
- Where jaundice is below the nipple line either at discharge or on review in the community, measure a blood bilirubin or a transcutaneous bilirubin level (TcB). Refer to chart for management
- Measure a blood bilirubin or TcB in dark skinned babies when any jaundice is visibly detected. Refer to Chart for management.
- If blood or TcB is below P75, assess clinically every 2-3 days. Consider another blood or TcB only if the jaundice is visibly worse.
- Measure a blood bilirubin if the TcB is above the P75 line
- If blood bilirubin is between P75 and P95 repeat a blood every 2 days
- If blood bilirubin is above P95 and below phototherapy line repeat a blood level daily.
- Continue to monitor blood levels until bilirubin has peaked or phototherapy zone is reached
- Where phototherapy is required, perform a blood group and DAT, full blood count, film and reticulocyte count, and bedside urine Clinitest for reducing substances. Commence Standard phototherapy (either overhead lights or a fibre optic blanket)
- Repeat blood bilirubin levels daily in the Phototherapy Zone
- Increased fluids not generally required with phototherapy unless there is a clinical concern regarding hydration, or if slow weight gain suggests inadequate milk intake
- Cease phototherapy when blood bilirubin is at least $50\mu\text{mol/L}$ below treatment threshold. Then repeat a TcB or blood bilirubin every 1-2 days until peaked.
- If bilirubin levels continue to rise despite standard phototherapy, or if a baby presents with a bilirubin level above exchange threshold, commence Intensive phototherapy (both overhead lights and fibre optic blanket), seek advice, and refer to a Level 6 Neonatal Service
- Seek paediatrician advice if the baby has not regained birth weight by 14 days, or if visible jaundice persists beyond 14 days

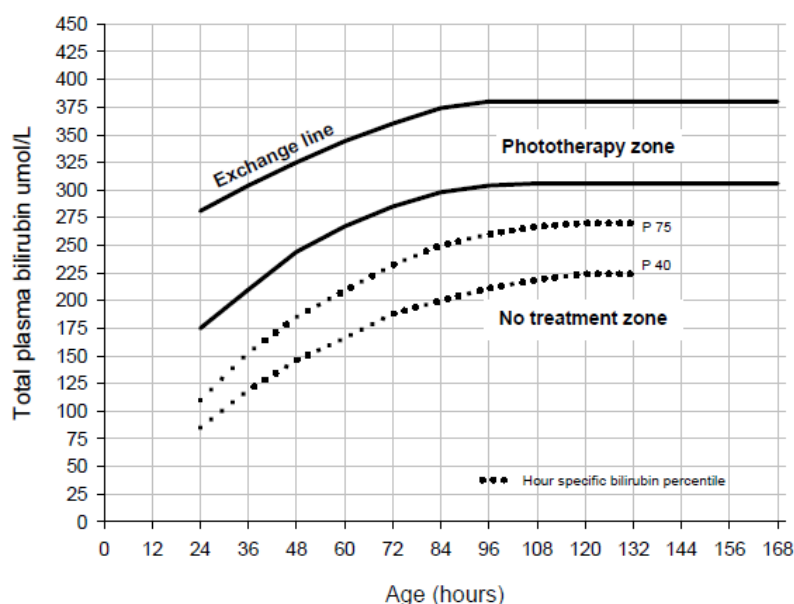
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Neonatal jaundice – management of lower risk babies $\geq 35^{+0}$ weeks gestation

(Community, postnatal ward and level 3 and 4 neonatal services)

- AT RISK:**
- Baby 35^{+0} - 37^{+6} wks, well, no set-up for haemolysis, and with an acceptable weight loss ($< 10\%$ of BW)
 - Baby $\geq 38^{+0}$ wks with weight loss $> 10\%$ birth weight, sleepiness or poor feeding
 - Early discharge (< 48 hours) is not recommended. Ensure lactation support for all breast feeding mothers
 - Babies who are sleepy, feeding poorly or who have lost $> 10\%$ of birth weight require paediatrician review. Consider underlying causes such as prematurity, poor milk transfer, sepsis, hypoglycaemia, metabolic disease



- Measure a blood or transcutaneous bilirubin level (TcB) if jaundice is below the nipple line in pale skinned babies
- Measure a blood bilirubin or TcB in dark skinned babies where any jaundice is detected
- If TcB below P75, repeat TcB daily until level has peaked or exceeds P75. Measure a blood bilirubin level if TcB is above P75.
- If blood level is above P75 and below phototherapy line repeat blood level daily
- If blood level is between P40 and P75 repeat level every 2 days
- If blood level is below P40 follow clinically and repeat only if visibly more jaundiced
- Continue repeat levels until bilirubin has peaked or phototherapy line reached.
- Where phototherapy is required, perform a blood group and DAT, full blood count, film and reticulocyte count, and bedside urine Clinitest for reducing substances. Commence Standard phototherapy (either overhead lights or a fibre optic blanket)
- Repeat blood bilirubin levels daily in the Phototherapy Zone
- Increased fluids not generally required unless there is a clinical concern regarding hydration, or if slow weight gain suggests inadequate milk intake
- Cease phototherapy when blood bilirubin is at least $50\mu\text{mol/L}$ below treatment threshold. Then repeat a TcB or blood bilirubin every 1-2 days until peaked.
- If bilirubin levels continue to rise despite standard phototherapy, or if a baby presents with a bilirubin level above exchange threshold, commence Intensive phototherapy (both overhead lights and fibre optic blanket), seek advice, and refer to a Level 6 Neonatal Service
- Seek paediatrician advice if the baby has not regained birth weight by 14 days, or if visible jaundice persists beyond 14 days

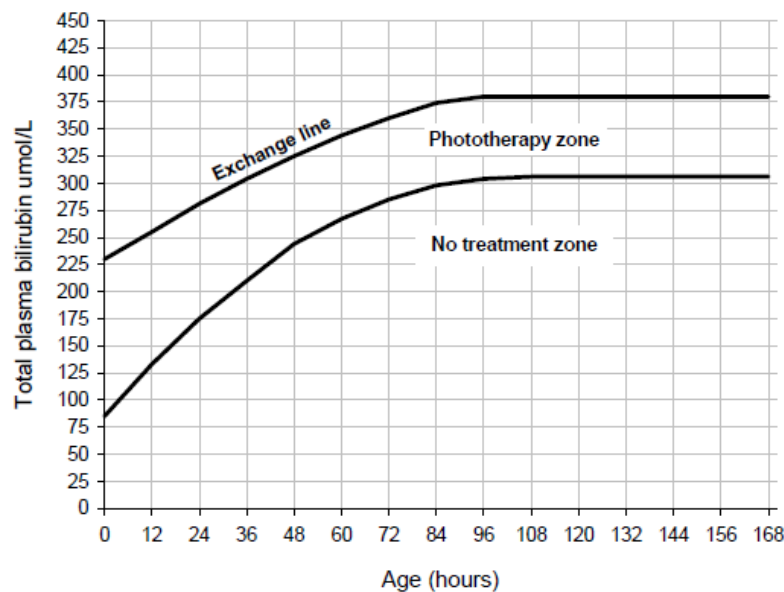
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Neonatal jaundice – management of higher risk babies

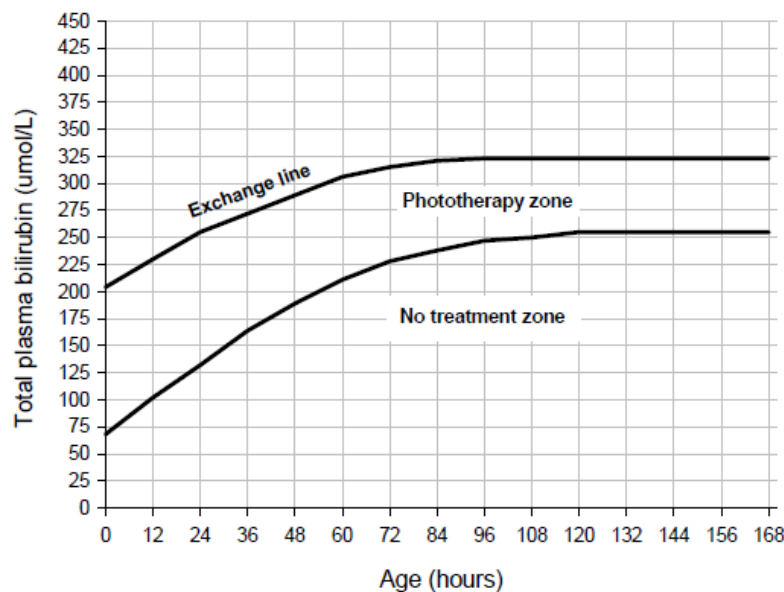
(Requiring Level 5 and 6 neonatal services - refer to body of the Guideline for details)

Baby $\geq 38^{+0}$ wks with confirmed or likely haemolysis



Baby $\geq 35^{+0}$ wks who is clearly unwell

Baby 35^{+0} - 37^{+6} wks with proven or likely haemolysis, poor feeding, weight loss $> 10\%$ BW



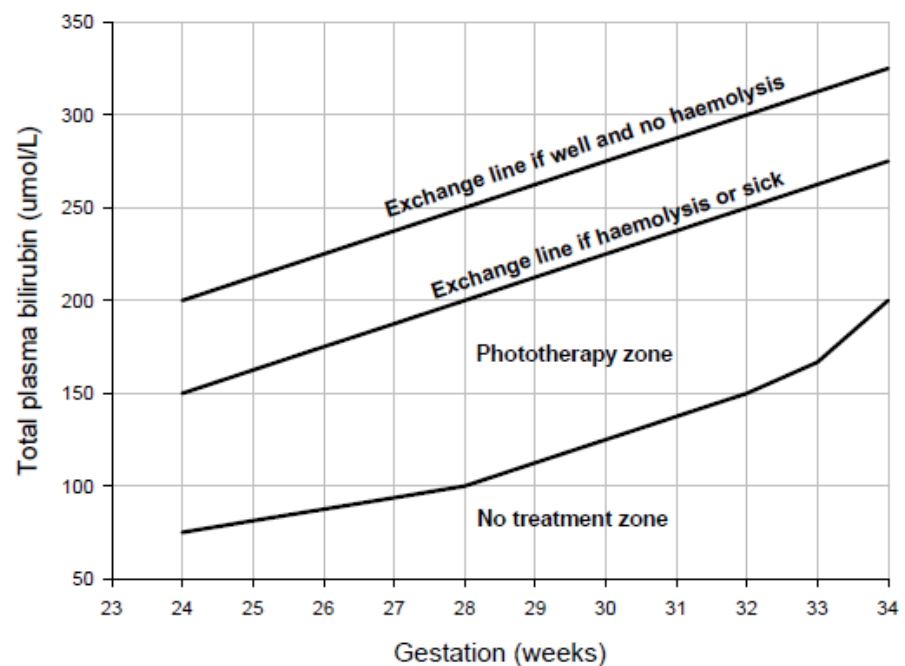
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Neonatal jaundice – management of higher risk babies

(Requiring Level 5 and 6 neonatal services)

Preterm baby < 35⁺⁰ wks



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Aim of the guideline

- > The aim of this guideline is to provide practical guidance for the management of jaundiced babies by midwives, general practitioners, paediatric residents and paediatricians working in country and metropolitan hospitals that provide Level 3-5 perinatal services, and for community midwives and child health nurses
- > Attached to this guideline are charts that may be used stand-alone for management of Lower and Higher risk babies

The importance of community management of jaundice

- > With current standards of perinatal care the great majority of babies who develop clinically significant jaundice will do so after discharge from hospital
- > Health services that provide a birthing service (Level 3 - 6 Perinatal Services) must have well coordinated maternity outreach systems for mothers and babies that enable regular clinical assessment of jaundice in the community, the provision of lactation support for breast feeding mothers, and the recognition of babies who are unwell

Appropriate clinical settings for management of jaundice

- > Management of jaundiced babies in the community, or in a Level 3 or 4 neonatal service is appropriate for well babies $> 35^{+0}$ wks – i.e. feeding well, no set-up for or confirmed haemolysis, and acceptable weight loss $< 10\%$ of birth weight
- > Management of jaundiced babies $> 38^{+0}$ weeks with sleepy behaviour, poor feeding, weight loss $> 10\%$ birth weight may be appropriate in a Level 3 or 4 neonatal service in consultation with a paediatrician.
- > Management is preferred in a Level 5 or 6 neonatal service where a jaundiced baby has confirmed or likely haemolysis, or is clearly unwell.

Risk assessment

- > It is important to assess all newborn babies for risk of developing either jaundice or kernicterus both at birth and before hospital discharge. 'Risk' refers to the likelihood of developing jaundice in treatment range based on American Academy of Pediatrics Clinical Practice Guideline treatment levels, or risk of bilirubin encephalopathy.¹

The following clinical factors identify increased risk:

1. A set-up for haemolysis

- > Previous child with antibody mediated haemolytic disease of the newborn (including ABO mediated haemolysis)
- > Family history of G6PD deficiency, inherited red cell membrane or metabolic defects (e.g. hereditary spherocytosis, pyruvate kinase deficiency) causing neonatal jaundice
- > A positive maternal blood group antibody screen and a positive cord blood direct antiglobulin test (DAT or Coombs' test) due to anti-D (not derived from maternal passive immunisation), anti-c, anti-Kell. A positive DAT due to other Rhesus antibodies, anti-A or B, and minor blood group antibodies are less likely to cause haemolysis
- > Visible jaundice of any degree in the first 24 hours after birth

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2. Weight loss > 10 % birth weight or poor feeding
3. Gestation 35⁺⁰ – 38⁺⁰ weeks

Article I. The following clinical factors constitute a high risk scenario:

1. Confirmed or likely haemolysis
 - > In utero haemolysis confirmed or presumed on the basis of fetal anaemia in the context of a positive maternal antibody screen
 - > After birth, a rate of rise of total bilirubin > 5µmol / L without phototherapy, or a continued rise despite effective phototherapy
 - > A baby presenting with a blood bilirubin level above exchange level
2. Unwell baby with sepsis, seizures, apnoea, unusual hypoglycaemia

Monitoring jaundice

- > All babies should be assessed clinically for jaundice at least daily while in hospital either by blanching the skin with a fingertip in bright natural or white fluorescent light, or by using a transcutaneous point-of-care light reflectance meter. The exceptions are those babies who are having close monitoring of blood (plasma or serum) total bilirubin levels.
- > Clinical screening and transcutaneous bilirubin measurement both have limited accuracy. Laboratory chemical methods for measuring plasma or serum total bilirubin are the gold standard.
- > Clinical or transcutaneous bilirubin estimation is suitable for Lower Risk babies.
- > Higher Risk babies require blood bilirubin measurements. Visual assessment of progression of jaundice is not reliable. The frequency of measurement depends on the clinical scenario and advice is given in the accompanying charts.
- > Blood samples collected for bilirubin analysis by midwives and child health nurses in the community should be protected from light by putting them in a brown paper bag. Carrying blood samples in a foam esky in the car is recommended to avoid excessive heat. Analysis should be undertaken as soon as is practical.
- > Parents should not be advised to place babies by a window or in direct sun due to risk of sunburn and overheating

Clinical assessment

- > A finding of jaundice extending below the nipple line will detect with high sensitivity total plasma bilirubin levels above the 75th centile for hour-specific bilirubin levels at between 48-72 hours of age (97 % sensitivity for levels > 205 µmol/L with low specificity).²
- > Jaundice visible below the nipple line should be checked - either with a transcutaneous point-of-care light reflectance meter or by a blood (plasma or serum) total bilirubin.
- > Clinical assessment has limited utility in black skinned babies, and any degree of detectable jaundice in these babies should be checked with either a transcutaneous or a blood level, and management guided by hour-specific percentiles.³

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Transcutaneous bilirubin measurement

- > Transcutaneous bilirubin measurement using a point-of-care light reflectance device is useful for screening jaundiced babies and reducing the number of blood tests required.³ Multi-wavelength spectral analysis is unaffected by gestation, postnatal age or skin pigmentation.⁴
- > Transcutaneous bilirubin measurements underestimate plasma or serum total bilirubin levels particularly at higher blood levels.⁵ It is reasonable practice to measure a blood bilirubin level if a transcutaneous level is \geq 75th centile. A transcutaneous level $<$ 75th centile can be managed with continued clinical review and either a repeat transcutaneous measurement or a blood level if the baby becomes visibly more jaundiced or if the baby develops poor feeding, excessive weight loss or becomes unwell.

Hour specific bilirubin charts

- > In healthy term and late preterm babies where haemolysis is unlikely, transcutaneous or blood levels are interpreted in the context of percentile charts for hour-specific bilirubin.^{3,4}
- > Hour-specific bilirubin percentiles are helpful in predicting jaundice that may require phototherapy, in reducing numbers of repeat blood tests and for guiding the frequency of community outreach assessments.³
- > Studies that have validated hour specific bilirubin levels are limited to well babies without haemolysis and their use is therefore restricted to these groups
- > For well babies $> 38^{+0}$ weeks gestation, a plasma total bilirubin below the 75th percentile line has a very low probability of rising to the AAP phototherapy threshold.³ Similarly, for the well late preterm baby 35^{+0} - 37^{+6} weeks gestation a plasma bilirubin level below the 40th centile has a very low probability of reaching treatment levels. Bilirubin levels above the 75th centile have risks of exceeding 340 $\mu\text{mol/L}$ of up to 40 % and 20 % respectively for well babies 35^{+0} - 37^{+6} and $> 38^{+0}$ weeks gestation.⁶

Phototherapy

- > Phototherapy and exchange transfusion decision lines in this guideline are derived from the American Academy of Pediatrics Clinical Practice Guideline 2004 for babies of $> 35^{+0}$ weeks gestation.¹ The AAP charts have been re-drawn to incorporate phototherapy and exchange lines on single chart, and to incorporate hour-specific bilirubin percentiles to assist community midwives and child health nurses when monitoring lower risk babies in the community.³
- > There are no published guidelines comparable to the above AAP Clinical Practice Guideline that relate to preterm infants $< 35^{+0}$ weeks gestation.⁷ A chart for phototherapy and exchange transfusion has been drawn from the numerical data presented by Ives, to assist Level 5 neonatal services.⁸
- > Phototherapy is most effective at high spectral irradiance (at least $30\mu\text{W/cm}^2/\text{nm}$) in the blue wavelength band (430-490nm) continuously applied to as much body surface area as possible.
- > Only phototherapy units that are stated by the manufacturer to deliver a minimum peak irradiance of 30 $\mu\text{W/cm}^2/\text{nm}$ at normal operating distance are suitable for the treatment of jaundice.
- > Standard phototherapy consists of either overhead phototherapy or a fibre optic blanket.

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- > Intensive phototherapy consists of both continuous overhead and fibre optic blanket phototherapy. Nasogastric feeding is desirable to facilitate continuous phototherapy and ensure adequate milk intake. Note: when the output of a single overhead bank is $> 30\mu\text{W}/\text{cm}^2/\text{nm}$, increasing irradiance to the same area of skin with a second bank will have a minimal additional effect in reducing bilirubin. Additional overhead light will only be helpful if the surface area exposed is increased.
- > Overhead phototherapy should be administered to babies nursed undressed in a nappy with the nappy undone, in either an incubator or basinet depending on environmental temperature.
- > Good quality overhead phototherapy units shouldn't need to come closer than 30 cm to the baby to deliver irradiance at close to saturation levels ($> 30\mu\text{W}/\text{cm}^2/\text{nm}$). Bringing lights closer to the baby can result in overheating, especially with halogen globes.
- > Pulse oximetry is advisable when babies are under blue lights, as cyanosis is not easily detected.
- > Fibre optic blankets are applied directly against the skin, with care taken to maximise contact between the skin and the blanket's effective surface area.
- > Phototherapy increases insensible water loss in babies of all gestations and postnatal ages. However, supplemental enteral fluids (milk or clear fluids) are not routinely required for the treatment of jaundice in term and late preterm babies.¹ Breast fed babies who are jaundiced and have excessive weight loss or poor weight gain should receive supplemental expressed breast milk, or formula if parents are agreeable.¹ Babies receiving Intensive phototherapy who are breast fed will need nasogastric feeding to avoid breaks in phototherapy.
- > Phototherapy can increase water loss considerably in preterm babies. Increased fluids may be required but this needs individual assessment taking renal function and cardio-respiratory function into account.

Exchange transfusion

Indications for exchange transfusion for jaundice are:

1. Rising total bilirubin despite intensive phototherapy and the exchange line is approached
2. Anaemia with a haemoglobin $< 100 \text{ g / L}$, cardiac failure or hydrops
3. Suspected kernicterus (exchange required even if bilirubin is below the exchange line)
 - > Exchange transfusion requires management in a Level 6 service because of risks and monitoring requirements. Neonatologist consultation and planned delivery in a Level 6 service are necessary where a haemolytic process is suspected in utero. If a baby is born outside of a level 6 service and has proven or likely haemolysis after birth (rise in bilirubin $> 5 \mu\text{mol/L/hr}$ without phototherapy, a continued rise despite effective phototherapy, presentation with a bilirubin above exchange levels) early transfer to a Level 6 service is recommended.

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Intravenous immunoglobulin

- > Meta-analyses of randomised controlled trials suggest that IVIG in a single dose of 0.5 - 1.0 g / kg in combination with phototherapy ameliorates haemolysis due to ABO and Rh incompatibility and reduces the need for exchange transfusion.^{9,10}
- > IVIG is a reasonable treatment option where phototherapy is not controlling bilirubin levels.

Prolonged jaundice

- > Jaundice that persists beyond 2 weeks in babies > 35+0 weeks gestation or 3 weeks in babies < 35+0 weeks gestation is termed 'prolonged' and requires investigation
- > When babies are discharged from community follow-up parents are to be advised that any visible jaundice after the age of 2 weeks requires medical review
- > Acholic stools require prompt paediatric medical review

Standard investigations for prolonged jaundice are:

1. Review the result of the Newborn Screening Test.
 2. Total and conjugated bilirubin
 3. Free T4
 4. Urine culture
- > Abnormal test results require specialist paediatric management – seek advice
 - > Where the above tests are normal in a healthy breast fed baby the parents can be counselled that their child has breast milk jaundice which is a natural condition that will resolve over the next 2-3 months. Note: it is not necessary to trial infant formula to make this diagnosis - this practice may adversely affect breast feeding

Follow-up of jaundiced babies

- > Current SA newborn hearing screening guidelines are to perform an automated auditory brainstem response test (in preference to oto-acoustic emission screening) where jaundice is due to haemolytic disease, or if bilirubin exceeds 350 $\mu\text{mol} / \text{L}$ in a well term baby or 250 $\mu\text{mol} / \text{L}$ in a sick term or preterm baby > 32⁺⁰ weeks gestation. All babies < 32⁺⁰ weeks gestation or < 1,500 grams birth weight (most of whom have jaundice) also have an AABR screen as routine. The AABR is done as close to discharge from hospital as possible. Later audiology follow-up solely for jaundice is not routine if the newborn hearing screen is passed
- > Babies with confirmed immune haemolysis require close follow-up over the following 4-6 weeks to watch for the development of late anaemia. Anaemia is more likely with rhesus isoimmunisation, where a weekly CBE and reticulocyte count is advised.
- > Give folic acid supplementation where continued haemolysis is suspected
- > Unusual haemolysis may require further evaluation for membrane or red cell metabolic defects. Haematologist advice is recommended.
- > All babies with symptoms of encephalopathy or who have been unwell require a structured long-term follow-up coordinated by a paediatrician

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Abbreviations

wks	weeks
BW	Birth weight
TcB	Transcutaneous bilirubin
ABO	ABO blood group system
e.g.	For example
DAT	Direct antiglobulin test
%	Percent
μmol / L	Micromole/s per litre
>	Greater than
i.e.	That is
<	Less than
AAP	American Academy of Paeditricians
μW/cm ² /nm	Microwatt/s per centimetre squared per nanometre
nm	Nanometre
cm	Centimetre
g/L	Grams per litre
μmol/L/hr	Micromole/s per litre per hour
Hb	Haemoglobin
IVIG	Intravenous immunoglobulin
g/kg	Gram/s per kilogram
Rh	Rhesus
+	Plus
T ₄	Thyroxine
SA	South Australia
AABR	Automated auditory brainstem response
/ kg / d	Per kilogram per day
CBE	Complete blood examination

Version control and change history

PDS reference: OCE use only

Version	Date from	Date to	Amendment
1.0	02 Aug 10	current	Original version