

Guideline for the investigation and management of unconjugated hyperbilirubinaemia

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Care for all babies

Unconjugated hyperbilirubinemia is common in newborn infants and affects 60% of term and 80% of preterm infants in the first week of life.

In all babies:

- Identify babies soon after birth as being more likely to develop significant hyperbilirubinemia or where jaundice may be more difficult to detect, if they have any of the following factors:
 - Gestational age under 38 weeks
 - A previous sibling with neonatal jaundice requiring phototherapy
 - A high risk of blood group incompatibility from antenatal history
 - Bruising such as cephalhaematoma
 - Babies with pigmented skin- jaundice is not more common but it may be less visible
 - Mother's intention to exclusively breastfeed. (Exclusive breast-feeding does increase the risk of jaundice but the benefits of breastfeeding outweigh this risk. It should **not** be used as an argument against breastfeeding. Mothers should be encouraged to breastfeed)

All the above babies should receive an additional inspection by a healthcare professional during the first 48 hours of life. If the baby appears jaundiced, assessment should be performed by SBR if less than 24 hours of age and thereafter Minolta measurement.

In infants where there is visible jaundice within 24 hours of age follow the appropriate pathway. Infants who have early jaundice (this usually means a bilirubin level of at least 85 $\mu\text{mol}/\text{litre}$ in infants with fair skin colour) are more likely to go on to develop significant hyperbilirubinemia.

In addition those infants where there is known antenatally to be a high risk of blood group incompatibility follow the appropriate pathway.

- Examine the baby for jaundice at every opportunity in the first 72 hours of life
- When looking for jaundice
 - Check the baby in bright and preferably natural light
 - Examination of the sclerae, gums and blanched skin is useful in babies of all skin colour
 - In babies who appear jaundiced, have a low threshold for bilirubin measurement by Minolta or SBR (serum bilirubin)
- Measuring the bilirubin level
 - Use the Minolta bilirubinometer in babies 35 weeks or greater and a postnatal age of more than 24 hours
 - Measure SBR if

- Minolta not available
 - baby is less than 35 weeks gestation
 - baby is jaundiced in first 24 hours
 - Minolta threshold for taking a Lab Bilirubin measurement is reached (see Minolta Bilimeter guideline for thresholds)
 - A dashed display (-- -- --) indicates the value is high (above 340), a **Lab bilirubin measurement must be carried out**, and appropriate treatment initiated if indicated, if this occurs.
- SBR blood samples should be taken with phototherapy lamps switched off

Management of unconjugated hyperbilirubinemia

General principles

- Most mature infants who develop jaundice and remain clinically well can be managed on the postnatal wards.
- Any infant with jaundice who is unwell or has jaundice not readily controlled with single phototherapy should be managed in the neonatal unit.
- Double phototherapy is not routinely used on the postnatal wards.
- Treatment decisions should be based on **actual** gestational age for the first week of life. Thereafter treat as per corrected gestational age.
- Decisions about treatment and continued monitoring of SBR are based on absolute level of SBR, rate of rise, the response to therapy and risk of haemolysis.
- When babies require intensive phototherapy, it is important to ensure that they are **maximally exposed** with nappy off if required. In some circumstances the baby may require NGT feeds if it is deemed that they cannot come out from under the phototherapy until the SBR improves.
- Maternal lactation should continue to be supported in any infant requiring phototherapy.
- Adequate information should be provided to parents about jaundice and its treatment by the nurse or doctor commencing phototherapy.
- Conjugated hyperbilirubinaemia should be investigated appropriately as per the conjugated jaundice guideline.
- There is a separate pathway for prolonged jaundice (>14 days in term infants and >21 days in preterm infants).

Treatment thresholds for phototherapy (PTX) and consideration for exchange transfusion (CET)

Thresholds apply to gestational age at birth until 1 week of age when corrected gestational age applies.

In some situations graphical representation of SBR level may be helpful: print out the relevant gestation-based graph from the 2010 NICE guideline. Note that treatment thresholds within these graphs may differ slightly from those in the table below and therefore in considering treatment this should be discussed with a consultant.

	< 24 hours			24-48 hours		> 48 hours	
Gestation	Rpt SBR within 6h	PTX and investgtn of early jaundice	CET	PTX	CET	PTX (GAx10)-100	CET (GAx100)
23	60	85	150	100	180	130	230
24						140	240
25						150	250
26						160	260
27						170	270
28	60	85	180	110	250	180	280
29						190	290
30						200	300
31						210	310
32	70	85	250	170	300	220	320
33						230	330
34						240	340
35	70	85	250	200	350	250	350
36						260	360
Term infants						PTX	CET
						Formulae do not apply	
37 and above	70	120	300	250	400	350	450

If SBR **below phototherapy threshold**, consider whether the infant requires a further assessment for jaundice (Minolta or serum bilirubin) in the next 24 hours or at least before discharge. Note that a single SBR level may not in itself be reassuring, particularly if there are other risk factors present. The rate of rise in SBR is also important particularly between 24 and 48 hrs, or after 48 hours if the level is within 50 $\mu\text{mol/l}$ of the phototherapy threshold.

Table of rate of rise $\geq 8.5 \mu\text{mol}/\text{hour}$

Interval between SBR measurements	Rate of rise $\geq 8.5 \mu\text{mol}/\text{hour}$
1h	≥ 8.5
2h	≥ 17
3h	≥ 25
4h	≥ 34
5h	≥ 42
6h	≥ 51
7h	≥ 59
8h	≥ 68
9h	≥ 76
10h	≥ 85
11h	≥ 93
12h	≥ 102

Early jaundice presenting in the first 24 hours

Any baby less than 24 hours with visible jaundice should be referred to the paediatrician urgently as this may be pathological.

Treat jaundice presenting in first 24 hours with phototherapy at least until you know the bilirubin level. There should be a doctor of at least middle grade level involved in the management plan.

Essential investigations include:

- Full history and examination
- SBR- should be **measured and recorded** within 2 hours of early jaundice being noted, including near patient testing of SBR (blood gas machine)
- Maternal blood group
- Baby blood group
- Direct Coombs Test (DCT)
- Full blood count and film

Consider additional tests:

- Consider red cell membrane and enzyme deficiencies eg G6PD deficiency particularly if male infant or in high risk ethnic groups (Mediterranean, African, Asian, Middle Eastern)
- Blood and CSF cultures- if there are features pointing to possible infection

Treatment of early jaundice

1. Treat immediately with single phototherapy until you know the bilirubin level.

2. If the SBR is **at or above exchange transfusion threshold** or **the baby has clinical signs of acute bilirubin encephalopathy**, inform consultant and

- Ensure baby has maximal exposure to several phototherapy units. Do not interrupt phototherapy for feeding and ensure maximal exposure i.e. no nappy and use small goggles taped at side of head.
- Consider IVIG for babies with blood group incompatibility
- Ensure adequate hydration (this may mean starting intravenous fluids)
- Prepare for exchange transfusion
- Repeat SBR 2 hourly (including near patient testing) and immediately prior to procedure to ensure continued need for exchange

3. If the SBR is **within 50 $\mu\text{mol/l}$ of exchange transfusion threshold**, inform consultant and

- i. Ensure baby has maximal exposure to several phototherapy units. Do not interrupt phototherapy for feeding and ensure maximal exposure i.e. no nappy and use small goggles taped at side of head. repeat SBR at 2 hours (including near patient testing) and consider preparing for exchange transfusion

4. If the SBR **indicates continued need for single phototherapy but is below exchange transfusion threshold by at least 50 $\mu\text{mol/l}$** , repeat SBR at 4 hours to monitor rate of rise:

- i. If SBR **at or above exchange transfusion threshold or the baby develops clinical signs of acute bilirubin encephalopathy**, inform consultant and
 - o Ensure baby has maximal exposure to several phototherapy units. Do not interrupt phototherapy for feeding and ensure maximal exposure i.e. no nappy and use small goggles taped at side of head. consider IVIG for babies with blood group incompatibility and
 - o ensure adequate hydration (this may mean starting intravenous fluids)
 - o prepare for exchange transfusion
 - o repeat SBR immediately prior to procedure to ensure continued need for exchange-process through blood gas machine for speed
- ii. If **SBR rising $>8.5 \mu\text{mol/l/hour}$ (see table), or within 50 $\mu\text{mol/l}$ of exchange transfusion threshold**, inform consultant and
 - o Ensure baby has maximal exposure to several phototherapy units. Do not interrupt phototherapy for feeding and ensure maximal exposure i.e. no nappy and use small goggles taped at side of head. Repeat SBR at 2 hours
 - o consider IVIG for babies with blood group incompatibility
 - o ensure adequate hydration (this may mean starting intravenous fluids)
 - o consider preparing for exchange transfusion
- iii. If **SBR rising but $<8.5 \mu\text{mol/l/hour}$** and below exchange transfusion threshold by at least 50 $\mu\text{mol/l}$, involve your senior. Use clinical judgement depending on age, gestation, underlying aetiology and any other illness indicators. Limit the interruption of phototherapy for feeding and ensure maximal exposure. If phototherapy cannot be delivered continuously and effectively or there are other concerning features, have a low threshold for admitting to the neonatal unit for drum phototherapy and monitoring.
- iv. If SBR is **stable or falling**, repeat at 6-12 hours

5. Stepping down treatment and monitoring. Decisions about treatment and continued monitoring of SBR will be based on absolute level of SBR, rate of rise, the response to therapy and risk of haemolysis but in general:

- If SBR falling and is more than 50 μmol below **exchange transfusion threshold**, phototherapy can be stepped down from drum to double or single phototherapy and an SBR repeated within 6-12 hours
- If SBR falling and is around 50 μmol below **phototherapy threshold**, phototherapy can be stopped and an SBR repeated within 12-18 hours

Jaundice presenting after the first 24 hours

Physiological jaundice is common after 24 hours of age, affecting 60% of term infants and 80% of preterm infants.

If SBR requires treatment, essential investigations include:

- Full history and examination
- Maternal blood group
- Baby blood group
- Direct Coombs Test (DCT)
- Full blood count

Consider additional tests according to history and examination:

- Blood film
- Consider red cell membrane and enzyme deficiencies eg G6PD deficiency particularly if male infant or in high risk ethnic groups
- Blood and CSF cultures- if there are features pointing to possible infection

Treatment of jaundice presenting after the first 24 hours

1. If SBR is **at or above the exchange transfusion threshold for gestation and postnatal age,**

- i. admit the infant to the neonatal unit immediately
- ii. Ensure baby has maximal exposure to several phototherapy units. Do not interrupt phototherapy for feeding and ensure maximal exposure i.e. no nappy and use small goggles taped at side of head. Inform consultant
- iii. consider preparing for exchange transfusion
- iv. repeat SBR after 2-4 hours of intensive drum phototherapy
 - If SBR **stable or rising and within the exchange transfusion threshold**, inform consultant, consider IVIG if haemolysis due to blood group incompatibility and proceed to exchange transfusion
 - If SBR is **stable or falling and below exchange transfusion threshold**, repeat every 4-6 hours. Discontinue phototherapy if at least 50 $\mu\text{mol/l}$ below threshold for phototherapy and recheck SBR after 6-12 hours to monitor rebound rise

2. If SBR is **above the phototherapy threshold for gestation and postnatal age and within 50 $\mu\text{mol/l}$ of the exchange transfusion threshold,**

- i. **Start immediate phototherapy and consider use of multiple phototherapy units.** Involve your senior. Use clinical judgement depending on age, gestation, underlying aetiology and any other illness indicators. Limit the interruption of phototherapy for feeding and ensure maximal exposure.
- ii. Repeat SBR after 2-4 hours:
 - If SBR **rising - do not delay, go to point 1 above.**
 - If SBR is **stable or falling and below exchange transfusion threshold**, repeat every 4-6 hours. Discontinue phototherapy if at least 50 $\mu\text{mol/l}$ below threshold for phototherapy and recheck SBR after 6-12 hours to monitor rebound rise

3. If SBR is **above the phototherapy threshold for gestation and postnatal age and below exchange transfusion threshold by >50 $\mu\text{mol/l}$,**

- i. treat with single phototherapy
- ii. using clinical judgement encourage short breaks for feeding, nappy changing and cuddles
- iii. continue lactation/feeding support
- iv. do not give additional fluids or feeds routinely
- v. monitor hydration by assessing wet nappies and feeding
- vi. repeat SBR in 6-12 hours:
 - If SBR is **stable or falling** repeat every 12 hours, discontinue phototherapy if at least 50 $\mu\text{mol/l}$ below threshold for phototherapy and recheck SBR after 12-18 hours to monitor rebound rise
 - If SBR **rising**, double phototherapy may be required to control rate of rise. If so the infant should be admitted to the neonatal unit.
 - If SBR **rising but <8.5 $\mu\text{mol/l/hour}$ and below exchange transfusion threshold by > 50 $\mu\text{mol/l}$** , start double phototherapy and repeat SBR at 4 hours.
 - If SBR **rising >8.5 $\mu\text{mol/l/hour}$, or within 50 $\mu\text{mol/l}$ of exchange transfusion threshold**, inform consultant and

- Ensure baby has maximal exposure to several phototherapy units. Do not interrupt phototherapy for feeding and ensure maximal exposure i.e. no nappy and use small goggles taped at side of head. repeat SBR at 2 hours
- consider preparing for exchange transfusion

4. If SBR **below phototherapy threshold**, consider whether the infant requires a further assessment for jaundice (Minolta or serum bilirubin) in the next 24 hours or at least before discharge. Note that a single SBR level may not in itself be reassuring, particularly if there are other risk factors present. The rate of rise in SBR is also important particularly between 24 and 48 hrs, or after 48 hours if the level is within 50 $\mu\text{mol/l}$ of the phototherapy threshold.

5. Decisions about treatment and continued monitoring of SBR will be based on absolute level of SBR, rate of rise, the response to therapy and risk of haemolysis but in general:

- If SBR falling and is more than 50 μmol below **exchange transfusion threshold**, phototherapy can be stepped down from drum to double or single phototherapy and an SBR repeated within 6-12 hours
- If SBR falling and is around 50 μmol below **phototherapy threshold**, phototherapy can be stopped and an SBR repeated within 6-12 hours

Management of babies with neonatal jaundice in the community

Management of babies with neonatal jaundice in the community is provided in a separate guideline.