GUIDELINE

Jaundice

Scope (Staff):	Midwifery, Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA, KEMH Postnatal Wards

Child Safe Organisation Statement of Commitment

CAHS commits to being a child safe organisation by applying the National Principles for Child Safe Organisations. This is a commitment to a strong culture supported by robust policies and procedures to reduce the likelihood of harm to children and young people.

This document should be read in conjunction with this disclaimer

Post-Natal Ward QRG: See Appendix 1: QRG Jaundice in the Infant ≥35 Weeks Gestation

Contents

Aim/Risk 2
Key Points 2
Background 2
Prevention of Hyperbilirubinaemia associated with isoimmune Haemolytic Disease 3
ABO incompatibility 3
Glucose-6-Phosphate Dehydrogenase deficiency (G6PD) 3
Age of onset 4
Clinical Assessment of Jaundice, Bilirubin Measurements 5
Management of Low-Risk Infants (not haemolytic or early onset <24hrs) 6
Management of HIGH RISK infants (Positive antibody screen or early onset <24hrs) 6
Escalation of care (near or above Exchange Transfusion Threshold) 8
Phototherapy Units and Dosage 8
Management of Prolonged Jaundice 10
Intravenous Immunoglobulin (IVIg) in Severe Haemolytic Disease of the Newborn 11
Appendix 1: Approach to Jaundice in the Infant ≥35 Weeks Gestation 14
Appendix 2: Approach to identify newborns with maternal anti-erythrocyte antibodies 15
Appendix 3. Approach to escalation of care. 16
Appendix 4: Guide to determine post-discharge follow-up (not received phototherapy. 17
Appendix 5: JM-105 Jaundice Meter Instructions for use. 18

Aim

To guide staff in the recognition and optimal treatment of acute bilirubin encephalopathy and prevention of kernicterus (chronic bilirubin encephalopathy) consequently.

Risk

Failure to follow a risk assessment approach to the management of jaundice may lead to delay in diagnosis and treatment resulting in hyperbilirubinaemia neurotoxicity.

Key Points

Point-of care bilirubin testing of whole blood on the Radiometer blood gas analysers is an alternative test to a traditional plasma bilirubin (SBR) which is sent to the laboratory. The test requires a minimal sample of blood, produces a result in 1-2 minutes and the results are as accurate as the traditional plasma bilirubin results in term and preterm neonates. In cases of prolonged jaundice (>2 weeks duration) a formal bilirubin should be requested from the laboratory so that the conjugated fraction can be measured.

- Visual determination of bilirubin levels are inherently problematic, any infant who appears clinically jaundiced <24hrs after birth should undergo formal evaluation with a bilirubin measurement. These infants should be considered high risk, where a haemolytic process is the most likely cause of the jaundice.
- Use hour specific treatment graphs when making clinical decisions regarding treatment and escalation of care (Jaundice: Phototherapy and Treatment Graphs). Use postmenstrual age when using the treatment graphs.
- For Postnatal Wards refer to QRG: Appendix 1 for infants ≥35 weeks

Background

- More than 80% of newborn infants will have some degree of jaundice as a result of elevated serum bilirubin levels. Hyperbilirubinaemia occurs when there is an imbalance between bilirubin production, conjugation and elimination. Unconjugated hyperbilirubinaemia which occurs < 24 hours of life or is prolonged beyond 14 days should be considered pathological until proven otherwise.
- Acute bilirubin encephalopathy and kernicterus (chronic bilirubin encephalopathy) arise as a consequence of bilirubin deposition in the basal ganglia and certain brainstem nuclei. Acute cases may be observed in the first weeks of life with hypertonia, retrocollis (neck extension), opisthotonos (state arching of head, neck and spinal column) and recurrent apnoea. Kernicterus is a permanent disabling neurological condition whereby unconjugated bilirubin is deposited in the basal ganglia and brainstem nuclei. This is characterized by some or all of the following:

Athetoid cerebral palsy	Sensori-neural deafness	Neuro-cognitive impairment
Seizures	Developmental delay	Oculomotor dysfunction

- Care should be escalated when an infant's bilirubin reaches or exceeds the **escalation-of-care threshold**, defined as **34 µmol/L below the exchange** transfusion threshold, as detailed in the hour-to-hour-specific bilirubin, and the presence of risk factors for bilirubin neurotoxicity exchange transfusion. See Appendix 2: Escalation of care) for details and refer to the Exchange Transfusion guideline when required.
- Conjugated (direct) hyperbilirubinemia (17umol/L), which is also associated with pale stools, is considered pathological and warrants diagnostic evaluation.

Prevention of Hyperbilirubinaemia associated with isoimmune Haemolytic Disease

- Prevention of hyperbilirubinaemia begins in pregnancy by recognising and treating women who are at risk of developing antibodies to red cell antigens, which can lead to haemolytic disease of the newborn.
- Pregnant women should be tested to determine their ABO blood group and Rh(D) type. The approach to identify newborns with maternal anti-erythrocyte antibodies and guide early management is outlined in Appendix 2.
- If the maternal blood type is Rh(D) negative, the Rh type of the infant should be determined to assess the need for administration of RhIG (anti D) to the mother.
- If the maternal antibody screen is positive or unknown (no prenatal antibody screen), the infant should have a DAT and the blood group determined as soon as possible from either cord or peripheral blood.

ABO incompatibility

- Maternal blood group O becomes pregnant with a fetus with a blood group of A, B, or AB. Mother's serum contains naturally occurring anti-A and anti-B, which tend to be of the IgG class and can cross the placenta and haemolyse the foetal RBCs.
- Can lead to a more aggressive jaundice than physiological jaundice with the potential for a more rapid rise in bilirubin and a more prolonged resolution phase which may last several weeks. Cord blood should be sent for routine DAT at birth on all neonates born to Group O mothers.

Glucose-6-Phosphate Dehydrogenase deficiency (G6PD)

G6PD should be considered in infants in whom the response to phototherapy is poor, or there is a relevant family, ethnic or geographic history. The condition is widespread, being present in approximately 12% of African Americans, and prevalence is higher in the Mediterranean, Middle East, Southeast Asia and Africa. Measuring G6PD activity during or soon after a haemolytic event or after an

exchange transfusion can lead to a falsely normal result. G6PD activity should be measured at least 3 months later.

Age of onset

Jaundice onset <24hrs

Should be considered abnormal/pathological and is most likely to be a haemolytic process.

Jaundice between 24 hours and 14 days

Is most commonly physiological in nature. Causes include:

- Haemolysis.
- Physiological jaundice.
- Suboptimal intake hyperbilirubinaemia
- Polycythaemia.
- Sepsis
- Breakdown of extravasated blood.
- Prematurity

Prolonged or Late Onset Jaundice (> 14 days)

Is a relatively common finding but should alert to the possibility of cholestasis. Screening all jaundiced newborns at 2-weeks will detect cholestasis in relatively few cases so the following recommendations are advised:

- A thorough physical examination is crucial to evaluate a jaundiced infant. Attention to hepatomegaly, splenomegaly and ill appearance warrants special considerations, as well as direct visualisation of stool pigment.
- Measurement of total and conjugated (direct) serum bilirubin at 2 weeks in formula-fed infants.
- Measurement of total and conjugated (direct) serum bilirubin at 3 weeks in breast-fed babies that appear otherwise well clinically.
- Conjugated (direct) hyperbilirubinemia (17umol/L) is considered pathological and warrants diagnostic evaluation. A direct bilirubin concentration >20% of the total is no longer regarded as necessary for the diagnosis of cholestasis.
- As well as considering biliary atresia, also consider other causes for direct hyperbilirubinaemia including urinary tract infection, isoimmune haemolytic disease, sepsis, and some inborn errors of metabolism.
- Measurements of serum bilirubin should always be fractionated into unconjugated (indirect) or conjugated (direct) hyperbilirubinemia.

Clinical Assessment of Jaundice, Bilirubin Measurements

- All infants should be visually assessed for jaundice at least every 12hrs following birth preferably in natural light, then 24hrly until discharge. bilirubin
- should be measured as soon as possible for infants noted to be jaundiced <24hrs after birth.
- Examine the sclerae and gums and press lightly on the skin to check for jaundice in 'blanched' skin.
- Skin pigmentation due to hyperbilirubinemia maybe harder to see in darker skin.
- TcB measurements may be performed as an initial screen for jaundice in the well, term or late preterm (≥35 weeks gestation and ≥ 2000grams) infant **who is greater than 24 hours of age**. Infants in whom jaundice presents less than 24 hours of age, or where other risk factors are present (e.g. preterm, maternal antibodies, possible sepsis, G6PD risk, etc.) should have an bilirubin performed in the first instance.
- Infants at risk of aggressive haemolysis require a low threshold for TcB (above 24 hrs of age) and/or bilirubin.
- TcB should not be relied upon for monitoring serum bilirubin levels while a baby is under phototherapy. A bilirubin should be performed to track progress once lights are instigated. However, a TcB can be used to monitor potential rebound jaundice after phototherapy is ceased. The frequency with which monitoring should occur varies with the absolute bilirubin, the expected or actual rate of change of serum bilirubin level, and risk factors present. In general, high-risk infants should be monitored 4-6 hourly initially. Monitor low risk infants daily.
- Any infant admitted to a general ward (including transfers from family birth centre to postnatal wards), should have either a TcB or bilirubin measured between 24 and 48hrs after birth or before discharge if that occurs earlier.
- Refer to the below table for TcB and bilirubin guide for infants ≥ 35 weeks gestation and ≥ 2000 grams:

TcB and bilirubin guide for infants ≥35 weeks gestation and ≥2000 grams		
Jaundice onset	TcB	Action
< 24 hours	_____	Perform bilirubin
24-48 hours	>140 µmol/L	Perform bilirubin
48-72 hours	>200 µmol/L	Perform bilirubin
> 72 hours	>260 µmol/L	Perform bilirubin

- The JM-105 jaundice meter is used to measure TcB. Refer to Appendix 5: Instructions for use of the JM-105 Jaundice meter

- Use hour specific treatment graphs when making clinical decisions regarding treatment and escalation of care (Jaundice: Phototherapy and Treatment Graphs).
- There is good correlation between TcB measurements and bilirubin concentrations with bilirubin generally within 51µmol/L of the TcB among newborn infants with bilirubin concentrations <255 µmol/L. Bilirubin should be measured if the TcB exceeds or is within 51 µmol/L of the phototherapy threshold or if the TcB is ≥255 µmol/L.
- The ABL-90 Flex Radiometer blood gas analyser has been validated in WA for use in term and preterm infants as a Point of Care (POC) test to measure total bilirubin. It requires a smaller sample of blood, with results available within 1-2 minutes. In cases of prolonged jaundice (>2 weeks duration) a formal bilirubin should be requested from the laboratory so that the conjugated fraction can be measured.

Management of Low-Risk Infants (not haemolytic or early onset <24hrs)

- Decisions to initiate phototherapy or deescalate care are guided by the treatment threshold jaundice graphs, which consider gestational age, the hour-specific bilirubin, rate of rise of bilirubin and the presence of risk factors for bilirubin neurotoxicity. If more than 1 TcB or bilirubin measure is available, the rate of increase may be used to identify infants at higher risk of subsequent hyperbilirubinemia. A rapid rate of increase 5.1 µmol/L per hour in the first 24 hours or 3.4 µmol/L per hour thereafter is exceptional and suggests haemolysis. In this case, perform a DAT if not previously done.
- If the maternal blood is group O RhD positive and the maternal antibody screen is negative, it is recommended to test the cord blood for the infant's blood type and DAT
- Neonates with 'physiological' jaundice may be managed on the postnatal wards, with attention to adequate feeding and hydration state.
- Refer to Appendix 4 for follow up of infants discharged who didn't receive phototherapy. Use clinical judgement and shared decision making to determine when to repeat bilirubin within this 4 to 24hr time window. Clinical judgement includes physical examination, presence of risk factors for the development of hyperbilirubinaemia or hyperbilirubinaemia neurotoxicity risk factors, feeding adequacy, weight trajectory, and family support.
- Sunlight exposure is not recommended for the management of hyperbilirubinaemia, and sunburn is a risk. Parents should be discouraged from using this approach.

Management of HIGH RISK infants (Positive antibody screen or early onset Jaundice <24hrs)

Infants at high risk for early and / or aggressive jaundice include the following:

- Preterm (risk increases with each additional week less than 40 week)
- Jaundice in the first 24 hr after birth
- Haemolysis from any cause, if known or suspected based on a rapid rate of increase in the bilirubin of >5µmol/l per hour in the first 24 hours or 3.4 µmol/l per hour thereafter.
- Pre-discharge transcutaneous bilirubin (TcB) or bilirubin concentration close to the phototherapy threshold
- Phototherapy before discharge
- Parent or sibling requiring phototherapy or exchange transfusion
- Family history or genetic ancestry suggestive of inherited red blood cell disorders, including glucose-6-phosphate dehydrogenase (G6PD) deficiency
- Exclusive breastfeeding with suboptimal intake
- Scalp hematoma or significant bruising
- Down syndrome
- Macrosomic infant of a diabetic mother
- Women who are RhD negative or in whom red cell antibodies have been detected are titres are usually monitored during pregnancy. In severe cases of RhD isoimmunisation, intra-uterine blood transfusion may have occurred. These infants are at increased risk for unconjugated hyperbilirubinaemia.

History and Investigations

Review maternal notes:

- Blood group and RhD status and antenatal prophylaxis administration of RhD immunoglobulin (RhD Ig) (Anti-D)
- Presence of any red cell antibodies and changes in titre concentrations.
- Presence of foetal hydrops, pleural/peritoneal effusion, anaemia, cardiac failure.
- Any intra-uterine blood transfusion performed.
- Mothers who received RhIG can have a positive antibody screen for anti-Rh(D), and RhIG can cause a positive DAT (anti- RhD) in the infant but generally no haemolysis.
- If an infant's DAT is known to be positive only to anti-Rh(D) because the mother received RhIG during pregnancy and the mother was known not to have Rh(D) antibodies before receiving RhIG, the infant can be treated as if the infant is DAT negative. However, any infant with a positive DAT attributable to an antibody other than anti-Rh(D) following maternal receipt of RhIG should be considered to be DAT positive.
- At the time of birth, a Cord Blood Group and DAT can be performed on Cord blood collected in a 9mL Cord Blood tube in L&BS.

Note: FBC and bilirubin cannot be done on a cord blood sample. FBC and bilirubin samples must be collected from the baby on admission to NICU.

Subsequent bilirubin /TcB measurements:

- Measure 4 hourly x 2 times, then every 12 hours x 3 times. Use (Jaundice: Phototherapy and Treatment Graphs) to determine treatment with phototherapy or escalation of care (See Appendix 3: Escalation of care).
- If more than 1 bilirubin/ TcB measurement is available, the rate of increase may be used to identify infants at higher risk of subsequent hyperbilirubinemia.
- A rapid rate of increase 5.1 µmol/L per hour in the first 24 hours or 3.4 µmol/L per hour thereafter is exceptional and suggests haemolysis. In this case, perform a DAT if not previously done.
- Refer to section below on phototherapy units and phototherapy management

Escalation of care (near or above Exchange Transfusion Threshold)

- Care should be escalated when an infant's bilirubin reaches or exceeds the **escalation-of-care threshold**, defined as **34 µmol/L below the exchange** transfusion threshold, as detailed in the hour-specific bilirubin, and the presence of risk factors for bilirubin neurotoxicity:
    - Prematurity (Gestational age <38 weeks)
    - Albumin <3.0g/dL
    - Isoimmune Haemolytic disease
    - G6PD or other haemolytic diseases
    - Sepsis
    - Any significant clinical instability in the last 24hrs
- Conjugated (direct) hyperbilirubinemia (17umol/L), which is also associated with pale stools, is considered pathological and warrants diagnostic evaluation.
- See Appendix 3: Escalation of care) for details and refer to the Exchange Transfusion guideline when required.

Phototherapy Units and Dosage

- The aim of phototherapy treatment is to lower the bilirubin level and to avoid exchange transfusion. Consider the age of the infant in hours, risk factors, and the rate of rise of serum bilirubin. See Phototherapy and Exchange Transfusion Treatment Graphs.
- Blue is the light range (420-470 nm) in which bilirubin most effectively absorbs light; when phototherapy is applied to bilirubin in the skin, the light absorbed causes photochemical reactions. The other major product from phototherapy is lumirubin, which is an irreversible structural isomer converted from native bilirubin that can be excreted by the kidneys in the unconjugated state.

- Phototherapy units have differing energy outputs. The higher the microwatts per cm^2 ($\mu W/cm^2$) the more efficient the unit is.
- Direct contact with a Bili blanket provides the most efficient form of phototherapy treatment therefore choose the appropriate size pad.
- Light dosage is dependent on distance from patient. The closer the light source is to the patient the more intense the irradiance becomes.
- Lullaby phototherapy is to commence on bright light function i.e.. select (II) switch to deliver high dose irradiance at 35 cm lamp distance from infant.
- Jaundice resulting from haemolysis of any cause may show a resistance to phototherapy necessitating an increase in the number of phototherapy lights, use of a 'Bili-Blanket' and more frequent monitoring of bilirubin, feeding and hydration status.

TYPE	STRENGTH	Low Dose Irradiance	High Dose Irradiance
		(lamp distance from infant if applicable)	
Giraffe PT Spot LED	18-45 $\mu W/cm^2/nm^{-1}$	50-60cm (23cm from roof of Omnibed)	40-50cm (almost touching roof of Omnibed)
Phototherapy blanket (fibre optic/LED)	Large and small pads sizes are available 35-50 $\mu W/cm^2/nm^{-1}$	Small 35$\mu w/cm^{-2}/nm^{-1}$	Large 50 $\mu w/cm^{-2}/nm^{-1}$
Lullaby	22-45 $\mu W/cm^2/nm^{-1}$	40-50cm = low light or (I) on switch	35cm =bright light or (II) on switch

Phototherapy Commencement and Complications

- Maintain stable temperature regulation - take baseline temperature then monitor as per level of care and maintain a Neutral Thermal Environment that is appropriate for the infants age and gestation. Consider both risks of overheating and hypothermia from exposure.
- Once phototherapy commences then monitoring of bilirubin is essential as the skin colour will no longer be a guide to the level.
- Total fluid volume meets infant's requirements as infants under phototherapy are at risk of increased insensible water loss which can lead to dehydration
    - Adjust total fluid volume – usually >10-15%
    - Monitor urine output, stools, daily weight
    - Monitor PGL's, U&E's, Urine: Specific gravity as ordered by medical team

- Early feeding assists with elimination of meconium, reducing the available bilirubin for reabsorption and thus interfering with the enterohepatic circulation depending on the Gestational Age of patient.
- Maximise infants skin exposure to light – remove all clothes apart from nappy, check the distance of the unit being used from the infant.
- Monitor skin integrity as infants undergoing phototherapy can develop erythematous macular rash or purpuric rash associated with transient porphyrinaemia and can develop loose stools – maintain with good hygiene and appropriate nappy care regime. Review by CNC/Medical as needed.
- Protect infant's eyes from light by covering infant's eyes with appropriate size eye cover without applying excessive pressure or occlude nares, remove eye cover with each set of cares to evaluate eyes. Leave pads off for short periods when the infant is out for a cuddle or feed with parent/carer.
- A benign rare condition called 'bronze baby syndrome' can develop as a result of direct hyperbilirubinaemia.
- Document start time and type unit in use on MR489/491 and in nursing progress notes (MR420.00) and medical team to update problem list (MR485.03) and document any bilirubin results in the summary flow chart (485.02)

Ceasing Phototherapy and Discharge

- Therapy can be ceased when the bilirubin is ≥20µmol/L below treatment threshold and the infant is old enough to handle the bilirubin load. Document date and time of cessation on MR489/91, and cessation order on MR420.00. Update MR485.03.
- Perform bilirubin or TcB at a minimum the day after cessation of phototherapy.
- Infants with haemolytic causes of jaundice are at greater risk of rebound when phototherapy is stopped, and they need ongoing bilirubin monitoring with a low threshold for testing in the days following cessation of phototherapy. Use clinical judgment considering risk factors, response to therapy and level of bilirubin to determine specific timings (4 - 24 hourly).
- Infants identified as having a haemolytic cause for jaundice should be considered for a 4-6 week follow up with FBP and reticulocyte count and consider prescribing folic acid on discharge for such infants. Excessive haemolysis in these circumstances may exaggerate and prolong the normal nadir in haemoglobin level seen during the first 4-8 weeks of life, on occasion
- Monitoring skin colour, feeding, weight gain and lethargy should be performed by Visiting Midwife (VMS) or Child Health Nurse.

Management of Prolonged Jaundice

In babies ≥37 weeks with jaundice >14 days and in those <37 weeks, jaundice lasting >21 days

- Look for pale chalky stools and/ dark urine staining the nappy

- Measure conjugated bilirubin, FBP, blood group and DAT(if not done), urine culture (if suspected UTI), metabolic screen (ensure Guthrie done)
- Consider referral to gastroenterology

Intravenous Immunoglobulin (IVIg) in Severe Haemolytic Disease of the Newborn

Haemolytic disease of the fetus and newborn (HDFN), also known as alloimmune HDFN or erythroblastosis fetalis, is caused by the destruction of red blood cells (RBCs) of the neonate or fetus by maternal immunoglobulin G (IgG) antibodies.

IVIg is indicated to prevent the need for first or repeat exchange transfusion in select cases of severe haemolytic disease of the newborn (HDN) undergoing intensive phototherapy. Can be used when:

- Positive Direct Antiglobulin Test (DAT)
- Bilirubin) continues to rise at 8-17mmol/L/hour despite intensive phototherapy
- Bilirubin is within 35-50mmol/L of the threshold for exchange transfusion.
- Other isoimmune haemolytic disease
- Difficulties obtaining appropriate blood for exchange transfusion
- Parental refusion for exchange transfusion.

If necessary Privigen may be re-dosed 12 hours after first administration. Studies have not shown any benefit in HDN in preterm infants.

IVIg requires parental consent for blood products. Observations and monitoring as per blood products protocols.

3B PCH - Privigen (Immunoglobulin Normal 5g/50mLs) is included in the CAHS formulary- restricted to haemolytic disease of newborn in neonatal patients and is stored in the automated dispensing machine (ADM) under Immunoglobulin to enable immediate access for use in Priority 1 retrievals after authorisation from the NETS or 3B Consultant.

KEMH - Requires Haematologist approval before issuing from Transfusion Medicine.

See Privigen 10 in Immunoglobulin Products – Transfusion Medicine Protocol.

Related CAHS internal policies, procedures and guidelines
Privigen 10 in Immunoglobulin Products Exchange transfusion.

Useful resources (including related forms)

Jaundice: Follow up Letter

Jaundice: Threshold Graphs, Phototherapy and Exchange Transfusion Treatment Graphs

References and related external legislation, policies, and guidelines

1. Okwundu CI, Bhutani VK, Uthman OA, Smith J, Olowoyeye A, Fiander M, Wiysonge CS. Transcutaneous bilirubinometry for detecting jaundice in term or late preterm neonates. Cochrane Database Syst Rev. 2024 May 28;5(5):CD011060.
2. Khurshid F, Rao SP, Sauve C, Gupta S. Universal screening for hyperbilirubinemia in term healthy newborns at discharge: A systematic review and meta-analysis. J Glob Health. 2022 Dec 29;12:12007.
3. Ono H, Kakiuchi S, Kusuda S. Immunoglobulin for hemolytic jaundice in Japan: A retrospective survey. Pediatr Int. 2023 Jan-Dec;65(1):e15702
4. Jalali SZ, Mahdipour S, Asgarzad R, Saadat F. Effect of intravenous immunoglobulin on the management of Rh- and ABO-mediated hemolytic disease of the newborn. Hematol Transfus Cell Ther. 2024 Apr 18:S2531-1379(24)00072-5.
5. American Academy of Pediatrics Subcommittee on H. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2004;114(1):297-316.
6. Atkinson M, Budge H. Review of the NICE guidance on neonatal jaundice. Arch Dis Child Educ Pract Ed. 2011;96(4):136-40.
7. https://www.nice.org.uk/guidance/cg98, accessed September 2024 (last updated October 2023).
8. Bhutani VK, Fetus tCo, Newborn. Phototherapy to Prevent Severe Neonatal Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Pediatrics. 2011;128(4):e1046-e52.
9. Guideline QC. Neonatal jaundice [Available from: https://www.health.qld.gov.au/__data/assets/pdf_file/0018/142038/g-jaundice.pdf.
10. Hyperbilirubinemia So. Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Pediatrics. 2004;114(1):297-316.
11. Kemper AR, Newman TB, Slaughter JL, Maisels MJ, Watchko JF, Downs SM, et al. Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Pediatrics. 2022;150(3). doi:10.1542/peds.2022-058859, (2022).
12. Lane E, Murray KF. Neonatal Cholestasis. Pediatr Clin North Am. 2017;64(3):621-39.
13. Maisels MJ, Watchko JF, Bhutani VK, Stevenson DK. An approach to the management of hyperbilirubinemia in the preterm infant less than 35 weeks of gestation. J Perinatol. 2012;32(9):660-4.
14. Pillai A, Pandita A, Osiovich H, Manhas D. Pathogenesis and Management of Indirect Hyperbilirubinemia in Preterm Neonates Less Than 35 Weeks: Moving Toward a Standardized Approach. NeoReviews. 2020;21(5):e298-e307.
15. Ronald J Wong VKB. Unconjugated hyperbilirubinemia in neonates: Etiology and pathogenesis Upto Date2018 [Available from: https://www.uptodate.com/contents/unconjugated-hyperbilirubinemia-in-term-and-late-preterm-newborns-screening
16. Shapiro SM. Definition of the clinical spectrum of kernicterus and bilirubin-induced neurologic dysfunction (BIND). J Perinatol. 2005;25(1):54-9.
17. Tyson JE, Pedroza C, Langer J, Green C, Morris B, Stevenson D, et al. Does aggressive phototherapy increase mortality while decreasing profound impairment among the smallest and sickest newborns? J Perinatol. 2012;32(9):677-84.
18. Thomas, D. H. *et al.* Total bilirubin assay differences may cause inconsistent treatment decisions in neonatal hyperbilirubinaemia. *Clinical Chemistry and Laboratory Medicine (CCLM).* **60** (11), 1736-1744 (2022).

This document can be made available in alternative formats on request.

Document Owner:	Neonatology		
Reviewer / Team:	Neonatology		
Date First Issued:	December 2011	Last Reviewed:	January 2025
Amendment Dates:	March 2025 – amended to include using Radiometer gas analyser to monitor bilirubin. May 2026 – amended to add when formal bilirubin should be requested.	Next Review Date:	January 2028
Approved by:	Neonatal Coordinating Group	Date:	26/05/2026
Endorsed by:	Neonatal Coordinating Group		
Standards Applicable:	NSQHS Standards: Child Safe Standards: 1,10		

Printed or personally saved electronic copies of this document are considered uncontrolled

Healthy kids, healthy communities

Compassion | Excellence | Collaboration | Accountability | Equity | Respect

Neonatology | Community Health | Mental Health | Perth Children's Hospital

Appendix 1: Approach to Jaundice in the Infant ≥35 Weeks Gestation

All infants should be clinically evaluated for jaundice every 8-12 hours

** Direct Antibody Test (DAT) should be done on all infants at risk of haemolysis and any infant requiring phototherapy.*

High Risk

Any of:

- Rh Iso-immunisation
- RhD(Neg) mother, antibody positive
- In-utero blood Tx, IVIG
- High antenatal titres of antibodies to any antigen
- Maternal Group O

At Birth:

- Urgent DAT on Cord blood
- Urgent FBC, bilirubin from baby
- ***Discuss with Consultant***

Moderate Risk

Any of:

- Antenatal antibodies to minor antigens
- Preterm <38 weeks
- Sick Infant (e.g., sepsis)
- Jaundice onset <24 hrs
- Cephalhaematoma / Subgaleal haemorrhage

If Jaundiced:

- Bilirubin. Repeat bilirubin 12-24hrly
- Low Threshold for DAT*
- bilirubin 12-24 hrly
- Consider sepsis, take a CRP, FBP

Low Risk

All of:

- Term ≥ 38 weeks
- Jaundice onset ≥48 hrs
- Anti-D given to RhD Neg mother
- No antibodies detected

If Jaundiced:

- TcB / bilirubin
- Repeat TcB/ bilirubin daily
- Monitor Feeding

See Jaundice Threshold Graphs

High-risk: Needs Phototherapy? Or DAT positive

Yes

- Discuss with consultant
- ?SCN Admission, Phototherapy strategy
- Concerning rate of rise of bilirubin: 4-5µmol/L/hr
- Repeat bilirubin 4-6 hrly

No

- Repeat bilirubin in 6-12 hours until rate of rise clear
- If below Tx range at 24 hours treat as per moderate risk

Moderate Risk: Needs Phototherapy?

Yes

- Start Phototherapy
- bilirubin, DAT next day*
- Wean phototherapy daily
- Perform TcB/ bilirubin day after discharge to monitor 'rebound'

No

TcB/bilirubin in 12-24 hours

Low risk: Needs Phototherapy?

Yes

- Start Phototherapy
- bilirubin, DAT next day*
- Daily Weight
- Attention to feeding

No

Inspect for jaundice daily
TcB/ bilirubin if jaundiced

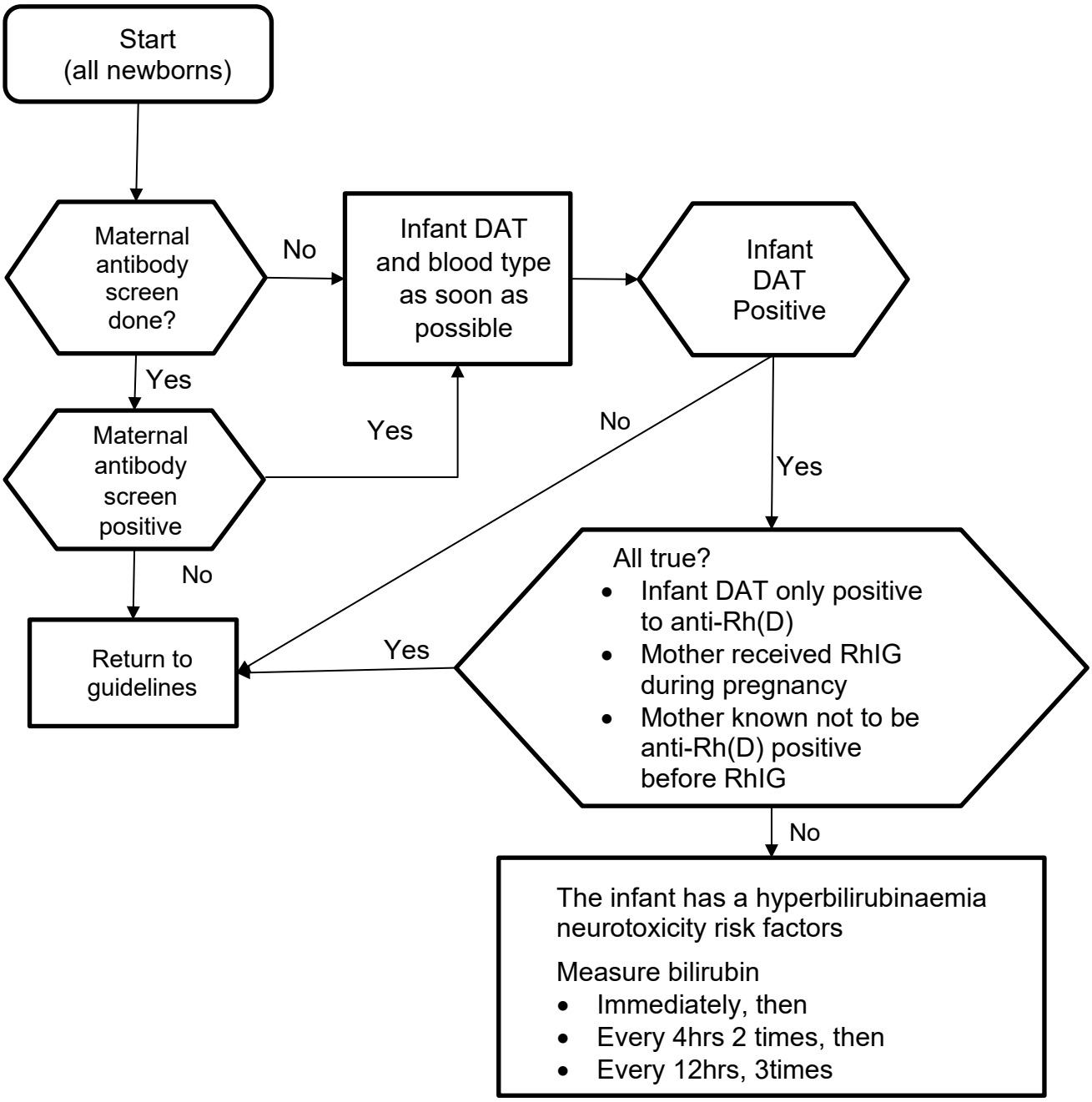
See TcB / bilirubin graph for further information

Discharge Planning

- Perform TCB/bilirubin day after discharge for jaundice needing Phototherapy. This can be done via VMS; it is not mandatory for such infants who are feeding well to remain in hospital for this monitoring.
- **Physiological jaundice may be monitored by parents/VMS at home. Perform bilirubin as needed.**
- Haemolytic jaundice (e.g. Rh or ABO incompatibility) is more likely to 'rebound', has more prolonged course and on occasion may result in anaemia in the weeks after discharge.

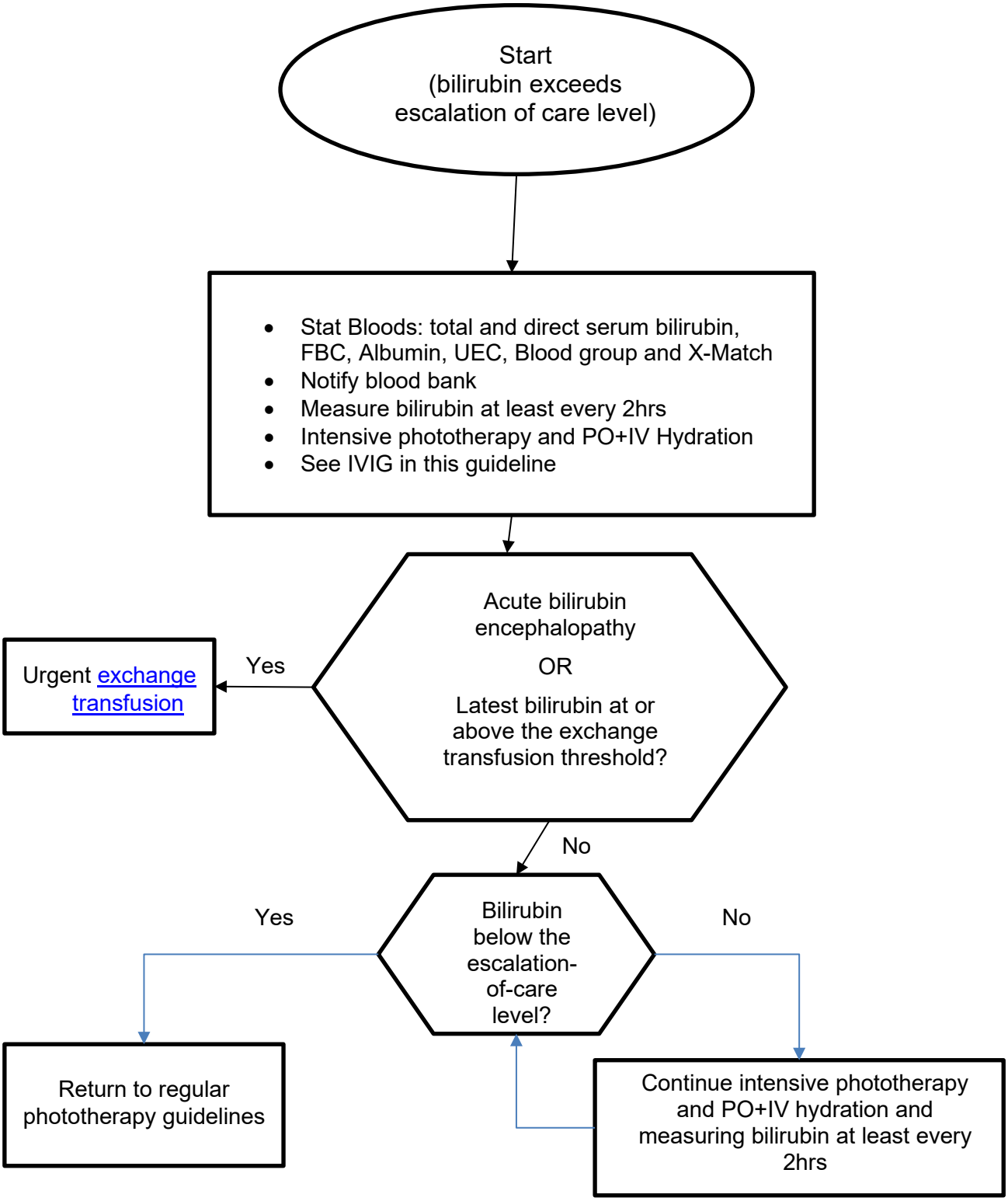
Appendix 2: Approach to identify newborns with maternal anti-erythrocyte antibodies to guide early management

(Adapted from Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation)[2]



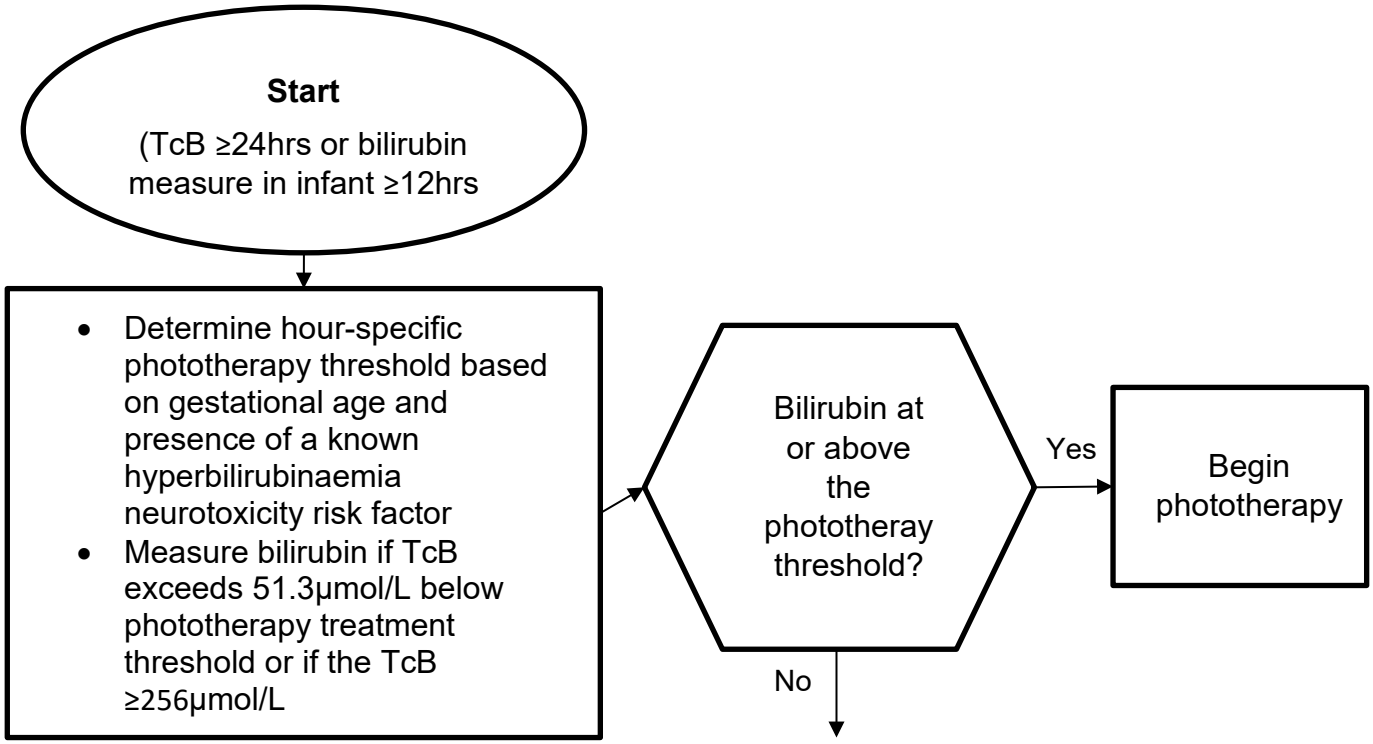
Appendix 3. Approach to escalation of care.

The escalation -of-care threshold is 34 µmol/L below the exchange transfusion threshold. Adapted from "Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation"[2]



Appendix 4: Guide to determine post-discharge follow-up for infants who have not received phototherapy.

Adapted from Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation[2]



Phototherapy threshold minus TcB or bilirubin		Discharge Recommendations
1.7 - 33µmol/L	Age <24hrs	Delay discharge, consider phototherapy, measure bilirubin in 4 – 8 hrs
	Age ≥24hrs	Measure bilirubin in 4 – 24hrs Options: • Delay discharge and consider phototherapy • Discharge without phototherapy but with close follow-up
34 - 58µmol/L	Regardless of age or discharge time	Bilirubin in 4 to 24hrs
60 - 92µmol/L	Regardless of age or discharge time	Bilirubin or TcB in 1 - 2days
94 - 118µmol/L	Discharging <72hrs	Follow-up within 2 days; TcB or bilirubin according to clinical judgement
	Discharging ≥72hrs	Clinical judgement
≥120µmol/L	Discharging <72hrs	Follow-up within 3 days; TcB or bilirubin according to clinical judgement
	Discharging ≥72hrs	Clinical judgement

Appendix 5: JM-105 Jaundice Meter Instructions for use.

The **JM-105 Jaundice meter** is an easy to use, non-invasive transcutaneous bilirubinometer (TcB) which estimates relative bilirubin in the newborn. The JM-105 provides a visual digital display which assists in screening for hyperbilirubinaemia. It does not replace serum bilirubin measurements.

Inclusion criteria include:

- Infants with visible jaundice and no set-up for sepsis
- ≥ 35weeks
- > 24hrs of age
- ≥ 2000gm
- phototherapy has not been commenced

Guidelines for use:

- Jaundice <24hrs of age:
  - Perform bilirubin – see jaundice policy for additional investigations
- Jaundice >24 hours of age plus risk factors (maternal antibiotics: history of G6PD)
  - Perform bilirubin - see jaundice policy for additional investigations
- Jaundice 24-48 hours of age in a well infant with no risk factors
  - If TcB > 140µmol/L – Perform bilirubin
- Jaundice 48-72 hours of age in a well infant no risk factors
  - If TcB > 200µmol/L – Perform bilirubin
- Jaundice >72hours of age with no risk factors
  - If TcB > 260µmol/L – Perform bilirubin

Preparation for use:

Perform the **Daily** Operational Checkout Procedure.

1. Remove the Jaundice Meter JM-105 from the docking station.
2. Press the power switch on.
3. Select Menu
4. Select CHECKER and touch OK to save selection.
5. Open the checker lid on the charging unit.

a. When the green READY light illuminates, place the tip of the JM-105 perpendicular on the reading checker circle down until you hear a click.
b. The display screen shows the “L” (long), “S” (short), and Delta values. The meter must read within the reference values posted under the checker lid. If so, the unit is ready to use.
c. If not, clean the tip of the probe with an alcohol swab and repeat step (a)
d. If values are still out of range, do not use. Leave faulty device on bench in Storeroom and inform Equipment Nurse.

Performing a measurement:

- Press the power switch on
- Select MENU
- Select MEASURE
- Press OK
- The letters AVE with the number of measurements selected will appear
- Place the Jaundice Meter JM-105 probe tip directly flat against the baby’s forehead
- Press lightly until you hear a click
- Lift the Jaundice Meter JM-105 from the skin between measurements and pause until the green READY light illuminates again
- Repeat the testing procedure until the three required number of measurements have been taken
- If the measured value is out of the measuring range (0-340µmol/L), a blinking value appears
- Clean probe tip with alcohol swab
- Return device to docking station
- Note: after one minute the screen goes blank but the power remains on

Error messages

ERROR	CAUSE	ACTION
ERROR01	Measured value is abnormal	Repeat the measurement
ERROR03	RAM error	Switch off and do not use
ERROR03 ERROR04 ERROR05	Averaging failure Hardware failure	Switch OFF power Wait 10s Switch ON
ERROR04	Memory error	Switch off device and do not use
ERROR05	Insufficient charge Circuit error	Charge the device If failure continues, switch off and do not use
ERROR06	Calibration data error	Switch off the device and do not use