NEONATAL GUIDELINES

Postnatal Haematology and Jaundice Guidelines

Version 2018.4.1

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Neonatal jaundice

Introduction:

Jaundice is caused by increased haem breakdown (haemolysis), interference with hepatic conjugation (e.g. hepatitis), or impairment of bile excretion (e.g. biliary atresia). Jaundice can, therefore, be either unconjugated or conjugated depending on its cause.

Jaundice can also be categorised according to timing:

Early <24 hours old - Requires immediate investigation and treatment to rule out haemolytic disease.
Prolonged >14 days in term babies >21 days in pre-term babies – Requires further investigation to look for an underlying cause.

Unconjugated Hyperbilirubinaemia

It is normal or "physiological" for babies to have mild unconjugated hyperbilirubinaemia. 60 – 70% of babies develop neonatal jaundice. But only a small number will require treatment. Neonates are prone to developing jaundice due to several reasons as stated below:

1. At birth there is a greater RBC load which leads to higher turnover.
2. Poor maturation of the hepatic enzymes, especially UGT.
3. Suboptimal feeding in the first few days of life can lead to dehydration and increase the enterohepatic circulation. Presence of β glucuronidase in breast milk can also increase the breakdown of conjugated to unconjugated bilirubin in the gut in breastfed babies.
4. Blood supply to the liver is reduced during the first week of life due to time needed to establish the hepatic arterial supply and open patent ductus arteriosus.
5. Colonic bacterial flora may not be well established.

Unconjugated jaundice is not always harmless. High levels of unconjugated bilirubin, which is lipid soluble and easily crosses the blood brain barrier, can cause acute bilirubin encephalopathy: lethargy, hypotonia and poor suck followed by irritability and hypertonia in association with fever and high-pitched cry. Left untreated, this may be fatal or lead to high frequency deafness, choreo- athetoid cerebral

palsy and severe learning problems. Kernicterus is the name given to the yellow staining of the basal ganglia found at post- mortem in bilirubin toxicity.

The level of bilirubin required to cause encephalopathy varies with gestational age and can also be affected by acidosis and hypoxia which displace bound bilirubin from albumin. Hypoalbuminaemia will also result in more free bilirubin which is able to cross the blood brain barrier. These factors should be taken into account when assessing jaundice.

Early recognition of jaundice and any associated risk factors and appropriate management with phototherapy and exchange transfusion (if indicated) should mean that kernicterus never happens.

How to look for jaundice (visual inspection):

- check the naked baby in bright and preferably natural light
- examine the sclerae and gums, and press lightly on the skin to check for signs of jaundice in 'blanched' skin.

Conjugated Jaundice

Conjugated hyperbilirubinaemia occurs in diseases where the flow of conjugated bilirubin into bile or the flow of bile into the intestine is impaired. It suggests a hepatobiliary problem. It is much less common than unconjugated hyperbilirubinaemia in neonates but it is vital to recognise conjugated hyperbilirubinaemia as it may indicate a serious underlying cause such as biliary atresia which requires surgical intervention within the first 8 weeks of life to be a success.

The conjugated fraction of bilirubin must always be requested in cases of prolonged jaundice and should be considered earlier than this if the clinical picture is suggestive of conjugated jaundice.

Jaundice – Causes and Risk Factors

Identifying babies more likely to develop significant hyperbilirubinaemia

1. Gestational age under 38 weeks
2. A previous sibling with neonatal jaundice requiring phototherapy
3. Known maternal antibodies (eg anti-C antibodies) – see Management of the baby with suspected haemolytic disease
4. Visible jaundice in the first 24 hours of life.
5. Mother's intention to breastfeed exclusively. Breast feeding in presence of co morbidities like dehydration, marked bruising, haemolytic disease and infection increases risk.
6. Significant bruising / cephalhaematoma Male sex
7. Ethnic minority population

Risk factors for developing kernicterus

a. Serum bilirubin > 340micromole/L in term babies.

b. Rapidly rising bilirubin of > 8.5micromole/L/hour.

c. Clinical features of bilirubin encephalopathy.

In the well term infant, problems are rarely seen below **340 micromol/l**.

Risk is significantly high above **510 micromol/L**. High dose lipid preparations can displace bilirubin from albumin and increase toxicity. This needs to be kept in mind in preterm babies on total parenteral nutrition (TPN) and lipid preparations.

In preterm babies the threshold for damage from bilirubin could be as low as **240 µmol/L.** Always plot the SBR on a NICE treatment graph corresponding with the baby's gestational age at birth.

Identification of Pathological Jaundice

- Visible in first 24 hours (suggests haemolysis and needs urgent investigation and treatment)
- Jaundice in presence of risk factors.
- Baby is "unwell"
- Total bilirubin >340 mmol/l (term infants) OR Above exchange transfusion line on the NICE

jaundice chart

- Rapid rate of rise of bilirubin. The risk is much higher if the increase in serum bilirubin is >8.5micromol/L/hour and this warrants an exchange transfusion.

Conjugated hyperbilirubinemia

- Serum conjugated bilirubin concentration of greater than 25 micromol/L OR
- more than 20% of the total bilirubin if the total bilirubin is >85micromol/L

Prolonged jaundice

- 14 days in term babies
- 21 days in preterm babies
- Jaundice which recurs having cleared

Causes of Unconjugated Hyperbilirubinaemia

a. Physiological Jaundice

b. Acute intravascular haemolysis

- Haemolytic disease e.g. Rhesus, ABO, Kell
- Red cell abnormalities e.g. G6PD, hereditary spherocytosis
- Viral infections e.g. CMV, Herpes, Toxoplasmosis
- Bacterial infection e.g. sepsis or urinary infection

c. Sequestered blood

- Excessive bruising, cephalhaematoma
- Intraventricular haemorrhage
- Haemangioma

d. Decreased conjugation

- Sepsis
- Criglar-Najjar syndrome (deficiency of glucuronyl transferase enzyme)

e. Increased enterohepatic circulation due to decreased gut movement

- Delayed feeding
- Constipation or bowel obstruction

f. Breast milk jaundice

Causes of CONJUGATED Hyperbilirubinaemia

a. Neonatal hepatitis

- Hepatitis A, B or C
- Other viral hepatitis
- Congenital viral infections: rubella, CMV, Herpes
- Galactosaemia

b. Other causes of conjugated hyperbilirubinaemia:

- Cystic fibrosis
- Endocrine causes (hypothyroidism, hypopituitarism)
- Prolonged TPN
- Biliary atresia
- Alagille syndrome
- Choledocal cyst
- α 1 antitrypsin deficiency
- Inspissated bile syndrome
- Inborn errors of metabolism

How to Investigate a Jaundiced Baby

This part of the guideline refers to the investigation of a baby who is noted to be jaundiced in the first 2 weeks of life. For the investigation of prolonged jaundice see the separate section on Prolonged Jaundice.

Beware of underestimating jaundice on visual inspection.

- Research has shown that the degree of jaundice estimated by health professionals on inspection does not correlate with serum bilirubin. It is easy to underestimate the level of bilirubin in the blood based on how yellow the baby appears.
- In particular be aware of the risk of underestimating jaundice in Asian or Afro- Caribbean infants.
- Pre-term infants often need treatment when little jaundice is visible.
- Also, beware the baby who has been under phototherapy; the skin may look clear but the blood or tissue bilirubin could still be high.

If a child is visually jaundiced:

For babies <24 hours old:

- Send lab serum bilirubin urgently and plot result on a NICE jaundice treatment chart.
- Start single phototherapy as a precaution whilst awaiting SBR result. This can be stopped if the SBR turns out to be below the phototherapy line.
- If <24 hours old also send FBC, blood film, group and DCT to look for haemolysis/ABO/Rhesus incompatibility and consider a septic screen if risk factors or features of sepsis.

For babies >24 hours old:

- Check bilirubin using a transcutaneous bilirubinometer if available.
- Plot TcBili result on a NICE jaundice treatment chart.
- Send a serum bilirubin to the lab and start single phototherapy in the meantime if:
    - TcB measures Bili > 250
    - TcB is below the treatment line but within 50micromol/L of the line
    - TcB high enough to require phototherapy send an SBR

- No TcBili available

- If SBR confirms jaundice requiring treatment, send a blood film, blood group and DCT with the next set of bloods to rule out haemolysis.
- Only request a split bilirubin (for conjugated fraction) if there are risk factors for conjugated hyperbilirubinaemia e.g. pale stools, dark urine, prolonged jaundice, features of congenital infection.
- NICE Treatment Charts*

*These are available on Sharepoint

- **Ensure you have selected the right graph** for the baby's gestational age at birth. Continue to use this graph. It is not necessary to change graphs when the baby's corrected gestational age changes.
- Print a copy of the graph, plot the bilirubin against age in hours/days and place it in the baby's notes.

Additional investigations as suggested by history/examination

- FBC and film and reticulocyte count – to look for evidence of haemolysis
- Group and DCT - to look for evidence of rhesus/ABO incompatibility and haemolysis
- U+E if history or examination suggests dehydration or if SBR very high
- Septic screen
- Split bilirubin for conjugated fraction
- Liver function tests, including coagulation screen
- G6PDH screen
- TFTs
- Cranial USS to rule out intracranial haemorrhage

Management of Unconjugated Hyperbilirubinaemia

Phototherapy is the main treatment for unconjugated jaundice. Phototherapy converts bilirubin to a soluble form allowing its renal excretion

Indications for phototherapy

- Phototherapy should be started in any baby whose serum or transcutaneous bilirubin plots above the treatment line on the NICE jaundice treatment chart (available on Sharepoint and via Google) or if the TCB is >250 or within 50micromol/L of the treatment line. NB Phototherapy started on the basis of a TCB can be stopped again if the SBR is below the treatment line.
- Remember, to ensure you have the correct chart for the baby's gestation.
- If the infant is sick (e.g. HIE, hypoxia, acidosis, hypoglycaemia, infection) lower thresholds for treatment are necessary.
- If the infant has suspected haemolysis, phototherapy should be started immediately and exchange level is dependent on the rate of rise rather than absolute level - see Management of the Baby with Suspected Haemolytic Disease.

How to Start Phototherapy

A. If serum bilirubin is above the treatment line and but more than 50 micromol/L below the threshold for exchange transfusion start single phototherapy.

1. Short breaks of up to 30 minutes for breast feeding can be allowed. Use clinical judgement.
2. Repeat serum bilirubin* 4-6 hours after starting phototherapy. Then every 6- 12 hours if level stable or falling.
3. Switch to continuous multiple phototherapy if level is not stable or falling. Monitor hydration by daily weighing of babies and checking for wet nappies.

B. If serum bilirubin less than 50 micromol/L below the threshold for exchange transfusion or if haemolytic disease of the newborn is suspected:

- Start continuous multiple phototherapy
- Admit to NICU. Inform consultant if SBR is above the exchange line
- Do not interrupt phototherapy for feeding. IV or NGT enteral feeding can continue. Monitor hydration.

- Repeat serum bilirubin* 4-6 hours after starting phototherapy. Then every 6-12 hours if level stable or falling or every 4 hours if it continues torise.
- If the SBR continues to rise despite multiple phototherapy calculate rate of rise and consider exchange transfusion if >8.4micromol/hour. Give IV immunoglobulin to bind bilirubin whilst exchange transfusion is being arranged. (See Management of the Infant with Suspected Haemolytic Disease and Exchange Transfusion Protocol).

*Once phototherapy has been started the transcutaneous bilirubinometer is no longer accurate and should not be used. Serum samples must be sent.

Types of Phototherapy

- Overhead lights
  - These are generally the first choice on NICU and are also available on the postnatal ward.
  - Additional overhead lights can be added to increase the level of phototherapy delivered.
  - Babies can get cold under overhead lights and may need to be in an incubator to maintain their temperature.
- NeoBLUE Cozy Phototherapy Bed
  - Available on the postnatal ward and NICU.
  - This is a mattress which delivers phototherapy and allows the baby to be covered with a blanket whilst undergoing treatment.
  - Only delivers single phototherapy but can be used in conjunction with overhead lights to deliver multiple phototherapy

Measuring spectral irradiance to ensure adequate phototherapy:

Spectroradiometers can be used to measure the spectral irradiance of the phototherapy units at several sites on the infant's body surface. The recommended spectral irradiance for intensive phototherapy is 30 $\mu W/cm^2/nm$. Ideally 80% of the body surface of the infant should receive this amount of phototherapy. Anticipated decreases in serum total bilirubin are 34
µmol/L/hour (2mg/dL/hour). This is not routinely carried out in hospitals across UK. It would be a practice that can be adopted over time at Singleton Hospital once appropriate equipment is available.

Caring for a baby receiving phototherapy

- Ensure as much skin exposure as possible. Lay on an open nappy. Remove hat.
- Ensure the eyes are covered with appropriate phototherapy eye protection.
- If using overhead lights, the baby will probably need an incubator or overhead heater to keep warm. The temperature should be measured 4-hourly.
- Phototherapy itself does not increase fluid requirements; however dehydrated babies often have more severe jaundice and an assessment of feeding and hydration should be made. If the SBR is particularly high or is not reducing despite phototherapy send U+Es and consider NG top ups.

When to Stop Phototherapy

- Stop phototherapy once serum bilirubin has fallen to a level at least 50 micromol/litre below the treatment line.
- Check rebound bilirubin 12-18 hours after stopping phototherapy. Babies do not necessarily remain in hospital for this. However, if further phototherapy is required after discharge the baby would need admission to Morriston.

Prior to Discharge

Be aware that the following babies are at risk of ongoing jaundice:

- Near term, i.e. GA 35 – 36/40 at birth
- Cephalhaematoma / bruising
- Exclusively breast fed
- Already received phototherapy on PNW
- Sibling with history of neonatal jaundice requiring phototherapy
- Presence of pathological jaundice, e.g. haemolytic

Ensure that the baby is feeding adequately prior to discharge.

The community midwives will follow babies up at home. In ABMU they carry a transcutaneous bilirubinometer for use on babies who have not already received phototherapy.

For babies who have been under phototherapy, where there is concern about ongoing/worsening jaundice, the midwife will arrange for serum bilirubin to be checked. Kindly liaise with community midwife for any baby who needs continued monitoring in community.

Management of Infants Incidentally Detected to Have Extremely High Bilirubin (Over or Near the Exchange Transfusion Line)

Although the risk of extremely high bilirubin can be antenatally predicted in infants where there is a known risk of haemolytic disease of the newborn, some babies will unexpectedly develop hyperbilirubinaemia, which puts them at risk of kernicterus.

If a baby is found to have a bilirubin level that is near or above the exchange transfusion line:

- Inform the parents of the need for immediate treatment and close monitoring.
- Admit to NICU and start multiple, continuous phototherapy – Inform consultant iflevel above exchange transfusion line.
- Take a full history including: age at onset of jaundice, feeding, stools, maternal blood group and antenatal concerns.
- Assess for CNS signs, signs of sepsis, hepatosplenomegaly, pallor.
- Send urgent FBC and blood film, DCT & Group, U+E, Bone profile, LFT, blood gas and PCX glucose.
    - If DCT shows evidence of haemolytic disease of the newborn refer to Management of the Infant with Suspected Haemolytic Disease.
- Undertake a full septic screen and start intravenous antibiotics.
- Ensure adequate hydration, either enteral + parenteral
    - Keep nil by mouth if plan to perform exchange transfusion, or baby unwell.
- Inform blood bank that blood may be required for an exchange transfusion.
- Insert lines in preparation for possible exchange transfusion (UVC/UAC).
- Monitor SBR 2-4 hourly initially until SBR seen to be falling then 6-8hourly.
- If SBR does not fall or continues to rise, discuss with consultant, give intra venous immunoglobulin (IVIG) and perform exchange transfusion (see Haemolytic Disease of the Newborn and Exchange Transfusion protocols).

Management of the Infant with Suspected Haemolytic Disease or who Develops Jaundice in the First 24 hours

Haemolytic disease of the newborn (HDN) is the pathological break down of red blood cells as a result of maternal antibodies in the baby's bloodstream. It should be suspected if the mother is known to have blood group antibodies. Most commonly these are Rhesus antibodies but anti-c, C, e, E or Kell antibodies (and others) can also cause HDN. A prediction of the likely degree of HDN can be made by the haematologists.

Treatment with intrauterine transfusion (IUT) is available. Babies who have received this may not require exchange transfusion but will usually continue to have haemolytic anaemia and therefore require follow up (see section on Late Anaemia).

Any baby who has received an IUT must have irradiated blood for any transfusion during the first year of life to avoid GVHD.

In the absence of antenatally detected antibodies, consider HDN in:

- Babies who are jaundiced within the first 24 hours
- Infants of mothers who have had a previously affected infant (Rhesus disease worsens in subsequent pregnancies)
- Babies who are anaemic or hydropic at birth

If you are made aware of a high risk foetus, inform blood bank as soon as possible so that they can cross-match blood against the mother's serum and have blood available for the infant at short notice.
Blood used for exchange transfusion is of a lower PCV than packs for ordinary transfusions. It needs to be specially prepared and has a shorter shelf life.

<u>In Babies Born to Mothers with Antenatally Detected Antibodies</u>

If the prediction is for moderate or high-risk of haemolytic disease:

- Fresh blood suitable for exchange transfusion should be ordered and delivery of the baby should not take place until this blood is ready in blood bank at Singleton Hospital except in extreme emergency.

- The neonatal team should be made aware of imminent delivery
- Neonatal consultant on-call should be informed prior to the baby's birth, or as soon as the team becomes aware of the baby's birth
- Send urgent cord bloods as listed below and chase ASAP
- Admit the baby to SCBU and start prophylactic multiple phototherapy If the

prediction is of mild HDN:

- The neonatal team should be made aware of imminent delivery
- Neonatal consultant on-call should be informed prior to the baby's birth, or as soon as the team becomes aware of the baby's birth
- Send urgent cord bloods as listed below and chase asap
- Prophylactic phototherapy should be started on postnatal ward

What to do in the first 24 hours At

delivery:

- Resuscitation as required
- Examine the baby for anaemia, signs of heart failure, oedema and hepatosplenomegaly Send cord

blood urgently for:

- Hb and blood film
- DCT
- Blood group (+ cross-matched if indicated)
- Serum bilirubin
- Clotting screen

NB. Cord bloods are not as accurate as a serum sample from the baby. Use these as an indicator but send a repeat set (preferably venous) from the baby as soon as possible within the first 2 hours of life.

Start prophylactic multiple phototherapy immediately

If a Baby is Found to be Jaundiced within the First 24 Hours of Life

- Always consider HDN as a possible cause so carry out the same investigations as those listed above and commence phototherapy.
- Also send a partial septic screen and start antibiotics as jaundice at <24 hours may be caused by infection and this must not be missed.

Hb at Birth (or within first 24 hours) <120g/Lor SBR on or above phototherapy line

- The baby is at high risk of requiring an early exchange transfusion.
- If initially admitted to PNW, transfer to NICU
- Continue multiple phototherapy, and discuss with the on call consultant as a matter of urgency.
- Consider giving IV immunoglobulin whilst preparing the exchange

Hb at Birth (or within the first 24 hours) >120g/L or SBR below phototherapy line

- Continue double phototherapy making sure the baby is as fully exposed as possible (no hats or nappies!).
- Check SBR 4-6 hourly in the first 24 – 48 hours, and calculate the rate of rise. (The baby may still need an exchange transfusion.)
- If rate of rise is >8.4micromol/L/hour or there is a rapid drop in Hb this is an indication for exchange transfusion.

Use of Intravenous immunoglobulin (IVIG)

Acts to bind unconjugated bilirubin preventing it crossing the blood brain barrier. Recommended for:

- Babies on multiple phototherapy whose bilirubin levels remain above the threshold for exchange transfusion and/or have signs of acute bilirubin encephalopathy while preparing for exchange transfusion.
- Babies with haemolytic disease if serum bilirubin level rises >8.5 micromole/L/hour. Dosage recommended: 500 mg/kg over 4 hours.

LATE ANAEMIA in babies with haemolytic disease of the newborn

All babies with HDN (even mild cases) can have ongoing haemolysis and are at risk of developing severe anaemia requiring top-up transfusions. Therefore:

- Check haemoglobin prior to discharge
- Babies with documented haemolysis or Coomb's test >2+ should be commenced on folic acid 500mcg/kg once daily
- Fill in the referral template on postnatal guidelines and give it to the neonatal secretaries on the same day and request consultant appointment for 6-8 weeks (If the baby has a discharge summary from the unit, this should be attached to the template).
- Organise blood tests in 2 weeks in OPD for FBC, film, reticulocyte count and bilirubin. Add to postnatal ward jobs list for bloods to be chased.
- Further follow up is decided based on these results.

Prolonged jaundice

Defined as jaundice persisting beyond 14 days in term and 21 days in preterm babies

It is vital to establish whether prolonged jaundice is unconjugated or conjugated as this will help direct investigations and further management.

All forms of prolonged jaundice should be investigated thoroughly as it may be an indicator of a serious underlying disease. In particular, conjugated jaundice must be investigated promptly as biliary atresia is a possible cause and its management is time sensitive. Surgery must take place within 8 weeks of birth to be successful.

Causes of Prolonged UNCONJUGATED Jaundice

A. Persistence of unconjugated jaundice from early neonatal period:

- Haemolytic jaundice (of any aetiology)
- Infection including UTI
- Breast milk jaundice – a diagnosis of exclusion only

B. Rare causes of unconjugated jaundice

- Inborn errors of metabolism (Galactosaemia, tyrosinaemia, lipid-storage disorders, and others)
- Hypothyroidism
- Drugs
- Crigler-Najjar
- Gilbert's
- Intestinal obstruction
- Cystic fibrosis

Causes of CONJUGATED Jaundice

a. Neonatal hepatitis

- Hepatitis A, B or C
- Other viral hepatitis
- Congenital viral infections: rubella, CMV, Herpes
- Galactosaemia

b. Other causes of conjugated hyperbilirubinaemia:

- Cystic fibrosis
- Endocrine causes (hypothyroidism, hypopituitarism)
- Prolonged TPN
- Biliary atresia
- Alagille syndrome
- Choledocal cyst
- ?1antitrypsin deficiency
- Inspissated bile syndrome
- Inborn errors of metabolism
- Many more

Prolonged CONJUGATED Jaundice

This is usually picked up from a serum split bilirubin but there may be a history of pale stools and dark urine. There are many causes of conjugated jaundice and this must be investigated thoroughly. In particular, biliary atresia must be ruled out early on as this requires surgical intervention within the first 8 weeks of life. Do base line bloods/urine and discuss with the consultant.

Investigation of prolonged jaundice

- History & examination to elicit cause.
- Look for pale, chalky stool or urine that stains the nappy dark.

Base line investigations:

- Split SBR (total and direct SBR- the direct SBR is the conjugated fraction)

  Further investigation is recommended in cases where serum conjugated bilirubin is greater than 25 micromol/L (definition by NICE guidance CG98)
- FBC. Group and DCT. Blood film.
- LFT & coagulation screen
- TFTs
- Urine culture, Septic screen if clinically indicated
- Urine for reducing substances

Further investigations in case of conjugated jaundice

- Hepatitis A, B and C
- Gal-1-put
- α 1 antitrypsin phenotype. (NB, since α 1 antitrypsin is an acute phase reactant, it may be raised in any intercurrent illness and may be normal even if there is a deficiency. Hence the need for the typing.)
- TORCH screen
- Serum amino acids and organic acids, and urine organic acids
- Urgent Liver USS (to exclude choledochal cyst, and look for signs of biliary atresia or neonatal hepatitis).
  - Baby should be NBM for at least 4 hours prior to the USS. If required intravenous fluids can be commenced.
  - If no gall bladder is visualised in the fasted USS there is a high risk of biliary atresia. With absent gall bladder or when there is a high degree of clinical suspicion discuss with radiologist and consider referral to specialised unit for further investigations.
- HIDA scan if no gall bladder seen on liver USS (radio-isotope scan of the liver to detect biliary atresia)

- X-ray spine (hemivertebra in Alagille syndrome)
- Eye examination (posterior embryotoxin)

Breast milk jaundice

- This is a diagnosis of exclusion. Excessive investigations may cause anxiety to parents, and lead mother to stop breast feeding. Jaundice is not a reason to stop breast-feeding but fluids may need to be increased.
- If the baby is well and is normal to examine, and has normally pigmented stools, check the baseline investigations (see above).
- If these are normal, no further investigations are needed unless the clinical picture changes or the jaundice clinically becomes darker, in which case, a further split SBR should be checked.
- If the jaundice does not resolve in a week, then the split SBR should again be repeated, but if it remains unconjugated and the baby is well, no further tests are needed.

Management will be based on the diagnosis suspected. The commonest causes are breast milk jaundice and jaundice associated with use of TPN in preterm babies and post-surgical babies. These mostly resolve spontaneously with supportive care. Stopping breast feeding is not recommended. A 24 hour break in breast feeding might benefit some babies. More serious conditions like biliary atresia will need surgical correction (Kasai procedure) within 8 weeks of life for optimum results and should be managed after discussion with specialist centres. Babies with neonatal cholestasis where the conjugated bilirubin fraction is greater than 50 umol/L will need additional supplements of fat soluble vitamins.

Option 1:
Dalivit 0.3 mls BD **OR** Abidec 0.3 mls BD orally Vitamin E 10mg/Kg OD orally
Vitamin K 1mg OD orally / intravenously Ursodeoxycholic acid 5-10 mg/Kg TDS orally

Option 2 (If medications in option 1 are not available):
Ketovite liquid 5 mls OD orally
Ketovite tablet 3 tab crushed along with Ketovite liquid Vitamin K 1 mg OD orally / intravenously
Ursodeoxycholic acid 5-10 mg/Kg TDS orally
In addition, for both options, consider Alfacalcidol 5-10 nanograms/kg/day if evidence of Vitamin D deficiency is confirmed. Calcium and phosphate levels need to be monitored.

NICE Parent Information Leaflet:

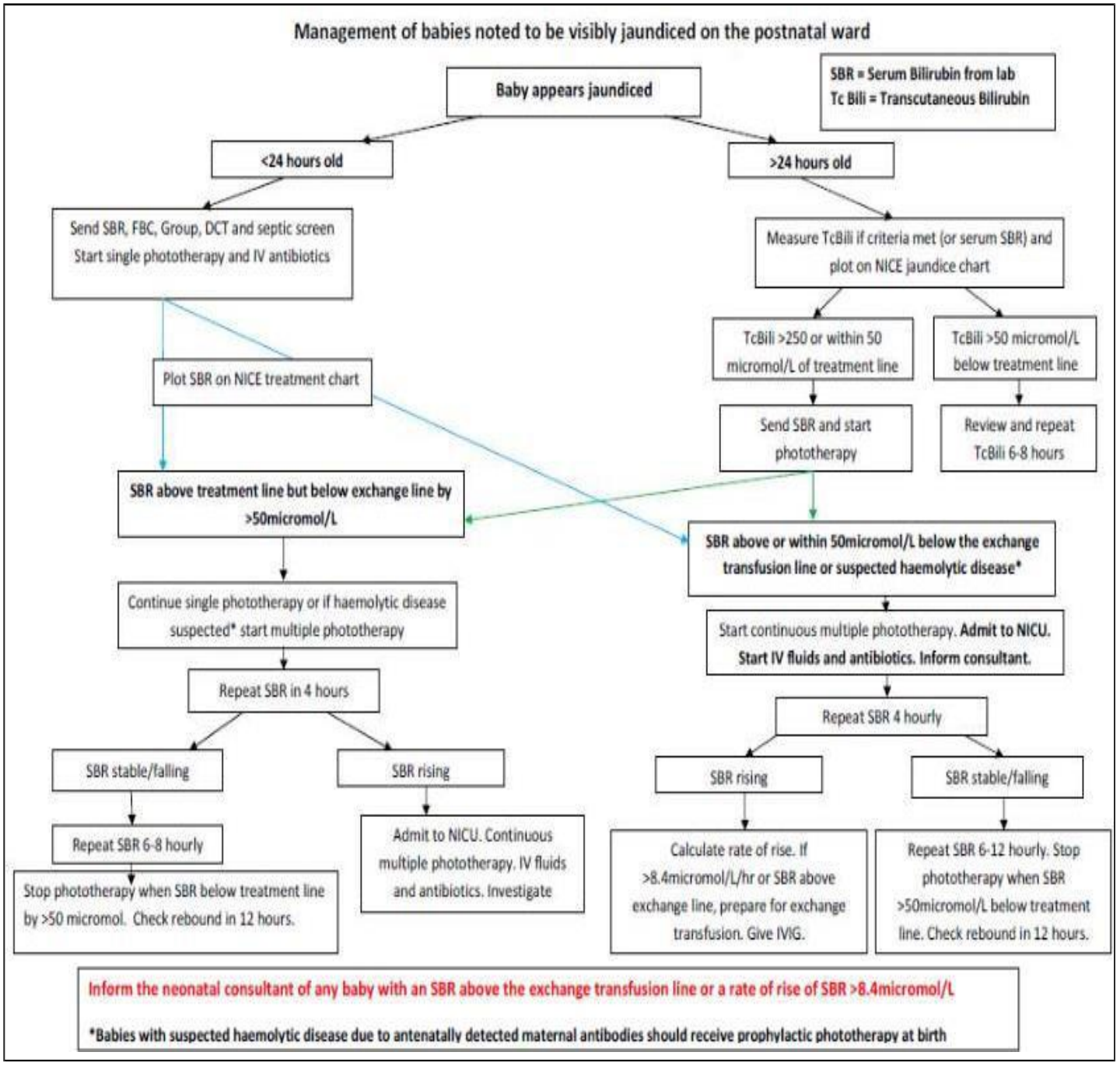
This is available at

https://www.nice.org.uk/guidance/cg98/resources/jaundice-in-newborn-babies-pdf-318006690757

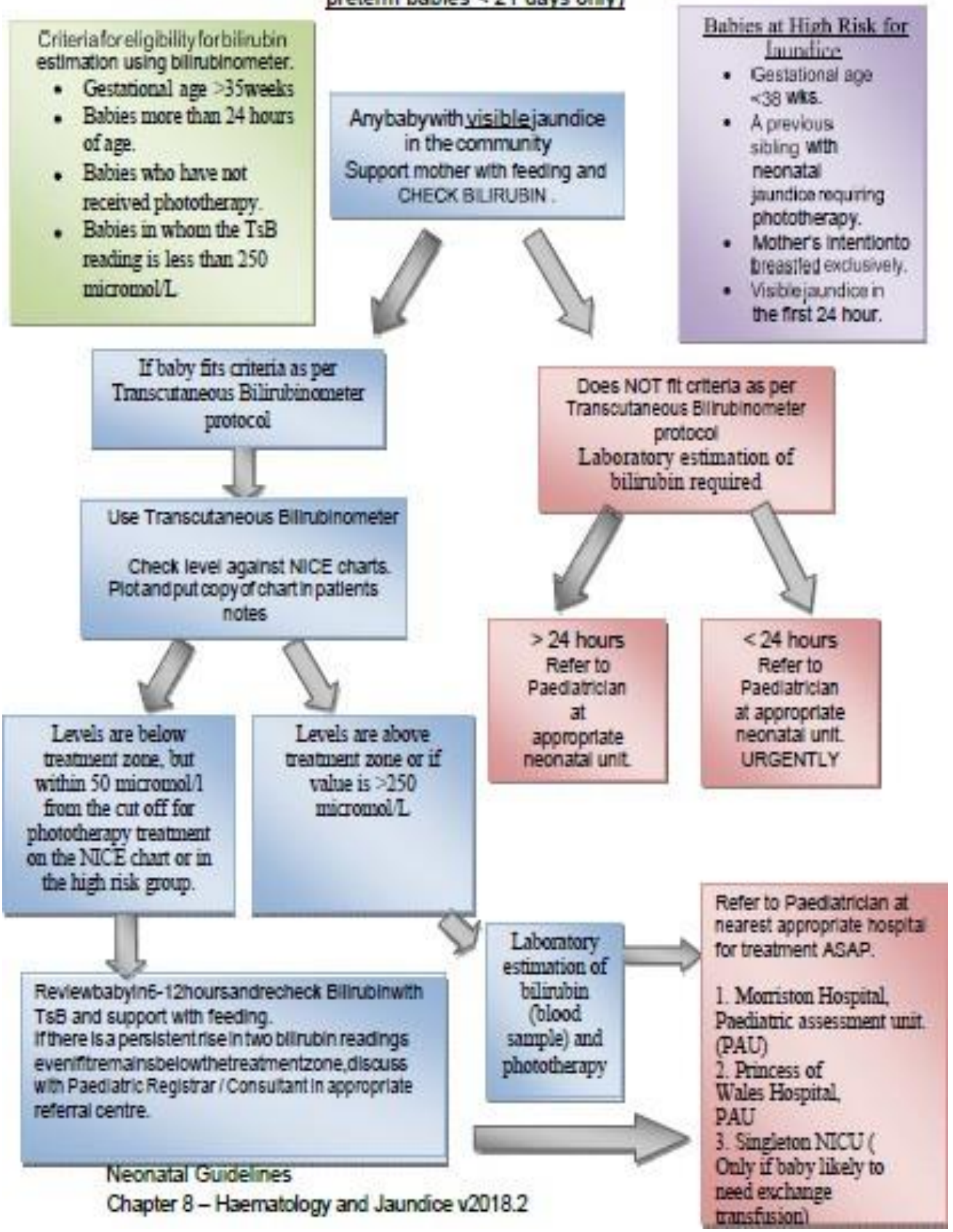
Further Reading:

1. NICE clinical guideline 98. Neonatal Jaundice. Issue date: May 2010
2. Janet M Rennie, Arvind Seghal, Ambelika De, Giles S Kendall and Tim J Cole. Range of UK practice regarding thresholds for phototherapy and exchange transfusion in neonatal hyperbilirubinaemia. *Arch. Dis. Child. Fetal Neonatal Ed.* published online 10 Nov 2008.
3. Subcommitte on Hyperbilirubinaemia, AAP. Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Pediatrics 2004. 114; (1):297-316.
4. Guidance on the Use of Routine Antenatal AntiD Prophylaxis for RhD Negative Women. NICE 2002.
5. British Committee for Standards in Haematology – Guidelines for the Use of Prophylactic Anti-D Immunoglobulin, 2004

Appendix 1: Jaundice management algorithm for postnatal ward



Appendix 2: Flow chart: Infants with visible jaundice in community within ABMU health board (To be used in term babies < 14 days and preterm babies < 21 days only)



Neonatal Guidelines
Chapter 8 – Haematology and Jaundice v2018.2

Guideline for the use of JM-105 (Dräger) transcutaneous bilirubinometer at Singleton Hospital.

Transcutaneous bilirubinometry is used for non invasive estimation of serum bilirubin in neonates. The gold standard for estimation of serum bilirubin is laboratory estimation of total serum bilirubin (TSB). The JM-105 provides measurement of transcutaneous bilirubin (TcB), identifying neonates who require a serum bilirubin measurement. This guideline is designed for using *JM-105 (Dräger) transcutaneous bilirubinometer* in the neonatal unit and postnatal ward in Singleton Hospital.

Who can use the bilirubinometer?
Currently in 2015 use is restricted to doctors and ANNPs in the neonatal team who have been trained in the use of the device. This could be later extended to nursing and midwifery staff with appropriate training.

Which babies are eligible to have their bilirubin levels assessed using transcutaneous bilirubinometer?

The JM-105 is appropriate for use on neonates who are:

1. ≥24 weeks gestational age at birth
2. less than 14 days of age. Above this age conjugated hyperbilirubinaemia should be ruled out by a blood test.
3. not undergoing phototherapy or have not undergone phototherapy or exchange transfusion.

A blood sample to estimate lab serum bilirubin should be sent for any baby who

1. is <24 hours of age with suspected jaundice.
2. has a TcB reading >250micromol/L.
3. has a TcB reading high enough to require phototherapy based on NICE treatment charts or is within 50micromols/L from phototherapy threshold. Phototherapy can be started following the high bilirubinometer reading, pending lab results.

Method of use
The bilirubinometer should be adequately charged. When not in use, it should be docked in the docking station. The doctor/ANNP using it should 'sign out' in the log book when taking it out of the docking station and 'sign in' when returning it. Daily pre-use checkout should be performed if the device is being used for the first time for the day. The result of the daily check should be documented in the record book available near the bilirubinometer.

Daily operational checkout procedure

1. Remove the JM-105 from the docking station.
2. Press the power switch on. This may come on automatically if its been recently used.
3. Select CHECKER and touch OK to save selection.
4. Open the checker lid on the charging unit.
5. When the green READY light illuminates, place the tip of the JM- 105 perpendicular on the reading checker circle. Press down until you hear a click.
6. The 'L' (long), 'S' (short), and Delta values must be within the reference values posted under the checker lid. If not, clean the tip and repeat. If values are still out of range, the device is out of calibration and should not be used. During 9 AM to 5 PM you can contact the medical physics team at Singleton Hospital to get a replacement pre charged bilirubinometer.
   Do not use a JM 105 bilirubinometer which has fa iled the calibration check.
7. Once every month the medical physics team will undertake a routine check on the JM 105 bilirubinometers. A routine calibration will be undertaken and the machine will be evaluated for any obvious faults. Any pending data from machine will be uploaded to limited access folder in ABMU shared drive by the medical physics team. The bilirubinometers will undergo a more detailed review & calibration every year by the Draeger team. The medical physics team will organize this. (Gary – bleep 5732 OR phone – 35750 or 35178)

Disinfecting the Bilirubinometer

The JM-105 bilirubinometer must be cleaned properly before and after each use. Prior to use in NICU wipe the machine clean using a medical instrument detergent (eg: Tuffie wipes) and then wipe clean using a gauze piece. Use 70% alcohol solution (Sani- Cloth 70)
to clean the measuring tip of the JM 105 bilirubinometer and make sure the meter is dry of disinfection solution before use. Do not disassemble the device for cleaning. Wipe exterior surfaces only. Do no autoclave. Do not use any steam cleaning device.

The JM-105 can also be disinfected if soiled with blood or body fluids with the following solutions, however if disinfection is required, after application, wipe the device down again with a gauze piece to remove any residual disinfectant.

Approved Disinfection Solutions

- Actichlor by Ecolab (This solution is available in Singleton NICU)
- Periodox RTU by Bio Med Protect
- Oxycide by ECOLAB
- Klorsept 17 by Medentech
- Dismozon pur by BODE Chemie

Skin preparation:

Wash your hands. Use alcohol gel. Use non sterile gloves.

In babies admitted to the neonatal unit prepare a small area of skin over the sternum using appropriate skin disinfection agent. Skin cleansing swab with 70% isopropyl alcohol can be used to gently wipe area clean. Allow alcohol to dry before measurement. Use an area with unbroken skin only for measurement.

In term babies being tested outside the NICU in the postnatal ward the JM 105 should be disinfected as above before and after use. Skin preparation in term babies in postnatal ward and can be used with discretion by the operator. Use over unbroken skin only.

JM 105 devices being used in the postnatal ward should not be used to test babies in the NICU. Please use devices designated for NICU only for checking babies in NICU.

Polycythaemia (PCT)

Polycythaemia can be defined as a central venous haematocrit (Hct) >65% for both term and preterm infants.

Causes / risk factors for PCT include IUGR, maternal diabetes, maternal hypertension, maternal smoking, delayed cord clamping, cord stripping, twin-twin transfusion, maternal-fetal transfusion, Beckwith-Wiedeman syndrome, hypo- and hyperthyroidism, perinatal asphyxia and trisomies.

When dealing with an infant with PCT always consider whether the cause needs investigation +/- treatment

Symptoms:

Not present at birth, but usually become evident within first 24 to 48 hours.

They include lethargy, hypotonia, vomiting, irritability, poor response to light, tremulousness.

Complications:

Neurological:

- Seizures
- Stroke
- Developmental delay
- Reduced IQ

Cardiopulmonary:

- Respiratory distress
- Pleural effusions
- Pulmonary hypertension

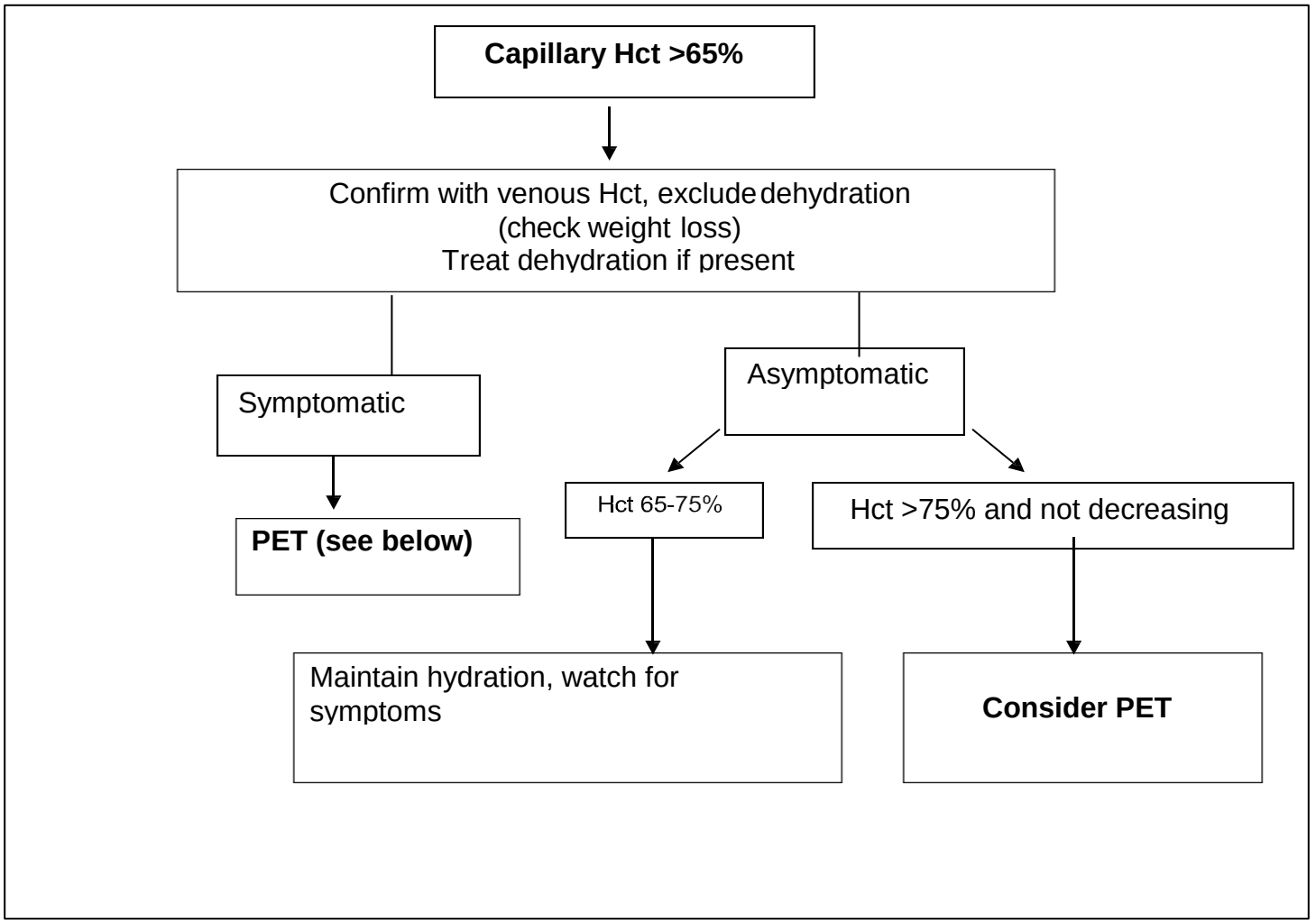
Metabolic:

- Hypoglycaemia
- Hypocalcaemia

Others:

- Necrotising enterocolitis
- Renal vein thrombosis
- Proteinuria, renal tubular damage
- Hyperbilirubinaemia
- Thrombocytopenia

Treatment:
Always discuss with consultant before treating



Technique for Partial Exchange Transfusion (PET)

Fluid: Normal saline

Volume: 20 ml per kg

Infuse saline by peripheral cannula at rate of 40 ml/kg/hour and withdraw 20 ml/kg of blood from the umbilical venous cannula at the same rate. Aim to complete exchange over 30 minutes. Do not allow the infant to get cold, and check blood glucose after the procedure. Stop feeds for 2-4 hours.

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