

Clinical Guideline/Standard Operating Procedure for the use of Transcutaneous Bilirubinometers in Neonatal and Maternity Services

For use in:	Maternity / Women and Children's / Community Midwifery
By:	Registered Midwives, Senior Maternity Care Assistants, Transitional Care Nursery Nurses
For:	Babies ≥ 35 weeks gestation and over 24 hours of age being cared for in maternity services
Division responsible for document:	Women and Children
Key words:	Jaundice, Transcutaneous, Neonate, Transcutaneous Bilirubinometer, TCB
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If Yes - does the strategy/policy deviate from the recommendations of NICE?	No

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If so why?	
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Version and Document Control:

Version Number	Date of Update	Change Description	Author
2.1	24/04/2020	No clinical changes to document, but due to Covid-19 a short review date has been given to allow for a thorough review of document in the future.	Dr S Mulla and Dr R Roy
2.2	17/06/2020	Thresholds changed. TCB charts have been created using the NICE phototherapy charts by gestational age.	D. Walker RM G. Richards IFC Dr R Roy
3	19/06/2020	Flowcharts tidied, footers amended	Gayle Richards
4	28/04/2022	Updated Quick reference flowcharts to adjust Yellow Zone procedure in line with NICE guidance and include clinical assessment. Update to scope to include babies who have previously been treated with phototherapy. Thresholds changed for >38 weeks to be in-line with NICE. Risk factors for neonatal jaundice added. Change from taking highest reading to average of 3 readings.	Sophie Morris

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Definitions of Terms Used / Glossary

Transcutaneous Bilirubinometer	TCB
Serum bilirubin level	SBR
Children's Assessment Unit	CAU
Advanced Neonatal Nurse Practitioner	ANNP
Senior House Officer	SHO
Dräger Jaundice Meter	JM-105

Quick Reference for Neonates requiring TCB for both Maternity Inpatient and in Community Midwifery Setting:

Ensure daily check of Dräger Jaundice Meter (JM-105) has been done, passed and recorded before proceeding with test.

Quick Reference for Neonates requiring subsequent TCB for both Maternity Inpatient and in Community Midwifery Setting:

Ensure daily check of Dräger Jaundice Meter (JM-105) has been done, passed and recorded before proceeding with test.

Objective of Guideline

Aim: To guide the usage of transcutaneous bilirubinometer (TCB) JM-105 as a screening tool for measuring the bilirubin levels in visibly jaundiced well babies ≥ 35 weeks gestation to determine the need for a Gas Bilirubin / laboratory serum bilirubin

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(SBR).

- a. Reduce the need for invasive and painful blood sampling for determining bilirubin level.
- b. Reduce parental anxiety with invasive blood sampling in well babies.
- c. Reduce waiting time for parents.
- d. Aid in referral to CAU as appropriate
- e. Reduce the inconvenience to families arising from the potentially avoidable return visits to hospital.

Rationale for the recommendations

Approximately 60% of term and 80% of preterm babies develop jaundice in the first week of life, and about 10% of breastfed babies are still jaundiced at 1 month of age. In most babies early jaundice is harmless. However, a few babies will develop very high levels of bilirubin, which can be harmful if not treated.

In order to determine the level of jaundice in babies, bilirubin level is currently checked by doctors, ANNP's, midwives and nurses by taking blood via heel prick or venepuncture and then sending it to the laboratory. The transcutaneous bilirubinometer (TCB) is a device, which measures the yellowness of the subcutaneous tissue by a non-invasive method. This method has been recommended by the national guidelines¹ and followed by several regional units in UK. It is a very useful tool to estimate the level of bilirubin in babies at risk or just as part of screening. However, the gold standard method remains laboratory estimation of serum bilirubin level.²

What is the benefit of using TCB?

- It significantly reduces the number of invasive blood sampling thus reducing workload of clinical staff and laboratory and numbers of babies/families needing to return to hospital.
- More acceptable, reduces anxiety and waiting times for parent.
- Accurate screening tool for visible jaundice.

Scope of practice

- Midwives, ANNPs, Paediatric & Neonatal SHOs and Registrars, Neonatal Nurses, Nursery Nurses and Senior Maternity Care Assistants trained to use JM-105.

Limitations

- The availability of TCBs in the community setting.
- Workload of community staff.
- Availability of staff trained to use the JM-105.

Training

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Training will be delivered by designated cascade trainers to those practitioners who will be using the TCB. A training register (Appendix 4) will then be sent to the POCT team who will maintain a register of those staff trained to use the JM-105. It is the practitioner's individual responsibility to ensure they are trained prior to using the JM-105. Training refreshers will be offered on an annual basis by the Practice Development Midwives supported by the Infant Feeding Team.

Process

Babies should be visibly inspected for jaundice at each midwifery contact, as part of the baby examination, ideally naked and in natural light. Inspecting the sclera, gums and blanched skin can aid in the detection of jaundice. Ensure daily check has been done, passed and recorded before using device.

Which babies should be tested with a TCB

- Is visibly jaundiced and more than or equal to 35 weeks gestation
- Is more than 24hrs of age and
- Less than 14 days of age
- Has jaundice that is worsening, noted either by parent/carer or professional, **even if baby has had previous phototherapy.**

Risk Factors for development of significant hyperbilirubinaemia [NICE, 2010]:

- Gestational age under 38 weeks
- A previous sibling with neonatal jaundice requiring phototherapy
- Visible jaundice in the first 24 hours
- Mother's intention to breastfeed exclusively*

*Exclusive breastfeeding 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.

Which babies should not be tested with a TCB and will need Gas Bilirubin / Serum Bilirubin check (SBR)

- Any baby born under 35 weeks gestation.
- Any baby with improving jaundice. The purpose of TCB is not to see a downward trend.
- Any baby less than 24 hours old.
- Any baby over 14 days old.
- Baby who is clinically unwell (e.g. not feeding well, looks septic, dehydrated)

Once a baby has been identified as suitable for TCB reading explain the rationale and procedure to the parents and gain consent to perform the test (See Appendix 1)

After taking the TCB reading (Community Midwifery)

- Any reading over 250 micromol/litre needs referral to CAU for Gas Bilirubin / SBR.

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- Take the **average** of the 3 readings from the JM-105 and compare to the Bilirubin Threshold Chart (Appendix 2).
- If the result is in the green zone continue midwifery-led care taking into account any feeding issues or other red flags.
- If the 1st result is within the yellow zone, arrange a repeat in 18 hours / first available appointment next day if risk factors are present, or 24 hours if no risk factors.
- If the 2nd result remains yellow, repeat in 18 hours if risk factors / first available appointment next day are present, or 24 hours without risk factors. If the result is green, continue normal care. If the result is red, refer to CAU for Gas Bilirubin / SBR +/- review.
- If the 3rd result remains yellow and baby is well, review any visible jaundice on Day 14 +/- referral to yellow alert clinic. If the result is green, continue normal care. If the result is yellow and baby is well, review jaundice on Day 14 +/- referral to yellow alert clinic. If the result is in the Red zone refer to CAU for Gas Bilirubin / SBR +/- review. Prepare the parents that this could mean a readmission for phototherapy.
- If the result is in the Red zone refer to CAU for Gas Bilirubin / SBR +/- review. Prepare the parents that this could mean a readmission for phototherapy.

After taking the TCB reading (Maternity In-Patient)

- Any reading over 250 micromol/litre needs referral for Gas Bilirubin / SBR – bleep 0417 (0900-1700) or 0416 (1700-0900) and refer to NICU Assessment Room.
- Take the **average** reading from the JM-105 and compare to the Bilirubin Threshold Chart (Appendix 2).
- If the result is in the green zone continue midwifery-led care taking into account any feeding issues or other red flags.
- If the 1st result is within the yellow zone arrange a repeat in 18 hours if risk factors are present, or 24 hours if no risk factors.
- If the 2nd result remains yellow, repeat in 18 hours if risk factors are present, or 24 hours without risk factors. If the result is green, continue normal care. If the result is in the red zone needs referral to on call neonatologist – bleep 0417 (0900-1700) or 0416 (1700-0900) and refer to NICU Assessment Room.
- If the 3rd result remains yellow and baby is well, review jaundice on Day 14 +/- referral to yellow alert clinic. Repeat in 18 hours if risk factors are present, or 24 hours without risk factors. If the result is green, continue normal care. If the result is in the red zone needs referral to on call neonatologist – bleep 0417 (0900-1700) or 0416 (1700-0900) and refer to NICU Assessment Room.

Summary of development and consultation process undertaken before registration and dissemination

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The author listed above drafted this document on behalf of The Infant Feeding Team and Community Midwifery Matron who have agreed the final content. During its development it has been circulated for comment to: Paediatric Clinic Governance Committee, Consultant Neonatologists, Consultant Paediatricians, Midwifery Managers, Infant Feeding Co-ordinators and Postnatal Ward Team Leader and Practice Development Midwives.

1. Bilirubin charts edited to make clear which number were in the red zone > symbols used instead of +.
2. Discrepancies in cleaning clarified.

References

1. NICE clinical guideline 98. Jaundice in Newborn Babies under 28 days. Issue date: October 2016
2. NNUH Clinical Guideline for Non- Invasive Bilirubin measurements using a Transcutaneous Bilirubinometer. [Trustdocs ID No: 12092](#) Issue date February 2017

Associated Documentation

NICE Clinical Guideline 98 Jaundice in Newborn Babies under 28 days

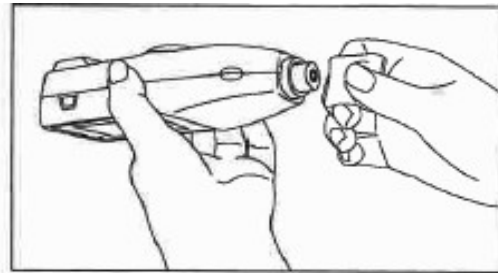
Appendix 1

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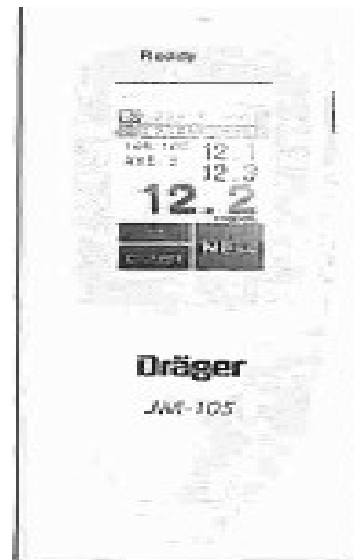
Use of JM-105

How to take a measurement

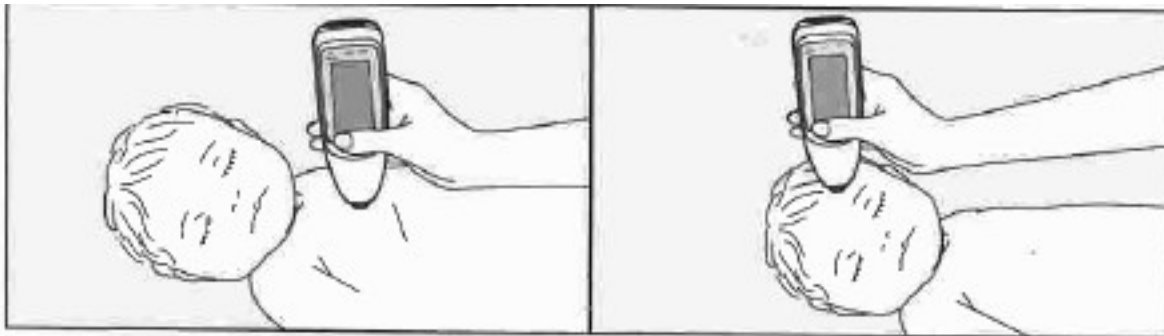
1. Clean the probe with a Clinell® wipe.



2. Press the power switch on.
3. Select MENU, select MEASURE and press OK.



4. Select measurement site: Mid-sternum is preferred but forehead can be used.



5. Place Jaundice meter JM105 tip flat against the baby's skin, **not at an angle**. Press lightly until you hear a click.
6. Lift the JM-105 from the skin between measurements and pause until green READY light illuminates again. Repeat the testing procedure until the required numbers of measurements (3) have been taken.
7. Record the average reading on the patient's notes and plot it and record against charts for assessing neonatal jaundice in the neonatal protocol.
8. Take appropriate action based on the reading (as per the flowchart).

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Appendix 2

Bilirubin (TCB) Threshold Charts

These charts have been created using the NICE phototherapy charts by gestational age. Green Zone is greater than 50 below the treatment line, Yellow Zone is within 50 of the treatment line and Red Zone is at or above the treatment line or >250micromol/L where NICE recommend Gas Bilirubin/SBR be completed.

35 weeks	Recheck if appears more jaundiced	Repeat in 18 hours / first available appointment next day	Requires urgent referral to CAU for Gas Bilirubin / SBR +/- review
Choose age column closest to actual age, Not completed age in hours.	Bilirubin in micromol/L	Bilirubin in micromol/L	Bilirubin in micromol/L
Age in Hours			
24 (1 day)	<60	60-110	>110
30	<75	75-125	>125
36	<95	95-145	>145
42	<110	110-160	>160
48 (2 days)	<130	130-180	>180
54	<145	145-195	>195
60	<165	165-215	>215
66	<180	180-230	>230
72 (3 days+)	<200	200-250	>250

36 weeks	Recheck if appears more jaundiced	Repeat in 18 hours / first available appointment next day	Requires urgent referral to CAU for Gas Bilirubin / SBR +/- review
Choose age column closest to actual age, Not completed age in hours.	Bilirubin in micromol/L	Bilirubin in micromol/L	Bilirubin in micromol/L
Age in Hours			
24 (1 day)	<65	65-115	>115
30	<80	80-130	>130
36	<100	100-150	>150
42	<120	120-170	>170
48 (2 days)	<135	135-185	>185
54	<150	150-200	>200
60	<170	170-220	>220
66	<190	190-240	>240
72 (3 days+)	<210	210-250	>250

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37 weeks Choose age column closest to actual age, Not completed age in hours. Age in Hours	Recheck if appears more jaundiced Bilirubin in micromol/L	Repeat in 18 hours / first available appointment next day Bilirubin in micromol/L	Requires urgent referral to CAU for Gas Bilirubin / SBR +/- review Bilirubin in micromol/L
24 (1 day)	<65	65-115	>115
30	<85	85-135	>135
36	<105	105-155	>155
42	<125	125-175	>175
48 (2 days)	<140	140-190	>190
54	<165	165-215	>215
60	<180	180-230	>230
66	<195	195-245	>245
72 (3 days+)	<220	220-250	>250

38+ weeks Choose age column closest to actual age, Not completed age in hours. Age in Hours	Recheck if appears more jaundiced Bilirubin in micromol/L	Repeat in 18 hours / first available appointment next day with Risk Factors or 24 hours if no risk factors Bilirubin in micromol/L	Requires urgent referral to CAU for Gas Bilirubin / SBR +/- review Bilirubin in micromol/L
24 (1 day)	<150	150-200	>200
30	<162	162-212	>212
36	<175	175-225	>225
42	<187	187-237	>237
48 (2 days)	<200	200-250	>250
54	<212	212-250	>250
60	<225	225-250	>250
66	<237	237-250	>250
72 (3 days+)	<250 (Alert and feeding effectively)	<250 (Lethargic or Feeding Issues)	>250

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Appendix 3

Drager JM-105 Jaundice Meter: Daily Operational Check Record Sheet

Month:

SN:

Date	L value range: -2.9 to -0.9	S value range: -2.6 to -0.6	Δ value range: -0.8 to +0.2	?within range	Signature
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
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21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

L value = measured value of long optical path

S value = measured value of short optical path

Δ value = difference between L and S values

- If any value is out of range, clean the checker and probe. Repeat the measurement.
- If values are still or repeatedly out of range, do not use the device and contact Point Of Care Testing Department (POCT) on extension 2969 or 01603 286969 extension 2710 or 01603 287710

Preparation of the JM-105 for Use:

Perform the Daily Operational Checkout Procedure

1. Remove the JM-105 from the docking station.
2. Press the power switch on.
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 meter perpendicular on the reading checker circle. Press down until you hear a click.
6. The display screen shows the "L" (long), "S" (short), and Delta values.
7. The meter must read within the reference values posted under the checker lid.
 - a. If so, the meter is ready to use.
 - b. If not, clean the tip and repeat.

If values are still out of range, do **NOT** use the meter and contact the POCT Co-ordinator. extension 2969 or 01603 286969 extension 2710 or 01603 287710

Storing the JM-105

- Clean the measuring probe.
- Place the meter in the docking station.
- Leave the device in the docking station when not in use.
- While the meter is in the docking station, power remains on. After 1 minute the screen goes blank; the power remains on.

Switching off the JM-105

To switch off power when the device is not in the docking station, press the power button and hold it down for 1 second.

Precautions

- **Cleaning**
 - The probe must be cleaned with Clinell wipes prior to testing each baby.
 - In the event of an isolated infectious baby, chlorine (Haztabs 1,000ppm) to be used on device.
 - If device is contaminated with blood or body fluids, chlorine (Haztabs 10,000 ppm) to be used.

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- A device check must be performed daily. If a check has not been carried out during the current day, the **MEASURE READING CHECKER** message appears for 3 secs when the device is switched on.
 - To clear the message, perform the operational checkout procedure.
- If check values are repeatedly out of range, do not use the JM-105; contact the POCT Co-ordinator on extension 2969 or 01603 286969 extension 2710 or 01603 287710

Limitations

- Only staff who have been trained by the Dräger Training Specialist or Link Trainers are authorised to perform patient testing.
- Use only on infants up to 14 days of age.
- Use only on infants of ≥ 35 weeks gestation at birth.
- Use only the sternum location when taking measurements (or forehead, at hospital sites only), where a sufficient amount of blood is circulated.
 - Clinical studies show consistently better results with measurements taken at the sternum versus the forehead.

Problem solving – error messages

Error code	Cause	Action
ERROR0 1	Measured value is abnormal	Repeat the measurement
ERROR0 3	RAM error	Switch off and do not use
ERROR0 3 ERROR0 4 ERROR0 5	Averaging failure Hardware failure	Switch OFF power Wait 10s Switch ON
ERROR0 4	Memory error	Switch off device and do not use
ERROR0 5	Insufficient charge, circuit error	Charge the device If failure continues, switch off and do not use
ERROR0 6	Calibration data error	Switch off the device and do not use

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Appendix 4

Training Register

Transcutaneous Bilirubin testing, Draeger JM-105 Jaundice Meter

Trainer:

Date (ddmmyyyy):

Surname	First name	Department	Grade	Operator ID (admin only)	Signature	Observation by trainer

Staff must:

- Follow the instructions for use, as outlined at training.
- Understand the importance of correct sampling and the implications of contraindications.

Failure to comply may result in the JM-105 being withdrawn from use

Please return register to: Theresa Hornsby, POCT Co-ordinator, Laboratory Medicine.