Pulse Oximetry and the Newborn
Standard Operating Procedure

UHDB/SOP/09:23/O22

Contents

1. Introduction

Pulse Oximetry is a quick, non-invasive test that measures the concentration of oxygen in the baby's blood using a sensor applied to the hand or foot of a newborn. Babies may experience low oxygen saturations for a number of reasons. This may reflect a baby with undiagnosed congenital heart disease, hypothermia, hypoglycaemia, breathing difficulties, slow adaptation to ex-utero life or sepsis. BAPM recommends measurement of oxygen saturation levels when there are clinical concerns as this can help in the earlier diagnosis of conditions before the baby's clinical condition worsens (BAPM, 2023). Measurement of oxygen saturation is not required for healthy term neonates with no clinical concerns.

NEWTT2 utilises the PIER principles adopted by the National Patient Safety Improvement Programme to support the early identification and escalation of any clinical concerns with a baby (BAPM, 2023). This SOP is designed for use on Labour Ward/ Birth Centre and Postnatal Wards. Babies admitted to the neonatal unit will have specific requirements relating to their ongoing monitoring and oxygenation needs.

Mild cyanosis is often unreliably detected by visual inspection, especially for babies with non-white skin, and BAPM recommend oxygen saturations instead. However oxygen saturations alone are not adequate indicators of end-organ perfusions and should be considered in conjunction with other observations and signs of baby well-being.

2. Abbreviations

BAPM	-	British Association of Perinatal Medicine
CHD	-	Congenital Heart Disease
FASP USS	-	Fetal Anomaly Screening Programme Ultrasound Scan
NEWTT2	-	Newborn Early Warning Trigger and Track Chart

NICU	-	Neonatal Intersive Care Unit
NIPE	-	Newborn & Infant Physical Examination
NNT	-	Neonatal Team
SpO2	-	Oxygen Saturation Level

3. Equipment

All clinical areas should have designated Pulse Oximetry Machines which should be stored in close proximity to neonatal emergency trolleys and equipment. Care should be taken to ensure that equipment is fit for purpose during routine ward daily checks and that a supply of probes is available with each machine. Staff should ensure they are aware of the location of such equipment. In addition, portable machines may be available from NICU. It is recommended to attach the probe to the hand or foot PRIOR to connecting to the machine and turning on.

4. Newborn Life Support

Blood oxygen levels in the fetus are significantly lower than in the new-born infant. Following birth arterial oxygen saturation rises from 50-60% to 90-95% (Dawson et al 2010), and the time this takes will vary from infant to infant but for most infants should reach 90% within 10 minutes of life (Lara-Canton et al 2022). If a baby is born in poor condition the practitioners should follow the new-born resuscitation algorithm. Oxygen saturation measurement forms part of the resuscitation toolkit.

The resuscitation council recommends that pulse oximetry should be used during resuscitation in the delivery room to provide ongoing measurement of oxygen saturation and heart rate. Pulse oximetry can demonstrate if oxygenation measures are adequate and when oxygen supplementation is needed or when it becomes unnecessary (i.e. when over 95%). Consider application of pulse oximetry whenever a baby is not gasping or breathing following commencement of inflation breaths.

Acceptable pre-ductal (right wrist) SpO2 (Time from Birth)	
2 mins	65%
5 mins	85%
10mins	90%

(Resuscitation Council UK, 2021)

During an emergency you may only be able to record saturations at one location. This should be pre-ductal (i.e. right wrist). Remember that levels will be lower initially. Please refer to the table above for acceptable levels. Leave the pulse oximeter probe in position until the situation has resolved.

5. Babies with Clinical Concerns

Please refer to NEWTT2 guidance for information regarding which babies should commence NEWT2 charts following birth. Any baby on a yellow or red hat bundle should have a NEWTT2 chart in use. If any observations on the chart fall outside normal parameters or if there are any other clinical concerns, then consider pulse oximetry as an additional measure for well-being. Pulse oximetry should be recorded when there are clinical concerns regardless of previous findings. Results should be documented on the NEWTT2 chart and escalated appropriately.

6. Pre & Post Ductal SATS and NIPE

FASP USS detects 50% of congenital heart disease meaning that up to 50% is detected after the baby is born. Cardiac assessment forms part of the NIPE examination which should be completed between 6hrs and 72hrs of age on all babies born over 34 weeks gestation (PHE 2021). Pulse oximetry does not form part of the routine NIPE examination, however there are a number of cases when it will be required.

1) Incomplete FASP: If it was not possible to complete the FASP USS between 18 weeks and 22weeks and 6 days then the USS becomes less reliable to detect CHD. This may occur because the USS was missed (e.g. out of the country or late booker) or due to poor imaging. In these cases pre & post ductal SpO2 should be completed by the NIPE practitioner as part of the NIPE examination. If these results are normal then there is no need for further review.
2) Family History of Congenital Heart Disease: Please refer to the CHD guideline for information relating to which conditions will require cardiology referral for baby. It may be necessary to discuss this with the neonatal team. If a cardiology referral is required then it is recommended that the NIPE practitioner completes pre & post ductal SpO2 as part of the NIPE assessment.
3) Following detection of cardiac murmur at NIPE: If the murmur persists at 24hrs then the baby will require pre & post ductal SpO2 prior to discharge. It is recommended that these be completed as part of the review by the NNT.
4) Known/Suspected cardiac anomaly: Some babies will have confirmed or suspected cardiac anomaly identified during antenatal USS or may have some other condition which is associated with cardiac disease (e.g T21, cleft palate). These babies should have a care plan documented for action by the NNT which may include pre & post ductal saturations.

7. Performing Pulse Oximetry

Pulse Oximetry should be completed in a safe, warm environment with good lighting - a cot or resuscitaire are ideal, with a resuscitaire the preferred option if there are clinical concerns. Where possible mums and babies should be kept together while the assessment is completed (BAPM, 2023). Avoid screening when a baby is crying or unsettled. Best results are obtained with a quiet, settled baby.

Saturations should be performed pre-ductally which means using the right wrist. Results should be documented on the NEWTT2 chart.

Ideally paired pre and post ductal saturations should be performed (Pre = right wrist, post = either foot or left wrist. If only one reading is available (e.g. emergency situations) this should be pre ductal. If a baby is visibly blue then escalation should be immediate but saturations can be performed while awaiting the neonatal team. Pallor caused by anaemia is often associated with normal saturations and therefore if an infant is pale then escalation is vital regardless of saturation readings.

Always attach the probe to the baby before attaching to the machine and turning on as this will give quicker results (O'Donnell et al, 2005). The saturation probe is applied to the baby's right wrist (provides a pre-ductal reading) and either foot (provides a post-ductal reading). It may be necessary to apply tape to the right hand & either foot to hold the probe in place and maintain a good reading. It is necessary to wait until a stable good quality waveform is seen. This may take up to 1 minute and a stable waveform should be observed for at least 30 seconds.

8. Interpreting Results after adaptation to extra-uterine life

When pulse oximetry is completed at birth due to clinical concerns then refer to paragraph 4 above for details of acceptable oxygenation levels.

When completing pulse oximetry due to clinical concerns/ NEWTT2 assessment then the following criteria should be used.

PASS: Both readings above 95% with less that 3% difference. No further action needed if part of routine NIPE assessment. If prompted by other clinical concerns then ALL assessments should be documented on NEWTT2 chart and escalated appropriately.

BORDERLINE: Either reading between 90-94% or difference greater than 3%. Triggers yellow box on NEWTT2 and scores 1. If other observations normal repeat in 1 hour however if any other clinical concerns or triggers on NEWTT2 then escalate to NNT for review following NEWTT2 pathway.

FAIL: Either reading 89% or below or if baby symptomatic. This will trigger purple box on NEWTT2 requiring immediate escalation to NNT. This finding is likely to be accompanied by other abnormal observations. Call for help and consider 2222.

Please bear in mind that any results should be considered in conjunction with any other findings and concerns.

9. References

British Association of Paediatric Medicine (2023): NEWTT2 - A framework for practice

Resuscitation Council UK (2021) Newborn Life Support Algorithm.

Public Health England (2021) Newborn and Infant Physical Examination: Programme Handbook

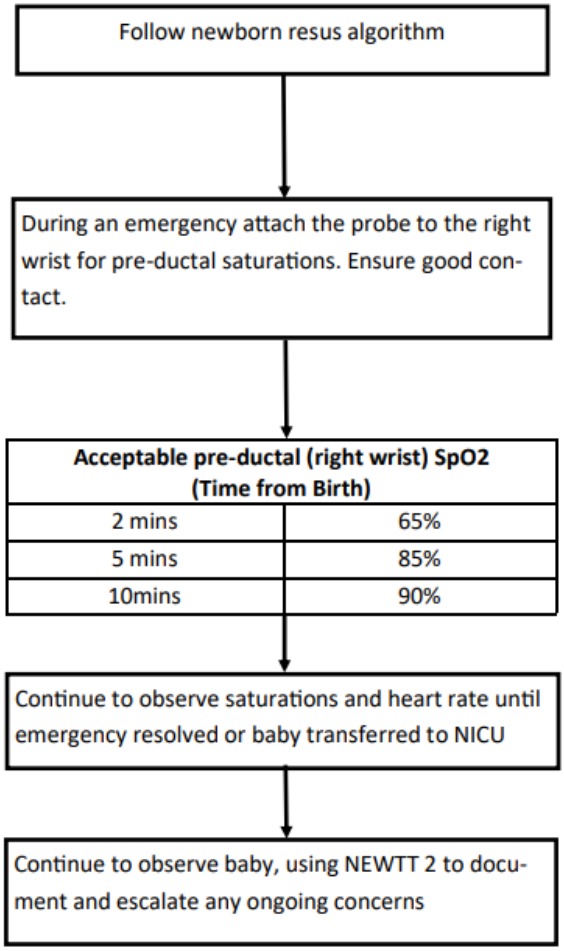
Lara-Canton, I,Badurdeen, S, Dekker, J, Davis, P, Roberts, C, te Pas, A & Vento, M. (2022) Oxygen Saturation and heart rate in healthy term and late preterm infants with delayed cord clamping. Paediatric Research

O'Donnell, C.P, Kamlin, C.O, Davis, P.G. & Morley, C.J. (2005) Feasibility of and delay in obtaining pulse oximetry during neonatal resuscitation. J Paediatrics 147 698-699

Dawson , J. A et al (2010) Defining the reference range for oxygen saturation for infants after birth. Paediatrics 125 e1340-e1347

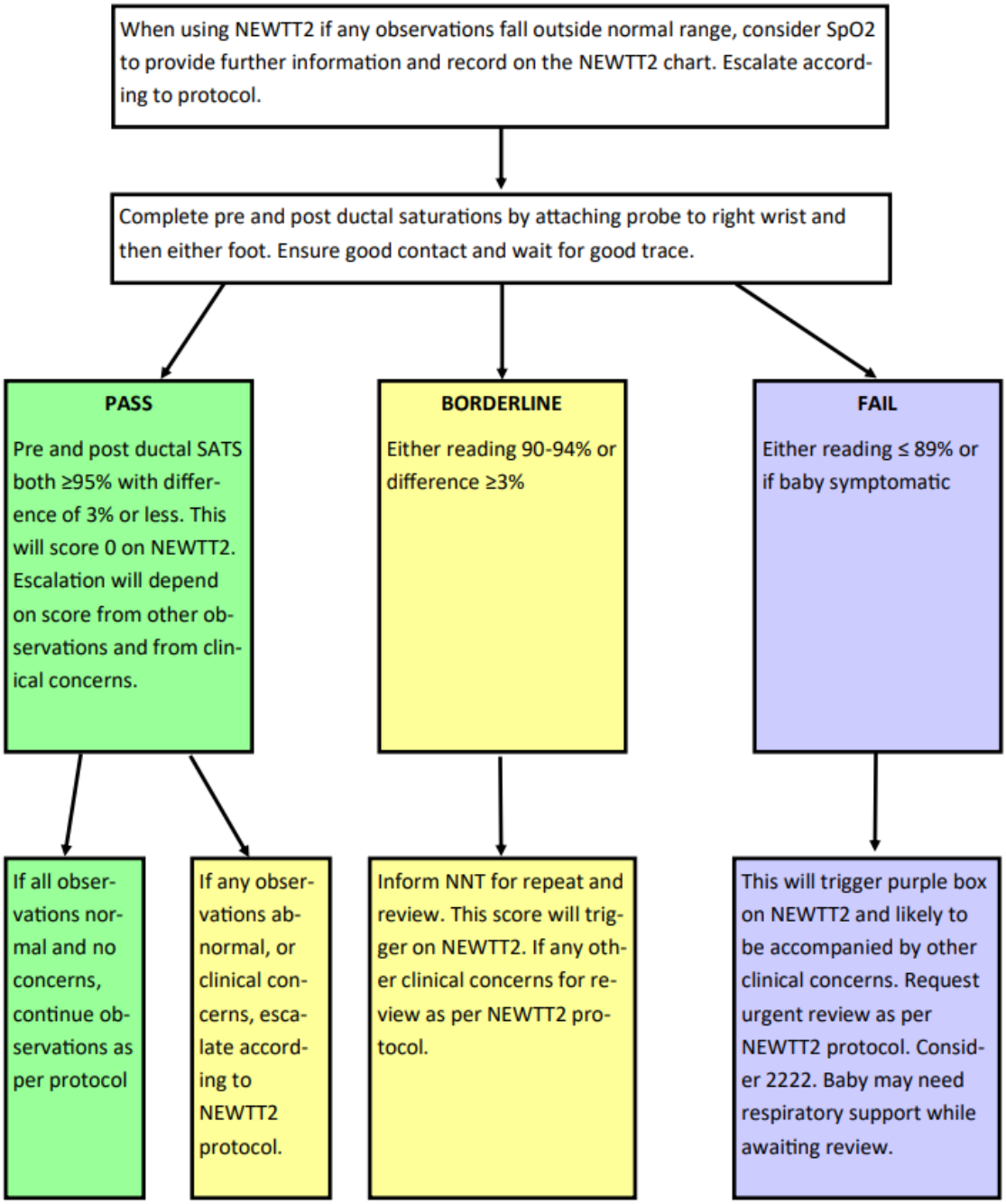
Appendix 1

SpO2 during an emergency at birth



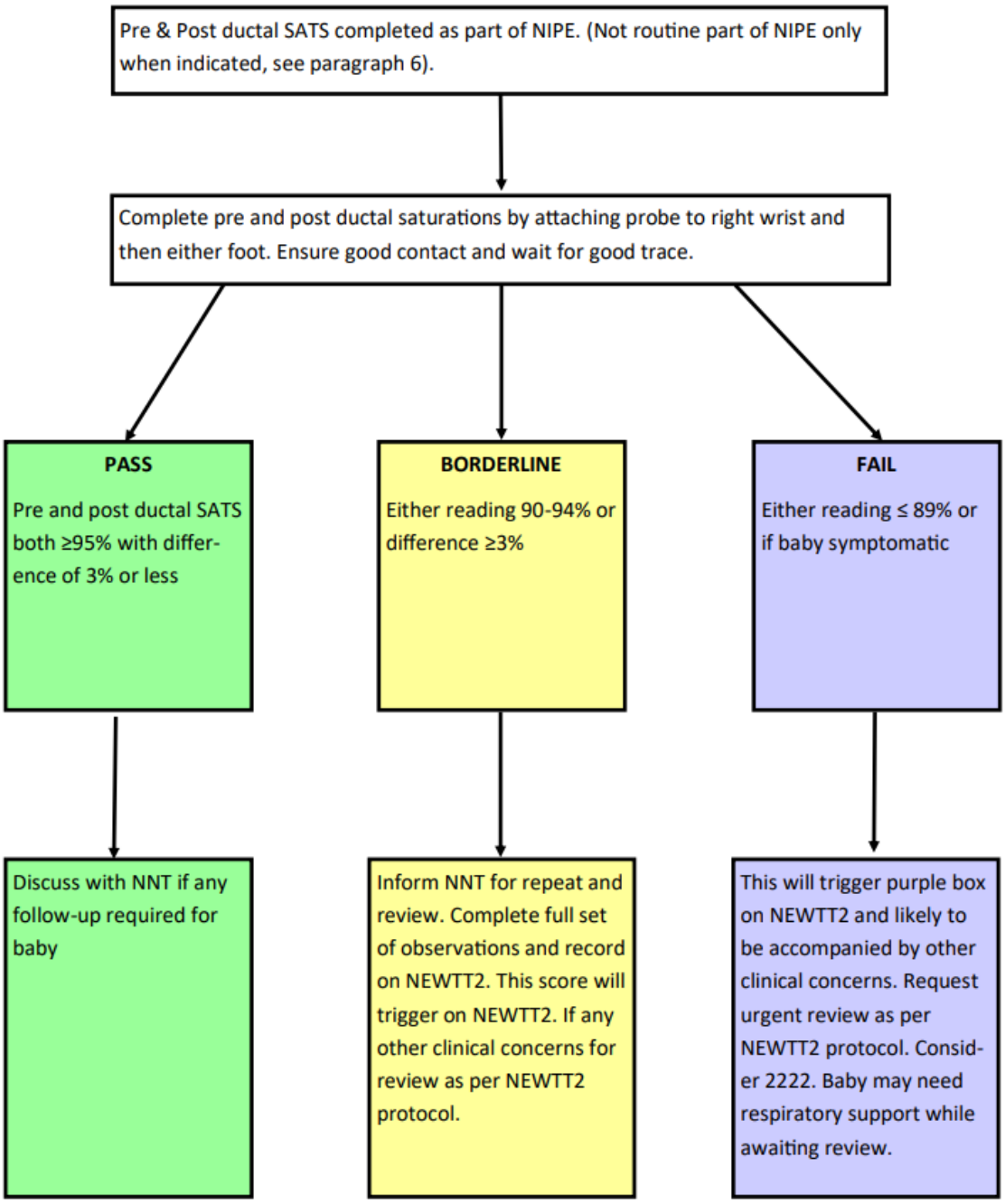
Appendix 2

SpO2 due to clinical concerns



Appendix 3

SpO2 as part of NIPE



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