



## GUIDELINE

# Pulse Oximetry Screening to Detect Critical Congenital Heart Disease

<b>Scope (Staff):</b>	Nursing and Medical Staff
<b>Scope (Area):</b>	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](#)

## Aim

Outline the timing and importance of pulse oximetry screening for detect for critical congenital heart disease in the newborn in the postnatal wards and within the neonatal unit.

## Risk

Failure to monitor and detect abnormalities can result in delay treatment or result in poor health outcomes for the newborn. Delayed diagnosis can be associated with increased mortality and morbidity from multi-organ damage.

## Background

Critical congenital heart disease can be diagnosed by fetal ultrasound, however around 50% will still be missed. Babies may lack clinical signs in the first day of life, appearing pink despite a “cyanotic” heart lesion, with lack of murmur and apparently palpable femoral pulses in coarctations. A UK study estimated that 25% of babies with congenital cyanotic heart disease are not diagnosed until after discharge from the nursery. At least 3 babies have been identified at KEMH over 8 years who were discharged with a critical congenital heart lesion undetected prior to screening.

There is a significant amount of data to suggest that routine use of pulse oximetry before discharge will diagnose a substantial proportion of babies who would have otherwise been missed by routine examination (~ 50%). The data is all from observational studies.

**This MEANS for every 1000 babies screened about 7 cases need further evaluation with 1 in 5 of those having a critical heart lesion.**

Timing of the screening is important, if done after 24 hours the screening outcomes were improved to a positive predictive value of 47%.

### Key points

- Pulse oximetry can detect some critical congenital heart disease that would otherwise be missed on routine examination / antenatal USS.
- The ideal time for oximetry is around 24 hours of age.
- Babies admitted to the Neonatal Unit at KEMH or PCH 3B should have this performed if >35 weeks GA and off respiratory support/ supplementary oxygen
- The probe is placed on right hand and either foot.
- Oxygen saturations of  $\geq 95\%$  at both sites plus a difference of  $\leq 3$  between right hand and either foot is considered normal. The baby can be discharged as normal.
- Verbal consent should be obtained and the screen documented in the notes on the Neonatal History MR410 form below day 1 check.

### Screening Process

#### Postnatal Wards

An \*appropriately prepared health professional to screen all neonates born at KEMH prior to discharge (ideally at around 24 hours of age, but for early discharge within 1 hour of discharge) with right hand and lower limb O<sub>2</sub> saturations.

- Note: \*An appropriately prepared health professional\* is either a paediatric medical officer or a midwife who has successfully undertaken the Full Physical examination of the Newborn (FPEON).

The screening should occur around the time of the discharge review. Take the highest number the trace gets to as the screening number on right hand and either foot (the probe only needs to be on until a good steady trace is obtained which may take < 1 minute). The baby should not be feeding and should be settled.

#### Neonatal Unit KEMH and PCH 3B

The screening should ideally occur at 24 hours of age or once respiratory support and/or supplemental oxygen has ceased for 24 to 48 hours. Take the highest number the trace gets to as the screening number on right and either foot (the probe only needs to only on until a good steady trace is obtained which may take < 1 minute). The baby should not be feeding and should be settled.

**For all newborns:**

**Normal is  $\geq 95\%$  oxygen saturation**

**AND**

**The difference between right hand and lower limb  $\leq 3\%$**

## Escalation of abnormal results

- If O<sub>2</sub> saturations 91 – 94% → medical review to consider other causes (mainly sepsis). If well with a normal examination → repeat screening test in 1-2hours when baby settled.
- If still abnormal after 2 tests → for a senior review (SR or Consultant Neonatologist) and refer to cardiology as necessary.
- If O<sub>2</sub> saturations <90% → admit to SCN from postnatal ward immediately and for senior review and continuous oximetry monitoring. Other causes need to be excluded (with possible septic work up and IV antibiotics, CXR and assessment. Other problems – upper airway, neurological, polycythaemia, persistent pulmonary hypertension). Studies show up to 50% of babies screening positive have signs of sepsis on further evaluation<sup>2</sup>.
  - For infants already admitted to SCN, escalate concerns to Senior Registrar or consultant.
- If no other causes are found, echocardiogram to be performed at time dictated by Cardiologist (may be the next day but prior to discharge).
- Refer to Appendix 1 for Quick Reference Guide

## Documentation

- The outcome of screening is to be documented under the neonatal examination on the Neonatal History MR410 form.
- Any abnormal screening is to be documented in the inpatient history with the medical review.

### References and related external legislation, policies, and guidelines

1. Brown KL, Ridout DA, Hoskote A. et al. Delayed diagnosis of congenital heart disease worsens preoperative condition and outcome of surgery in neonates. Heart 2006;92:1298-1302
2. Mahle AT, Newburger JW, Paul Matherne G et al. Role of pulse oximetry in examining newborns for congenital heart disease: a scientific statement from the AHA and AAP. Pediatrics 2009;124: 823-836
3. Tautz J, Merkel C, Loersch F et al. Implication of pulse oximetry screening for detection of congenital heart defects. Klin Padiatr 2010; 222(5):291-5

4. Riede FT, Worner C, Dahnert I et al. Effectiveness of neonatal pulse oximetry screening for detection of critical congenital heart disease in daily clinical routine- results from a prospective multicenter study. Eur J Pediatr 2010; 169: 975-981
5. De Whal Granelli A, Wennergren M et al. Impact of pulse oximetry screening on the detection of duct dependent congenital heart disease: a Swedish prospective screening study in 39 821 newborns. BMJ 2009;338:a3037
6. Walsh W. Evaluation of pulse oximetry screening in Middle Tennessee: cases for consideration before universal screening. J Perinat 2011; 31, 125-129
7. Ewer EK, Middleton LJ et al. Pulse oximetry screening for congenital heart defects in newborn infants (Pulseox): A test accuracy study. Lancet 2011; 378(785-794)
8. Royal North Shore Sydney Hospital guidelines
9. Swiss National guideline: Kuelling B, Arlettaz Mieth R, Bauersfeld U, Balmer C. Pulse oximetry screening for congenital heart defects in Switzerland: most but not all maternity units screen their neonates. Swiss Med Wkly 2009 Nov 28;139(47-48):699-704
10. Ewer EK Screening for Critical Congenital Heart Defects with Pulse Oximetry: Medical Aspects. Amer J Perinatol 2016; 33(11): 1062-1066
11. Hom La, Oster, ME et al. AAP updates recommendations on use of pulse oximetry to screen newborns for critical congenital heart disease. American Academy of Pediatrics, 2024. Accessed from <https://publications.aap.org/aapnews/news/30947/AAP-updates-recommendations-on-use-of-pulse?autologincheck=redirected>

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

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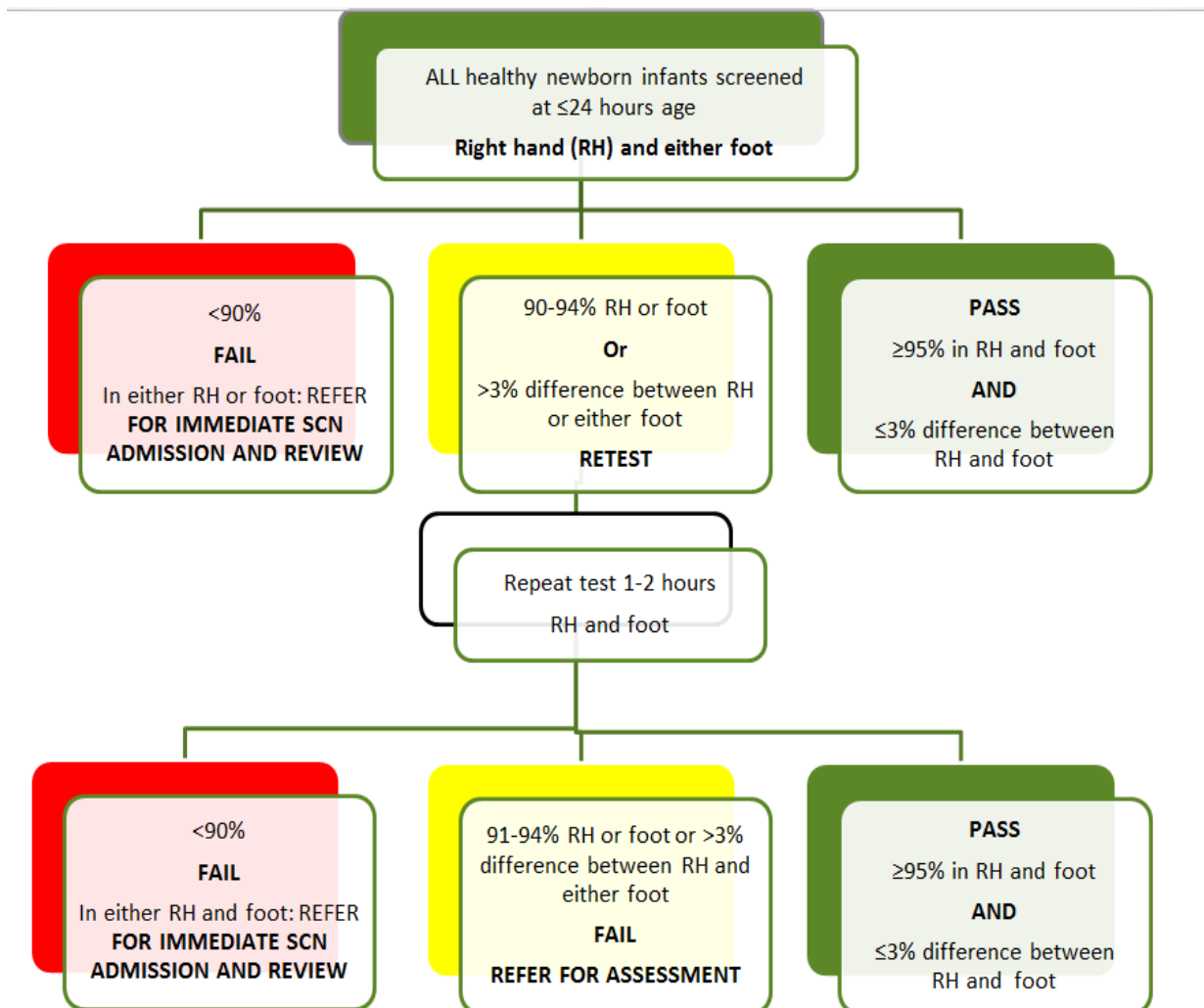
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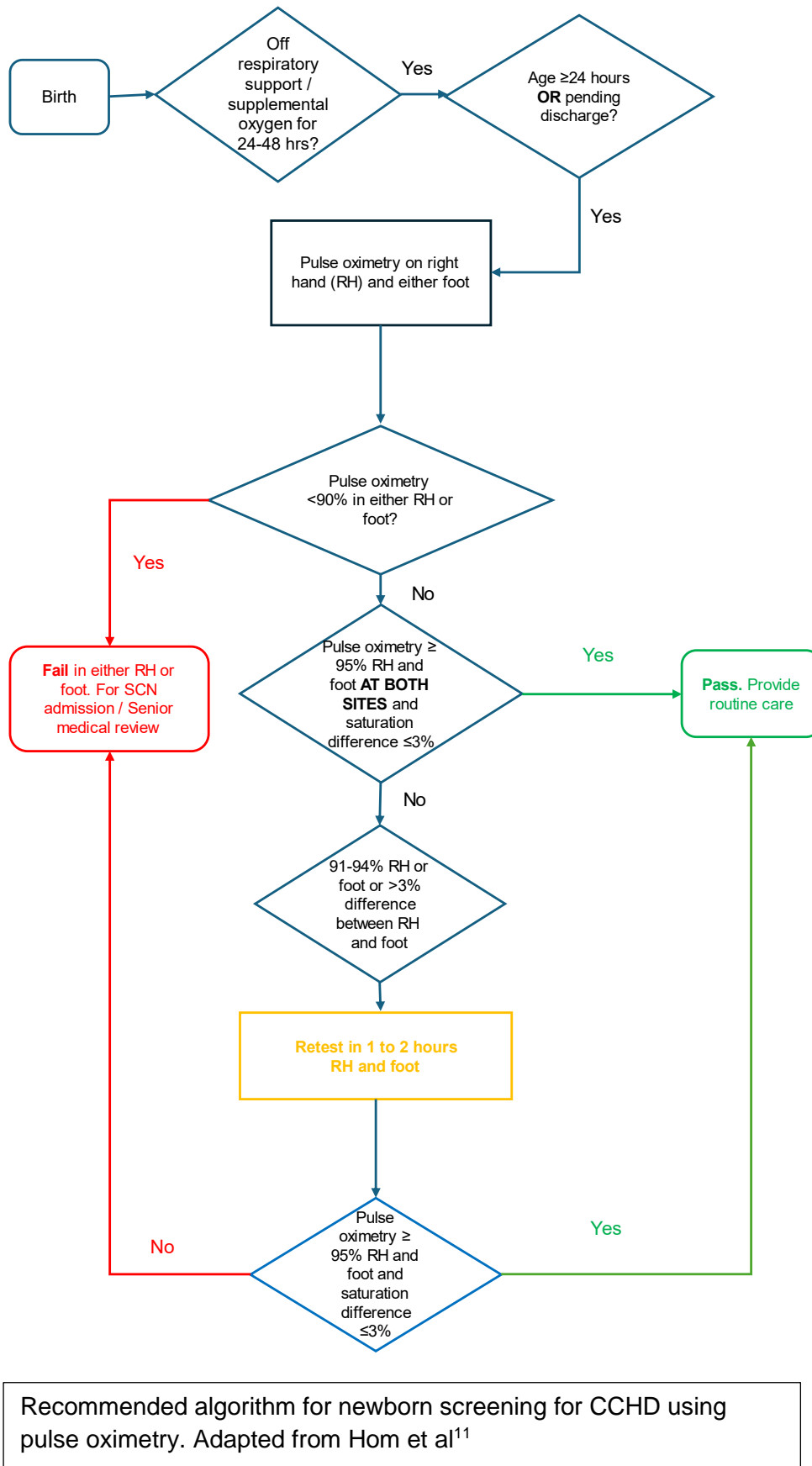
Compassion
Excellence
Collaboration
Accountability
Equity
Respect

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## Appendix 1: Postnatal Wards Quick Reference



## Appendix 2: Neonatal Unit Pulse Oximetry Algorithm



Recommended algorithm for newborn screening for CCHD using pulse oximetry. Adapted from Hom et al<sup>11</sup>

### Appendix 3: Further information

Many studies have shown that babies with serious, potentially life-threatening, non-cardiac, hypoxemic condition, such as respiratory or infective disorders, are also identified by POS. These babies are usually classified as false positives, but it is generally accepted that early detection of these babies, before they become unwell, is a potential advantage and the label of false positive is perhaps a misnomer.

The majority of the data comes from screening lower limb at  $\geq 95\%$  cut off. Some studies have also included a measurement of the difference between upper and lower limb (to rule out coarctation of the aorta). Certainly coarctation of the aorta remains a diagnostic challenge and in the studies reviewed by AAP this is the cardiac lesion least likely to be found with the oximetry screening test.

After a Western Australian audit of cases in 2018 with only 4% being diagnosed statewide on oximetry screening a decision was made to include the difference between pre and post ductal (right hand and foot) saturations with  $>3$  being considered abnormal and if on repeat consistently different should also warrant echocardiography. This is now standard in most international guidelines (America, Canada and Europe) although some use a difference  $>2$  not 3. The aim is to diagnose more left obstructed lesions (including coarctation of the aorta) prior to discharge.