



Title: Critical Congenital Heart Disease Pulse Oximetry Screening Protocol

Purpose:

- To ensure a consistent and effective methodology for performing and evaluating a Critical Congenital Heart Disease (CCHD) pulse oximetry screen on a newborn.

Scope or Principle:

This protocol outlines the Newborn Screening Ontario (NSO) guideline for performing and evaluating a CCHD screen on a newborn. Health Care Providers (HCPs) will screen all newborns ideally between 24 and 48 hours post-delivery for CCHD using the NSO approved algorithm.

Background:

CCHD screening in asymptomatic newborns can assist in the early identification and treatment of CCHD, resulting in better outcomes for affected babies. It is important to note that this is a screening test performed on well babies and is not a diagnostic test.

Responsibility:

HCPs caring for newborns including but not limited to nurses and midwives, during the first days of life should be familiar with the protocol. The screener should possess the knowledge, skill, and judgement to offer and perform CCHD screening along with CCHD screening education for parents/families. It is one component of the clinical picture. The screen result **must** be considered alongside an assessment by or under direct supervision of someone capable of interpreting the result within the complete clinical picture.

Definitions/Acronyms:

- NSO = Newborn Screening Ontario
- CCHD = Critical Congenital Heart Disease
- HCP = Health Care Provider
- SpO₂ = Saturation of pulse oximetry, measurement of oxygen saturation
- NICU/SCN/PICU = Neonatal Intensive Care Unit/Special Care Nursery/Paediatric Intensive Care Unit
- DBS card = Dried Blood Spot card
- CCHD screen = a non-invasive comparative pre and post-ductal pulse oximetry test performed on an asymptomatic newborn as an identifier of possible cardiac issues

Related Documentation:

- Newborn Screening Ontario Critical Congenital Heart Disease Pulse Oximetry Screening – NICU/SCN/PICU Babies Protocol
- Newborn Screening Ontario Critical Congenital Heart Disease Pulse Oximetry Screening – Early Discharge Protocol
- Newborn Screening Ontario Critical Congenital Heart Disease Pulse Oximetry Screening – Community Screening Protocol (Non-Hospital Setting)
- Newborn Screening Ontario Critical Congenital Heart Disease Pulse Oximetry Screening – Screen Positive Workup Protocol



Procedure:

Screening

1. Provide education explaining the purpose and benefit of CCHD screening to parents/families of newborn. Obtain consent to perform the screen.
 - a. Include the following in the explanation: *The screen is non-invasive and pain free, involves oxygen measurements in the right hand and either foot. The values are compared and then evaluated. This evaluation can give us information about the newborn's oxygen levels. The screen is not diagnostic but can indicate more testing is necessary.*
2. Perform the CCHD screen using pulse oximetry ideally when the newborn is between 24 and 48 hours of age, with an optimal window of between 24 and 36 hours of age. Screens performed prior to 24 hours of age have been shown to demonstrate a higher false positive rate than screens performed in the suggested 24-48 hour window.
3. Position the pulse oximeter probe on the RIGHT hand for a pre-ductal oxygen saturation measurement (SpO₂) and on EITHER foot for a post-ductal oxygen saturation measurement (SpO₂). Align the light emitter portion of the pulse oximeter probe facing the photodetector portion of the pulse oximeter probe.
4. Perform the CCHD screen consecutively, the first measurement directly followed by the second measurement.
5. Conduct the CCHD screen using a motion tolerant pulse oximeter approved by or provided by NSO.
6. The newborn should ideally be in a quiet, non-fussing state. Complete the CCHD screen prior to any invasive procedure or care activity that disturbs the infant.
7. Once a reliable signal is obtained (this will be evident using confidence indicators specific to the pulse oximeter e.g. pleth/waveform is regular), observe the oxygen saturation (SpO₂) values for 30 seconds and note the **highest** SpO₂ value achieved.

Evaluation of Results:

1. Evaluate the 2 measurements (pre-ductal and post-ductal) using the NSO approved CCHD Algorithm and/or the NSO CCHD Evaluation Chart (refer to Appendix A and Appendix B)
 - A screen negative (**Pass**)
 - If the pulse oximetry is greater than or equal to 95% in the right hand or either foot AND with less than or equal to 3% difference in oxygen saturation between the right hand and foot –
 - **No further screening is required.**
 - A screen positive – (**Refer**)
 - If the pulse oximetry is less than 90% in the right hand or either foot
 - OR**
 - If the pulse oximetry is less than 95% on both extremities OR the pulse oximetry difference in oxygen saturation is greater than 3% between the right hand and either foot for 3 consecutive measures each separated by 1 hour
 - **Notify the Most Responsible Practitioner of the screen positive result.**



- **Make an urgent referral within 6-8 hours to a physician for further investigation; Refer to Screen Positive Workup Protocol.**
2. Document the pulse oximetry values and the evaluated screen result in the infant’s chart or medical record and on the CCHD screen portion of the DBS card (Appendix C). Send the completed CCHD screen result page to NSO. If the screen is not performed, document this, along with the reason, on the CCHD screen portion of the DBS card and send to NSO. Every baby should have a CCHD form completed with either a screen result or a reason indicating why the screen was not performed.

EVALUATION OF SCREENING VALUES:

INITIAL SCREEN

Pulse oximetry is greater than or equal to 95% in the right hand or either foot AND with less than or equal to 3% difference in oxygen saturation between the right hand and foot	PASS
Pulse oximetry is 90-94% on both extremities OR the pulse oximetry difference in oxygen saturation is greater than 3% between the right hand and either foot	REPEAT IN 1 HR
Pulse oximetry is less than 90% in the right hand or either foot	REFER

SECOND SCREEN ONE HOUR LATER (IF INDICATED BY INITIAL SCREEN)

Pulse oximetry is greater than or equal to 95% in the right hand or either foot AND with less than or equal to 3% difference in oxygen saturation between the right hand and foot	PASS
Pulse oximetry is 90-94% on both extremities OR the pulse oximetry difference in oxygen saturation is greater than 3% between the right hand and either foot	REPEAT IN 1 HR
Pulse oximetry is less than 90% in the right hand or either foot	REFER

THIRD SCREEN ONE HOUR LATER (IF INDICATED BY SECOND SCREEN)

Pulse oximetry is greater than or equal to 95% in the right hand or either foot AND with less than or equal to 3% difference in oxygen saturation between the right hand and foot	PASS
Pulse oximetry is 90-94% on both extremities OR the pulse oximetry difference in oxygen saturation is greater than 3% between the right hand and either foot	REFER
Pulse oximetry is less than 90% in the right hand or either foot	REFER

Special Considerations:

Please consider associated protocols for screening in the following circumstances:

- Baby admitted to NICU/SCN/PICU
- Early (less than 24 hour) discharge of newborn
- Screening in a non-hospital environment



References:

- American Academy of Pediatrics, *Newborn Screening for CCHD, Answers and Resources for Primary Care Pediatricians*; (2016) retrieved from <https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/PEHDIC/Pages/Newborn-Screening-for-CCHD.aspx> CCS document
- Center for Disease Control, *Screening for Critical Congenital Heart Defects*, (2016) retrieved from <http://www.cdc.gov/ncbddd/heartdefects/cchd-facts.html>
- Kemper AR, Mahle WT, Martin GR, et al. *Strategies For Implementing Screening For Critical Congenital Heart Disease*. *Pediatrics*. 2011;128(5):e1259-e1267. doi:10.1542/peds.2011-1317.
- Utah Public Health Department, *CCHD Toolkit*, (2016) retrieved from <http://www.health.utah.gov/cchd/>
- Wong KK, Fournier A, Fruitman DS, Graves L, Human DG, Narvey M, Russell JL, *CCS/CPCA Position Statement on Pulse Oximetry Screening in Newborns to Enhance Detection of Critical Congenital Heart Disease*, *Canadian Journal of Cardiology* (2016), doi: 10.1016/j.cjca.2016.10.006.

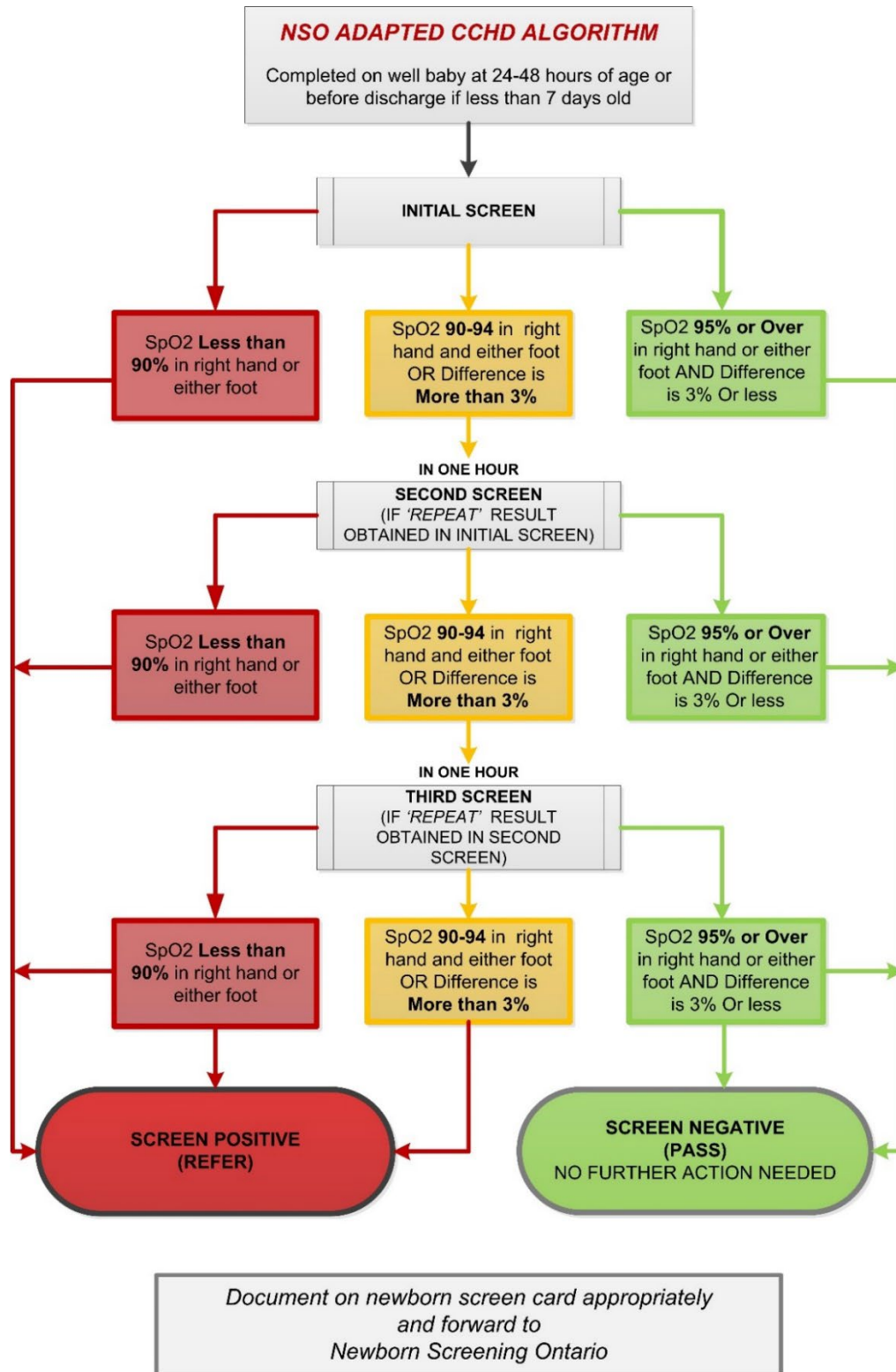
Reviewed by:

- CCHD Disease Specific Working Group (2023/10)



Appendix A:

CCHD Screening Algorithm



(Adapted from Kemper et al, 2011)



Appendix B:

CCHD Evaluation Chart

		RIGHT Hand Pulse Oximetry Measurement												
		100	99	98	97	96	95	94	93	92	91	90	≤89	
Either Foot Pulse Oximetry Measurement	100	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	PASS Screen complete
	99	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	
	98	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Red	
	97	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Red	REPEAT In 1 hr (max 2 repeats)
	96	Yellow	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Red	
	95	Yellow	Yellow	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Red	
	94	Yellow	Yellow	Yellow	Green	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Red	REFER Physician assessment required
	93	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	Yellow	Yellow	Yellow	Yellow	Red	
	92	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow	Red	
	91	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	
	90	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	
	≤89	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	

(Adapted from Utah Department of Public Health)

