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PULSEOXIMETER IN THE DIAGNOSIS OF NEONATAL CARDIOLOGY DISEASES AT BIRTH

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ABSTRACT

Health outcomes are improved when newborn babies with critical congenital heart defects are detected before acute cardiovascular collapse. The main screening tests used to identify these babies include prenatal ultrasound and post-natal clinical examination. However, even though both these methods are available, a significant proportion of babies are still missed. Routine pulseoximeter readings have been reported as an additional screening test that can potentially improve the detection of CCHD (Mawson *et al.*, 2018). Continuous measurements with the Pulseoximeter are very simple and very reliable. Because the Pulseoximeter responds rapid to oxygenation changes and does not need calibration, it is very valuable in the assessment of therapeutic procedures in patients with cyanotic heart diseases. We hereby conclude that the Pulseoximeter is an important new diagnostic tool in pediatric cardiology. We reviewed the available literature addressing current detection methods for CCHD, burden of missed and /or delayed diagnosis of CCHD, rationale of oximetry screening, and clinical studies of oximetry in otherwise asymptomatic newborns.

KEYWORDS: Neonatal, Cardiology, Pulseoximeter, CCHD

Congenital heart diseases occur in 8 per 1000 live births; with approximately 1/3 of these neonates requiring intervention in the first month of life (Mathur and Mathur, 2017). Neonates with respiratory distress; cyanosis or dysmorphic syndromes commonly have CHD. Clinical suspicion increase in a symptomatic infant with a cardiac murmur, but the presence or absence of a murmur does not assure either the presence or absence of significant CHD. Infants suspected to have CHD may be divided into premature and term infants, as well as infants with duct dependent pulmonary blood flow, infants with duct dependent systemic blood flow, and infants with unrestricted pulmonary blood flow based on pulse-oximetry values.

MATERIALS AND METHODS

Many cross sectional studies and retrospective studies used a common screening protocol for diagnosis of congenital heart diseases by simple tool of pulse-oximetry for neonates before discharge (Ewer and Martin, 2016).

RESEARCH METHODOLOGY

Timely reliable monitoring is vital when trying to accurately assess a newborn oxygenation status. Sensors provide monitoring solutions specifically for newborns that help clinicians with pertinent physiological data quickly and efficiently – without sacrificing accuracy. Pulse-oximetry demonstrates the highest sensitivity and specificity during induced conditions of motion and low perfusion (Bachman *et al.*, 2019).

STUDY DESIGN

Pulse oximetry estimates arterial oxygen saturation by measuring the absorption of light in human tissue beds. As light passes through human tissue, it is absorbed in various degrees by tissue, bone, blood vessels, fluids, skin, venous and arterial blood, including various types of haemoglobin. The light absorption changes as the amount of blood in tissue bed changes and as the relative amount of oxygenated and deoxygenated haemoglobin change (Salyer, 2003).

FAILED SCREEN

A screen is considered failed if

1. Any oxygen saturation measure is <90% (in the initial screen or in repeat screen)
2. Oxygen saturation is <95% in the right hand and foot on three measures, each separated by one hour or
3. A saturation >3% difference exists in oxygen saturation between the right hand and foot on three measures, each separated by one hour.

Any infant who fails the screen should have an evaluation for causes of hypoxemia. If a reversible cause of hypoxemia is identified and appropriately treated, an echocardiogram may not be necessary.

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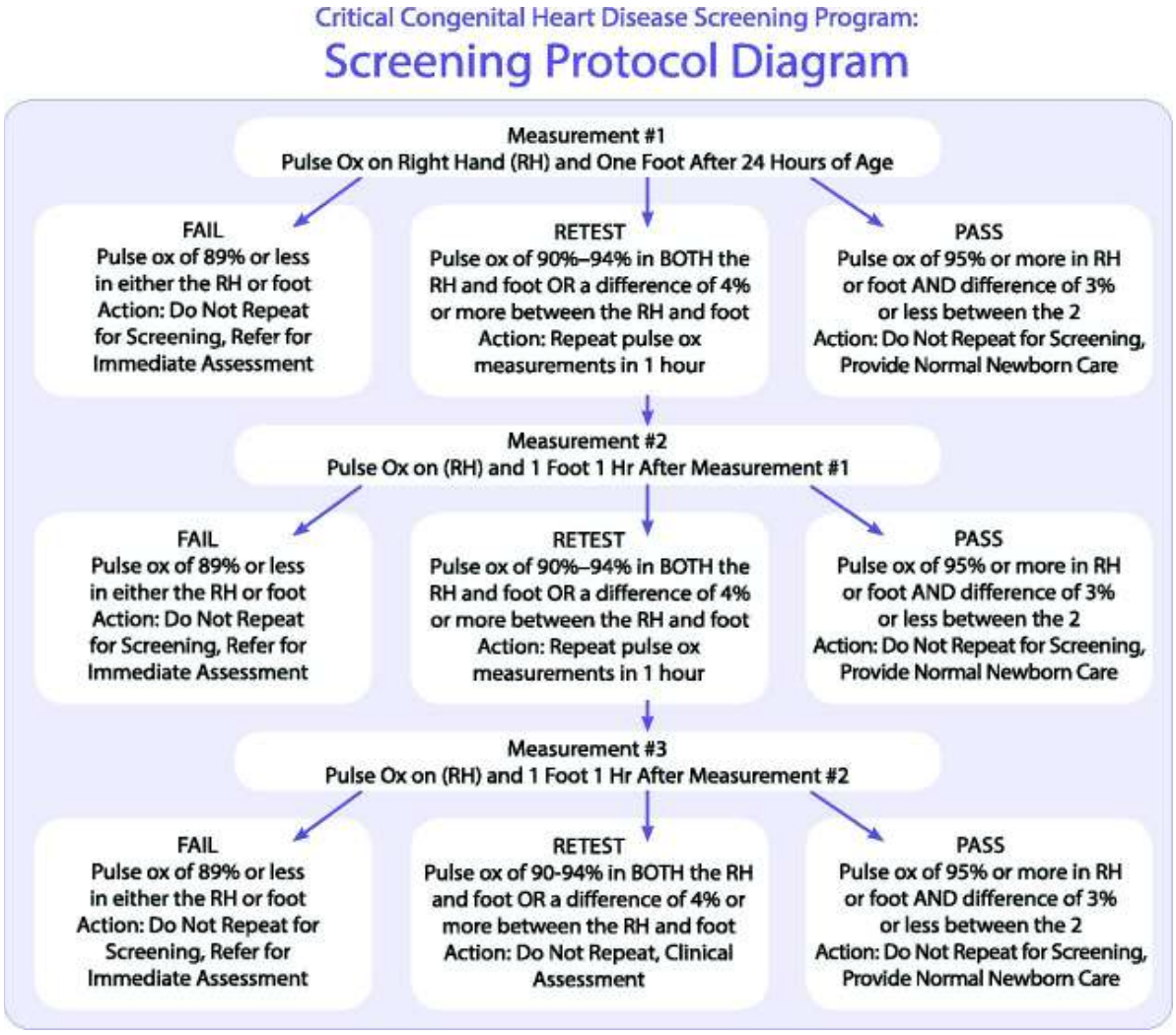

PASSED SCREENS

Any screening with an oxygen saturation measure that is >95% in the right hand or foot with a <3% absolute difference between the right hand and foot is considered a passed screen and screening should end. To reduce false positive screens, screen the neonate while baby is alert or after 24 hours old.

META-ANALYSIS

According to a cross sectional study in term neonates done in July 2010 and April 2011; pulse-oximetry was determined before neonatal hospital discharge and in case of post ductal oxygen saturation <95%, a Doppler Echocardiogram was performed. It was concluded that pulse-oximetry had a good sensitivity and specificity for the identification of CHD in neonates. Low oxygen saturation, higher respiratory frequency and early post-natal age were related to CHD (Plana *et al.*, 2018).

An update work done in 2017 of pulse-oximetry screening for detecting critical congenital heart disease in the newborns concluded that pulse –oximetry is safe, feasible and non-invasive method for screening CHD. It is a nice method to detect the CHD along-with the physical evaluation by medical personal.

Pulse –oximetry is also used for detection of birth prevalence of critical cyanotic CHD. Studies based on pulse-oximetry for timely diagnosis of CHD helps us to improve survival and reduce morbidity. Hence it would be ideal to identify CHD neonates at birth to initiate appropriate treatment promptly (Braun *et al.*, 2017). It is important to classify symptomatic and asymptomatic neonates with cardiac diseases/ cardiac emergencies i.e. when they occur and to discuss the underlying pathophysiology. Diagnosis in the delivery room or nursery includes pulse-oximetry, NIBP measures of all 4 limbs, evaluation of central and peripheral pulse status, blood gas evaluation, hyperoxia test and echocardiography in suspected CHD neonates.

CONCLUSION

Collectively, the evidence from our evaluation and meta-analysis supports the easy method, the feasibility, minimal burden and potential benefits of implementing systemic early screening in newborns for identifying congenital heart diseases.

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