International Journal of Contemporary Pediatrics
Gunasekaran N et al. Int J Contemp Pediatr. 2026 Jun;13(6):894-898
https://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20261531

Original Research Article

Role of pulse oximetry screening at 1 hour and 24 hours for early detection of congenital heart disease in newborns

Nandhini Gunasekaran, Kartik R.*

Department of Pediatrics, Rajarajeshwari Medical College and Hospital, Bangalore, Karnataka, India

Received: 03 April 2026
Revised: 17 May 2026
Accepted: 19 May 2026

***Correspondence:**
Dr. Kartik R.,
E-mail: dockartiksowmya@gmail.com

ABSTRACT

Background: Congenital heart disease (CHD) is one of the most common congenital anomalies affecting newborns worldwide. Early detection of critical CHD is essential for reducing neonatal morbidity and mortality. Pulse oximetry screening is a simple, non-invasive, and cost-effective tool for early identification of hypoxemia associated with congenital cardiac defects.
Methods: This prospective observational study was conducted in the Department of Paediatrics, Rajarajeshwari Medical College and Hospital, Bangalore, from 1st January 2026 to 31st march 2026. A total of 116 term neonates underwent pulse oximetry screening at 1 hour and 24 hours after birth using pre-ductal and post-ductal oxygen saturation measurements.
Results: Among the screened neonates, 57 (49.1%) were males and 59 (50.9%) were females. Three neonates (2.6%) screened positive and were referred for echocardiographic evaluation. Majority of neonates remained asymptomatic during screening.
Conclusions: Pulse oximetry screening is an effective and feasible screening modality for early detection of CHD in asymptomatic newborns.

Keywords: Congenital heart disease, Pulse oximetry, Newborn screening, Echocardiography

INTRODUCTION

Congenital heart disease (CHD) is among the most common congenital anomalies in newborns, with an incidence of approximately 8-10 per 1000 live births. Nearly one-third of these defects are classified as critical congenital heart disease requiring early intervention. Delayed diagnosis may lead to severe complications including hypoxemia, cardiovascular collapse, and death.

Several studies have demonstrated that newborns with congenital heart disease may remain clinically asymptomatic during the early neonatal period.[1-3] Clinical examination alone may fail to identify these neonates, especially in resource-limited settings.

Pulse oximetry screening has emerged as an effective adjunct to routine neonatal examination. It is simple, inexpensive, non-invasive, and easy to perform in postnatal wards. Pulse oximetry helps identify hypoxemia before the onset of cyanosis and overt clinical deterioration.

The burden of congenital heart disease is particularly significant in developing countries where access to specialized pediatric cardiology services may be limited. Delayed diagnosis often contributes to increased neonatal morbidity and prolonged hospital stay.

Previous studies demonstrated improved early detection rates and high specificity of pulse oximetry screening.[3,6,9]

Therefore, the present study was undertaken to evaluate the role of pulse oximetry screening at 1 hour and 24 hours after birth for early detection of congenital heart disease in newborns.

Aim and objectives

Aim

Aim was to evaluate the role of pulse oximetry screening in early detection of congenital heart disease among newborns.

Objectives

Objectives were to perform pulse oximetry screening at 1 hour and 24 hours after birth, to identify neonates with abnormal pulse oximetry findings, to refer screen-positive neonates for echocardiographic confirmation and to assess feasibility as a routine screening tool.

METHODS

This prospective observational study was conducted in the Department of Paediatrics, Rajarajeshwari Medical College and Hospital, Bangalore, from 1st January 2026 to 31st March 2026.

Sample size

A total of 116 term neonates admitted to the postnatal ward were included in the study.

Fisher's formula: $p(1-p)\ z^2\ x/d^2$

Procedure and data collection

Neonates with prematurity, respiratory distress, major congenital anomalies, or those requiring immediate intensive care admission were excluded.

Convenient sampling technique was used, and all eligible neonates delivered during the study period were enrolled after obtaining informed parental consent.

Detailed maternal history including gestational diabetes mellitus, pregnancy-induced hypertension, antenatal complications, and antenatal scans findings were recorded. Neonatal demographic details such as sex, gestational age, birth weight, and mode of delivery were documented.

Pulse oximetry screening was performed using a standard neonatal pulse oximeter probe. Pre-ductal oxygen saturation was measured from the right hand and post-ductal saturation from either foot at 1 hour and 24 hours after birth.

Clinical examination including heart rate, respiratory rate, cyanosis, murmur, respiratory distress, and capillary refill time was assessed at both screening intervals.

A screening result was considered positive if oxygen saturation was less than 95% in either extremity or if the difference between pre-ductal and post-ductal saturation exceeded 3%.

All screen-positive neonates underwent detailed clinical examination and referral for two-dimensional echocardiography. Sample size was based on all eligible term neonates delivered during the study period.

Statistical analysis

The collected data were entered into Microsoft excel and analyzed using statistical package for social sciences (SPSS) software version 23.0. Descriptive statistical analysis was performed for all study variables. Categorical variables such as gender, mode of delivery, maternal risk factors, and pulse oximetry screening outcomes were expressed as frequencies and percentages. Continuous variables such as oxygen saturation values were expressed as mean±standard deviation.

Pre-ductal and post-ductal oxygen saturation values measured at 1 hour and 24 hours after birth were assessed and compared based on predefined screening criteria. Neonates with oxygen saturation less than 95% or a difference greater than 3% between pre-ductal and post-ductal saturation were considered screen positive and were referred for echocardiographic evaluation.

The Chi-square test or Fisher's exact test was used for comparison of categorical variables wherever applicable. A p value of less than 0.05 was considered statistically significant.

RESULTS

A total of 116 neonates were included in the present study. There was an almost equal distribution of male and female neonates.

A slightly higher proportion of neonates were delivered by lower segment cesarean section compared to vaginal delivery.

Maternal risk factors such as gestational diabetes mellitus and pregnancy-induced hypertension were observed only in a small proportion of mothers.

Pulse oximetry screening was performed using pre-ductal and post-ductal oxygen saturation measurements at both 1 hour and 24 hours after birth. Majority of neonates had oxygen saturation values above 95%.

Three neonates screened positive based on predefined screening criteria. All screen-positive neonates underwent further evaluation with echocardiography.

Clinical examination findings such as cyanosis, murmur, respiratory distress, tachypnea, and prolonged capillary refill time were absent in the majority of screened neonates. This emphasizes the utility of pulse oximetry in identifying asymptomatic neonates who may otherwise be missed during routine clinical examination.

Table 1 shows that a total of 116 neonates were included in the study, with an almost equal distribution of males (49.1%) and females (50.9%). Regarding the mode of delivery, a slightly higher proportion of neonates were delivered by LSCS (55.2%) compared to vaginal delivery (44.8%), indicating a predominance of caesarean deliveries in the study population.

Table 2 shows that maternal risk factors were present in a small proportion of cases. Both gestational diabetes mellitus (GDM) and pregnancy-induced hypertension (PIH) were observed in 4.3% of mothers each, while the majority (95.7%) had no such risk factors, indicating a predominantly low-risk maternal population in the study.

Table 1: Baseline characteristics of neonates.

Variables	Category	N (%)
Sex	Male	57 (49.1)
	Female	59 (50.9)
Mode of delivery	Vaginal (NVD)	52 (44.8)
	LSCS (Elective + emergency)	64 (55.2)

Table 2: Maternal risk factors.

Variables	Category	N (%)
GDM	Present	5 (4.3)
	Absent	111 (95.7)
PIH	Present	5 (4.3)
	Absent	111 (95.7)

Table 3 describes the pulse oximetry screening protocol used in the study. Screening was performed using pre-ductal (right hand) and post-ductal (foot) oxygen saturation measurements at 1 hour and 24 hours after birth. A screening result was considered positive if SpO_2 was less than 95% or if there was a difference of more than 3% between the two measurements. A total of 116 neonates were screened using this standardized method.

Table 4 shows that the majority of neonates had negative screening results (97.4%), while a small proportion (2.6%) were screen positive. This indicates low positivity rate of pulse oximetry screening in study population.

Table 5 shows that all screen-positive neonates (100%) were appropriately referred for 2D echocardiographic evaluation, ensuring further diagnostic assessment. The majority of neonates (97.4%) were screen negative, indicating normal screening results in most cases.

Table 3: Pulse oximetry screening characteristics.

Parameters	Details
Screening method	Pre-ductal (right hand) and post-ductal (foot) SpO_2
Timing of screening	1 hour and 24 hours after birth
Criteria for positive screen	SpO_2 <95% OR pre–post difference >3%
Total neonates screened	116

Table 4: Pulse oximetry screening outcome.

Screening result	N (%)
Screen negative	113 (97.4)
Screen positive	3 (2.6)
Total	116 (100)

Table 5: Outcome of screen-positive neonates.

Parameters	N (%)
Screen-positive neonates	3 (100)
Referred for 2D echocardiography	3 (100)
Screen-negative neonates	113 (97.4)

DISCUSSION

The present study evaluated the role of pulse oximetry screening in early detection of congenital heart disease among newborns. Pulse oximetry is simple, economical, non-invasive, and widely available.

The positivity rate observed in the present study was low and comparable to previous studies reporting low false-positive rates with pulse oximetry screening.[6,8]

Most neonates did not exhibit overt clinical symptoms during routine clinical examination, similar to findings reported in earlier neonatal screening studies.[9] This observation is comparable to previous studies where many neonates with congenital heart disease remained asymptomatic during the early neonatal period.

All screen-positive neonates underwent echo cardiographic evaluation, enabling timely diagnosis and referral.

Pulse oximetry screening is advantageous because it is inexpensive, easy to perform, and requires minimal training. It can therefore be effectively integrated into routine neonatal care even in peripheral healthcare settings.

The present study also highlights the importance of combining pulse oximetry with careful clinical examination. While pulse oximetry improves early detection, clinical assessment remains important in

identifying neonates with associated systemic abnormalities.

Similar studies conducted by Ewer et al and Granelli et al also demonstrated that pulse oximetry screening significantly improves early identification of critical congenital heart disease before clinical deterioration occurs.[3,6]

Pulse oximetry screening has gained widespread acceptance as a reliable method for early detection of congenital heart disease in newborns. Multiple studies conducted across different countries have consistently demonstrated high specificity and good sensitivity of pulse oximetry screening when performed before discharge from the hospital.[3,6,11] The non-invasive nature of the procedure makes it suitable for routine neonatal care without causing discomfort to the baby.

One of the major strengths of pulse oximetry screening is its ability to detect hypoxemia before the onset of clinically visible cyanosis. This is particularly important because many neonates with critical congenital heart disease may initially appear healthy and asymptomatic.[3,9] Early recognition through screening allows timely referral for echocardiography and specialist evaluation.

In developing countries, where access to pediatric cardiology facilities may be limited, pulse oximetry can serve as an inexpensive bedside tool for early identification of high-risk neonates. The screening process requires minimal equipment and can be performed by trained nursing staff or healthcare workers. Therefore, incorporation of pulse oximetry into standard newborn screening protocols may significantly improve neonatal outcomes.

The present study demonstrated that the majority of neonates screened negative and remained clinically stable throughout the observation period. This finding supports the feasibility of implementing pulse oximetry screening without causing unnecessary anxiety or excessive referrals. Similar findings have been reported in several previous neonatal screening studies.[6,7]

Another important advantage of pulse oximetry screening is that it may help detect non-cardiac causes of hypoxemia such as neonatal pneumonia, sepsis, transient tachypnea of newborn, and persistent pulmonary hypertension. Thus, the benefits of screening extend beyond congenital heart disease alone.

Healthcare worker training and standardization of screening protocols are essential for successful implementation of pulse oximetry screening programs. Proper timing of screening, appropriate probe placement, and repeat measurements in borderline cases help improve the accuracy of results.

Further multicentric studies with larger sample sizes are recommended to establish national guidelines for routine pulse oximetry screening in newborns. Integration of pulse oximetry into routine neonatal examination may contribute significantly toward reduction in neonatal morbidity and mortality associated with delayed diagnosis of congenital heart disease.

Limitations

Limitations of the study include the relatively small sample size and single-center design.

CONCLUSION

Pulse oximetry screening is an effective, feasible, reliable, and non-invasive screening modality for early detection of congenital heart disease in newborns. Routine implementation of pulse oximetry screening in postnatal wards is strongly recommended.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Botto LD, Correa A, Erickson JD. Racial and temporal variations in the prevalence of heart defects. Pediatrics. 2001;107(3):E32.
2. Talner CN. Report of the New England Regional Infant Cardiac Program. Pediatrics. 1980;65(1pt2):375-461.
3. Ewer AK, Middleton LJ, Furmston AT, Abhay B, Jane PD, Shakila T, et al. Pulse oximetry screening for congenital heart defects in newborn infants. Lancet. 2011;378(9793):785-94.
4. Arlettaz R, Bauschatz AS, Monkhoff M, Bettina E, Urs B. The contribution of pulse oximetry to the early detection of congenital heart disease in newborns. Eur J Pediatr. 2006;165(2):94-8.
5. Koppel RI, Druschel CM, Carter T, Goldberg BE, Mehta PN, Talwar R, et al. effectiveness of [ulse oximetry screening for congenital heart disease in asymptomatic newborn. pediatrics.2003;111:451-5.
6. Granelli A, Wennergren M, Sandberg K, Mats M, Carina B, Leif I, et al. Impact of pulse oximetry screening on detection of duct dependent congenital heart disease. BMJ. 2009;338:a3037.
7. Padmapriya S, Senthilvelan B, Gopalakrishnan H, Subramanian S. Role of pulse oximetry in screening newborns for congenital heart disease at 1 hour and 24 hours after birth. Int J Contemp Pediatr. 2016;3:631-4.
8. Shah F, Chatterjee R, Patel PC. Early detection of critical congenital heart disease in newborns using pulse oximetry screening. Int J Med Res Health Sci. 2015;4:78-83.

9. Mahle WT, Newburger JW, Matherne GP, Frank CS, Tracey RH, Robert K, et al. Role of pulse oximetry in examining newborns for congenital heart disease. Circulation. 2009;120(5):447-58.
10. Griebsch I, Knowles RL, Brown J, Catherine B, Christopher W, Carol AD, et al. Cost-effectiveness of newborn screening methods for congenital heart disease. Int J Technol Assess Health Care. 2007;23(2):192-204.
11. Thangaratinam S, Daniels J, Ewer AK, Khalid SK, Andrew KE. Accuracy of pulse oximetry in screening for congenital heart disease. Lancet. 2012;379(9835):2459-64.
12. de-Wahl Granelli A, Mellander M, Sunnegårdh J. Screening for duct-dependent congenital heart disease with pulse oximetry. Acta Paediatr. 2005;94:1590-6.

Cite this article as: Gunasekaran N, Kartik R. Role of pulse oximetry screening at 1 hour and 24 hours for early detection of congenital heart disease in newborns. Int J Contemp Pediatr 2026;13:894-8.