Correspondence

To the Editors

Effectiveness of newborn pulse oximetry screening for the identification of critical congenital heart disease in a tertiary care hospital in Sri Lanka

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Dear Editors,

Read with interest the article "Effectiveness of newborn pulse oximetry screening for the identification of critical congenital heart disease in a tertiary care hospital in Sri Lanka", published in your journal of child health in the December 2021 issue[1]. It is a well-conducted study that conveys a clear message about the benefits and early detection of critical heart disease in newborns[1]. I must congratulate all the authors of the study for laying this milestone in the field of neonatal screening programmes in developing countries, which will increase the acceptance of the same in other countries as well. With respect to this study, I want to address some of the important aspects of neonatal pulse oximetry screening.

1. Only term babies were included in the study, preterm babies being excluded. So, the chances are that it may not represent the exact neonatal population and may not reflect the exact incidence and prevalence of congenital cyanotic heart disease. Was there any specific reason for the non-inclusion of preterm babies in the study? Any risk of data bias?
2. It is good that all babies in this study were screened after 24 hours, which increased the sensitivity and specificity of the screening. Even though the standard guidelines also recommend that screening be conducted between the hours of 24–48 hours, it is more reliable and sensitive[2]. Can we increase the pick-up rate by doing pulse oximetry at 2 different timings? On one occasion, we may miss some of the cases of mild congenital heart disease as the baby may not manifest symptoms till the end of the first week of life when the duct is closed.
3. In this study, out of 18 babies with congenital heart disease, murmurs and cyanosis were noticed in 3 and 2 babies only, respectively. So, this almost favours the algorithm that merely newborn clinical examination and visual perception of cyanosis is not reliable and may miss some of the cases and lack specificity and sensitivity. Cardiac murmurs are not always heard in neonatal cardiac disease in the neonatal period and vice versa also. The timing of screening of neonates also affects the pulse oximetry reading, especially if done while sleeping or awake and if done within 24 hours of doing the auditory examination[3].
4. Some of the harm from routine screening is the false positive rate, which may raise anxiety among parents and warrant unnecessary investigations. The condition becomes more difficult if echocardiography is not available at the centre and the patient needs to be referred, creating unnecessary panic and so raising an issue of poor acceptance among parents[4].
5. In this study, pulse oximetry was done in 8718 babies and only 19 babies showed a positive screening test, and echocardiography was positive in 18 babies only. So, according to this study, the overall incidence comes out to be 0.2 percent and 1.5 per 1000 live births, which constitutes a lower incidence rate as compared to the overall incidence. The actual incidence mentioned in your index article and one of the previous studies done by Perera KSY, *et al*[5] in the same institute in Sri Lanka show a very high incidence of around 125/10000 live births. The incidence which was picked up by oximetry was low, only 1.5 per 1000 live births, so it may be possible that we missed some of the cases.

Although clinical examination alone is unreliable to detect heart diseases in neonates, if combined with pulse oximetry screening, then it becomes more sensitive, specific, and reliable[2]. So, we should also focus on clinical examination equally, which was done in this study also by the author, which is a good thing. We cannot afford to forget our clinical acumen and the reliability of physical clinical examination in medicine.

But it is sure that the advantages of neonatal screening are much more than the harm and parental anxiety, so whether this should be included in a routine newborn screening programme or not is again a debate. Many developed countries, like the US, have universally adopted this policy of routine screening, but countries like the UK have not adopted and implemented it routinely[6]. Overall, newborn pulse oximetry screening is cost-effective, feasible, and accessible as the nurses and healthcare workers can be trained, and it can be started in individual hospitals and can be included in newborn screening programmes in developing countries also[1,2,3].

References

1. Gamhewage NC, Perera KSY, Weerasekera M. Effectiveness of newborn pulse oximetry screening for the identification of critical congenital heart disease in a tertiary care hospital in Sri Lanka. *Sri Lanka Journal of Child Health* 2021; **50**(4): 699–703. http://doi.org/10.4038/sljch.v50i4.9890.

2. Zhao QM, Ma XJ, Ge XL, Liu F, Yan WL, Wu L *et al*. Neonatal congenital heart disease screening group. Pulse oximetry with clinical assessment to screen for congenital heart disease in neonates in China: a prospective study. *Lancet* 2014; **384**(9945):747-54. http://doi.org/ 10.1016/S0140-6736(14)60198-7.

3. Kemper AR, Mahle WT, Martin GR, Cooley WC, Kumar P, Morrow WR, et al. Strategies for implementing screening for critical congenital heart disease. *Pediatrics* 2011; 128(5): e1259–e1267.

4. Powell R, Pattison H, Bhoyar A, Furmston A, Middleton L, Daniels J, *et al.* Pulse oximetry screening for congenital heart defects in newborn infants: an evaluation of acceptability to mothers. *Archives of Disease in Childhood Fetal and Neonatal Edition* 2013; **98**(1): F59–63.

5. Perera KSY, Gamhewage NC, Weerasekera M. Prospective study on incidence and pattern of congenital abnormalities in a tertiary care hospital in Sri Lanka. *Sri Lanka Journal of Child Health* 2019; **48**(4): 321-5. http://dx.doi.org/10.4038/sljch.v48i4.8826

6. Brown S, Liyanage S, Mikrou P, Singh A, Ewer AK. Newborn pulse oximetry screening in the UK: a 2020 survey. *Lancet* 2020; **396**(10255): 881. http://doi.org/10.1016/S01406736(20)31959-0

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Response by authors of article

Dear Editors,

Critical congenital heart defects (CCHD) constitute a group of structural heart diseases which need intervention early in life for survival[1]. Examples include critical aortic stenosis, coarctation of aorta and hypoplastic left heart syndrome[1]. Although clinical examination of the newborn helps to recognise those with congenital heart defects, it is known to miss some types of CCHD. In this background, pulse oximetry screening (POS) is a very effective intervention, enabling identification of 5 out of 6 babies with CCHD, with a very low false positive rate (0.06%) when POS is done after 24 hours of age[2]. We conducted the study on "Effectiveness of newborn pulse oximetry screening for the identification of critical congenital heart disease in a tertiary care hospital in Sri Lanka" to re iterate the significance of carrying out POS in the Sri Lankan setup[3].

In our study, we have recruited only term babies. This is because we wanted to highlight the importance of POS in detecting CCHD in clinically well babies in the post-natal wards, which is the main objective of POS. In our setup, all preterm babies <34 weeks gestation are admitted to the newborn care unit, while 34-37 weeks babies are reviewed by a medical officer soon after delivery and examined, including assessment of the saturation of the baby. During this assessment, any baby with low saturation would be identified and evaluated.

Due to the high false positive rate of POS when it is done before 24 hours of age (0.47%–0.5% vs 0.05%–0.11%)[2], many guidelines recommend that POS must be performed after 24 hours of life. Nevertheless, there have been concerns about this recommendation, as some babies with CCHD can present with postnatal collapse, when the ductus is closing. Studies have demonstrated that nearly 50% of cases of CCHD can develop symptoms in the first 24 hours of life[4]. Considering the above factors,

along with the very high false positive rate when POS is performed early, the American Academy of Paediatrics recommended that it is acceptable to perform POS in the first 24 hours of life. However, they have not changed the current practice[2]. This remains an area where Sri Lanka can re-visit.

POS utilises the difference between pre- and post-ductal oxygen saturation, while the ductus is open. Most congenital heart diseases do not have right to left shunting and will not be detected by POS (e.g., ventricular septal defect, atrial septal defect, pulmonary stenosis) while most of the critical heart diseases will be detected due to a positive POS. In a study conducted in Sri Jayewardenepura General Hospital, only a minority (2.95 per 10,000 live births) had CCHD[5]. This explains the higher incidence of total congenital heart disease vs those picked by POS.

In conclusion, it is evident that POS is a very effective method in detecting CCHD early. This is of particular importance to countries like Sri Lanka where anomaly scans are not performed as a routine in all the centres.

References

1. Riede FT, Wörner C, Dähnert I, Möckel A, Kostelka M, Schneider P. Effectiveness of neonatal pulse oximetry screening for detection of critical congenital heart disease in daily clinical routine: Results from a prospective multicentre study. *European Journal of Pediatrics* 2010; **169**(8): 975-81. https://doi.org/10.1007/s00431-010-1160-4 PMid: 20195633 PMCid: PMC2890074

2. Martin GR, Ewer AK, Gaviglio A, Hom LA, Saarinen A, Sontag M, et al. Updated strategies for pulse oximetry screening for critical congenital heart disease. *Pediatrics* 2020; **146**(1): e20191650.

3. Gamhewage NC, Perera KSY, Weerasekera M. Effectiveness of newborn pulse oximetry screening for the identification of critical congenital heart disease in a tertiary care hospital in Sri Lanka. *Sri Lanka Journal of Child Health* 2021; **50**(4): 699–703. http://doi.org/10.4038/sljch.v50i4.9890

4. de-Wahl Granelli A, Wennergren M, Sandberg K, Mellander M, Bejlum C, Inganäs L, *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**: 3037.

5. Perera KSY, Gamhewage NC, Weerasekera M. Prospective study on incidence and pattern of congenital abnormalities in a tertiary care hospital in Sri Lanka. *Sri Lanka Journal of Child Health* 2019; **48**(4): 321-5. http://dx.doi.org/10.4038/sljch.v48i4.8826

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