Article

Pulse oximetry to screen for critical congenital cardiopathy in neonates: current practices in Flanders

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Keywords

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Abstract

Based on a survey on current practices using systematic pulse oximetry to screen for critical congenital cardiopathy in the 59 maternities in Flanders and a response rate of 91 % (54/59), we conclude that at least 48 units already have implemented systematic pulse oximetry screening. Before the Vlaamse Vereniging voor Kindergeneeskunde guideline (≤2015), there were 2 maternity wards that already conducted pulse oximetry, with a steady annual increase (+4, +8, +13, +8, +11, +1) until 2021. Commonly reported barriers were limited resources (time, staff, equipment), the need of training initiatives, the presence of false-positives, the absence of echocardiographic expertise, or interference with earlier discharge.

Introduction

Congenital cardiopathies are the most common group of congenital malformations, with a prevalence of 9.4/1000. About 15-25% of these cases are critical congenital heart diseases (CCHD), defined as a potential life-threatening duct-dependent heart lesion requiring an invasive procedure in first 28 days of life (15% -25 % of the CHD, about 17/10 000) (1). Pulse oximetry (PO) aims to identify CCHD cases as 'pre-collapse' detection is associated with improved outcome (1).

PO hereby adds to prenatal screening (ultrasound) and postnatal clinical examination. There is a progressive increase in prenatal ultrasound-based CCHD detection, but this remains below 50%, while the neonatal clinical examination also has limitations (sensitivity suggested to be 52%), so that PO is useful to close the diagnostic gap (2). However, these data are based on meta-analysis, and do not necessary reflect the setting in Flanders (prenatal screening, postnatal clinical examination).

Also when combined with neonatal clinical examination, there is an add on benefit in both sensitivity and specificity of PO. Based on a hypothetic population of 10 000 cases and 17 cases with CCHD, clinical examination itself will result in 109 positive results, of whom 9 will have a CCHD (and 8/17 cases will be missed, sensitivity 52%, specificity 98-99%). Adding PO to the screening procedure based on clinical examination will result in detection of 16/17 (+7) true cases, be it based on 216 (+107) positive results (sensitivity 92%, specificity 98%). An additional reflection on these 200 false positive cases is that 37-70% (mean 50%) of these cases have other issues, like persistent pulmonary hypertension, respiratory distress, sepsis, or non-critical congenital heart disease (3). An overview on sensitivity, specificity and false-positive ratio of PO for CCHD screening is provided in Table 1.

In the meanwhile and driven by these meta-analyses, advices, public consultations or guidelines on PO screening have been provided by different pediatric societies (US, UK, Canada), including the Vlaamse Vereniging voor Kindergeneeskunde (VVK) statement (2016) on PO as part of the short hospital stay approach (8). As this statement was published in 2016, we conducted a survey on the current practices and the perceived barriers on PO implementation in the 59 Flemish maternities 5 years after its release (8).

Methods

Following ethical approval of the survey (MP017253, 19.01.2021) by KU Leuven, and with the logistic support of the VVK secretary in the GDPR setting (General Data Regulation Protection), an online questionnaire was repeatedly circulated (February-March 2021) to all heads of the relevant departments (pediatrics, neonatology). The questionnaire focused on current practices, the implementation pathway and perceived burdens on PO screening.

Results

The response rate (54/59, 91%) was high. As 48/54 of the maternity wards have a systematic PO screening program, this means that at least 48/59 (81%) of the maternity wards have implemented systematic PO screening. Before the VVK guideline (≤2015), there were 2 maternity wards that already conducted PO, with a steady annual increase (+4, +8, +13, +8, +11, +1, one unit has not reported on the year of implementation), until 2021. Other units only screen in the event of abnormal clinical findings (n=4), and 2 of the responders do not have a PO strategy yet, while the majority of these maternities intend to implement systematic PO screening in the next year(s). Commonly reported barriers are limited resources (time, staff, equipment) in the absence of funding, the need for training initiatives, the presence of false-positives, the absence of echocardiographic expertise in the event of a positive screening, or interference with earlier discharge.

Discussion

Within 5 years after the VVK guidance text on early discharge practices including PO screening was published, at least 81% of the maternity wards have developed, organized, and implemented a systematic PO screening program. There is a progressive annual increase, while the majority of units that do not yet provide this systematic PO screening have the intention to do this in the next year(s). When compared to other (European) countries, it seems that there is a trend to reach near universal screening, be it without structured efforts or imposed guidelines from authorities when compared to other regions (9). Barriers relate to 'logistics', as well as the false positive rate (table 1).

Related to this and as one of the limitations of our survey, we have not collected information on how (protocol) PO screening is conducted, and to what extent this is standardized within and between maternity wards. We further

Table 1 : Sensitivity, specificity and false-positive ratio of pulse oximetry (PO) for critical congenital heart disease screening as reported in systematic reviews and meta-analyses (chronologically, CI = 95 % confidence interval) (4-7).

source	studies pooled	newborns (number)	sensitivity PO	specificity PO	false+ PO
Thangaratinam 2007 (4)	8	35.960	63,4% (CI: 25-98,5%)	99,8% (CI: 98-100%)	0,2% (0-2%)
Thangaratinam 2012 (5)	13	229.421	76,5% (CI: 67,7-83,5%)	99,9% (CI: 99,7-99,9%)	0,14% (0,06-0,33%)
Du 2017 (6)	22		69% (CI: 67-72%)	99% (CI: 99-99%)	
Plana 2018 (7)	19	436.758	76,3% (CI: 69,5-82%)	99,9% (CI: 99,7-99,9%)	0,14% (0,07-0,22%)

suggest to consider qualitative research in addition to the current quantitative research, with emphasis on the different health care providers involved (pediatricians, pediatric cardiologists, midwives). We are neither aware on the opinions of parents on this additional screening opportunity with a higher sensitivity, at the cost of an increase in false positives (be it that a relevant portion has another non-CCHD diagnosis). In our opinion, formal registration as valid screening technique within the existing framework of preventive medicine and screening practices, and subsequent reimbursement are needed to create a qualitative, sustainable setting.

Conflict of interest

The authors have no conflict of interest to declare.

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