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REVIEW ARTICLE

The importance of neonatal screening in the early detection of cardiac malformations

La importancia del cribado neonatal en la detección precoz de malformaciones cardiacas

A importância da triagem neonatal na detecção precoce das malformações cardíacas

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Abstract

The aim was to analyze scientific articles dealing with the theme congenital heart disease in order to identify possible early diagnoses to treat the disease, as well as care offered by the nursing professional to the newborn. From this, an integrative review was carried out based on the findings available in the Virtual Health Library, where the descriptors "newborn", "neonatal intensive care units" and "cardiopathies" were used. 260 articles were found and after the inclusion and exclusion criteria, 12 articles were selected to direct this study. After summarizing the results of each selected article, the importance of early detection of cardiac malformations, pulse oximetry screening, perioperative care and complications and advances in operative management were identified. Based on the information obtained, possible consequences of congenital heart disease in neonates were discussed, such as the performance of the nursing team in this scenario. The need for scientific production was evident, demonstrating greater nursing knowledge about the care provided.

Descriptors: Infant, Newborn; Intensive Care Units, Neonatal; Heart Diseases; Nursing Care; Neonatal Nursing.

Resumén

El objetivo fue analizar artículos científicos que traten el tema cardiopatías congénitas con el fin de identificar posibles diagnósticos precoces para el tratamiento de la enfermedad, así como los cuidados ofrecidos por el profesional de enfermería al recién nacido. A partir de ello, se realizó una revisión integradora a partir de los hallazgos disponibles en la Biblioteca Virtual en Salud, donde se utilizaron los descriptores “recién nacido”, “unidades de cuidados intensivos neonatales” y “cardiopatías”. Se encontraron 260 artículos y después de los criterios de inclusión y exclusión, se seleccionaron 12 artículos para dirigir este estudio. Luego de resumir los resultados de cada artículo seleccionado, se identificó la importancia de la detección temprana de malformaciones cardíacas, el tamizaje con oximetría de pulso, el cuidado perioperatorio y las complicaciones y los avances en el manejo operatorio. Con base en las informaciones obtenidas, fueron discutidas las posibles consecuencias de las cardiopatías congénitas en los neonatos, como la actuación del equipo de enfermería en ese escenario. Se evidenció la necesidad de producción científica, demostrando mayor conocimiento de enfermería sobre el cuidado prestado.

Descriptores: Recién Nacido; Unidades de Cuidado Intensivo Neonatal; Cardiopatías; Atención de Enfermería; Enfermería Neonatal.

Resumo

Objetivou-se analisar artigos científicos que tratassem da temática cardiopatia congênita afim de identificar possíveis diagnósticos precoces para tratar a doença, assim como cuidados oferecidos pelo profissional de enfermagem ao recém-nascido. A partir disso, foi realizada uma revisão integrativa com base nos achados disponíveis na Biblioteca Virtual em Saúde, onde foram utilizados os descritores "recém-nascido", "unidades de terapia intensiva neonatal" e "cardiopatias". Foram encontrados 260 artigos e após os critérios de inclusão e exclusão foram selecionados 12 artigos para direcionar esse estudo. Após a síntese dos resultados de cada artigo selecionado, identificou-se a importância da detecção precoce das malformações cardíacas, da triagem de oximetria de pulso, dos cuidados e complicações perioperatórias e do avanço no manejo operatório. Mediante as informações obtidas, foi discutido possíveis desdobramentos da doença cardíaca congênita em neonatos, tal como a atuação da equipe de enfermagem nesse cenário. Ficou evidente a necessidade de produção científica demonstrando maior conhecimento da enfermagem sobre os cuidados prestados.

Descritores: Recém-Nascido; Unidades de Terapia Intensiva Neonatal; Cardiopatias; Cuidados de Enfermagem; Enfermagem Neonatal.

Introduction

Congenital heart disease (CHD) is one of the main causes of infant mortality worldwide, accounting for 40% of fetal malformations. The incidence of CHD according to the World Health Organization (WHO) is approximately 1% in Brazil, considering 2.8 million live births per year, 29 thousand would be new cases of congenital heart disease annually in the country. According to the American Heart Association, this abnormality in newborns is a defect in the structure and function of the heart that occurs in the developing fetus and can affect about 1 in 100 children[1-3].

Congenital heart disease (CHD) is increasingly recognized as a significant contributor to infant mortality and morbidity in low-income countries and, therefore, late detection of heart disease in the newborn (NB) results in a considerable rate of lethality and incidence of this anomaly. Neonates with heart disease are aged between 0 and 28 days of life, and may present some clinical signs such as arrhythmia, heart murmur, cyanosis, low cardiac output, fatigue during breastfeeding, tachypnea, skin pallor, sweating, tachycardia, hypotension, among others[4-7].

Considering CHD as the most common type of birth defect, critical congenital heart disease (CCC) is defined as a heart defect that can lead to death, requiring surgery or intervention within the first 28 days. This malformation in the structure of the heart exists from the moment of birth and corresponds to 25% of cases of CHD. In addition, neonates who present CCC can remain asymptomatic at birth and, when discharged from the hospital, they can manifest cardiac decompensation at home, thus, its early recognition is of paramount importance[2,5,7-9].

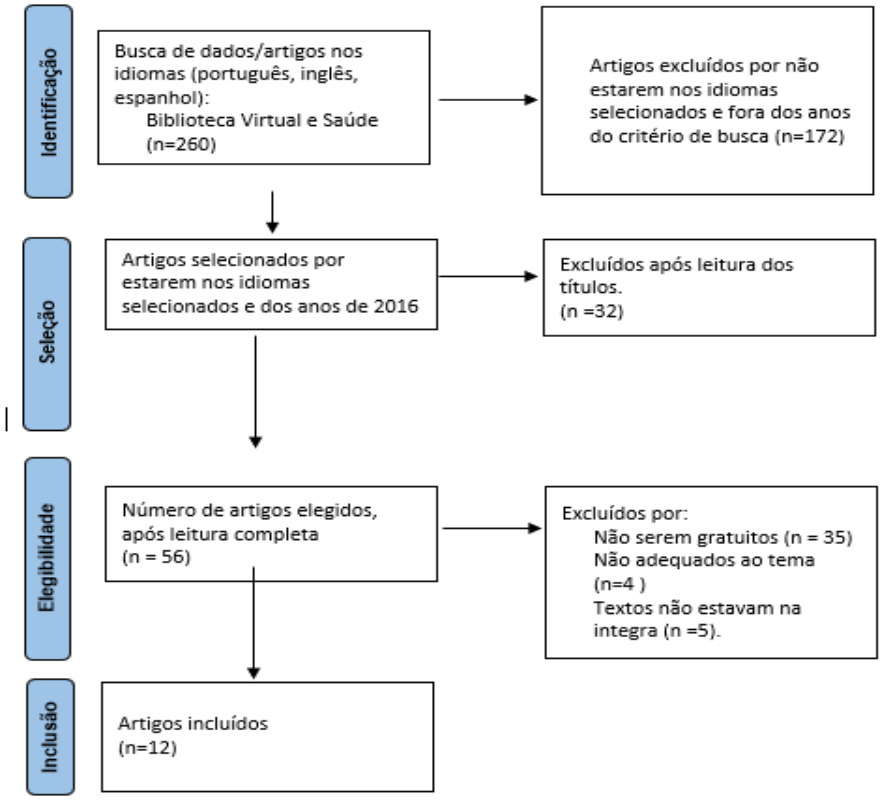
Considering that congenital heart diseases are anomalies capable of determining the child's life and development conditions and that nursing is inserted in all stages of care for babies with heart diseases, even in non-specialized units, there is a need to improve the clinical practice of nurses, so that there can be safe care based on scientific evidence. As a result, nursing care provided to a child with CHD should be performed as soon as there is a diagnostic suspicion, in order to prepare a care plan based on data collection[8].

Even after birth, nurses must be able to provide intensive, rigorous and systematized care to newborns with congenital heart disease, whether critical or not. Not only that, this professional must be attentive to all possible clinical complications and to maintain the comfort of this child. Therefore, this study aims to understand how the early diagnosis is performed in neonates with congenital heart disease and demonstrate which perioperative care should be offered by the nursing professional.

Methodology

An integrative literature review was carried out which consists of gathering a collection of scientific journals, with the purpose of discussing a certain subject that has been addressed previously. In this way, it is possible to summarize and analyze content scientifically through a few steps[10,11].

Figure 1. Flowchart of selected articles. Rio de Janeiro, RJ, Brazil, 2021



The steps are identification of the topic, literature search, categorization of studies, evaluation of studies that were included in the literature review, interpretation and analysis of results and finally, the synthesis of the knowledge obtained and evidenced in the analyzed articles. Thus, the guiding question was elaborated: How to carry out the early

diagnosis of congenital heart disease and what care should the nursing professional be able to offer the NB in the perioperative period?

Data from the present study were collected in August 2021 on the Virtual Health Library (BVS) platform. Then, the Descriptors in Health Sciences (DeCS) were used together with the Boolean operators "AND". The following descriptors were defined: "newborn", "neonatal intensive care units" and "cardiopathies" and in the VHL, a total of 260 articles were obtained. Articles dated from 2016 to 2021 and articles that were in Portuguese, English and Spanish were defined as inclusion criteria. Periodicals whose title, abstract and full reading were not suitable for the research object were excluded, along with texts that were not free and not available. The chosen platform and the inclusion and exclusion criteria are shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Flowchart, contained in Figure 1. After the inclusion and exclusion criteria established above, 12 articles were selected[10].

Results

The countries of origin of the selected articles were the United States with 05 articles, Brazil with 02 articles, followed by India, Mexico, Holland, China and Gabon with 01 article each. It can be said that on average 83.5% of the studies were published in foreign journals and 16.5% were published in national journals. The following table shows the selected articles according to the year, journal, title and summary of the article.

Quadro 1. Síntese dos resultados selecionados. Rio de Janeiro, RJ, Brasil, 2021

Year	Journal	Title	Authors	Summary of results
2020	Arch Dis Child	Neonatal cardiac surgery in low resource settings: implications of birth weight	Gunasekara, Chamith; Moynihan, Katie; Sudhakar, Abish; Sunil, Gopalraj Sumangala; Kotayil, et al.	In India, the prevalence of low birth weight is notorious and this factor influences child mortality and perioperative complications twice as much when the child has congenital heart disease.
2020	Rev Paul Pediatr	Drug- related problems in cardiac neonates under intensive care	Nascimento, Amanda Roseane Farias do; Leopoldino, Ramon Weyler Duarte; et al.	Problems related to medication were identified in NB, where the main reason was the way of using the medication due to the error in administration and "inappropriate administration time and/or interval". Too high or too low dose error was also frequent.
2019	Am J Perinatol	Updates in Congenital Heart Disease: Can Outcomes Improve?	Martin, Gerard R; Cross, Russel R; Hom, Lisa A; Klugman, Darren.	The study shows the ability of echocardiography to provide diagnoses in most newborns, but it does not correspond to all cases, some need additional tests for an efficient diagnosis.
2018	Dev Med Child Neurol	Neurobehavioral evaluation of neonates with congenital heart disease: a cohort study	Whitnee Hogan, Sarah Winter, Nelangi M Pinto, Cindy Weng, Xiaoming Sheng, et al.	Standardized neonatal neurobehavioral assessments demonstrate that neonates with CHD have different neurobehavioral performance compared to full-term neonates.
2018	Arch Cardiol Mex	Frecuencia, tipo y predictores de complicaciones pleuropulmonares en los primeros treinta días del postoperatorio de pacientes pediátricos intervenidos de cirugía cardiovascular sin apoyo de circulación extracorpórea	Jessica Jacqueline, Alejandro Solano, Flor Teresita, Airam Gabriela, Janet Flores, Juan Carlos.	Standardized neonatal neurobehavioral assessments demonstrate that neonates with CHD have different neurobehavioral performance.
2018	Pediatr Res	Amplitude-integrated electroencephalography during the first 72 h after birth in neonates diagnosed prenatally with congenital heart disease	Mirthe J Mebius, Nathalie JE Oostdijk ,Sara J Kuik, Arend F Bos, Rolf MF Berger ,CaterinaM Bilardo, Elisabeth MW Kooi eHendrik J Ter Horst.	Clinical characteristics and biochemical parameters that are associated with the background patterns of the Integrated Amplitude Electroencalography (aEEG) were analyzed, based on the studies, only with sedatives remained significant with the final objective.
2017	J. Perinatol	Evaluation of critical congenital heart defects screening using pulse oximetry in the neonatal intensive care unit	Van Naarden Braun, K; Grazel, R; Koppel, R; Laskhminrusimnha,S; Lohr, J; Kumar, P; Govindaswami, B; Giuliano, M; Cohen, M; Spillane, N; Jegatheesan, P; McClure, D; Hassinger, D; Fofah, O; Chandra, S; Allen, D; Axelrod, R; Blau, J; Hudome, S; Assing, E; Garg, LF.	Assesses the implementation of early screening for critical congenital heart disease in the neonatal intensive care unit and the possible exclusion of subpopulations from universal screening.

2016	Online braz. J. nurs	Cuidados de enfermagem neonatal ao bebê com cardiopatia congênita: revisão integrativa	Magalhães, Simone Silveira; Queiroz, Maria Veraci Oliveira; Chaves, Edna Maria Camelo.	In this integrative review, the identification of CCD was analyzed, as well as the care provided to the neonate and their family in the ICU.
2016	Acta Pediat	Pulse oximetry could significantly enhance the early detection of critical congenital heart disease in neonatal intensive care units	Hu, Xiao-Jing; Zhao, Qu-Ming; Ma, Xiao-Jing; Yan, Wei- Li; Ge, Xiao-Ling; Jia, Bing; Liu, Fang; Wu, Lin; Ye, Ming; Huang, Guo-Ying.	The study evaluated the feasibility of pulse oximetry in screening for critical congenital heart disease in intensive care units.
2016	Circ Cardiovasc Qual Outcomes	Feasibility of a Team Approach to Complex Congenital Heart Defect Neurodevelopmental Follow-Up: Early Experience of a Combined Cardiology/Neonatal Intensive Care Unit Follow-Up Program	Chorma, Olena; Baldwin, H Scott; Neumaier, Jamie; Gogliotti, Shirley; Powers, Deborah; Mouvery, Amanda; Bichell, David; Maitre, Nathalie L.	Babies with congenital heart disease are at high risk of neurodevelopmental outcomes.
2016	J Thorac Cardiovasc Surg	Outcomes of neonates requiring prolonged stay in the intensive care unit after surgical repair of congenital heart disease	Mori, Maloto; McCracken, Courtney; Maher, Kevin; Kogon, Brian; Mahle, William; Kanter, Kirk; Alsoufi, Bahaaldin.	The study compares the NBs who had a hospital stay of 30 days and those who did not have a prolonged hospital stay. It was found that the long hospital stay interferes with the quality of life of neonates.
2016	J Perinatol	Pulse oximetry screening for critical congenital heart disease in the neonatal intensive care unit	Goetz, EM; Magnuson, K M; Eickhoff, J C; Porte, M A; Hokanson, J S.	Pulse oximetry assessment was analyzed at two sites for neonates and a screening protocol was established in order to identify children with CCHD.

From the synthesis of the results of each selected article, it was possible to identify that most studies highlight the importance of early detection of cardiac malformations. Another important focus is pulse oximetry screening, which was mentioned in 40% of the studies, while perioperative care and complications and advances in operative management are mentioned by 15% of the authors[2,5,9-13].

Discussion

In the studies presented, congenital heart disease is one of the leading causes of death in children worldwide. It is estimated that for every 100 babies born alive, one has a heart disease, and that 80% of newborns with CHD will require some cardiac surgery during their evolution. Congenital heart disease results from an alteration in the embryonic development of a normal heart structure, which causes an altered blood flow in the region that will structurally and functionally influence the circulatory system[1,4,8,12,14].

The stage of presentation and course of symptoms depend on factors such as the nature and severity of the anatomic defect and changes in cardiovascular physiology. As for the symptoms, cyanosis, low cardiac output, tachypnea may occur, and in some cases, there may be the presence of blowing. Therefore, data analysis showed that early detection of cardiac malformations is a significant contributor to the prevention of infant mortality and morbidity[2,8,15,16].

This early identification of congenital heart disease allows carrier children to receive timely interventions, such as surgical cardiovascular repair or cardiac catheterization, which dramatically increases the chances of avoiding not only death but also the morbidity associated with heart failure. Regarding perioperative care and complications, it is evident that neonates who undergo cardiac surgery end up requiring a prolonged stay in the intensive care unit (ICU)[2,4,11].

One of the studies also discusses preterm children and low birth weight, even in terms of newborns, in low- and middle-income countries, arguing that this low weight negatively affects the results in the postoperative period of CHD. It was also observed that among the 12 studies, only one highlighted the importance of the care of the nursing team with newborns being centered on the family, which characterizes a deficit in the relevance of the needs of this child's family, since long hospitalizations and health problems directly affect the family structure[8,11].

Pulse oximetry screening is classified as a factor of great relevance to assist in the identification of early congenital heart disease in newborns within the first 48 hours of life. In most services, performing neonatal screening for critical congenital heart disease is currently an activity of the nursing team that can help discover hypoxia not detected visually, being a simple and accessible way, complementing the clinical evaluation[2,4,9,12,17].

Unsatisfactory neurological development was considered in neonates with CCC. The decrease in attention, regulation, asymmetry, stress, arousal and excitability, as well as the increase in non-ideal reflexes, lethargy and need for handling the NB were analyzed using the

Neurobehavioral Scale of the Neonatal Intensive Care Units Network. From this, it was possible to "assess the full range of neonatal behavior in various subdomains to identify patterns that can predict later neurodevelopment." Yet another study detected neuroimaging abnormalities suggesting long-term follow-up of children with CHD, even after the perioperative period[1,15].

Regarding the role of nursing professionals, it is argued that there is a need to improve their clinical practice in order to develop care aimed at the safety of the NB. This fact is due to drug-related problems, which often occur in the Neonatal ICU, due to sudden changes in body weight and the development of the newborn's organs and systems, as explained in a study. Because of this, it is necessary that there are constant adjustments in the dosage and greater attention during drug administration in neonates[12].

Conclusion

In view of the above, it was shown that congenital heart diseases are the main causes of death in children worldwide. Those that survive, these anomalies affect life and development conditions and nursing is inserted in all stages of care for babies with congenital heart disease. We emphasize the need to improve the clinical practice of nurses, in order to have safe care based on scientific evidence.

The study showed that 80% of diagnosed neonates undergo some surgical intervention in their training. The intervention should be carried out according to the evolution of the symptomatological condition and physiological changes. However, early diagnosis is a significant contributor, proof of which we have pulse oximetry, which is a very relevant factor for the early identification of CHD in the first 48 hours of life.

Thus, the present study emphasizes that neonatal screening is an activity performed by the nursing team, which can help in the early detection of congenital heart diseases. Therefore, it is essential to develop nursing care, adjustments in dosage, attention to drug administration, in order to ensure the safety of the newborn.

References

1. Chorna O, Baldwin Scott H, Neumaier J, Gogliotti S, Powers D, Mouvery A, et al. Feasibility of a Team Approach to Complex Congenital Heart Defect Neurodevelopmental Follow-Up: Early Experience of a Combined Cardiology/Neonatal Intensive Care Unit Follow-Up Program. Circ Cardiovasc Qual Outcomes. 2016;9:432–440. DOI: 10.1161/CIRCOUTCOMES.116.002614
2. Martin RG, Cross RR, Hom AL, Klugman D. Updates in Congenital Heart Disease: Can Outcomes Improve? Am J Perinatol [Internet]. 2019 [acesso em 3 setembro de 2021];36(S02):S22-S28. Disponível em: https://www.thieme-connect.de/products/ejournals/abstract/10.1055/s-0039-1691773
3. Ministério da Saúde (BR). Síntese de evidências para políticas de saúde: diagnóstico precoce de cardiopatias congênitas / Ministério da Saúde, Secretaria de Ciência, Tecnologia e Insumos Estratégicos, Departamento de Ciência e Tecnologia [Internet]. Brasília (DF): MS; 2017 [acesso em 3 setembro 2021]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/sintese_evidencias_politicas_cardiopatias_congenitas.pdf
4. Gunasekara CM, Moynihan K, Sudhakar A, Sunil GS, Kotayil BP, Bayya PR, et al. Neonatal cardiac surgery in low resource settings: implications of birth weight. Arch Dis Child [Internet]. 2020 [acesso em 19 setembro de 2021];105:1140-1145. Disponível em: https://adc.bmj.com/content/105/12/1140
5. Braun KVN, Grazel R, Koppel R, Lakshminrusimha S, Lohr J, Kumar P, et al. Evaluation of critical congenital heart defects screening using pulse oximetry in the neonatal intensive care unit. J Perinatol. 2017;37:1117–1123. DOI: 10.1038/jp.2017.105
6. Mebius M, Oostdijk N, Kuik SJ, Bos AF, Berger RMF, Bilardo CM, et al. Amplitude-integrated electroencephalography during the first 72 h after birth in neonates diagnosed prenatally with congenital heart disease. Pediatr Res. 2021;83:798–803. DOI:10.1038/pr.2017.311
7. Ministério da Saúde (BR). Portaria n°1.727, de 17 de julho de 2017. Aprova o Plano Nacional de Assistência à Criança com Cardiopatia Congênita [Internet]. Brasília (DF): MS; 2017 [acesso em 10 setembro 2021]. Disponível em: https://portalarquivos2.saude.gov.br/images/pdf/2018/junho/12/SEI-MS-2937931-Nota-Tecnica.pdf
8. Magalhães SS, Queiroz MVO, Chaves EMC. Cuidados da enfermagem neonatal ao bebê com cardiopatia congênita: revisão integrativa. Online braz j nurs [Internet]. 2016 [acesso em 23 outubro de 2021];15(4):724-734. Disponível em: http://www.objnursing.uff.br/index.php/nursing/article/view/5415
9. Xiao-jing Hu, Qu-ming Z, Xiao-jing M,Wei-li Y, Ge X, Jia B, et al. Pulse oximetry could significantly enhance the early detection of critical congenital heart disease in neonatal intensive care units. Acta Paediatr [Internet]. 2021 [acesso em 23 outubro de 2021];105(11):e499–e505. DOI: 10.1111/apa.13553
10. Machado TO, Souza TCP, Lopes GNM, Silva MLL, Silva WGR, Santos RM, et al. Uso de drogas ilícitas na gestação: quais os malefícios à integridade do bebê? Glob Acad Nurs. 2021;2(Spe.1):e102. DOI: 10.5935/2675-5602.20200102
11. Nascimento DT, Koeppe GBO, Oliveira PO, Valadao R, Prado TSB, Santos NS, et al. Estratégias de saúde para manutenção da qualidade da assistência na quimioterapia no contexto da pandemia da COVID-19. Glob Acad Nurs. 2021;2(Spe.2):e117. DOI: 10.5935/2675-5602.20200117
12. Nascimento ARF, Leopoldino RWD, Santos MRETS, Costa TX, Martins RR. Problemas Relacionados a Medicamentos em Neonatos Cardiopatas sob Terapia Intensiva. Rev Paul Pediatr. 2020;38:e2018134. DOI: 10.1590/1984-0462/2020/38/2018134
13. Hernández-López JJ, Solano-Gutiérrez A, Rosas-Aragon FT, Antunez-Soto AG, lores-Lujano J, Nuñes-Enriquez JC. Frecuencia, tipo y predictores de complicaciones pleuropulmonares en los primeros treinta días del postoperatorio de pacientes pediátricos intervenidos de cirugía cardiovascular sin apoyo de circulación extracorpórea. Arch Cardiol Mex. 2018;88(4):261-267. DOI: 10.1016/j.acmx.2017.06.003
14. Makoto M, McCraken C, Maher K, Kogon B, Mahle W, Kanter K, et al. Outcomes of neonates requiring prolonged stay in the intensive care unit after surgical repair of congenital heart disease. J Thorac Cardiovasc Surg. 2016;152(3):720-7. DOI: 10.1016/j.jtcvs.2016.04.040

15. Hogan JW, Winter S, Pinto NM, Weng C, Sheng X, Conradt E, et al. Neurobehavioral evaluation of neonates with congenital heart disease: a cohort study. Dev Med Child Neurol. 2018;60(12):1225–1231. DOI: 10.1111/dmcn.13912
16. Oliveira GMM, Brant LCC, Polanczyk CA, Biolo A, Nascimento BR, Malta DC, et al. Estatistica Cardiovascular – Brasil 2020. Arq. Bras. Cardiol. 2020;115(3). DOI: 10.36660/abc.20200812
17. Goetz E, Magnuson K, Eickhoff J, Porte MA, Hokanson JS. Pulse oximetry screening for critical congenital heart disease in the neonatal intensive care unit. J Perinat [Internet]. 2016 [acesso em 31 outubro de 2021];36:52–56. Disponível em: https://www.nature.com/articles/jp2015150