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# PULSE OXIMETRY IN THE DETECTION OF CONGENITAL HEART DISEASES IN NEWBORNS IN NEONATAL UNIT: KNOWLEDGE AND PRACTICES OF HEALTH PROFESSIONALS

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## ARTICLE INFO

## ABSTRACT

Congenital cardiac anomalies are characterized by structural abnormalities or cardiocirculatory appearing during their formation, being present since birth and may lead to death in intrauterine life, childhood or adult life, requiring diagnosis in the first days of life because of their rapid evolution. Early diagnosis by means of oximetry and echocardiography tests increases the chances of survival, reducing neonatal mortality. Nurses and physicians involved should know their possible results. It aims to reveal the knowledge and practices of nurses and physicians about pulse oximetry in the detection of congenital heart diseases in newborns (NBs) in neonatal units. This is a descriptive, exploratory study with a qualitative approach, conducted at the Neonatal Intensive Care Unit of a Regional Hospital in Belém, Pará, Brazil, from August to November 2017. Interviews were collected from 3 nurses and 3 physicians, with a minimum period of 2 years of experience in neonatology. As a result, 6 categories were designated from the content organization, focused on professionals' interpretative knowledge, diagnosis and conduction in observable changes. In conclusion, it was observed that the adequate training of these professionals leads to an adequate interpretation of cardiologic screening tests, contributing to the improvement and clinical monitoring of these NBs.

## INTRODUCTION

Congenital cardiac anomalies are characterized by heart's structural abnormalities or cardio circulatory alterations, appearing during its formation.

Present from the moment of birth, it may lead to death in intrauterine life, childhood or adult life. Thus, it needs a diagnosis in the first days of life, due to their rapid clinical evolution to more severe cases (BRASIL, 2017; FROTA *et al*., 2014; MORAIS; MIMOSO, 2013). Congenital heart disease

aggregates a variety of malformations that present themselves in simple forms such as communication between cavities that spontaneously regress until malformations of greater severity, such as the complete absence of one or more heart chambers or valves that require several surgical procedures or catheterizations (BRASIL, 2017; FROTA *et al.*, 2014; MORAIS; MIMOSO, 2013). These factors can cause early neonatal death, which is one of the main problems of neonatal morbimortality, affecting approximately 8 of each live birth and 30% of these are discharged from hospital without diagnosis and evolves into shock, hypoxia or death before receiving the appropriate treatment. However, in order to change this scenario, it is recommended that the diagnosis be made in the first days of life (MORAIS; MIMOSO, 2013; MOSER *et al.*, 2014; MEDEIROS *et al.*, 2015).

Early diagnosis increases the chances of survival, reducing neonatal mortality rates. This diagnosis should be by means of the oximetry test or echocardiography, which is considered the gold standard method for diagnosis in the most severe cases, however, presents higher costs for implementation in addition to requiring specialized professionals. Thus, pulse oximetry represents a viable diagnostic method for the screening of congenital heart diseases, due to its better cost-benefit ratio (BRASIL, 2014b). In Brazil, pulse oximetry or the little heart test was inserted in the neonatal screening and became mandatory since 2014, through Ordinance Nº. 20/2014 (BRASIL, 2014a). This test allows early identification of healthy newborns who present some serious disease in the heart before discharge from the maternity ward and, if so, the patient is submitted to an echocardiogram to confirm the diagnosis (ALBUQUERQUE *et al.*, 2015). The Ministry of Health emphasizes in its Manual called, "Technical Standards and Operational Routines of the National Program for Neonatal Screening (PNTN)", the importance of training professionals who are directly or indirectly involved in performing neonatal screening tests for congenital heart disease. Thus, the health professionals involved in the performance of the test, nurses and physicians, should have knowledge about measurement site, time of measurement, normal result and abnormal result (BASTOS, 2017). Given the above, it is questioned if nurses and physicians know about pulse oximetry in the detection of congenital heart disease in newborns in neonatal units and their modes of care in this case. Thus, the study aims to unveil the knowledge and practices of nurses and physicians about pulse oximetry in the detection of congenital heart diseases in newborns in neonatal units.

## MATERIALS AND METHODS

It was a descriptive, exploratory study with a qualitative approach, characterized as field research, conducted in a Neonatal Intensive Care Unit (NICU) of a Regional Hospital, in the city of Belém, Pará, Brazil, from August to November 2017. The data were collected through in-depth interviews, where the participants were individually approached according to their availability to participate in the study, in order to provide a minimum embarrass and discomfort. The sampling was performed by convenience, using the snowball process, in which physicians and nurses from NICU indicated their peers to participate in the study, consisting of 3 nurses and 3 physicians working in neonatology. Sample size was based on response saturation. The number of approached participants was sufficient for recurrence of information. The saturated data correspond to the absence of new element or of new information making it unnecessary to increase the sample quantity, seeing that there is no change in the understanding of the phenomenon studied and thus the researcher can explain the factors identified by him as involved in the origin of the theoretical configuration he presents. This criterion allows establishing the validity of a set of data (MEDEIROS *et al.*, 2015; SBP, 2012). The study included nurses and physicians working in the NICU, those with at least, two years of experience in neonatology and who have experienced a situation of detection of congenital heart disease of the newborn in a neonatal unit. Nurses and physicians who were absent from the institution at the time of data collection were not included. The data analysis was performed through Bardin's content analysis. After the transcription of the speeches obtained, three steps were followed: a) pre-analysis; b) material exploration; and c) data interpretation. The interpretation of the data is based on the content of the answers and on the reference authors consulted, establishing inferences and interpretations from the highlighting of information from the answers obtained (BARDIN, 2011). This study was approved by the Research Ethics Committee of Universidade da Amazônia - UNAMA, CAAE 79560117.4.0000.5173, and Opinion number: 2.393.877. It attended to the prerogatives of Resolutions 466/12, 510/16 and 580/18 of the National Health Council. All the participants signed the Free and Informed Consent Form, leaving one way of its possession. Anonymity was preserved, identifying their speech through alphanumeric codes (M= Physician and E = Nurse), in increasing numerical order according to the order in which they were approached.

## RESULTS AND DISCUSSION

The study was conducted with 6 professionals, being 3 nurses and 3 physicians, all female, minimum age of 37 years and maximum age of 55 years, with graduation time ranging from 8 to 25 years, all having a graduation degree, where all claim to have specialization in neonatology. The corpus of the study enabled the organization of the content from six categories: a) Knowledge about pulse oximetry in newborns; b) Identification of signs of congenital heart diseases in newborns with 24 hours of birth; c) Test/examination to investigate congenital heart diseases in newborns with 24 hours of birth; d) Pulse oximetry in newborns; e) Participation in training on pulse oximetry in newborns; f) Facilities and difficulties in performing pulse oximetry in newborns to detect congenital heart diseases. In the first category, "knowledge about pulse oximetry in newborns", the interviewees reported that pulse oximetry allows the detection of congenital heart diseases in newborns by means of saturation levels as well as respiratory alterations. From the monitoring of the newborns, the appropriate conduct leads to the necessary treatment and care in order to solve the clinical problem. The second category brought the identification of signs of heart disease among the interviewees, reporting several signs, such as heart murmur, dyspnea, cyanosis, respiratory distress, sweating, edemas and fatigue for breastfeeding.

The third category, "test/examination to investigate congenital heart diseases in newborns with 24 hours of birth", showed that 4 of the 6 interviewed professionals perform some type of test or examination for the investigation of congenital heart diseases. They also demonstrated knowledge about the necessary procedures to perform pulse oximetry, mentioning the pre-ductal locus (right upper limb) and the post ductal locus between 24 and 48 hours of life, taking into account

peripheral saturation. While changes in oximetry are found, the participants who perform the test in the usual manner usually make the referral to the cardiologist as well as request the echocardiogram. In the case of nurses, they discuss the clinical case with the physician, so that complementary tests are required. The fourth category, "pulse oximetry in newborns", expressed the participation of the participants in training programs on pulse oximetry in newborns to perform the little heart test. It was identified that 1 nurse and 3 physicians participated in some training and report on the importance of performing the test for the diagnosis of congenital heart diseases and 2 nurses reported that they did not participate in training on pulse oximetry in newborns.

Regarding the speech of the participants who participated in updates, it is evident in their interviews the importance of early diagnosis of heart diseases in order to improve the treatment and assistance given, confirming the need for training the team. In the fifth category, called "Participation in training on pulse oximetry in newborns", 3 interviewees pointed out the ease of performing pulse oximetry in newborns for the detection of congenital heart diseases and 3 agreed that it is easy to perform oximetry; however, they did not relate the examination for the detection of congenital heart diseases. The difficulties pointed out were related to the performance of pulse oximetry for the detection of congenital heart diseases, and to the scarcity of pulse oximetry equipment, such as the difficulty. The last category was "facilities and difficulties in performing pulse oximetry in newborns to detect congenital heart diseases". This part of view was related to the practice itself directed to how it was been done. Some aspects were observed in order to achieve the results, they were: a) Practice of oximetry testing; b) Member for checking the heart test; c) Time of measurement; d) result of the tests and; e) Facilities and difficulties in performing the oximetry test. Taking in consideration all the categories exposed, it was observed that medical professional had the knowledge about the little heart's test as well as its purpose, otherwise, the group of nurses only one showed knowledge about the test. Critical congenital heart diseases can be diagnosed early in the first days of life, being the pulse oximetry and monitoring of oxygen saturation fundamental. They are also considered the fifth vital sign during NB monitoring due to the fact of avoiding complications such as shock, acidosis, cardiac arrest or neurological worsening that are common to occur before the intervention and treatment of heart disease (MORAIS; MIMOSO, 2013). Its great advantage lies in its ability to allow continuous, safe and effective monitoring of blood oxygenation in a non-invasive way, instantaneously and without the need for calibration (MOSER *et al.*, 2014; MEDEIROS *et al.*, 2015).

In turn, hospital discharge, which in most neonatal units in the country is performed between 36 and 48 hours of life, is a period in which the clinical manifestations of critical heart diseases may not be noticeable and cardiac auscultation may be apparently normal, making the opportunity for diagnosis and intervention as well as the prevention of complications is lost (MORAIS; MIMOSO, 2013). Regarding the identification of signs of congenital heart disease in newborns with 24 hours of birth, the interviewees reported several signs, but had similar responses in some of the signs of heart disease: 4 professionals indicated cyanosis, 2 indicated respiratory distress, 4 indicated murmur and 3 dyspnea, as one of the main signs of heart disease. Due to the absence of heart disease

symptoms at birth, from the first 24 hours of life or after the first week of birth, symptoms such as low systemic output, progressive tachypnea, fatigue during feeds, skin pallor, severe sweating, tachycardia, reduced amplitude of central and peripheral pulses and systemic arterial hypotension should be observed (BRASIL, 2011). The identification of congenital heart diseases includes the observation of peripheral or central cyanosis, palpation of the precordial and peripheral pulses, and identification of murmurs by cardiac auscultation (BRASIL, 2017). During the research it was found that physicians investigate heart diseases by means of the little heart test as well as by evaluating the saturation obtained in the right hand and in one of the feet. Lacerda *et al.*, (2016) stipulated as acceptable result 95% both in the right upper limb and in the lower limb with a difference of 3% between these measurements. The tests performed by medical professionals were performed appropriately and according to recommended techniques. Despite being a simple and agile test, some factors can contribute to an incorrect interpretation of the result. Among the main factors that contribute to the misinterpretation of the little heart test are: poor position of the sensor, disturbed by movement, ambient light and electromagnetic radiation. It is important to emphasize that the newborn needs to have its extremities heated (SBP, 2012). In addition, saturation is considered abnormal when the SpO2 measurement is less than 95% or shows a difference equal to or greater than 3% between upper limb measurements in lower limbs. In this case, a new evaluation should be performed after 1 hour. In case the result remains altered, the newborn must perform an echogram within 24 hours and be referred to the pediatric cardiologist (LACERDA *et al.*, 2016). With regard to the participation of nurses, they perform physical examination and oximetry to monitor the NB's vital signs during hospitalization, as well as recognize the purpose of the tests mentioned above, which converge for the detection of congestive heart disease; however, it is not part of the protocol procedure.

The participation in training on pulse oximetry in newborns for the little heart's test was answered as important by most nursing professionals for assisting in the early diagnosis of heart diseases, contributing to care improvement, assist for the recognition of severe congenital heart diseases, clinical monitoring and cardiac evaluation. Among interviewees who did not participate in training, 1 points out to have knowledge about oximetry for the use of the test and 1 reports little knowledge about oximetry for the purposes of the little heart test. In this context, the oximetry test should be performed in all newborns, clinically stable within 24 to 48 hours and before discharge (SBP, 2012). This evaluation before discharge has demonstrated a high specificity (99%) and moderate sensitivity (75%) of early detection of heart diseases (BRAZIL, 2014). With regard to the practice of the heel prick and based on the law of Professional Nursing Practice, Law n°. 7.498/86 and Decree n°. 94.406/87, Article 8, ensures the professional Nurse the competence to perform complex nursing procedures in newborns, with nursing care of greater technical complexity that require adequate scientific knowledge and ability to make decisions, a situation that characterizes pulse oximetry in neonatal screening, according to Ordinance n°. 20/2014, Ministry of Health. The positioning of the equipment to perform the little heart's test should be positioned in the right upper limb (pre-ductal) and in one of the lower limbs (post-ductal). In order to the test to be performed effectively, the neonate must have its extremities heated and the pulse oximetry monitor must demonstrate a waveform with

homogeneous tracing. In addition, during the exam some precautions should be maintained such as ensuring the sensor's contact with the NB's skin without injuring it, the detector light needs to be aligned, covering the sensor to avoid light interference, evaluating the proper correlation between the pulse signal and heart rate as well as using only a neonatal pulse sensor (ARGENTINA, 2015).

As could be seen, continuing education as a guideline for training and improvement of health professionals is revealed as a strong tool for the exercise of professional practice, because through it can be pointed out the knowledge needs as well as the organization of educational demands that are generated in the work process (MEDEIROS, 2015). In this sense, it is important the existence of an encouragement for these continued education actions for nursing, aimed to professional's qualification and for the improvement of care technologies. In addition, it should be applied in nursing actions to ensure the use of this screening technology with quality and clinical judgment capacity, given that the clinical evaluation of both nurses and physicians are essential for the diagnosis of heart diseases (MEDEIROS, 2015). The performance of tests that evidence cardiological changes, such as clinical routine screening in health establishments is an important measure of nursing care to the newborn, in which the nurse must ensure the proper recording of variations, in which this professional must be able to correlate the abnormal results with the parameters established by the Ministry of Health.

### Final Considerations

The study showed that the level of information and training of these professionals regarding the little heart's test directly reflect on decision-making through the parameters of the test, making it impossible for the professional to conduct early detection of heart diseases, which is essential for the prevention of neonatal mortality. It also revealed that, although the professionals responsible for the neonatal screening of newborns recognize the importance of the test, they present difficulties in handling the device as well as performing the test demonstrating the need for the implementation of educational technologies and continued training of these professionals in order to reduce infant morbidity and mortality, in this study, focusing on congenital heart diseases are among those that most lead NBs to death.

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