

PULSE OXIMETRY IN TRIAGING CONGENITAL CARDIOPATHIES: THE NURSE'S KNOWLEDGE AND ROLE*

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ABSTRACT: Pulse oximetry in the neonatal units is presented as a process for triaging serious congenital cardiopathies. The study aims to assess the level of information, and the work, of the nurses in pulse oximetry undertaken on the newborns in a public maternity unit in the municipality of João Pessoa, Paraíba. It is a descriptive study with a quanti-qualitative approach, undertaken with 13 staff nurses through the use of a semistructured interview in January – March 2015. The results showed that the majority of the nurses have knowledge regarding the 'little heart test' (teste do coraçãozinho), the rationale for undertaking it, and the normal parameters for oxygen saturation, as well as the conducts to be taken in the event of a result outside these parameters. However, 84.6% mentioned difficulties in implementing it due to having to alter the routine of the nursing care. It is believed that the little heart test for triaging congenital cardiopathies brings good results in the early identification of these malformations.

DESCRIPTORS: Nursing; Cardiopathies; Pulse oximetry.

OXIMETRIA DE PULSO EM TRIAGEM DE CARDIOPATIAS CONGÊNITAS: CONHECIMENTO E ATUAÇÃO DO ENFERMEIRO

RESUMO: A oximetria de pulso nas unidades neonatais apresenta-se como um processo de triagem de cardiopatias congênicas graves. O estudo tem como objetivo avaliar o nível de informação e a atuação dos enfermeiros na oximetria de pulso realizada nos recém-nascidos de uma maternidade pública do município de João Pessoa, Paraíba. Trata-se de estudo descritivo com abordagem quanti-qualitativa, realizado com 13 enfermeiras assistenciais através de entrevista semiestruturada no período de janeiro a março de 2015. Os resultados mostraram que a maioria das enfermeiras tem conhecimento sobre o teste do coraçãozinho, a justificativa para realizá-lo, os parâmetros de normalidades da saturação de oxigênio, assim como as condutas que devem ser tomadas diante de um resultado alterado. No entanto, 84,6% referiram dificuldades na sua implantação em virtude de modificar a rotina da assistência de enfermagem. Acredita-se que o teste do coraçãozinho para triagem de cardiopatias congênicas traz bons resultados na captação precoce dessas malformações.

DESCRIPTORIOS: Enfermagem; Cardiopatia; Oximetria de pulso.

OXIMETRÍA DE PULSO EN SELECCIÓN DE CARDIOPATÍAS CONGÉNITAS: CONOCIMIENTO Y ACTUACIÓN DEL ENFERMERO

RESUMEN: La oximetría de pulso en las unidades neonatales se presenta como un proceso de selección de cardiopatías congénitas severas. El estudio tiene como finalidad evaluar el nivel de información y la actuación de los enfermeros en la oximetría de pulso realizada en recién nacidos de una maternidad pública del municipio de João Pessoa, Paraíba. Es un estudio descriptivo con abordaje cuantitativo cualitativo, realizado con 13 enfermeras asistenciales a través de entrevista semiestruturada en el periodo de enero a marzo de 2015. Los resultados mostraron que la mayoría de las enfermeras tiene conocimiento sobre el test del corazóncito, la justificativa para realizarlo, los parámetros de normalidad de la saturación de oxígeno, así como las conductas delante de un resultado alterado. Sin embargo, 84,6% hablaron de dificultades en su implantación por el hecho de cambiarse la rutina de la asistencia de enfermería. Se cree que el test del corazóncito para selección de cardiopatías congénitas trae buenos resultados en la captación precoz de esas malas formaciones.

DESCRIPTORIOS: Enfermería; Cardiopatía; Oximetría de pulso.

*Article extracted from the thesis entitled: "Analysis of Databases of a Referral Service in Pediatric and Fetal Cardiology". Postgraduate Program of the University of Pernambuco, 2013.

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Received: 16/04/2015

Finalized: 13/08/2015

INTRODUCTION

The evolution of technology has exponentially increased the growth of the computer and electronic device industry, making the use of various types of device common in all parts of the world, including in the hospital ambit. One is witnessing, therefore, a culture in which technology is essential – and humans, in their turn, need to learn about this new context and adapt to it⁽¹⁾.

In this regard, pulse oximetry constitutes a technological advance which allows the continuous and noninvasive monitoring of oxygen saturation in the arterial blood, is used as one more tool in neonatal triage, and is presented as a possibility for reducing the incidence of mortality and the seriousness of the complications, in the cases of congenital cardiopathies⁽²⁾.

The congenital cardiopathies are the main problems in neonatal morbidity and mortality, affecting approximately eight in each 1000 live births⁽³⁾. Around 30% of these newborns are discharged without being diagnosed, and progress to shock, hypoxia, or early death prior to receiving appropriate treatment⁽⁴⁾. They bring together a varied set of cardiac malformations, with different physiological aspects. Some of these, classified as serious congenital malformations, require diagnosis in the very first days of life, due to their rapid progression, as they can cause early death⁽⁵⁾.

Improving the diagnosis of these cardiopathies could reduce the level of neonatal mortality in our environment. The ideal method for diagnosing congenital cardiopathy is the echocardiogram with color flow mapping in the fetal or postnatal period⁽⁶⁾. However, this test requires relevant costs, apart from specialized professionals, hindering the early diagnosis of the more serious congenital cardiopathies⁽⁵⁾.

In the group of these cardiopathies, there is a mixing of blood between the systemic and pulmonary circulations, which results in a reduction in peripheral saturation of O₂. In this regard, the measuring of pulse oximetry routinely in apparently healthy newborns with gestational ages >34 weeks has shown high sensitivity and specificity for the early detection of these cardiopathies⁽⁷⁾.

It is necessary, however, to take into account that the clinical evaluation of the nurse and the physician are highly valuable in identifying abnormalities, including cardiopathies, among

newborns.

In this regard, one multicentric study undertaken in the State of Paraíba in 2012 shows the enormous relevance of clinical evaluation associated with pulse oximetry and the triage echocardiogram. A total of 7026 pulse oximetries were undertaken and 119 patients were referred for an echocardiogram. Of these, 10.1% presented complex cardiopathy, 14.3% shunt cardiopathy, 3.4% obstructive cardiopathy, 26.9% transitional circulation, 2.5% non-structural alterations and 42.9% had normal echocardiograms. Indication for the echocardiogram was clinical in 79% and based on the oximetry, in isolation, in 21%. Only two patients had prenatal diagnosis of congenital cardiopathy⁽⁸⁾.

Based in this context, the use of pulse oximetry in the neonatal units is presented as one more process for triaging serious congenital cardiopathies, in a viable form in relation to costs and professionals who can undertake it efficaciously. Known as the 'little heart test' (*teste do coraçãozinho*), this method has obtained good results in identifying these malformations at an early stage.

In this context, the nurse is the ideal professional to choose for undertaking neonatal triage. With the information and knowledge regarding the correct handling of pulse oximetries, the nurse can optimize and assist in the quality and efficacy of this process.

Thus, the study aims to assess the level of information and the role of the nurses in pulse oximetry, undertaken with newborns in a public maternity unit in the municipality of João Pessoa, Paraíba.

METHODOLOGY

The study was of the descriptive type with a quanti-qualitative approach, undertaken in January – March 2015 in a maternity unit which is a center of excellence for the State, located in the municipality of João Pessoa, Paraíba.

The population was made up of nurses who worked in the departments which provide care to the newborns in the maternity unit studied. The sample was made up of 13 nurses who voluntarily accepted to participate in the study after being appropriately informed regarding the study objective and signing the terms of free and informed consent.

The construction of the data was undertaken

based on a semistructured interview script, made up of two parts. The first part contains data referent to the characteristics of the profile of the nurses who undertake the little heart test, emphasizing the following variables: age range, time since qualification, length of service in the institution, the postgraduate qualification which the nurse has undertaken, and the area in which she works.

The second part refers to the level of information and the actions of the nurses regarding the little heart test, thus meeting the research objective. In this part, there were open questions regarding how the nurses understood the little heart test, and whether they understood the rationale for undertaking it. Following that, the difficulties in implementing the test in the work, the ideal parameters for pulse oximetry, and the conduct to be undertaken in the event of the ideal parameters being exceeded were investigated. These questions should show alternative choices such that the nurse could opt for the best response.

The compilation of the quantitative data was undertaken using Microsoft Excel and was presented in graphs and tables. The quantitative variables were subjected to descriptive measures and frequency distributions. For the analysis of the qualitative data, the authors used the technique of the Discourse of the Collective Subject (DCS), which consists of a set of procedures which highlight the key expressions in the accounts of the study participants, which viabilizes the thinking in summary form and makes possible the interpretation in order to ground the results⁽⁹⁾.

Throughout all its phases, this study adopted the guidelines and regulatory standards for research involving human beings, found in Resolution 466/12 of the National Health Council⁽¹⁰⁾ and was approved by the Research Ethics Committee of the Oswaldo Cruz Teaching Hospital (HUOC/PROCAPE) of the University of Pernambuco, under Decision N. 391/391 of 09/06/2013.

RESULTS

The data obtained are presented at three points: the first shows the characterization of the nurses who undertake pulse oximetry (Table 1); the second presents the study's qualitative data, referent to the nurses' knowledge regarding pulse oximetry; and the third shows the quantitative data referent to the difficulties involved in implementing the test, the parameters of normalities, and the conducts to be taken by the

Table 1 - Professional profile of the nurses who undertake pulse oximetry. João Pessoa, State of Pernambuco (PB), Brazil, 2015

Professional Profile	N=13	%
Age range		
21-30 years old	1	8
31- 40 years old	9	69
41-50 years old	1	8
51-60 years old	2	15
Time since qualification		
1-5 years	3	24
6-10 years	5	38
11-15 years	2	15
16-20 years	1	8
21-25 years	2	15
Length of Service in the Institution		
0-5 years	10	77
6-10 years	2	15
11-15 years	1	8
Postgraduate qualification (lato sensu)		
Yes	10	77
No	3	23
Area of Postgraduate Qualification*		
Public Health	2	20
Urgent and Emergency	1	10
Public Health and Occupational Nursing	3	30
Others	4	40
Departments in which staff work		
Mother-and-child ward	10	77
Kangaroo Care**	1	8
Triage	1	8
NICC***	1	8

*The area of the postgraduate qualification obtained 10 responses due to the fact that 3 nurses had no postgraduate qualification.

**Kangaroo Care is the department which uses the Mother-Kangaroo Method, which is a type of neonatal care based in early and progressive skin to skin contact between father, mother and baby.

***NICC: Nosocomial Infection Control Commission

nurses in the event of a result which falls outside normal parameters.

One can observe in Table 1 that the nurses' predominant age range is between 31 and 40 years old, corresponding to 69%. The time since academic qualification varied from 01 to 25 years, with highest prevalence between six and 10 years, corresponding to 38%; the length of service in the institution varied between 0 and 15 years, with 77% of the interviewees in the period of 0

to 5 years of work in the institution. In relation to the lato sensu postgraduate qualification, 77% of the nurses interviewed stated that they had some type of specialization, 30% being in Public Health and Occupational Nursing, and 40% in other areas which were not specified. The area of highest prevalence for working, among the interviewees, was the mother-and-child ward, which corresponded to 77%, with the mother-and-child binomial receiving the first care, including the little heart test, undertaken by the nurse.

Regarding the nurses' knowledge regarding the little heart test, the following questions are presented:

1. What do you understand by 'little heart test'?

Based on the responses to this question, two central ideas were extracted. The first related to the neonatal triaging of serious congenital cardiopathies, and the second, to the test undertaken through pulse oximetry.

It is a triaging examination undertaken with the newborns, in the first 24 hours of life, using pulse oximetry, in which you evaluate the level of oxygen saturation and the cardiac frequency, with the aim of detecting at an early stage the serious congenital cardiopathies, the aim being to avoid sudden and premature death in newborns (DCS 1).

2. What is the rationale for undertaking the little heart test?

From the nurses' discourses, the following central ideas emerged: tracking serious congenital cardiopathies, initiating early treatment, and reducing child mortality.

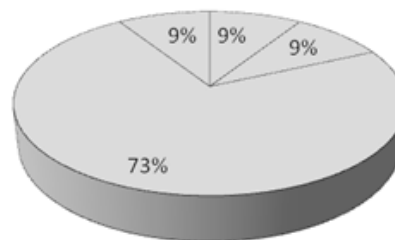
The analysis of the accounts allowed the construction of the second Discourse of the Collective Subject, expressed below:

Undertaking the little heart test using pulse oximetry is necessary in tracking serious congenital cardiopathies, so as to initiate specific treatment as early as possible, avoiding more serious complications and reducing child mortality (DCS 2).

The data also showed that 77% of the nurses stated that they did not have knowledge, or had not heard about the little heart test, prior to its implementation in the hospital unit; only 23% stated that they had heard about the test via the Internet.

Another question put to the nurses was whether they experienced difficulty in the implementation of the little heart test at work. The majority of

the interviewees (85%) mentioned difficulties in inserting the test in the routine of the nursing care. The difficulties reported are illustrated in Figure 1.



73% - Accumulation of tasks and lack of training
 9% - Accumulation of tasks
 9% - Lack of training
 9% - Others

Figure 1 – Difficulties in implementing the little heart test. João Pessoa (PB), Brazil, 2015

Figure 1 shows that the accumulation of tasks, associated with lack of training, was the main difficulty faced by nurses in implementing the little heart test in the routine of the nursing care, corresponding to 73% of the difficulties cited.

Continuing the quantitative analysis, the question was asked whether nurses knew the parameters of normality for pulse oximetry undertaken with newborns recommended by the Ministry of Health – which are peripheral saturation greater or equal to 95% in both measurements (upper right limb and lower limb) and a difference of below 3% between the measurements of the upper right limb and the lower limb.

The majority (85%) of the interviewees were able to identify the parameters of normality according to the norms proposed by the Ministry of Health.

The majority (73%) of the nurses recognize that peripheral saturation greater than or equal to 95% in both the measurements (upper right limb and lower limb) and difference lower than 3% between the measurements of the upper right limb and the lower limb is considered the ideal standard by the Ministry of Health. The last question asked whether they knew the conduct to be taken in the event of identifying a result which fell outside the parameters of normality in the heart test.

Of the 13 nurses who made up the sample, 11 said that they knew the conduct which the health professional should take.

DISCUSSION

Analyzing the accounts, summarized using the Discourse of the Collective Subject 1, it was possible to perceive that the nurses were able to state what the little heart test was. In the same way, through Discourse of the Collective Subject 2, they reported that the objective of the little heart test was to assist in detecting congenital cardiopathies at an early stage and consequently to contribute to reducing child morbidity and mortality.

The neonatal component of child mortality is closely linked to the care provided in the period of the gestation, birth, and the newborn period. This therefore entails appropriate attention at the time of birth, and the care undertaken for newborns, with simple and inexpensive practices which are based on scientific evidence, which increase the survival rates for newborns⁽⁷⁾. Among these practices, emphasis is placed on the little heart test, which aims to triage serious congenital cardiopathies.

Serious congenital cardiopathies are considered to be those in which the clinical presentation results from closing or restriction of the arterial canal (canal-dependent cardiopathies), such as: cardiopathies with pulmonary flow dependent on the arterial canal: pulmonary atresia and similar; cardiopathies with systemic flow dependent on the arterial canal: hypoplastic left heart syndrome, critical coarctation of the aorta and similar; and cardiopathies with parallel circulation: transposition of the great arteries⁽⁶⁾.

In the group of serious congenital cardiopathies, there is a mixing of blood between the systemic and pulmonary circulations, which entails a reduction in the peripheral oxygen saturation. In this way, the rationale for undertaking pulse oximetry as a method for tracking serious congenital cardiopathies occurs due to the fact that there is hypoxia even before cyanosis is evidenced⁽¹¹⁾. In this regard, checking pulse oximetry in order to triage the congenital cardiopathies is presented as a satisfactory test and indicator of cardiac abnormalities.

The study data also showed that the majority of the nurses know how to interpret the results of the little heart test, pointing to the parameters considered ideal, recommended by the Ministry of Health, and that they also have knowledge regarding conducts to be taken in the event of a result which falls outside the accepted parameters for pulse oximetry.

The Ministry of Health considers the result to be normal when peripheral saturation is greater than or equal to 95% in both measurements (upper right limb and lower limb) and there is a difference below 3% between the measurements of the upper right limb and the lower limb. Should any measurement of SpO₂ be less than 95%, or should there be a difference equal to or greater than 3% between the measurements of the upper right limb and the lower limb, another check must be undertaken after 1 hour. Should the result be confirmed, an echocardiogram must be undertaken within the next 24 hours⁽¹²⁾.

The ideal method for confirming the diagnosis of congenital cardiopathy is the echocardiogram with color flow mapping, which is not viable in the routine of all live births, due to its cost and the specialized knowledge involved in its use. As a result, the neonatal triage of congenital cardiopathies using pulse oximetry makes it possible to select those apparently healthy newborns who would otherwise be discharged from hospital within 36 to 48 hours⁽⁶⁾.

However, continuous clinical assessment on the part of health professionals is fundamental, with emphasis being placed on the Systematization of Nursing Care for the nurses, in which routine actions are implemented which identify the set as a whole and the specific characteristics of each patient.

Pulse oximetry constitutes an innovative technology, which uses the absorption of red and infrared light by the oxygenated hemoglobin. The interpretation of the O₂ saturation must take into account various factors, such as: poor positioning of the sensor, and artifacts resulting from movement, ambient light and temperature, among others⁽³⁾. It is a noninvasive and painless method which can be done quickly. Undertaking this test does not rule out the need to undertake a complete and thorough physical examination, in addition to cardiac auscultation prior to discharge from hospital.

In this scenario, the nurse is the professional indicated to undertake the little heart test, as she is responsible for the primary care provided to the mother-and-child binomial in the puerperal period. This being the case, her role in the process of triaging for congenital cardiopathies potentializes the quality of the care provided to the newborns.

One may observe that the Law of Professional Exercise N. 7,498/86⁽¹³⁾ and Decree N. 94,406/87⁽¹⁴⁾,

Article 8, assure to the professional nurse the competency to undertake complex nursing procedures with newborns, with nursing care of greater technical complexity requiring appropriate scientific knowledge and the capacity to take decisions, a situation which characterizes pulse oximetry in Neonatal Triage, in accordance with Ministerial Ordinance N. 20/2014 of the Ministry of Health⁽¹⁵⁾.

In the setting where the study was undertaken, a maternity unit which is a center of excellence in gynecology and obstetrics for that State, the little heart test was established in the neonatal units beginning in 2014, through Ministerial Ordinance N. 20, of 10th June 2014, which made public the decision to incorporate pulse oximetry – little heart test, to be undertaken universally, being part of neonatal triage within the Unified Health System (SUS).

In this context, pulse oximetry constitutes an important measure in nursing care for the newborn in the neonatal triage of congenital cardiopathies, and may be undertaken continuously without excessive costs. It is a relevant attribute of the nurse, who must ensure the appropriate recording of variations in the oximetry, as well as knowing how to correlate its abnormalities within the parameters established by the Ministry of Health.

As a result, the nurse's knowledge in undertaking the little heart test is highly important in relation to the stages involved in triaging for neonatal congenital cardiopathies. The nurses' level of knowledge regarding this topic, and a rigorous attention to results which fall outside the parameters of normality, ensure that decisions will be made correctly and will contribute efficaciously to tracking serious congenital cardiopathies.

In the light of the above, there is no obstacle to undertaking pulse oximetry in neonatal triaging by the nurse, given that nurses have specialized technical training which is compatible with undertaking the procedure, it being necessary to observe the norms, routines and care protocols which govern the professional exercising of Nursing.

FINAL CONSIDERATIONS

The results revealed that the nurses know the concept and objective of the little heart test, and that they know how to describe how this is applied in the nursing practice through checking oxygen saturation with the purpose of triaging possible

congenital cardiopathies and thus reducing the rate of child mortality.

The study also showed that a large number of nurses experienced difficulties at the time the test was implanted in the service, as they did not have knowledge regarding the functioning of the same and because there was no training regarding its implantation; added to the numerous tasks which already form part of the nurse's routine in the Mother-and-Child Ward.

Another important data which the study evidenced was that a significant number of nurses know how to identify the normal parameters for pulse oximetry in newborns and the conducts to be undertaken if a result falls outside these parameters.

In this context, one can perceive the importance of the nurse's role in undertaking the little heart test in the neonatal units. Studies involving this issue, however, remain incipient, there being a need for further research to demonstrate the benefits of this role, which the nurse can take on through the implantation of the neonatal triage program, specifically with the little heart test.

As a result, the study indicates that the knowledge and level of information of these professionals regarding congenital cardiopathies, and regarding the little heart test, may be reflected directly in decisions made referent to the test parameters, making possible the correct treatment of the newborns in the process of triaging for cardiac abnormalities.

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