

# KNOWLEDGE OF NURSING TECHNICIANS AND AIDES ABOUT CENTRAL VENOUS CATHETER CARE IN A PEDIATRIC HOSPITAL

## CONHECIMENTO DE TÉCNICOS E AUXILIARES DE ENFERMAGEM SOBRE CUIDADOS COM CATETERES CENTRAIS EM UM HOSPITAL PEDIÁTRICO

## CONOCIMIENTO DE TÉCNICOS Y AUXILIARES DE ENFERMERÍA ACERCA DE LA ATENCIÓN CON CATETERES CENTRALES EN UN HOSPITAL PEDIÁTRICO

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**Objective:** identify the knowledge of nursing technicians and aides about maintenance practices of long-, medium- and short-term central venous catheters in children. **Method:** a descriptive exploratory study of a quantitative approach was conducted from September to November 2017, with 157 nursing technicians and aides from the hospitalization units of an exclusively pediatric institution in the state of Paraná, Brazil. **Results:** this study found that 134 (85.3%) participants answered they had received guidance on nursing practices with central venous catheters, but 92 (58%) participants highlighted that 1 ml syringe should not be used when handling these devices, showing improper practices regarding these catheters. **Conclusion:** although the nursing team was aware of the maintenance of central venous catheters, improper practices were still observed regarding basic actions with these intravenous devices of great relevance for an effective pediatric drug therapy.

**Descriptors:** Nursing care. Central venous catheterization. Intravenous administration. Continuing education.

*Objetivo:* identificar os conhecimentos de técnicos e auxiliares de enfermagem acerca dos cuidados com a manutenção de cateteres venosos centrais de longa, média e curta permanência em crianças. *Método:* estudo exploratório-descritivo com abordagem quantitativa, realizado de setembro a novembro de 2017, com amostra de 157 técnicos e auxiliares de enfermagem das unidades de internação de uma instituição exclusivamente pediátrica do estado do Paraná, Brasil. *Resultados:* responderam que já haviam recebido orientações sobre cuidados de enfermagem com cateteres centrais 134 (85,3%) participantes, entretanto 92 (58%) colaboradores pontuaram que a seringa de 1 ml não deve ser utilizada no manuseio desses dispositivos, evidenciando que ainda ocorriam erros nos apontamentos quanto aos

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*cuidados adequados com esses acessos. Conclusão: apesar de a equipe de enfermagem conhecer os cuidados com a manutenção de cateteres centrais, percebeu-se que ainda existiam dificuldades quanto aos cuidados primordiais com esses dispositivos intravenosos de grande relevância para a eficácia da terapia medicamentosa em pediatria.*

*Descritores: Cuidados de enfermagem. Cateterismo venoso central. Administração intravenosa. Educação continuada.*

*Objetivo: identificar conocimientos de técnicos y auxiliares de enfermería acerca de la atención con el mantenimiento de catéteres venosos centrales de larga, media y corta permanencia en niños. Método: estudio exploratorio-descriptivo, cuantitativo, de septiembre a noviembre de 2017, con muestra de 157 técnicos y auxiliares de enfermería de las unidades de internación de una institución exclusivamente pediátrica del Paraná, Brasil. Resultados: respondieron que ya habían recibido orientaciones sobre cuidados de enfermería con catéteres centrales 134 (85,3%) participantes, sin embargo 92 (58%) puntuaron que la jeringa de 1 ml no debe ser utilizada en el manejo de esos dispositivos, evidenciándose que se produjeron errores en los apuntes en cuanto a los cuidados adecuados con esos accesos. Conclusión: a pesar del equipo de enfermería conocer la atención con el mantenimiento de catéteres centrales, se percibieron dificultades en cuanto a los cuidados primordiales con esos dispositivos intravenosos de gran relevancia para eficacia de la terapia medicamentosa en pediatría.*

*Descriptores: Atención de enfermería. Cateterismo venoso central. Administración intravenosa. Educación continua.*

## Introduction

Quality in health care is still a complex issue and should be considered a priority by the institutions and their professionals<sup>(1)</sup>. Thus, improving the quality of care is a continuous challenge for organizations worldwide<sup>(2)</sup>.

Some aspects should be taken into account to achieve quality, such as availability of proper infrastructure, resources, and personnel for the services offered. In addition, the information system should be able to monitor and establish a structure of recognition and incentive aligned with quality and, above all, the acquisition of knowledge and skills to manage and improve the quality of specific services and the system as a whole<sup>(3)</sup>.

In terms of human resources, nursing professionals play a central role in health organizations, whose essence is the individual care, aligned with quality and safety practices<sup>(1)</sup>.

In this respect, patients who need intravenous therapy require frequent nursing care, since such therapy implies constant and transversal evaluation throughout the process. Therefore, it is very important to select the best intravenous device according to the patient needs<sup>(4)</sup>. Nursing practices in intravenous therapy are based on the maintenance of a safe venous access, suggesting permeability with the lowest risk of developing local or systemic infections<sup>(5)</sup>.

Central venous catheter (CVC) is an intravenous device available in health services. It is an important tool for a proper and efficient therapy to hospitalized patients. Its composition material ensures better condition and greater variability for uninterrupted treatments that require intravenous access<sup>(6)</sup>. However, although the CVC is an ally in infusion therapy, this device also poses risks to patients, such as formation of thrombi, embolism, and primary bloodstream infections (PBSI). Therefore, the role of the nursing team is critical in central venous catheter care, since these professionals are directly responsible for its maintenance and daily evaluation to reduce risks of infection<sup>(7)</sup>.

Therefore, this study is justified as it identifies the knowledge of the nursing team about the maintenance of central venous catheters, which are important tools for an effective intravenous therapy to pediatric patients.

This study attempted to answer the following guiding question: What is the knowledge of nursing technicians and aides about the maintenance of long-, medium- and short-term central venous catheters in children?

Based on this question, the objective of this study was to identify the knowledge of nursing technicians and aides about the maintenance of

long-, medium- and short-term central venous catheters in children.

## Method

This is a descriptive exploratory study of a quantitative approach, conducted in hospitalization units of an exclusively pediatric institution in the state of Paraná, Brazil. The study participants were nursing aides and technicians.

The total population of this study consisted of 264 nursing aides and technicians. The sample calculation resulted in 157 nursing professionals, observing the 95% confidence level and 5% sampling error. The calculation of total population did not include nursing professionals from the emergency staff, the hemodialysis service, outpatient clinics, and intensive care units, considering the study objective. The exclusion of emergency units from the hemodialysis service, outpatient clinics and intensive care units is justified by the authors' intention to identify the knowledge of nursing professionals who work in pediatric hospitalization units (infirmaries), where the health care characteristics are singular and different from the other units above.

A questionnaire, consisting of 11 questions, was applied for data collection from September 12 to November 6, 2017. Before starting this study, the questionnaire was submitted to pre-testing with the aim to identify the knowledge of nursing technicians and/or aides about the nursing care of central venous catheters.

The questions were about CVC protection during patient bath, CVC washing technique, interval between turbulent flush procedures, size of syringe that should not be used in these devices, interval between dressing changes, who is in charge of clearing and collecting blood of central catheters, and the right moments of hand hygiene before handling this device.

The inclusion criteria were: participants over 18 years of age, signing of an informed consent form, nursing technicians or aides from the nursing team of hospital infirmaries. The exclusion criteria were: nursing professionals on vacation or on leave on the questionnaire

application day; nursing technicians and aides working in emergency units, intensive care units, hemodialysis services and outpatient clinics.

The ethical aspects related to human research observed the guidelines of Resolution no. 466/12 of the National Health Council<sup>(8)</sup> and the legislation in force in the study period. This study was approved by a research ethics committee, under protocol no. 2.228.85.

After approval of this study, the questionnaires were applied to the study sample. First, the questionnaires were handed to the employees, explaining the study objectives. Then, each participant signed the informed consent form. As soon as every participant finished answering the questionnaire, the researchers collected it; the participants returned it after 40 minutes on average. Data collection took place in a reserved area in the infirmaries, considering the restricted physical space in each hospitalization unit and the activities the nursing staff had to perform during data collection.

The information obtained with the questionnaires was organized in electronic spreadsheets, with the help of CALC application, version 4.1. Then, they were analyzed using simple statistics – absolute frequency (n) and relative frequency (%).

## Results

Regarding the professional characterization of the study participants, 92 (59%) worked in the daytime period and 65 (41%) in the nighttime period. In terms of professional category, 45 (29%) were nursing aides and 112 (71%) were nursing technicians. When considering their experience in the nursing area since their degree, most participants, 111 (70.7%), presented more than 2 years of experience.

Another aspect addressed in the questionnaire was whether the nursing professional had already received any instruction about nursing care when handling central venous catheters: 134 (85.3%) answered yes, 22 (14.1%) answered no, and 1 (0.6%) did not answer. Regarding the need to protect the central venous access during patient

bath, 1 (0.6%) indicated that such protection was not necessary, while 156 (99.4%) answered the protection was required during patient bath.

Regarding the syringe size/capacity used with catheters, 92 (58%) participants, that is, more than half, answered the 1 ml syringe should not be used with central catheters; 25 (15%) answered the 20 ml syringe cannot be used, 13 (8%) answered the 10 ml syringe should not be used, and 53 (34%) answered the 50 ml syringe should not be used. Therefore, more than one alternative was marked by the participants.

In terms of the solution that should be used in turbulent flush of short- and medium-term central venous catheters and the interval between turbulent flush procedures, of all 157 participants, 152 (97%) answered it should be performed with saline solution 0.9% every 6 hours and 5 (3%) answered saline solution 20% every 4 hours; no

participant chose glucose solution every 6 hours or heparin solution 5% once a day.

Regarding the professional who should perform CVC clearance, 128 (81.5%) answered the nurse, while 23 (15%) participants answered the nurse or the nursing aide or technician; 4 (2.5%) answered that only the physician should perform CVC clearance, and 2 (1.2%) answered the nursing aide or technician would be responsible for performing this technique.

About the professional who should collect blood with central venous catheters, 116 (74%) participants chose the nurse, 38 (24%) chose laboratory technicians and nurses, and 3 (2%) answered nursing aides and technicians. No participant answered laboratory technicians only.

In terms of nursing care for maintenance and prevention of catheter-related bloodstream infection, the participants could select more than one answer (Table 1).

**Table 1** – Answers related to nursing care for maintenance and prevention of infection. Curitiba, Paraná, Brazil – 2017 (N=157)

Care practices	n	%
Wash hands with water ONLY before and after handling the catheter and the circuit.	30	19
Wash hands with water ONLY after handling the catheter and the circuit.	10	6
Rub hands with glycerin alcohol before any contact with the patient and his/her catheter.	97	62
Rub hands with glycerin alcohol after any contact with the patient and his/her catheter.	84	53
Clean connections and screwed lids of the catheter with alcohol 70% for at least 10 seconds.	140	89
Use isopropyl alcohol sachet to clean connections and occluders of central venous catheters.	126	80

Source: Created by the authors.

The frequency of transparent polyurethane film dressing change, present in dressings of central venous catheters, and the professional who should change such dressing were also analyzed. According to this study, most participants, 138 (88.1%), answered the dressing should be changed every seven days or if presenting poor conditions. They added nurses should perform this procedure. However, 13 (8.2%) reported that dressing should be changed daily and that nursing technicians and nurses should change it; 4 (2.5%) answered it should

be changed every 4 days and that the patient's companion, together with the nursing aide, should change this dressing; 2 (1.2%) participants did not answer this question; and no participant marked the option of changing the dressing twice a day, and the nurse should change it.

The last aspect addressed was about nursing care to avoid loss and blockage of CVCs. This question also allowed the selection of more than one answer. Table 2 shows the results found in this question.

**Table 2** – Answers related to nursing care to avoid loss and blockage of central venous catheters. Curitiba, Paraná, Brazil – 2017 (N=157)

Care practices	n	%
Perform catheter turbulent flush before and after the administration of intravenous medication.	143	91
For intravenous therapy prescribed by the physician, it is not necessary to perform catheter turbulent flush every 6 hours.	19	12
In fully implanted catheters, keep continuous intravenous therapy, as prescribed by the physician.	134	85
For short- and medium-term catheters, perform catheter turbulent flush every 6 hours, or according to instructions from the nurse.	129	82
Perform catheter turbulent flush only if the CVC presents a risk of blockage.	14	9
Catheter washout between medications is not required.	2	1

Source: Created by the authors.

## Discussion

When working with patients, the nursing staff should dedicate special attention to all direct and indirect procedures, since studies have indicated improper work conditions, reduced quality of materials, insufficient human resources and inadequate remuneration of these professionals. Therefore, these factors can favor the physical and psychological exhaustion of these professionals and increase the risks of workplace and patient accidents<sup>(9)</sup>.

Regarding the significant number of professionals from technical programs in the health area, predominantly nursing aides and technicians, it is important to highlight that the objective of their professional practice is to preserve the patient's life and health, based on human and ethical foundations, with interpersonal as the essence of such relation<sup>(10)</sup>.

In the educational context, the teaching process should be seen as the foundation of construction and sustainability regarding professional training in health, incorporating values, knowledge and experiences<sup>(11)</sup>.

The third aspect analyzed refers to nursing care instructions when handling central venous catheters. It should be noted that, in the context of health education, permanent education in health should be promoted, allowing the identification of knowledge gaps of professionals and, therefore, actions to improve the work process.

Thus, permanent education in health can help structure a health care unit with more responsible and competent professionals performing more conscious and qualified work, promoting service of higher quality to the population<sup>(12)</sup>.

Another aspect analyzed in this study was the importance of protecting the central venous catheter dressing. Based on the answers, the participants understood the importance of this care, since most of them answered that it would be necessary to protect the CVC during patient bath.

In this segment, special attention should be dedicated to the risks of catheter-related bloodstream infection and the importance of greater precaution during insertion and maintenance of deep venous catheters, as well as the use of evidence-based actions to support proper handling of these devices by the health team. Therefore, systematized care, following standards set by evidence-based guidelines, promotes greater safety and quality during the team work process, effectively resulting in reduced rates of care-related infections<sup>(13)</sup>.

Regarding the syringe used for catheter infusion, although more than half of the participants provided the correct answer, the percentage of participants providing incorrect answers is a concern, because syringes of less than 10 ml exert more pressure on the lumen of the device, and the lower the volume of the syringe the greater the pressure. Hence, the

device can break, both externally and internally in the bloodstream<sup>(14)</sup>, causing embolism, which is an important adverse event that poses a risk to the patient's life.

Regarding the turbulent flush solution that should be used with short- and medium-term central venous catheters and the interval between turbulent flush procedures, the authors highlight that it is important to consider the years of experience in nursing. Thus, washout is commonly performed at every nursing shift. In the nursing practice, it is an essential care and must be performed before and after drug administration, when the interval of the medications is greater than six or eight hours<sup>(14)</sup>.

It is important to perform the turbulent flush technique with a volume that is consistent with the size of the patient and catheter, and corresponding restrictions, using sodium chloride 0.9% in a 10 ml syringe or larger capacity. However, a heparinized solution can also be used, and in this case, each route must be locked, according to its primer. In addition, the nurse should clamp the route(s) and apply a little pressure to the syringe plunger before disconnecting it from the system<sup>(15)</sup>.

About the use of a saline or heparinized solution, a study concludes that, at first, there seems to be no difference between a heparinized solution and sodium chloride 0.9% in terms of efficacy in the maintenance of central venous catheter permeability. A saline solution does not increase the risk of catheter-related bloodstream infection. Besides, a saline solution is preferable to reduce the exposure to heparin and its potential complications<sup>(15)</sup>.

Regarding the professional who can perform central catheter clearance, the literature does not highlight the nurse as the professional in charge of this procedure; instead, it shows the nursing team should be able to identify the blockage and start clearing the blocked catheter as fast as possible<sup>(14)</sup>. However, when dealing with a central venous catheter requiring more complex care, the nurse should handle it, since standard professional nursing practice emphasizes that the nurse is responsible for performing procedures

requiring greater technical complexity, scientific knowledge and the ability to make quick decisions<sup>(16)</sup>.

Regarding catheter clearance, it should be noted that clots are not cleared by the action of heparin; instead, they are detached from the wall. Therefore, they should be sucked at the end of the clearing technique, avoiding clot introduction into the patient's bloodstream and its effects<sup>(14)</sup>.

Regarding the professional in charge of blood collection technique in some central catheters, the protocol of the institution where this study was conducted defines the nurse should perform blood collection. But no evidence was found in the literature regarding this procedure. The literature shows that blood collection is allowed only with long-term semi-implantable or tunneled central catheters.<sup>(17)</sup> However, as the study site is a pediatric institution, it allows blood collection with other types of catheters, according to the flow, reflux and size of each type of catheter, and the clinical status of the patient.

About nursing care for the maintenance and prevention of catheter-related bloodstream infection, it is important to consider that wearing gloves does not replace hand hygiene, which involves washing and/or rubbing with alcohol. Regarding specific care with catheters, hand hygiene should be performed before and after touching the catheter insertion site, and before and after handling or changing the dressing<sup>(17)</sup>.

Despite the dissemination of care to prevent bloodstream-related infections, studies show that hand hygiene before and after the procedures and sanitization of connections before drug administration are still not fully incorporated by both nurses and nursing technicians. Therefore, it is important to promote more discussion on the prevention of bloodstream infection and permanent and continuing education of the teams to address their main vulnerabilities<sup>(9)</sup>.

When changing central catheter dressing, nurses need to be watchful and careful, since the technique and dressing cover selected will interfere in the effective protection of the catheter insertion site and possible colonization

by microorganisms due to blocked insertion site<sup>(18)</sup>.

Therefore, understanding the fundamental noncompliant actions linked with changing catheter dressing can help reduce complications related to the use of central catheters and improve the nursing team's knowledge about proper handling of these devices<sup>(18)</sup>.

The last aspect addressed in the questionnaire was related to nursing care to avoid CVC loss and blockage. As mentioned above, it involves turbulent flush between drug administration – the protocol of the study institution defines it must be performed before and after drug administration. For a catheter in intravenous therapy prescribed by the physician, turbulent flush is also required, according to the institution's protocol, so that the device lumen is cleared with the pressure exerted. It should be noted that turbulent flush must be performed for any catheter and not only with those posing a risk of blockage.

The literature has no study on fully implantable catheters in continuous intravenous therapy; however, in the institution where this study was conducted, they are maintained with continuous intravenous therapy, with a physician's prescription, soon after puncture in constant use.

For proper intravenous therapy, measures have to be adopted to keep the permeability of central venous catheters. However, when these devices are blocked, the patient has some negative effects, especially pediatric patients, because of repeated painful puncture, interrupted drug therapy or parenteral nutrition, and catheter handling in an attempt to clear it, which promotes greater predisposition to infection and stress in the child and the team<sup>(14)</sup>.

This situation may extend hospital stay as readmissions increase the concern among health care providers and, therefore, efforts to reduce it may be supported by clinical administrators, since efficient delivery of high-quality health care must be provided<sup>(19)</sup>.

Inadequate maintenance procedures of central venous catheters performed by the nursing aides and technicians who participated

in this study may be linked with the therapy applied to the patient. Therefore, this study can promote reflections on the proposed theme so that professional practice can be reformulated, since the effectiveness of central venous catheter care can help reduce venipuncture attempts and stress, increase patient comfort and help reduce costs related to several attempts of peripheral punctures.

One limitation of this study is perhaps the fact that it was conducted with a small group of nursing professionals, and the application of the questionnaire during the participant's work time may have resulted in quick answers, favoring responses that are not consistent with the guidelines or care performed at the institution.

## Conclusion

The results show that, although the participants perform some proper procedures of central venous catheter maintenance, especially regarding the catheter protection during the bath, the type of solution for turbulent flush, the interval of catheter washout, the professional who can clear blocked CVCs, the frequency to change dressing and the need to clean connectors and occluders with an alcohol solution 70%, the nursing team still do not know some procedures with this type of access.

It is important to emphasize that, in pediatric hospitals, in specific situations, the central access is the only possible venous access for the patient, and the only safe route for the administration of certain medications to ensure proper and efficient treatment. Therefore, the lack of knowledge of the nursing team, even to a small degree, related to proper care of this device indicates an alarming concern.

Despite the fact that most participants identified proper care when handling a central access in terms of hand hygiene and the correct use of syringes, those participants who provided incorrect answers in these items are sources of concern, as these are extremely important for the patients, considering that, when performed

improperly, they can affect the integrity of the catheter and the patient.

When considering these aspects and although central venous catheter maintenance is a common care procedure in hospitals, there are still doubts about basic care regarding a central access that is safe for the patient. Therefore, permanent training actions on such care still have to be promoted, so that high-quality care can be delivered to patients, and for the institution, consequent reduction of extended hospitalization expenses caused by catheter-related bloodstream infection.

### Collaborations

1. conception, design, analysis and interpretation of data: Jessika Rodrigues Rocha and Débora Maria Vargas Makuch;

2. writing of the article and relevant critical review of the intellectual content: Jessika Rodrigues Rocha, Juliana Ollé Mendes da Silva, Milena da Costa and Débora Maria Vargas Makuch;

3. final approval of the version to be published: Jessika Rodrigues Rocha and Débora Maria Vargas Makuch.

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