







Construction of a nursing care instrument for patients with central venous catheters

Construção de instrumento de cuidado do enfermeiro ao paciente com cateter venoso central

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-  Stefhanie Conceição de Jesus¹
-  Kátia Cilene Godinho Bertoncello¹
-  Fernanda Alves Ferreira Gonçalves²
-  Aline Daiane Colaço¹
-  Geline Nascente Soares Lentz¹
-  Dulcinéia Ghizoni Schneider¹

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¹Universidade Federal de Santa Catarina. Florianópolis, SC, Brazil.

²Universidade Federal de Goiás. Goiânia, GO, Brazil.

Corresponding author:

Stefhanie Conceição de Jesus
Campus Reitor João David Ferreira Lima
Trindade, Universidade Federal de Santa Catarina.
CEP: 88040-900. Trindade, Florianópolis, SC, Brazil.
E-mail: stefhaniec.j@gmail.com

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ABSTRACT

Objective: to build a nursing care instrument for patients with short-term central venous catheters in an Intensive Care Unit. **Methods:** a multi-method study in three stages: structuring of the instrument; pre-testing of the instrument; agreement analyses among nurses and final composition of the instrument. **Results:** the instrument, in its first version, presented three domains related to the moment of insertion (five items), maintenance (15 items) and catheter removal (ten items). Most of the 30 items were assessed as relevant (23/77%) and presented a satisfactory Content Validity Index (28/93%). Ten items were reformulated, 32 new items were included, and three items were deleted. **Conclusion:** the instrument was constructed, which presented response validity for the care of nurses to patients with central venous catheters in Intensive Care Units, consisting of three domains and 59 items evaluated by nurses and considered appropriate for the moments of insertion, maintenance and removal of the catheter.

Descriptors: Nursing Care; Catheters; Intensive Care Units.

RESUMO

Objetivo: construir um instrumento de cuidados do enfermeiro ao paciente com cateter venoso central de curta permanência em Unidade de Terapia Intensiva. **Métodos:** estudo multimétodo em três etapas: estruturação do instrumento; pré-teste do instrumento; análises de concordância entre os enfermeiros e composição final do instrumento. **Resultados:** o instrumento, em sua primeira versão, apresentou três domínios relacionados ao momento de inserção (cinco itens), manutenção (15 itens) e remoção do cateter (dez itens). A maioria dos 30 itens foi avaliada como relevante (23/77%) e apresentou satisfatório Índice de Validade de Conteúdo (28/93%). Reformularam-se dez itens, incluíram-se 32 novos e excluíram-se três itens. **Conclusão:** foi construído o instrumento, que apresentou validade de resposta para os cuidados do enfermeiro ao paciente com cateter venoso central em Unidade de Terapia Intensiva, compondo-se de três domínios e 59 itens avaliados por enfermeiros e considerados adequados para os momentos de inserção, manutenção e remoção do cateter.

Descritores: Cuidados de Enfermagem; Cateteres; Unidades de Terapia Intensiva.

Introduction

The short-term central venous catheter is the most common type of central venous access device used in patients admitted to Intensive Care Units. The choice of this device is associated with the profile of patients admitted to these units - with or at risk of developing acute organ dysfunction - and their therapeutic needs, which may include hemodynamic monitoring, multiple medications, large infusion volumes, blood and/or blood component administration, and parenteral nutrition⁽¹⁾. Thus, for the treatment of critically ill patients, the central venous catheter is an indispensable technology, while it can also confer risks to patients.

Patients using central venous catheters and with inadequate care to the device may suffer damage, generating unfavorable outcomes in health services. The patient with damage may have a longer hospital stay, a higher probability of readmission in 30 days, and a higher probability of death, besides generating a higher economic cost to the institutions⁽²⁾. Therefore, it is necessary to structure and systematize the services, so that the care of patients is delivered safely, especially in units that require highly complex care and directed to high-risk devices, such as the short-term central venous catheter.

Central venous catheters are among the medical devices most associated with negative patient outcomes. In a prospective cohort developed over a 12-month period, an infection rate of 12.6% and an incidence of 19/1,000 Intensive Care Unit/days were obtained, being central venous catheter-associated bloodstream infections the most common type (48.8%, 15.9/1,000 device days)⁽³⁾. In Brazil, in an observational study, there was a high percentage of complications in critically ill patients using the 196 catheters analyzed. Of the 170 double lumen catheters, 61 (35.8%) resulted in some type of complication and 14 (53.8%) of the 26 monolumen catheters analyzed⁽⁴⁾.

For patient safety, nurses' care must be based on the best scientific evidence. The literature guides not only innovation in care, but also enables the best and safest patient care. In addition, the participation of nurses in the construction of instruments that guide nursing work favors the prevention and control of problems experienced in their daily lives⁽⁵⁾. To improve health indicators and provide harm-free care in the care setting, several strategies have been adopted, such as: procedure standardization, checklist, team training, and bundle implementation⁽⁶⁻⁷⁾. However, a directing of efforts of strategies is observed, above all, to care for the maintenance of the catheter⁽⁷⁻⁸⁾, therefore, care is required to cover all moments of catheter use - its installation, maintenance and removal.

Given the complex scenario of Intensive Care Units and considering the risks related to the use of central venous catheters by critically ill patients, efforts must be made to ensure that nurses' care is safe and of quality. For this, it is necessary to create technologies that enable care plans based on scientific evidence and that the safety of the critically ill patient be assured, which is why this study was conducted, aiming to answer the following question: What is the nurse's care of the patient admitted to an Intensive Care Unit at the time of installation, maintenance and removal of the short term central venous catheter? The objective was defined as: to build a nursing care instrument for patients with short-term central venous catheters in an Intensive Care Unit.

Methods

Multi-method study conducted from November 2019 to August 2020. The procedures for this study were divided into three steps pertaining to the structuring of the instrument, the pre-test with nurses, and the analyses of the instrument⁽⁹⁾.

The first step, structuring the instrument, was based on literature consultation. A systematic review

study was conducted to investigate the evidence of the contributions of nurses' care to reduce adverse events in patients with central venous catheters, which has its results presented in a publication⁽¹⁰⁾. After an initial study, recommendations from national and international bodies and societies were synthesized and gathered on the subject related to vascular accesses^(6-7,11). The compilation of these findings, associated with the clinical experiences of the researchers, allowed the construction of the preliminary version of the instrument.

In the second stage, pre-test, seven nurses who were qualified in critical care (specialization or master's degree) and who were part of the collaboration framework of the research group of the researchers responsible for the study, were invited⁽¹²⁾. This quantity considered the literature, which describes an acceptable number of experts for the evaluation panel composition of three to ten⁽¹³⁾. Upon confirming participation in the study, each nurse received, by e-mail, a link to access the instrument built in electronic form. For each item of the instrument, a four-point Likert-type scale was available, ranging from one - not relevant to four - very relevant, and a space for free typing for comments and suggestions to each item of the instrument when the nurses deemed pertinent were available.

In the third stage, statistical analyses and adjustments were conducted on the instrument, whose data was obtained in the pre-test and inserted into a spreadsheet in Microsoft Excel®, version 2019. The percentages of agreement between the nurses for each item and each domain of the instrument were calculated, considering a percentage of 90% agreement. Those with a lower percentage were reformulated. The Content Validity Index (CVI) of the answers marked three or four points was applied to evaluate the degree of agreement between the evaluators, considering the cutoff point equal to or greater than 0.78. The nurses' suggestions were analyzed for the main-

tenance, modification or exclusion of items.

This study was submitted to the Research Ethics Committee of the Federal University of Santa Catarina, under Opinion No. 3,908,791/2019, and developed respecting the ethical precepts in research with human beings. Thus, all participants, prior to the study, consented to their participation by signing the Free and Informed Consent Term.

Results

To build the instrument, this study was conducted in three stages. The first stage was based on the understanding of the study phenomenon, whose structure of the instrument was given in three domains: the first with five items related to the nurse's care regarding catheter insertion; the second with 15 items related to the nurse's care regarding catheter maintenance and the third with ten items related to the nurse's care regarding catheter removal.

The second step in the process of constructing the instrument was the pre-test. In this stage, seven nurses participated, being six (86%) female and one (14%) male, with an average age of 30 years, all residents in the State of Santa Catarina. The average time of graduation in Nursing was six years, the majority (57%), were masters in Nursing, and the others were specialists (43%), varying from one to eight years of training in the specialty. Five (71%) nurses said they had worked for zero to five years in their specialty area, two (29%) said they had worked for ten years.

Regarding the care instrument, three domains pertinent to care related to insertion, maintenance and removal of the central venous catheter were defined, all of which presented a percentage of agreement higher than 90% (Domain A - 97%; Domain B - 94%; Domain C - 94%). Of the 30 items, 23 (77%) were evaluated as relevant and 28 (93%) presented CVI higher than 0.78 (Table 1).

Table 1 – Items with nurse care for patients with short-term central venous catheters and nurses’ assessment of the instrument. Florianópolis, SC, Brazil, 2021

Domain A – Catheter insertion	N1	N2	N3	N4	N5	N6	N7	%	CVI
Discuss with the multi-professional team the choice of intravenous therapy, venous catheter and catheter puncture site.	4	4	4	4	4	4	4	100.0	1.00
Carry out health education with patients/family members about the therapy adopted and the need for CVC use, the care related to maintenance and surveillance of signs of complications.	4	3	4	4	4	4	4	100.0	1.00
Perform materials management for CVC installation (CVC kit or cart).	4	4	4	4	4	3	4	100.0	1.00
Perform prior hair removal at the CVC puncture site when inserting into a femoral vein.	3	1	4	3	3	4	3	85.7	0.86
Audit with a checklist the CVC installation procedure with respect to professional adherence to infection prevention recommendations, aseptic technique breakdown, and material resources.	4	4	4	4	4	4	4	100.0	1.00
Domain B – Catheter Maintenance									
Confirm correct CVC positioning with visualization technology.	4	4	4	4	4	4	4	100.0	1.00
Perform health education with patients about changing the catheter insertion dressing before doing it.	4	3	3	4	4	4	4	100.0	1.00
Perform dressing at catheter puncture site with sterile gauze for 48 hours or until bleeding stops.	3	4	4	4	4	4	3	100.0	1.00
Change the CVC insertion dressing to transparent semipermeable film with a prescription to change it every seven days or sooner if necessary.	4	4	4	4	4	4	4	100.0	1.00
Change dressing covers when there are signs of bleeding, sweating and/or peeling.	4	4	4	4	4	4	4	100	1.00
Use catheter stabilization device at each CVC insertion dressing change.	4	2	4	4	4	3	4	100.0	0.86
Protect catheter insertion site covers, the catheter and its connections with impermeable material during bathing.	4	2	3	4	4	3	4	85.7	0.86
Monitor, daily and at each dressing change, the catheter insertion site for signs of infection.	4	4	4	4	4	4	4	100.0	1.00
Sanitize the catheter insertion site with sterile gauze soaked in 0.9% saline solution and apply 0.5% alcoholic chlorhexidine antiseptic solution at each dressing change.	4	4	4	4	4	4	4	100.0	1.00
Allow 30 seconds for spontaneous drying after application of 0.5% alcoholic chlorhexidine antiseptic solution at the catheter insertion site.	4	4	4	4	4	4	4	100.0	1.00
Once a day, flush the CVC in the pulsatile technique with 0.9% sodium chloride, in a minimum volume corresponding to twice the internal volume of the catheter system.	2	2	3	3	4	3	4	71.5	0.71
Perform mechanical friction for five to 15 seconds on valved connectors and inlets for the addition of medications with alcohol-based antiseptic solution before manipulating the CVC for flushing.	4	4	4	4	4	4	4	100.0	1.00
Monitor in loco, daily, bedside nurse and manager, the need for CVC continuity.	4	4	4	4	4	4	4	100.0	1.00
Ensure exclusive CVC lumen for parenteral nutrition administration when applicable.	4	4	4	4	4	4	4	100.0	1.00
Perform hand hygiene of patients with 2% chlorhexidine three times a day.	2	1	2	3	4	4	4	57.1	0.57
Domain C – Catheter removal									
Provide guidance to the patient about: removal of the CVC; valsava maneuver; bed rest and dressing maintenance.	4	4	4	4	4	4	4	100.0	1.00
Position patient in dorsal decubitus, or Trendelenburg (head down position when tilting the bed), in the absence of contraindication, for CVC removal.	4	1	2	3	3	4	4	71.4	0.86
Keep clamps and three way connectors closed before starting CVC removal.	4	4	3	3	4	4	4	100.0	1.00
Ask the patient, during extraction of the final portion of the catheter, to perform the valsava maneuver (forced expiration of air against a closed glottis), when possible. Otherwise, remove the CVC during the patient’s active exhalation.	4	4	2	4	4	3	4	85.7	0.86
Immediately stop the CVC removal process in the presence of physical resistance at the moment of traction.	4	4	4	4	4	4	4	100.0	1.00
Clean the insertion site with 0.9% saline solution and antiseptics with 0.5% alcoholic chlorhexidine before removing the catheter.	2	4	3	3	4	4	4	85.7	0.86
Gently remove the CVC with one hand while the other lightly presses on the insertion site with sterile gauze.	4	4	3	4	4	4	4	100.0	1.00
Apply digital compression to the ostium immediately until complete hemostasis for approximately five minutes.	4	4	4	4	4	4	4	100.0	1.00
Apply a sterile, fully occlusive adhesive dressing and hold for a duration of 24 hours.	3	4	4	4	4	4	4	100.0	1.00
Assess the integrity of the removed CVC.	4	4	4	3	4	4	4	100.0	1.00

CVC: Central venous catheter; N1, N2... Nurse1, Nurse2...; %: Percent agreement; CVI: Content Validity Index

The suggestions of the nurses in the items and domains, in general, were followed, except for describing, in the item of the second domain, the lumen that should be used for parenteral nutrition, since, in the literature analyzed, there is no recommendation for which route parenteral nutrition should be installed.

To the first domain, the addition of guidelines to be carried out regarding health education with patients/family members was suggested. In addition, the inclusion of care pertinent to the evaluation of the possibility of a peripheral venous route before the installation of the central venous catheter was suggested. In agreement with the suggestion, the items were elaborated according to the literature. Thus, the domain resulted in six items.

To the second domain, there were suggestions for inclusion of items pertinent to the care of nurses in different situations during the maintenance of the central venous catheter. Among the suggestions, care related to the safe handling of the catheter; to catheter and device maintenance; to routine procedures with the patient using a central venous catheter; to monitoring the dressing after bathing; to continuous infusions in the central venous catheter and the technique for removing catheter obstruction. In addition, from the general evaluation of the domain, other care pertinent to maintenance, contained in the literature, were added to the instrument. Therefore, in the corresponding domain, 30 new items were added to the instrument to compose the different care situations pointed out by the nurses.

As for adjustments to the items formulated for the second domain, the following were suggested: description of the visualization technology to confirm the correct positioning of the catheter after installation; grouping the health education item to the item of the first domain of the instrument; changing the exchange of the first dressing at the catheter puncture site from 48h to 24h; remove the hygienic care with 0.9% saline solution during dressing changes; include the sentence “before applying the semi-permeable co-

ver” in the item pertinent to application of 0.5% alcoholic chlorhexidine antiseptic solution at the catheter insertion site. The items use of catheter stabilization device at each dressing change and item pertinent to the hygiene of patients’ hands with 2% chlorhexidine were excluded.

Regarding the third domain, the nurses proposed the inclusion of an item corresponding to the removal of suture threads that are used to stabilize the central venous catheter, adding an item pertinent to the nurse’s care in this procedure.

At the end, considering the analyses and corrections pertinent to the third stage of the study, the care instrument presented three domains and 59 items. Reformulations were made in ten items according to percentages of agreement and suggestions; 32 new items were included, according to suggestions, and three items were excluded, also complying with nurses’ suggestions consistent with the literature.

Discussion

A limitations presented in the study were the characteristics of the nurses in the pre-test stage of the instrument, since all were residents of a single region of Brazil, which may have contributed to the similarity of the evaluations related to the report of the items in the instrument, making it difficult to represent or generalize terms considering the other regions of the country. Despite this, this step provided evaluations in the instrument, with regard to the relevance and understanding of the items, to achieve as much as possible of the necessary adjustments.

It is considered that the results of this study can be used to support future research in the field of nurses’ care with patients with central venous catheters admitted to Intensive Care Units. As for the nurse’s care instrument built, it will serve to fill the gap in the literature of instruments that cover all moments of care of patients with central venous catheters, whether with care related to insertion, maintenance or re-

removal of the device. In addition, this study proposed the production of an instrument with application in a very specific and similar scenario of care that occurs in different Intensive Care Units.

Although the preliminary version of the instrument has been modified as to the number of items, it is important to ensure the agreement of those under evaluation. The concordance rate, in the literature, expected to be equal or higher than 90%, represents the adequacy of the items and domains evaluated. This rate can be used to point out necessary changes in items and/or domains in the instrument⁽¹⁴⁾. Thus, it is an important indicator of weaknesses of these components when the percentage is lower than recommended.

As for the nurses' suggestions to the first domain, the suggestion of an item related to the evaluation of a peripheral venous route before the installation of the central venous catheter was adhered to. In terms of infection prevention, a peripheral route is preferable, as it poses less risk when there is appropriate care management^(1,15). Therefore, it is a care that gives the nurse the possibility to ensure less risk exposure to the patient.

For catheter maintenance, second domain, new items were included regarding dressing changes and prevention of catheter occlusion. It is known that standardized covers for catheter dressings reduce the occurrence of infection, protect the insertion site and prevent bleeding, such as sterile gauze, and allow better visualization of the insertion site - such as transparent film⁽⁶⁾. An item pertinent to the catheter patient's bath was also added, since at this moment of care, due to the water and its temperature, humidity may occur inside the catheter insertion dressing, favoring the occurrence of infection⁽¹¹⁾. Flushing the catheter helps to reduce biofilm inside the catheter, reduces the risk of contact between incompatible medications, and prevents catheter dysfunction due to flow obstruction⁽⁶⁾.

Another occlusion prevention strategy is to maintain an exclusive catheter route for parenteral nutrition administration. Organizing the venous infu-

sion is important not only because of the possibility of precipitation within the lumen due to substance interaction, but also because of the possibility of reduced activity or inactivation of the drugs⁽¹⁶⁾.

Other precautions, also aiming at preventing infections and other unfavorable outcomes, were added to the instrument. Care related to hand hygiene before handling a central venous catheter has been added. Although neglected, hand hygiene is the least expensive and most effective measure for preventing health care-related infections. The adoption and increased performance of this protective measure contributes to the reduction of bloodstream infection rates in the Intensive Care Unit⁽⁸⁾. Therefore, hand hygiene is a fundamental care to be contained in the nurse's care instrument. The addition of the item pertinent to aseptic and safe technique when manipulating the catheter was aimed at preventing catheter migration with loss of function and preventing infection⁽⁷⁾. Also, for the prevention of infection, it is important to identify the infusion system with labels, contributing to the surveillance and monitoring of the integrity and validity, and therefore, at each replacement of the infusion system, proper identification must be ensured⁽⁶⁾, as well as requiring the replacement of defective products or products in unsuitable condition for use⁽¹¹⁾.

Catheter removal represented the third and last domain. In this domain, nurses suggested care pertinent to the removal of suture threads used to stabilize the catheter. Sutures for catheter stabilization can trigger infection due to the potential for contamination of the suture threads and to the vulnerability caused by skin micro-perforations⁽⁶⁾. However, its use is a traditional and commonly employed practice in Brazil. This adherence may be related to some uncertainties pertinent to the other stabilization methods. In a recent pilot randomized clinical trial study, the highest incidence of failure when comparing the efficacy of four methods of catheter coverage and stabilization was in the group that used a sutureless stabilization device and chlorhexidine gluconate dressing⁽¹⁷⁾.

Conclusion

The constructed instrument showed evidence of validity of the response for the care of nurses to patients in Intensive Care Unit, these being important for the different moments of care related to the short term central venous catheter. The instrument was composed of three domains and 59 items structured based on the scientific literature and on the assessments of nurses specialized in critical care. Thus, the procedures performed in this study provided subsidies for the refinement of the instrument, which has the potential to contribute to patient safety and the quality of nursing care.

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Authors' Contribution

Conception and design, data analysis and interpretation, article writing and final approval of the version to be published: Jesus SC.

Data analysis and interpretation: Lentz GNS.

Relevant critical review of the intellectual content: Bertoncillo KCG, Gonçalves FAF, Colaço AD, Schneider DG.

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