Rev Rene. 2022;23:e81043.
DOI: 10.15253/2175-6783.20222381043
www.periodicos.ufc.br/rene

Original Article

Development and validation of an instrument to assess the knowledge of oncology nurses about a fully implanted catheter

Elaboração e validação de instrumento para avaliação do conhecimento de enfermeiros oncológicos sobre cateter totalmente implantado

How to cite this article:
Pereira JM, Guedes NG, Silva VM, Carvalho REFL. Development and validation of an instrument to assess the knowledge of oncology nurses about a fully implanted catheter. Rev Rene. 2022;23:e81043. DOI: https://doi.org/10.15253/2175-6783.20222381043

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Conflict of interest: the authors have declared that there is no conflict of interest.

ABSTRACT
Objective: to develop and validate an instrument to assess the knowledge of oncology nurses about the fully implanted central venous catheter. **Methods:** this is a methodological study. The instrument was built based on an integrative review and included 25 questions (10 about general aspects of the device and puncture; 10 about heparinization and complications; and 5 about the dressing). After construction, the instrument was evaluated by five experts, in a single round, in four items, on the adequacy of the questions to the objectives of the instrument, the valuation of the questions, the content and the clarity of each question. Adequacy was confirmed by the minimum Concordance Index of 80%. **Results**: all items in the questions about heparinization and complications were considered adequate, and two questions about general aspects and puncture and one question about dressing had an agreement rate of 60%. Changes were made as suggested by experts. **Conclusion**: the instrument, for the most part, presented clear, relevant questions that serve the purpose. **Contributions to practice**: it is expected to contribute with institutions and with a safe care of nurses who assist cancer patients with fully implanted catheters.
Descriptors: Catheters; Oncology Nursing; Validation Study; Nursing Care.

RESUMO
Objetivo: elaborar e validar um instrumento para avaliação do conhecimento de enfermeiros oncológicos sobre o cateter venoso central totalmente implantado. **Métodos:** trata-se de pesquisa metodológica. O instrumento foi construído com base em uma revisão integrativa e contemplou 25 questões (10 a respeito dos aspectos gerais do dispositivo e punção; 10 sobre heparinização e complicações; e 5 sobre o curativo). Após a construção, o instrumento foi avaliado por cinco especialistas, em rodada única, em quatro itens, sobre adequação das questões aos objetivos do instrumento, à valoração das questões, ao conteúdo e à clareza de cada questão. A adequação foi confirmada pelo Índice de Concordância mínimo de 80%. **Resultados**: todos os itens das questões sobre heparinização e complicações foram considerados adequados, e duas questões sobre aspectos gerais e punção e uma questão sobre curativo obtiveram Índice de Concordância de 60%. Foram realizadas alterações conforme sugestões dos especialistas. **Conclusão**: o instrumento, em sua maior parte, apresentou questões claras, relevantes e que atendem à finalidade. **Contribuições para a prática**: espera-se contribuir com instituições e com um cuidado seguro dos enfermeiros que assistem pacientes oncológicos portadores do cateter totalmente implantado.
Descritores: Cateteres; Enfermagem Oncológica; Estudo de Validação; Cuidados de Enfermagem.

Received: June 22nd 2022; Accepted: Aug. 31st 2022.

Introduction

Cancer is a public health problem, being the second leading cause of death in Brazil and worldwide. Around 625 thousand new cases are estimated for the 2020/2022 biennium, and their cost reached more than BRL 68 billion in 2017, involving investments in promotion, prevention, diagnosis, treatment and rehabilitation of patients, in addition to the indirect costs of premature death, absenteeism and disability retirement[1].

Increasingly, studies are being invested in more effective therapies, with fewer side effects and with systemic antitumor properties, especially antineoplastic chemotherapy[1]. The administration of this therapy requires greater technical complexity, clinical reasoning and scientific knowledge in the implementation of care, as well as in the prevention and identification of possible complications[2].

The vesicant and irritating characteristics of these drugs and their prolonged use warn about the feasibility of a safe and long-term venous access, which can be obtained through the fully implanted central venous catheter (CVC-FI)[3]. This catheter is a siliconized rubber device whose distal end is coupled to a puncture chamber located in the subcutaneous tissue. It is indicated for the administration of chemotherapy, blood products, antibiotics, parenteral nutrition, and analgesics[4-5].

Despite being a safe route, complications related to CVC-FI such as infections, obstruction, extravasation, thrombosis, hematomas and catheter displacement may arise[5]. Among them, infection and obstruction are the most identified and may be directly related to improper handling of the device[6]. Such complications cause the patient to need to remove the device, use broad-spectrum antibiotics, as well as delay chemotherapy[5-7]. These events can be caused or potentiated when there is a lack of knowledge on the part of those who handle the catheter[6,8-9].

According to the Technical Regulation on the Practice of Nursing Professionals in Chemotherapy, it is the responsibility of nurses to promote fully implantable venous access, to administer anticancer chemotherapy, as well as to take care of the care with this device, evidencing the importance of nurses' knowledge about the CVC-FI[10]. Even with few studies dealing with this assessment, limited knowledge is described[7-9] regarding the attitudes and level of knowledge of nursing professionals regarding the management of catheters, causing important repercussions during the treatment of patients with the device.

Identifying knowledge gaps related to care with the device will support the improvement of nurses regarding the handling of the CVC-FI, thus providing more safety to the patient. Among the technologies developed, health assessment measurement instruments have been used as tools that measure specific indicators, contributing to the improvement of health praxis[11-12]. The construction of these instruments has a great influence on decisions about care, treatment and/or interventions and on the formulation of health programs and institutional policies[13].

Given the above, the question is: Does the instrument to assess the knowledge of oncology nurses about the CVC-FI have valid content properties? The use of the tool proposed in this study will identify gaps in knowledge about the CVC-FI and, consequently, will help in the elaboration of strategies for the continuing education of nurses.

Thus, this study aimed to develop and validate an instrument to assess the knowledge of oncology nurses about the fully implanted central venous catheter.

Methods

It is a methodological study. The recommendations for the development of health care technologies were followed with the execution of the steps: submission of the project to the Research Ethics Committee; bibliographic survey of the topic studied; elaboration of the instrument; and, finally, evaluation of the material by subject matter experts[13-14] (Figure 1).

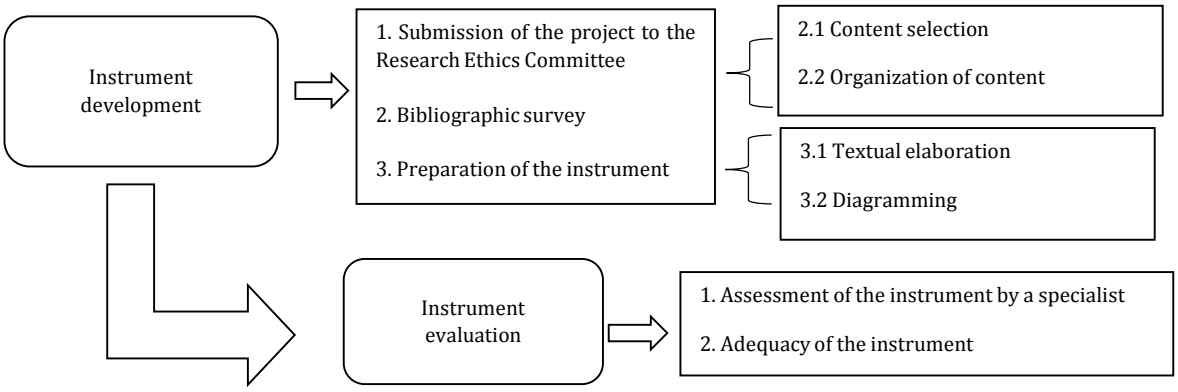

Figure 1 – Flowchart of the stages of development of the instrument to assess the knowledge of oncology nurses about the fully implanted central venous catheter. Fortaleza, CE, Brazil, 2019

For the elaboration of the instrument, an integrative review was carried out from July to December 2018, with searches on nursing care related to CVC-FI in the electronic databases: Medical Literature Analysis and Retrieval System Online (MEDLINE), Cumulative Index to Nursing and Allied (CINAHL), Latin American and Caribbean Literature in Health Sciences (LILACS). The research was carried out in August 2018, in a paired and independent way by two researchers on the same day and time. It was used as a guiding question: What are the nursing care related to CVC-FI in adult cancer patients?

For the search, the keyword implanted catheter and the following *Descritores em Ciências da Saúde*/ Medical Subject Headings (DeCS/MeSH) controlled descriptors were used: central venous catheterization, oncology nursing, nursing care, maintenance, and antisepsis. The following crossings were performed: central venous catheterization AND oncology nursing; implanted catheter AND nursing care; central venous catheterization AND maintenance; implanted catheter AND antisepsis. Articles published in English, Portuguese, or Spanish, between 2008 and 2018, that answered the guiding question and without restriction regarding the methodological design were included, to expand the search. Figure 2 shows the process of identification, selection and eligibility of the studies found.

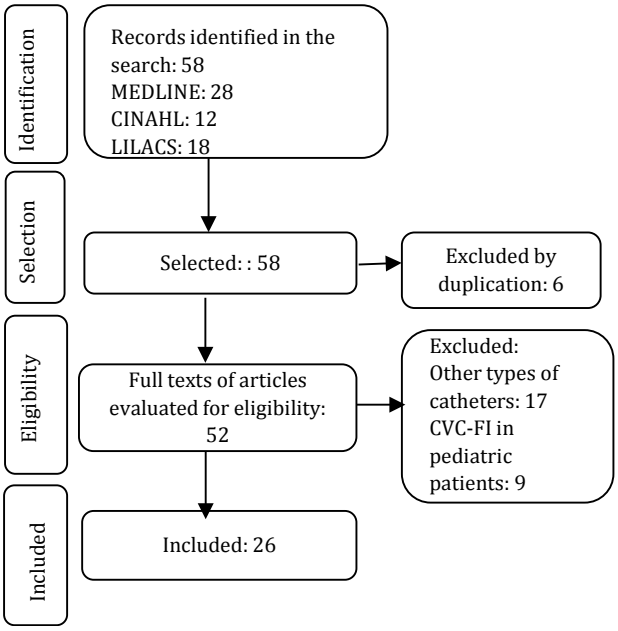

Figure 2 – Flowchart of the stages of identification, selection, eligibility, and inclusion of studies. Fortaleza, CE, Brazil, 2019

The two researchers read the works in their entirety, in a paired and independent way, and selected the information that answered the guiding question. Differences of opinion were resolved in conversation with a third researcher, and the article was included or excluded by consensus. The data were used to construct the instrument to assess nurses' knowledge related to CVC-FI in cancer patients, and this instrument was later evaluated by the specialists.

In organizing the review data, the following themes were highlighted: indication; procedures for handling the catheter – puncture technique and maintenance; complications and dressing.

The instrument included 25 questions, among which 10 addressed general aspects of the device and puncture; 10 questions addressed heparinization and CVC-FI complications; and, 5 questions addressed the dressing. The instrument had a total score of 10 (100%), which was initially distributed among the topics as follows: 4.25 points for questions about general aspects of catheters and puncture; 3.25 points for complications and heparinization; and 2.5 points for questions about the dressing. The questions were multiple choice, with four items as an option.

For the instrument to measure the level of knowledge of nurses, values were assigned to each question: questions considered easy to know were worth 0.25 point; those of intermediate level, 0.5 point; and high-level ones, 1 point. The choice of item valuation was based on the complexity of nurses' knowledge and skills regarding the device[7-9,15-16]. This distribution of scores was also evaluated by the experts. A score of 7 (70%) was considered as a sufficient value of knowledge about the CVC-FI, which, in the same way, was defined by the experts.

Their evaluation was carried out from November 2018 to January 2019. The composition of the group of experts was defined, after the construction of the instrument, by intentional non-probabilistic sampling, with a minimum number of five members, as recommended[17].

Initially, the analysis of eligibility criteria was based on the Lattes Curriculum, available on the website of the National Council for Scientific and Technological Development/*Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq). The identification of specialists was carried out by searching the platform for the subjects "fully implanted central venous catheter and oncology"; and with the filters: degree (specialist/master/doctor), professional activity (nurses) and production area (health area).

A total of 22 nurses and/or researchers were found, of which 14 were invited based on adapted criteria[18]: having a master's degree in nursing (4 points); be a master with a dissertation in the area of interest (1 point); to participate in research groups involving the theme (1 point); having a published article on the subject (2 points); have a doctorate in nursing, with a thesis in the area of interest (2 points); have clinical experience of at least two years in the field of oncology (2 points); have specialization in the field of oncology (2 points). It was considered as an area/theme: oncology, fully implanted catheter, educational technology in health.

After selection, the invitation letter was sent to the experts via e-mail. Upon acceptance, the Free and Informed Consent Term, the knowledge assessment instrument, and the data collection instrument to be used by the specialists were sent. It was requested to return, by e-mail, the term and the instrument answered within a maximum period of 45 days. 14 nurses who reached the minimum score of 5 points were included. Of these, nine were excluded for not responding to the email sent.

An evaluation round was carried out by five experts. The instrument used by them was divided into two sections.

The first section included information related to the characterization data of the specialists such as age, sex, time since graduation, working time, working time in oncology, titles, and topics of their publications.

The second section included instructions regarding the evaluation of the 25 questions, namely: item 1) adequacy of the question to the instrument's objectives; item 2) adequacy of the valuation of the issue; item 3) content adequacy in relation to the literature; item 4) clarity of the question statement; and space for suggestions. The last evaluation section referred to the general assessment of the instrument regarding its coherence; essay; adequacy to measure nurses' knowledge related to CVC-FI; relevance to the practice of oncology nurses; and adequacy to the ob-

jective of knowledge assessment. Finally, a space was made available for any suggestions.

The assessment was organized using a four-point Likert scale: 1 – Inadequate; 2 – Partially adequate; 3 – Adequate; 4 – Totally adequate; and NA – Not applicable. Specialists were asked to justify the items whose answers were options 1, 2 or NA. After evaluating the instrument, a minimum Concordance Index (CI) of 80% was considered as a criterion for the adequacy of the evaluated question[19].

The CI of each item was calculated through the sum of the answers that represented agreement (3 and 4), divided by the total number of specialists, obtaining the average of the CIs, later multiplied by 100, for description in percentage. Considering the experts' suggestions and the relevance of the instrument's adequacy, the items with a CI of less than 80% were reformulated.

The Research Ethics Committee of the *Instituto do Câncer do Ceará/Hospital Haroldo Juaçaba* issued a favorable opinion for the execution of the study, under protocol nº 2.926.632/2018.

Results

All specialists were female nurses, four from the Northeast and one from the Midwest, aged between 27 and 38 years, 5 to 16 years of training and 4 to 14 years of experience with cancer patients. There were three specialists, a master, and a doctor; and, of these, four worked in assistance. All of them carried out research in oncology: two of them on the topic of CVC-FI; and three, on technologies and/or validation of technologies.

Table 1 shows the items evaluated, agreement rates for each item and the experts' suggestions.

Table 1 – Items evaluated by experts and agreement index. Fortaleza, CE, Brazil, 2019

Questions	Agreement index				Considerations
	Item 1(%)	Item 2(%)	Item 3(%)	Item 4(%)	
General aspects and punch (4.25 points)					
1. Indications for device implantation, except: (0.50 point) - Bilateral mastectomy women - Patients have a difficult venous network - Prolonged infusion of vesicant substances - Drug infusion for less than six months	100.0	80.0	100.0	100.0	Decrease the question value from 0.5 to 0.25 point.
2. The CVC-FI is made of steel and titanium material and with siliconized sealing material in its distal portion, being ideal for multiple punctures. Therefore, the device can support approximately how many punctures? (0.5 point) - 500 - Between 300 and 1,000 - 2,000 - Between 2001 and 3000	100.0	100.0	100.0	80.0	Indicate the needle used to puncture the device, as it interferes with the number of punctures.
3. The ideal needle to puncture the CVC-FI, due to the shape of its bevel, does not have a cut in the siliconized septum; it penetrates it without harming it. According to the statement, mark the needle used in the procedure: (0.25 point) - Hickman - Huber - Scalp - Jelco	100.0	100.0	100.0	100.0	Increase the value from 0.25 to 0.5 point.
4. Usually, the CVC-FI is implanted inside a few veins. They are, except: (0.5 point) - Femoral - Axillary - subclavian - medial cubital	100.0	80.0	100.0	100.0	Decrease the question value from 0.5 to 0.25 point.
5. The CVC-FI can be used to infuse some substances. They are: (0.25 point) - Chemotherapy infusion only - Parenteral nutrition and chemotherapy - Antibiotics, chemotherapy, and blood products - Antibiotics, chemotherapy, blood products and total parenteral nutrition	100.0	80.0	100.0	100.0	–

(the Table 1 continue in the next page...)

Questions	Agreement index				Considerations
	Item 1(%)	Item 2(%)	Item 3(%)	Item 4(%)	
6. Currently, there are numerous studies carried out with the objective of identifying the most effective product for cleaning the patient's skin to perform the CVC-FI puncture aseptically. Therefore, according to the updated guideline, which is the ideal product for such a procedure: (1 point) - 70% alcohol% - 2% chlorhexidine - Topical powder - Alcoholic chlorhexidine	100.0	80.0	60.0	80.0	Add to options "b" and "d" the type of chlorhexidine and the concentration content.
7. Generally, the puncture of the device for the infusion of chemotherapy is performed on an outpatient basis, but sometimes there is a need to use the device in hospitalizations caused by treatment intercurrences, requiring periodic replacement of the needle. What is the ideal time to change the needle? (in days) (0.25 point) - 3 - 5 - 7 - 10	100.0	80.0	100.0	100.0	Increase question value from 0.25 to 0.5 point.
8. It is considered nursing care before device puncture, with the aim of not causing heavy bleeding that can lead to hypovolemic shock. What care does the statement refer to? (0.5 point). - Cleansing the skin with chlorhexidine - Use of the Huber point needle - Infuse optimal amount of heparin according to protocol - Check platelet count	100.0	100.0	100.0	100.0	–
9. The insertion of the CVC-FI is performed in the operating room, with application of sedation and local anesthesia. The patient is usually discharged from the hospital within 24 hours, and how long can the device be used after insertion? (in hours) (0.25 point) - 24 - 48 - 72 - Between 36 and 72	100.0	80.0	60.0	100.0	Increase question value from 0.25 to 0.5 point. Review literature: there is evidence that the device can be used soon after insertion.
10. The angle required to perform the puncture of the CVC-FI is: (0.25 point) - 35° - 45° - 15° - 90°	100.0	100.0	100.0	100.0	–
Heparinization and complications (3.25 points)					
11. Catheter heparinization is an essential practice to prevent the following complication: (0.25 point) - Thrombosis - Obstruction - Infection - Extravasation	100.0	100.0	100.0	100.0	–
12. After the end of treatment, the patient remains with the CVC-FI usually for five years. During this period, it is necessary to carry out maintenance of this device with periodic heparinization. So, what is the ideal time to perform device maintenance? (in weeks) (0.25 point) - 2 - 4 - 8 - Between 4 and 8	100.0	100.0	80.0	100.0	Swap time from weeks to days.
13. There are several types of heparin on the market. Among them, which one is recommended for the maintenance of the CVC-FI? (0.5 point) - Unfractionated heparin - Low molecular weight heparin 15,000 IU/ml - Low molecular weight heparin 5,000 IU/ml - Low molecular weight heparin 10,000 IU/ml	100.0	100.0	100.0	100.0	–
14. According to national and international literature, there are still discrepancies in the ideal amount of heparin to perform heparinization of the CVC-FI. The main concern of specialists is the overdose of heparin, as it can cause the following complication in the patient: (0.25 points) - Obstruction - Thrombosis - Thrombocytopenia - Thrombocytopenia	100.0	100.0	80.0	100.0	Change item "c" (thrombocytopenia), as item "d" is "thrombocytopenia". They are synonyms.
15. Materials necessary for heparinization, except: (0.25 point) - Heparin - 10 ml syringe - Distilled water - 0.9% saline	100.0	100.0	100.0	100.0	–

(the Table 1 continue in the next page...)

Questions	Agreement index				Considerations
	Item 1(%)	Item 2(%)	Item 3(%)	Item 4(%)	
16. According to national and international literature, what is the composition of the heparinized solution? And how much should be administered to the adult patient? (1 point) - 1 ml of heparin + 9 ml of SF 0.9%, 3 ml are administered - 1 ml of heparin + 9 ml of SF 0.9%, 5 ml is administered - 0.2 ml of heparin + 9.8 ml of SF 0.9% is administered 3 ml - 0.2 ml of heparin + 9.8 ml of SF 0.9% is administered 5 ml	100.0	100.0	80.0	100.0	_
17. Catheter removal is indicated in some situations. They are, except: (0.25 point) - End of treatment - Endocarditis - Bacteremia with no apparent cause that does not improve with the administration of antibiotic therapy through the catheter - Bacteremia with no apparent cause that improves in the administration of antibiotic therapy through the catheter	100.0	100.0	100.0	100.0	_
18. Improper handling of the CVC-FI can cause serious complications for the patient. Among the complications listed below, which one is caused by improper puncture of the device? (0.25 point) - Obstruction - Catheter kinking - Infection - Thrombosis	100.0	100.0	100.0	100.0	_
19. Select the option that has a non-compliance action related to CVC-FI: (0.25 point) - If the catheter is manipulated at an interval shorter than 24 hours, it can be saline with 10 ml or 20 ml of SF 0.9% after each use and be heparinized only every 24 hours. - In case of absence of venous return, do not administer solutions, - After administration of blood components, irrigate the catheter with 10 ml of 0.9% SF in push. - The correct positioning of the needle in the reservoir is only confirmed by the presence of venous return and/or by the free, easy, and painless infusion of the infusion to be administered.	100.0	100.0	100.0	80.0	_
20. Complications related to CVC-FIs are classified as acute and chronic. They are, respectively: (0.25 point) - Occur in the perioperative period and before the first use; and those that occur after the first use. - Occur after the first use; and occur in the perioperative period and before the first use. - Occur in the perioperative period and after the first use; and occur after the first use. - Occur after the first use; and occur before first use.	100.0	100.0	100.0	80.0	Change the terms "acute and chronic" to "early and late".
Dressing (2.5 points)					
21. The purpose of performing the dressing after device puncture is: (0.25 point) - Prevent thrombosis. - Prevent extravasation. - Prevent infections, provide patient comfort, and protect the needle. - Fix the needle.	100.0	100.0	100.0	100.0	_
22. How long does it take to change the conventional dressing and the semipermeable film dressing, respectively? (in hours) (0.5 point) - 24 and 48 - 48 and 72 - 48 and 48 - 48 and 96	100.0	100.0	60.0	100.0	Change the time unit from hours to days.
23. Nursing care related to the CVC-FI dressing, except: (1 point) - Use procedure gloves. - If moisture is present, use semipermeable film. - Change the dressing whenever it is wet or when there are signs that indicate infection. - The correct positioning of the needle is confirmed by the presence of venous return and/or free, easy, and painless infusion of the solution to be administered.	100.0	60.0	100.0	100.0	Decrease question value from 1 to 0.5 point.
24. The type of dressing to be performed after removing the needle is: (0.5 point) - Aseptic - Semipermeable - Conventional - Compressive	100.0	60.0	100.0	100.0	Decrease question value from 0.5 to 0.25 point.
25. Patients who perform chemotherapy infusions on an outpatient basis who have the CVC-FI, after the chemotherapy session, go home. So, after removing the needle, it is nursing care to be oriented to the patient: (0.25 point) - Remove the bandage after bathing. - Remove the bandage only after 24 hours and protect it before bathing. - Remove when you get home. - Remove after 12 hours.	100.0	100.0	100.0	100.0	_

CVC-FI: fully implanted central venous catheter; Item 1: adequacy of the question to the instrument's objectives; Item 2: adequacy of question valuation; Item 3: content adequacy in relation to literature; Item 4: clarity of question statement; SF: saline

In the first section, which corresponds to general aspects and puncture, the items had a CI greater than or equal to 80%, with the exception of item 3, from questions 6 and 9, which had a CI of 60%. In these items, the options were reformulated according to expert guidance. As for the reformulation of the wording of question 2, "Huber needle" was added, which is indicated for the puncture of the device. With the suggestions regarding the evaluation of the questions, the topic General aspects and Puncture received a total of 4.5 points. In question 6, the type of chlorhexidine and its concentration content were added to the options, according to what is available on the market and indicated by specialists.

All items on Heparinization of the catheter and its complications had a CI equal to or greater than 80%, with the substitution of the terms "weeks" for "days" in question 12; and "acute and chronic" for "early and late" in question 20. In question 14, the option "thrombocytopenia", as it is synonymous with "thrombocytopenia", was replaced by hemolysis, keeping the correct option the one indicating "thrombocytopenia".

In the Curative topic, all items evaluated in questions 21 and 25 had a CI equal to 100%. Questions 22, 23 and 24 had one item each with a CI of 60%, and the specialists' suggestions regarding the replacement of the time unit, change of template and adequacy of the valuation were accepted. As for the sum of the values of the questions, changes were made, starting to be worth 2.25 points.

Aspects related to the experts' assessment in the third section of the instrument are described in Table 2.

Table 2 – General assessment of the instrument to assess nurses' knowledge about the fully implanted central venous catheter. Fortaleza, CE, Brazil, 2019

Evaluative items	Concordance Index (%)
The instrument is consistent with the proposal.	100.0
It is worded clearly.	80.0
The instrument is suitable for measuring nurses' knowledge related to CVC-FI*.	100.0
The instrument addresses a relevant topic for the practice of oncology nurses.	100.0
It is suitable for use in the scientific environment in research to assess nurses' knowledge related to the device.	100.0

*CVC-FI: fully implanted central venous catheter

Considering the Concordance Indexes, the experts believe that the instrument is coherent, clear, relevant in the practice of oncology nurses and serves the purpose of evaluating the knowledge related to CVC-FI in the care and scientific environment (Table 2).

The experts also suggested the inclusion of the reference(s) used in each question, since the evidence can bring small differences on the subject.

Discussion

The literature review on the use of the CVC-FI in cancer patients and the evaluation by specialists of the constructed instrument culminated in the completion of a technology that aims to assess the knowledge of cancer nurses.

The validation of an instrument is an important step after the construction of technologies. To this

end, a group of experts with experience in the area of the content covered was used, which was responsible for analyzing the instrument and consequent improvement of the technology developed in order to make it more representative of a specific construct.

The CVC-FI is indicated in the need for venous therapies with vesicant and irritating characteristics that require a time of more than 30 days, as well as for patients with fragile vascular network, women with bilateral mastectomies and oncological treatment for more than six months. This device is almost exclusive to cancer patients due to its characteristics, but it can already be used in non-cancer patients[4,9].

The veins of choice for catheter implantation are: cephalic, external and internal jugular, subclavian. Other veins such as the saphenous, brachial or femoral veins can also be used, but they offer greater risks of infection and obstruction[4,6,8].

We emphasize the need for the nurse to assess the conditions of the insertion site and the presence of pain before performing the first puncture[7,16-17]. The adjustments suggested by the specialists in question 9 were relevant and in line with studies[3-5] that show the use of the device immediately after its insertion. However, the presence of pain at the site should be observed, as one can wait for one to three days[9].

As for the needle used for puncture, Huber does not damage the septum because it is not sharp and has a lateralized bevel. A 90° angle is recommended for puncture, which reduces trauma to the device's silicone membrane and thus increases its durability — it can withstand up to 3,000 punctures[8,15]. However, there is still the use of sharp needles that cause greater wear of the puncture chamber, due to the high cost found in the acquisition of the Huber needle, generating less time of use[15].

After puncture, it is recommended that the needle be changed every seven days[4-5,8], despite the absence of complications with the needle permanence for an average time of 28 days[14]. In addition, it is necessary to identify the proper positioning of the needle in the device through the blood reflux test, removing 2ml to 3ml of blood from the catheter. In view of the possibility of the absence of blood reflux, confirmation by means of a free, painless, and easy-to-perform infusion of the solution to be infused is recommended. It is noteworthy that, in cases of absence of blood return, resistance and/or pain at the time of infusion, the nurse needs to check the adequacy of the needle positioning and other possible mechanical factors related to the obstruction[9,17].

Another important care is the aseptic cleaning of the patient's skin before accessing the CVC-FI. It is known that the use of 2% alcoholic chlorhexidine reduces the incidence of infection by 50%, compared to the use of other antiseptics such as topical polvidine and 0.5% alcoholic chlorhexidine, as it has a residual action that prevents skin recolonization[20]. Alcoholic chlorhexidine at 2% is also recommended by the Centers for Disease Control and Prevention (CDC), American Society of Clinical Oncology and Infusion Nursing Society (INS)[21]. In this sense, the specification regarding the concentration content of the solution was added to the instrument.

The questions on the topic of heparinization had a CI equal to or greater than 80%. Nevertheless, the amount of heparin needed and the comparison of the effectiveness of heparinization with salinization to maintain device patency are controversial. Catheter heparinization has been chosen to maintain patency. However, over the years, the usual practice of this method seems to hide the iatrogenic effects of the drug itself, such as thrombocytopenia[21-22].

In order to find procedures that reduce the level of adverse events related to catheter care, it was shown that the lowest dose of heparin for maintenance intervals of 28 to 56 days is the most used to maintain CVC-FI patency in patients adult oncology is 100IU/ml, ranging from 3ml or 5ml. Doses higher than 300UI/ml are unnecessary and can contribute to the development of complications[22]. Thus, it is recommended to use heparin 5,000 IU/ml, a dose of 0.2ml of heparin for 9.8ml of SF 0.9%, with 3ml of the solution being administered, according to question

16. It should be noted that the extension of the device (dead space) holds 2 ml, so by administering 3 ml of the solution, it ensures that 100 IU of heparin performs device patency. These findings corroborate the INS recommendations[21].

Evidence points to the absence of significant complications when using salinization instead of heparinization to maintain CVC-FI patency[23-25]. Despite this, the instrument considered maintenance with heparin solution, as it is the most performed conduct in clinical practice[3,9]; Therefore, it was decided to evaluate it.

As for complications related to the device, it is evident that obstruction and infection are the main causes and may be related to improper handling of the device[5-8]. To prevent obstruction, nurses' knowledge about device-related care is essential, such as not administering incompatible drugs simultaneously; flush with 20 ml of saline after fluid administration; and, if the device is not used for longer than 48 hours, perform heparinization or salinization, depending on the protocol of each institution[21].

Device infection can start with the microbiota of the patient's epidermis during catheter puncture, as the surface of the catheter material is quickly coated with a glycoprotein film, which forms a substrate where bacteria adhere to tissue cells[26]. Such an event is relevant, as cancer patients have a depressed immune system, making them more susceptible to opportunistic infections that can start with the colonization of the CVC-FI[27].

The Occlusion Management Guideline for Central Venous Access Devices emphasizes the importance of the health professional in the management of CVC-FI and in the prevention of complications arising from the use of the catheter, in addition to advocating the standardization of conducts related to clinical practice with CVC-FI. It is noteworthy that the nurse must gather knowledge, skills and attitudes that enable positive results with the CVC-FI and safe handling[21].

A constant practice of nurses is dressing, which aims to stabilize and protect the insertion of the needle, prevent infection, and provide comfort to the patient. It should be done using gauze and tape (simple dressing) with daily change, as well as the use of transparent film with change every seven days[15,25]. In the event of a dirty, wet dressing that comes off, or in the presence of phlogistic signs such as redness, edema and secretion, it must be replaced immediately, regardless of when the last change was[4-6]. The items in question 22, which deals with this topic, were changed from "days" to "hours"; and the correct answer was changed because, in this version, there was no item indicating one day for conventional dressing and seven days for dressing with semipermeable film.

After removing the needle, it is recommended to apply a compressive dressing for one to two hours of the procedure[20]. With the same compression time, the use of a blood stop dressing may be indicated, and removal in the bath may be recommended for greater comfort and less pain[25]. In addition, the evaluation of the instrument by the specialists made it possible to make the necessary adjustments for the instrument to become clearer and to meet the objective of measuring nurses' knowledge about the CVC-FI.

The information obtained with the construction of the instrument identifies existing strengths and weaknesses regarding nurses' knowledge and alerts to the need for training and construction of technologies that strengthen knowledge and reduce complications associated with improper handling.

Validation studies with application of the instrument to nurses are recommended, focusing on its refinement, strengthening reliability and safety of use as a measurement instrument.

Study limitations

It is believed that, with a greater number of specialists, a greater index of validity of the instrument could be obtained. Furthermore, a subsequent round of the initial one would ratify the adjustments made in the final version. The findings are considered

since the Agreement Index does not assess the concomitance of the values assigned between the examiners and does not consider influences of an agreement established by chance.

Contributions to practice

It is expected to contribute with institutions in the use of the instrument, to measure the knowledge of nurses who work with the device. According to this measurement, methods of continuing education on this topic can be planned and, in this way, ensure safe care for nurses who assist cancer patients with CVCFI.

Conclusion

Based on an integrative literature review and expert assessment, an instrument was developed to assess the knowledge of oncology nurses about the fully implanted central venous catheter, and the questions were adjusted according to the experts' assessment. The final instrument contains 25 questions covering: general aspects of the device and puncture; heparinization and CVC-FI complications; and bandage.

All questions about heparinization and complications had a Concordance Index equal to or greater than 80%. Two questions about general aspects and puncture and two questions about dressing obtained an agreement rate of 60% in the items about content and valuation, respectively. In the end, the evaluated instrument obtained, for the most part, adequacy regarding the objectives; the valuation of issues; to the content; and the clarity.

Authors' contribution

Conception and design or analysis and interpretation of data: Pereira JM, Guedes NG.
Manuscript writing or relevant critical review of intellectual content: Pereira JM, Guedes NG.
Final approval of the version to be published: Pereira JM, Guedes NG, Silva VM, Carvalho REFL.
Agreement to be responsible for all aspects of the manuscript related to accuracy or completeness and that any part of the manuscript is investigated and resolved properly: Pereira JM, Guedes NG, Silva VM, Carvalho REFL.

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