

CARE PROTOCOL WITH TOTALLY IMPLANTED VENOUS CATHETER: A COLLECTIVE CONSTRUCTION

Deborah Franscielle da Fonseca¹ 
Patrícia Peres de Oliveira¹ 
Rosilene Aparecida Costa Amaral¹ 
Luciana Helena da Silva Nicoli¹ 
Edilene Aparecida Araújo da Silveira¹ 
Andrea Bezerra Rodrigues² 

¹Universidade Federal de São João del Rei. Divinópolis, Minas Gerais, Brasil.

²Universidade Federal do Ceará. Fortaleza, Ceará, Brasil.

ABSTRACT

Objective: to collectively construct a fully implanted central venous catheter care protocol with nurses from a highly complex oncology center.

Method: a convergent care research, conducted at a hospital qualified as a highly complex oncology care unit in Minas Gerais, Brazil, from September 2017 to January 2018. The construction of the protocol was guided by Evidence Based Practice. Initially, data was collected from client records. After that, five workshops were held with the nurses, aiming to verify the material and human resources available, besides the viable care to compose the protocol. The analysis involved processes of apprehension, synthesis, theorization and transference.

Results: most of the 219 medical records evaluated from clients with fully implanted venous catheters were female (77.1%), with a mean age 49.6 years old, breast cancer, and average catheter stay of 502 days. The nurses participating in the research were female, with a mean age 30.2 years old, time since graduation of 5.2 years and experience in oncology of 4.8 years on average. During the workshops, the participants reflected on the daily routine of the service, with a theoretical and scientific basis, which allowed, considering the professionals' opinion, to verify the care evidences and the practicability of the practices in the study scenario for the construction of a protocol. Care emerged related to puncture, manipulation, salinization and catheter clearance.

Conclusion: the protocol construction process involved the participation of all oncology nurses, and all the mentioned care has scientific evidence for its use.

DESCRIPTORS: Oncology nursing. Nursing care. Central venous catheterization. Evidence-based nursing. Oncology.

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PROTOCOLO DE CUIDADOS COM CATETER VENOSO TOTALMENTE IMPLANTADO: UMA CONSTRUÇÃO COLETIVA

RESUMO

Objetivo: construir coletivamente um protocolo de cuidados para cateter venoso central totalmente implantado com enfermeiras de um centro de alta complexidade em oncologia.

Método: pesquisa convergente assistencial, realizada em um hospital habilitado como unidade de assistência de alta complexidade em oncologia de Minas Gerais, Brasil. A coleta de dados ocorreu entre setembro de 2017 a janeiro de 2018. A construção do protocolo foi norteada pela Prática Baseada em Evidências. Inicialmente, coletaram-se dados nos prontuários dos clientes. Após, procedeu-se à realização de cinco oficinas com as enfermeiras, visando à averiguação dos recursos materiais e humanos disponíveis, além dos cuidados viáveis para compor o protocolo. A análise envolveu processos de apreensão, síntese, teorização e transferência.

Resultados: a maioria dos 219 prontuários avaliados de clientes com cateter venoso totalmente implantado era do sexo feminino (77,1%), média de idade 49,6 anos, câncer de mama, permanência média dos cateteres de 502 dias. As enfermeiras participantes da pesquisa eram do sexo feminino, média de idade 30,2 anos, tempo de formação 5,2 anos e experiência em oncologia 4,8 anos em média. Durante a realização das oficinas, as participantes refletiram sobre o cotidiano do serviço, com embasamento teórico-científico, o que permitiu, considerando a opinião dos profissionais, verificar as evidências assistenciais e a exequibilidade das práticas no cenário do estudo para a construção de um protocolo. Emergiram cuidados relacionados a: punção, manipulação, salinização e desobstrução dos cateteres.

Conclusão: o processo de construção do protocolo envolveu a participação de todas as enfermeiras da oncologia, e todos os cuidados mencionados possuem evidências científicas quanto à sua utilização.

DESCRITORES: Enfermagem oncológica. Cuidados de enfermagem. Cateterismo venoso central. Enfermagem baseada em evidências. Oncologia.

PROTOCOLO DE CUIDADOS CON CATÉTER VENOSO TOTALMENTE IMPLANTADO: UNA CONSTRUCCIÓN COLECTIVA

RESUMEN

Objetivo: construir de manera colectiva un protocolo de cuidados para el catéter venoso central totalmente implantado con enfermeras de un centro oncológico de alta complejidad.

Método: investigación convergente asistencial, realizada en un hospital habilitado como unidad de asistencia oncológica de alta complejidad de Minas Gerais, Brasil, de septiembre de 2017 a enero de 2018. La elaboración del protocolo fue dirigida por la Práctica Basada en Evidencias. Inicialmente, los datos se recolectaron de los expedientes médicos de los clientes. Luego se realizaron cinco talleres con las enfermeras, con el fin de determinar los recursos materiales y humanos disponibles, además de los cuidados viables para componer el protocolo. El análisis abarcó procesos de aprensión, síntesis, teorización y transferencia.

Resultados: la mayoría de los 219 expedientes médicos evaluados de los clientes con catéter venoso totalmente implantado perteneció a mujeres (77,1%), con una edad media de 49,6 años, con cáncer de mama, y 502 días de permanencia media de los catéteres. Las enfermeras que participaron de la investigación tuvieron una edad media de 30,2 años, con un tiempo de formación de 5,2 años y una experiencia media en oncología de 4,8 años. Durante el desarrollo de los talleres, las participantes reflexionaron sobre su trabajo cotidiano, con bases teórico-científicas; esto permitió, según la opinión de los profesionales, verificar las evidencias asistenciales y la viabilidad de las prácticas en el ambiente del estudio para elaborar un protocolo. Surgieron cuidados relacionados con la punción, manipulación, salinización y desobstrucción de los catéteres.

Conclusión: el proceso de elaboración del protocolo implicó la participación de todas las enfermeras de oncología, y todos los cuidados mencionados cuentan con evidencias científicas en cuanto a su utilización.

DESCRIPTORES: Enfermería oncológica. Cuidados de enfermería. Cateterismo venoso central. Enfermería basada en evidencias. Oncología.

INTRODUCTION

Cancer is the leading cause of death worldwide.¹⁻³ Its treatment is complex, multidisciplinary and depends on clinical staging, pathological features of malignant neoplasia and predictive and prognostic factors.¹⁻⁴

Among the treatment modalities, regarding antineoplastic chemotherapy, it is noteworthy that, in order to ensure patient safety and the reduction of inherent process damage, when indicated intravenously, some aspects should be observed, such as the definition of the drugs, the duration of the treatment, the frequency of use and the conditions of the venous access. The types of central venous catheters (CVC) are the following: Peripheral insertion CVCs, short-term CVCs (passed through central vein puncture), semi-deployed (tunneled) CVCs and totally implanted CVCs.⁴

The use of the CVC is a widely employed option in oncology for the administration of antineoplastic therapy,^{2,4} mainly the fully implanted central venous catheter (CVC-TI), since it has several benefits for the patient/client. However, its use is not free of significant complications, and the oncologist nurse is the professional responsible for the care with a CVC-TI.⁵⁻⁷

Oncologic nursing care based on good practices requires the elaboration and implementation of an integrated system of care protocols, which through adequate theoretical support enables the realization of evidence-based nursing actions, favoring the taking of professional decisions quickly, effectively and individually.⁸⁻¹¹

The concepts for procedure/routine or protocol terminology are not yet consensual;¹² however, the definitions that differentiate them are necessary. The standard operating procedure or routine consists of a document that contains all the steps for performing an activity, the stages, those responsible for performing each stage, the materials needed, and the frequency, ensuring standardization in performing the procedures.¹¹ The protocol addresses systematically structured recommendations for a specific care situation, guides practitioners in care decisions for prevention,¹³ recovery or rehabilitation of health.¹²

Protocols organize and streamline health services, establishing flows.¹¹ For this, they need to be built on the principles of Evidence Based Practice (EBP) and observing the ethical precepts of the profession.¹¹⁻¹² Regarding nursing protocols, their development can occur in conjunction with nursing professionals and with the organizational structure. This collective construction enables the acquisition and advancement of knowledge, integrating competence and quality in the provision of care.^{8,13}

In this context, in order to perform effective actions for care with CVC-TI, the following question emerged: What care do nurses consider relevant to compose an evidence-based care protocol for the client with a CVC-TI in a high complexity oncology center?

The present study is justified because the use of CVC-TIs is an increasingly common practice in hospitals specialized in cancer treatment and in general hospitals; it is a fundamental procedure for therapeutic success, in addition to the need to standardize nursing care practices through the collective construction of a care protocol for the CVC-TI.

Thus, this study aims to collectively construct a care protocol for totally implanted central venous catheters with nurses from a center of high complexity in oncology.

METHOD

This is a qualitative research of the convergent care type, a reputable method that is based on a situation of practice and, thus, it directly goes along with the researcher's purpose.¹⁴

To increase the research process, the Convergent Care Research (CCR) establishes four phases: conception, instrumentation, scrutiny and interpretation. These phases constitute a process with several consecutive and interrelated stages, which do not always happen linearly.¹⁴

The conception phase includes the definition of the area of interest, the formulation of the research problem, the literature review and the definition of the theoretical framework. In the instrumentation phase, methodological decisions are defined, such as the choice of study site, participants, methods and techniques for obtaining and recording research data. In the scrutiny phase, the data collection strategies are established and adopted, followed by the analysis phase of the data found. The analysis phase establishes the interpretation of what was obtained.¹⁴

In this study, the conception phase emerged after one of the researchers performed a supervised internship in the chemotherapy sector and found the need for protocols and routines based on scientific evidence, which met the need for nurses who asked for assistance in the elaboration of possible therapeutic strategies within the reality they experienced, in order to improve nursing care for cancer clients, starting with the care actions for CVC-TI and the framework in EBP.

In the instrumentation phase, the study site was defined, namely the chemotherapy sector of a large hospital located in the state of Minas Gerais, qualified as a High Complexity Oncology Care Unit (HC-OCU).

The clientele assisted by the chemotherapy unit consisted mostly of users of the Unified Health System (*Sistema Único de Saúde - SUS*). The nursing staff was composed of 10 nurses and four nursing assistants, who worked on a 44-hour workweek.

The study participants were chosen according to the following inclusion criteria: being a nurse in the chemotherapy unit, working at least six months at the site. Exclusion criteria were those who were on vacation, on sick leave or away for professional training.

Following these criteria, a total of 10 nurses was obtained, of which nine performed the care function and one was the nursing coordinator of the researched service; that is, all consented to participate. Data collection took place from September 2017 to January 2018 and was performed in two stages.

In the first stage, the medical records of all clients who implanted CVC-TIs in the researched institution were identified, which allowed a *follow up* from the surgical implantation of all devices since 2008 to their last manipulation. Thus, initially, 232 clients with CVC-TIs were followed up; of these, 219 comprised the final sample, as 13 were excluded due to incompleteness of data. These data were compiled in an Excel® spreadsheet containing medical record number, age, gender, medical diagnosis, indication for catheter implantation, caliber, date, place and insertion vessel, if there was difficulty in insertion, subsequent complications, and date of last manipulation.

In the second stage, data was collected for the characterization of the nurses participating in the study and for holding five workshops, which took place in a private room in the researched scenario, according to the participants' preference and availability; each workshop had an average duration of 60 minutes.

During the workshops, nurses and researchers identified the available material and human resources and the feasible care measures to compose the CVC-TI-specific protocol to include interventions considering cost, ease of implementation, availability of material, and adherence to these measures.

Data was collected to characterize the nurses and to carry out the workshops after contacting the coordinator of the nursing service. A meeting was scheduled with the other team members to present the research proposal, its objectives and to sign the Free Informed Consent Form (FICF).

From this, the instrument was applied for the characterization of the nurses, containing questions about the identification of the professional, training, qualification, professional experience, length of service in the area of oncology; after that, the first workshop started.

In Figure 1, we see a scheme related to the five discussion workshops held with the presence of all nurses and researchers.

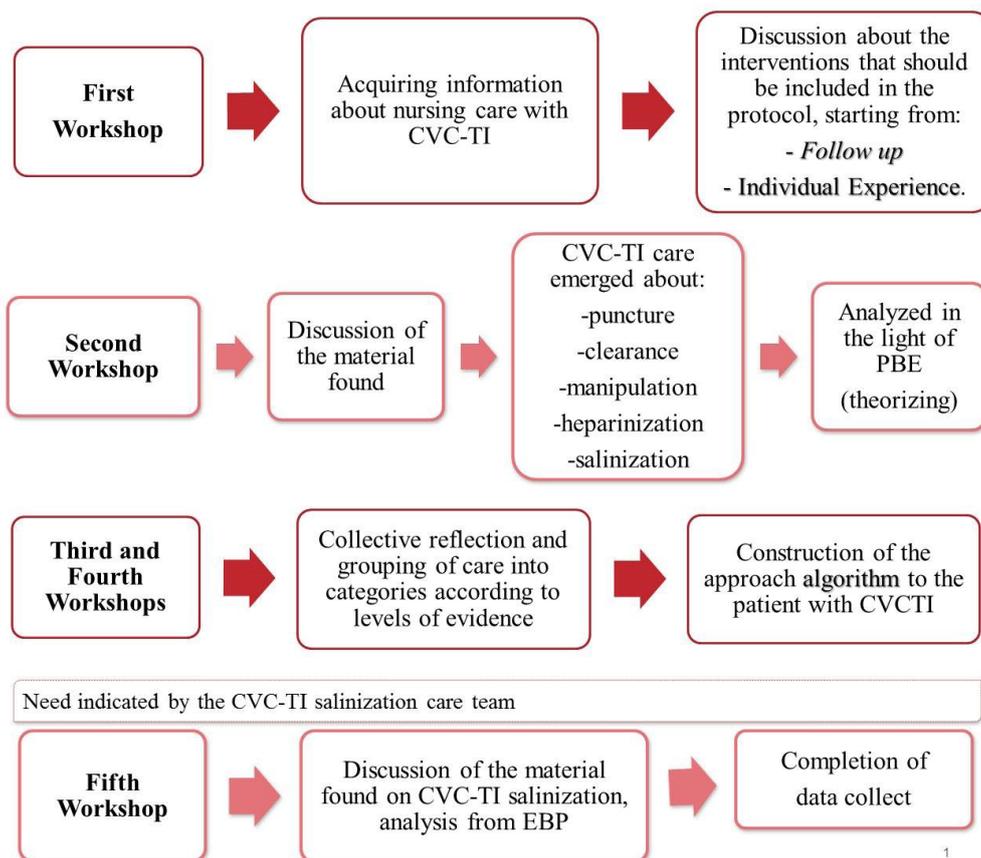


Figure 1 – Schematic representation of the five workshops carried out for the elaboration of the Totally Implanted Central Venous Catheter care protocol, Minas Gerais, Brazil, 2018

It is noteworthy that, in the first workshop, the main databases for research studies chosen by the researchers (*Medical Literature Analysis and Retrieval System Online* - MEDLINE, SCOPUS, *Latin American and Caribbean Health Sciences Literature* - LILACS and *Cumulative Index to Nursing and Allied Health Literature* - CINAHL) and; descriptors from *Medical Subject Headings* (MeSH) and Health Sciences Descriptors (*Descritores em Ciências da Saúde*, DeCS), related to the theme (these were chosen by the researchers and participants), were presented in PowerPoint® to the research participants.

After the first workshop, the researchers and participants (in pairs) organized themselves to search for studies, based on the combination of the MeSHs for the research mnemonics: (*Catheterization* [Mesh] OR *Catheters* [Mesh] OR *Catheter obstruction* [Mesh]) AND (*Occluded* [Mesh] OR *thrombosis/prevention control* [Mesh] OR *disinfection of needleless connector* [Mesh] OR *heparin/administration* [Mesh] OR *anticoagulants/administration* [Mesh] OR *Pressure* [Mesh] OR *sodium chloride/administration* [Mesh] OR *Chlorhexidine* [Mesh] OR *Flushing* [Mesh]) AND (*Nursing* [Mesh] OR *Oncologic Nursing* [Mesh]).

The search process was performed in pairs (nurse and researcher), at a previously scheduled time and in a private room with computers, located in the study hospital. The titles and abstracts of articles retrieved from the search, when available, were read and analyzed to identify those potentially eligible for the study. Inconsistencies or doubts were resolved by consensus.

For the separation, synthesis and documenting of the essential data found in each study, a structured instrument was used, containing the following items: year of publication, country of origin, objectives, method, description of care with CVC-TI and conclusions.

In the EBP, evidence levels are organized by classification systems. In the present study, the classification proposed by Melnyk¹⁵ was adopted, which organizes the levels of evidence according to Figure 2.

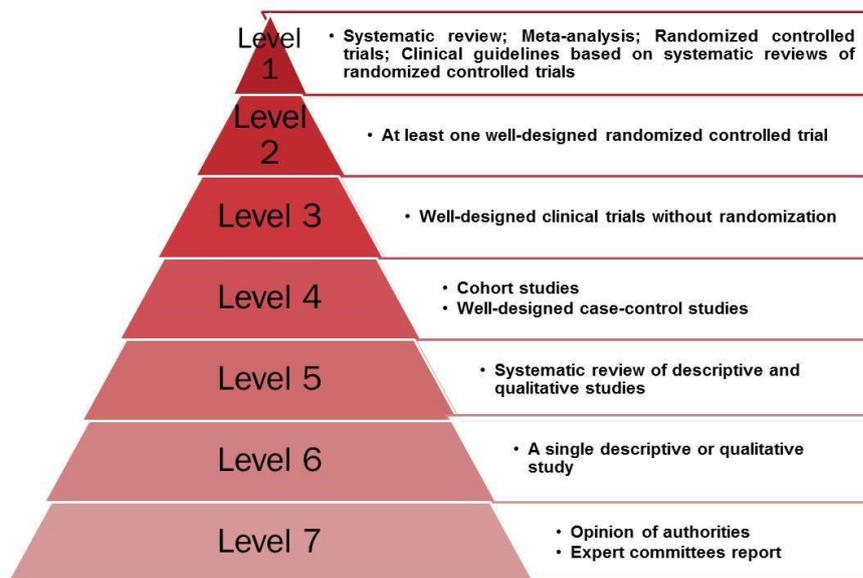


Figure 2 – Schematic representation adapted from the evidence level Classification proposed by Melnyk and Fineout-Overholt.¹⁵ Minas Gerais, Brazil, 2018

In the first screening, and after examining of the title and abstract (whenever necessary) and removing the duplicates, the search in the databases generated 307 records, of which 64 were read in full. Twenty-seven publications that did not answer the research question after abstract analysis were excluded. Therefore, 37 articles remained, which were included in the main analysis.

The second workshop discussed the studies found, with the emergence of the care related to CVC-TI puncture, clearance, manipulation and salinization, and the studies were analyzed in the light of the criteria of the EBP, which comprised the initial phase of theorization.

In the third and fourth workshops, after collective reflection, care was grouped into categories and organized according to the levels of evidence, and an approach algorithm to clients with CVC-TI was produced, considering the feasibility of performing these practices in the study setting.

In the fifth workshop, care was organized according to the levels of evidence, always focusing on the feasibility of the practices in the study setting.

For the analysis and interpretation of the data, the Morse and Field framework was adopted, recommended by the developers of the PCA methodology, which presents four other phases: apprehension, synthesis, theorization and transfer or recontextualization.¹⁶

It is noteworthy that during the interpretation phase, the analysis of the associations and variations of the data took place, giving theoretical grounds to the interpretation of the information related in the synthesis; and of transference or recontextualization, attributing significance to the results, with the explanation of their effects on care.¹⁴ In this phase, the elaboration of the protocol and its analysis took place in the light of the criteria of the EBP, which comprised the initial phase of theorization.

The apprehension process comprised the gathering and organization of information from the participating nurses, the *follow up* of clients with CVC-TI clients and the discussion workshops.

The synthesis consisted of the study of the information obtained from the analysis of the associations and variations of the collected material. At this stage, the care measures emerged, and were analyzed considering the criteria of the EBP (theorizing). Finally, the transfer, which comprised the final phase of theorization, resulting from the combination of the care elected by the nurses, enabled the construction of the contextualized protocol to the study scenario.

The first two authors of this article were responsible for the final version of the CVC-TI care protocol (puncture, manipulation, salinization and clearance), containing information on indication, justification, scope, interventions, level of evidence and indicators. The protocol was approved by the coordinating nurse and the clinical director of the oncology sector of the study scenario.

This study met the requirements of Resolution No. 466/2012 of the National Health Council, obtaining approval from the research ethics committee.

The waiver of the FICF was authorized for data collection regarding the clients' *follow up* because it was a collection from institutional registration information, and there was no contact, intervention or treatment of the clients followed.

RESULTS

219 records of clients with CVC-TI were evaluated. The first implantation described took place in April 2008, and the last in May 2017. The maximum usage time of CVC-TI from its implantation to its last manipulation was 2,340 days, with a mean stay of 502 days. Most participants were female (77.1%), with a mean age of 49.6 years old. The anatomical topographies of cancer with the highest incidence were breast, followed by gastrointestinal. Clinical indications for CVC-TI implantation were antineoplastic chemotherapy and difficult-to-puncture peripheral venous access.

Regarding venous access, it was in the right subclavian vein was punctured (64.3%) in its majority, followed by the left subclavian vein (25.1%); in relation to the CVC-TI caliber, 76.3% corresponded to 8.0 *French* (Fr), and in 79.5% of surgical insertions there was no report of difficulty. CVC-TI related complications were infection (3.1%), deep vein thrombosis (1.8%), and obstruction (0.9%).

Regarding the research participants, all were female nurses, aged between 20 and 40 years old, with an average of 30.2 years old, training time between one and 12 years, average of 5.2 years, 70% attending higher education in a private institution, and 70% having some *lato sensu* specialization in the following areas: urgency and emergency (2); aesthetics and cosmetology (1); oncologic nursing (1); public health (1); hospital management (1); hospital nursing (oncology) (1). Regarding the time of experience in oncology, it ranged from one to 12 years, with a mean of 4.8 years.

Through reflection from the first workshop, the information collected by the participants from the forms, the nurses reflected on their daily life in the outpatient service, which enabled the elaboration of care for CVC-TI. The choice of care by professionals was guided by evidence to prove its effectiveness and by the feasibility of application in the entire oncology realm. The elaboration of the care protocol algorithm for CVC-TI is described in Figure 3.

The CVC-TI care was grouped into four categories, which correspond to those related to puncture, manipulation, salinization and clearance (Table1).

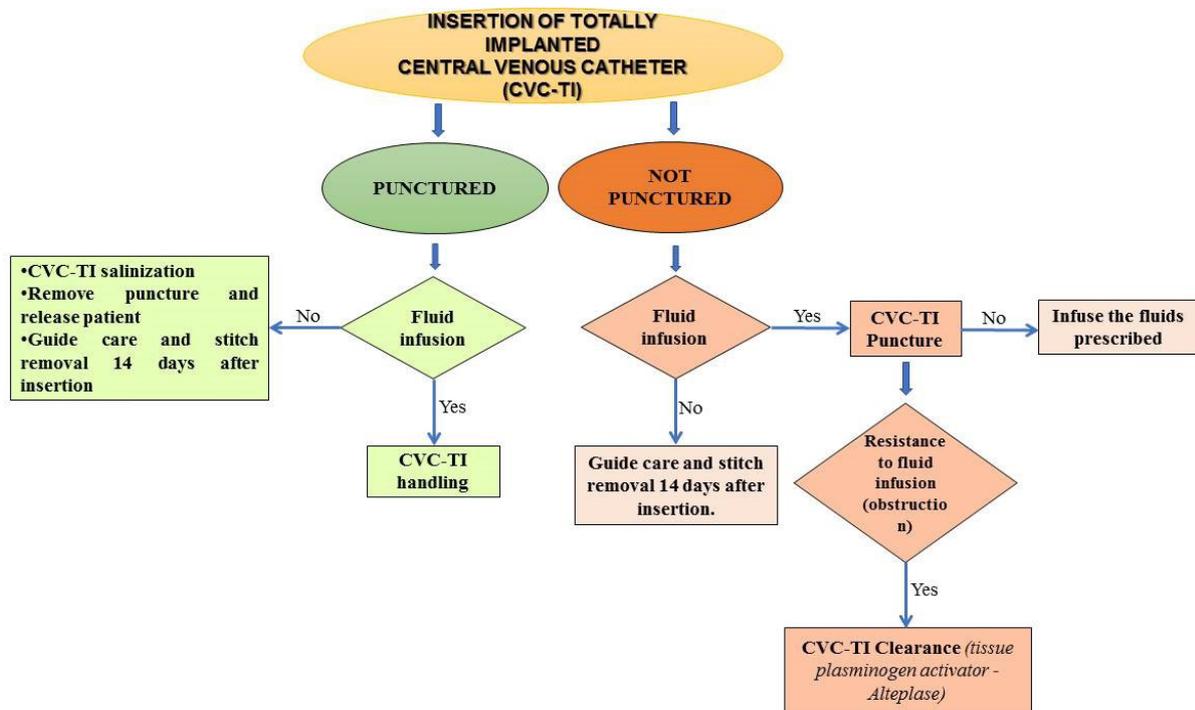


Figure 3 – Algorithm of the Totally Implanted Central Venous Catheter care protocol. Minas Gerais, Brazil, 2018

Table 1 – Categories, care measures related to the Totally Implanted Central Venous Catheter, and level of evidence. Minas Gerais, Brazil, 2018

Categories	Care measures related to the Fully Implanted Central Venous Catheter (CVC-TI)	Evidence level
CVC-TI puncture	Clean hands with anti-germ chlorhexidine 2%.	Level II
	Wear proper attire (mask and glasses).	Level III
	Position the client in semi-fowler and advise not to talk during the procedure; evaluate the need to provide surgical mask for use.	Level III
	Open the CVC-TI Puncture Kit and other materials with aseptic technique.	Level III
	Put on sterile procedure gloves.	Level I
	Perform antisepsis with 0.5% alcohol chlorhexidine with the aid of surgical forceps in the CVC-TI implantation region, start at the central region and make increasing circular movements up to a diameter of 10 centimeters. Repeat the procedure two more times increasing the diameter and wait for the alcoholic solution to dry for 30 seconds.	Level I
	Puncture the central region of the chamber with the dominant hand, insert the puncture device at an angle of 90° in relation to the CVC-TI until it gently touches its lower part.	Level VII
	Aspirate all the solution contained in the chamber (average, 5 mL in adults and 3 mL in children) or until blood is refluxed.	Level VII
	Attach the 10 mL syringe to the puncture device and flush the chamber with 20 mL of 0.9% PS within approximately two minutes, avoiding excessive pressure.	Level I
Attach the puncture device: occlusive dressing with sterile gauze or clear sterile polyurethane film (in case of hospitalized client); identify the bandage with the date, time and name of the person in charge; proceed to the indication of the puncture (infusion according to the prescription).	Level I	

Table 1 – Cont.

Categories	Care measures related to the Fully Implanted Central Venous Catheter (CVC-TI)	Evidence level
CVC-TI handling	Clean hands with anti-germ chlorhexidine 2%.	Level II
	Perform circular motion friction three times at the needle outlet with 70% alcohol swab or 70% alcohol-soaked gauze for 5 to 15 seconds, clamp the needle extender and disconnect the system.	Level I
	Keep tip of needle extension and equipment protected with sterile gauze after disconnection.	Level III
	Keep the system closed and protect all inlet ports (study site does not use needleless connectors); after unclamping the needle extender and administering fluids or manipulating the system, reconnect the connections.	Level III
	Salinize CVC-TI without prescription/indication of fluid infusion for up to 30 days.	Level I
CVC-TI salinization	Clean hands with anti-germ chlorhexidine 2%.	Level II
	Clamp the needle extender and connect the 10 mL syringe with 0.9% PS, infuse the 20 mL in <i>flush</i> (positive pressure) and re-clamp the extender.	Level I
	Locate and fix the CVC-TI with a small bandage folded gauze and remove the needle. Protect the puncture site with occlusive and/or compressive dressing with sterile gauze and micropore.	Level I
	Sanitize hands with anti-germ chlorhexidine 2% (soap).	Level III
CVC-TI clearance	Note the presence of signs of obstruction: inability to aspirate at least 3 mL of blood and/or infusion of 5 mL of saline.	Level III
	Aspirate 2 mL of the reconstituted solution from the Alteplase vial and infuse into the CVC-TI.	Level III
	Wait 30 minutes and reassess CVC-TI function. Aspirate 4 mL to 5 mL of blood to remove possible residual clots (if function restored). Then gently irrigate CVC-TI with 10 mL of 0.9% PS.	Level III
	Wait 120 minutes since the last test (if CVC-TI function has not been restored); if occlusion remains, a second dose of the same volume may be administered, repeat the procedure.	Level III
	Contact doctor if CVC-TI function is still not restored. Medical evaluation will define the next conduct.	Level VII

It is noted that this protocol considered that the protocol describes a specific care/care situation (care measures for CVC-TI), with operational details (the algorithm described in Figure 3) and specifications on what to do (presented in the algorithm) and in Chart 1): who should do it (only nurses manipulate all CVCs in the study setting) and how to do it (as shown in Chart 1).

Next, based on the literature, the care measures listed by nurses to compose the CVC-TI care protocol will be discussed.

DISCUSSION

The process of collective construction through the workshops allowed nurses to perceive themselves as active participants because, through collective reflection on the care with CVC-TI, in their opinion, the care evidence and the feasibility of best practices in their context were considered, integrating competence and quality in the provision of nursing care.

Regarding the data collection, organization and analysis procedures of this study, although hard for nurses and researchers, they allowed to know about all the CVC-TIs inserted in the institution, as well as the permanence, caliber and complications, apart from the revision and updating of the

content to compose the care measures with CVC-TI, after the workshops and the peer analysis work of the articles. The algorithm and the interventions described were based on the scientific literature. It was observed that the built algorithm directed the care flow of the nursing team after insertion of the CVC-TI in the cancer client.

It is noteworthy that the need for periodic reviews of the algorithm, of the care measures included in the protocol and of the evaluation of its use was agreed. It is noteworthy that nurses recognized the importance of the protocol both for customer care and for the safety, organization and humanization of care.

The use of CVC-TI requires percutaneous puncture of the reservoir, and measures to prevent CVC-TI and CVC-related bloodstream infections are essential.^{5,17}

The suggestions of the professionals participating in the research for CVC-TI puncture, considering the recommendations consistent in the literature and applicability in the service, were as follows: hand hygiene with chlorhexidine 2%; use of personal protection and maximum sterile protection barrier (mask, goggles, sterile glove, sterile puncture kit containing surgical forceps, vat rim and fenestrated field, other materials to perform the procedure and sterile gauze).^{5,17}

As for the preparation of the skin, the importance of the professional being prepared is emphasized. Antisepsis should be performed using a 0.5% alcohol chlorhexidine solution, starting the technique in the central region of the CVC-TI implantation, in increasing circular movements up to a diameter of 10 cm, three times, and waiting 30 seconds for the spontaneous drying of the solution.^{5,18}

When puncturing the device, the practitioner should initially evaluate its operation by aspirating all the solution contained in the chamber (average, 5 ml in adults and 3 ml in children) or even refluxing blood to avoid complications. Finally, they should install the prescribed serum and medication circuit, protecting with sterile gauze and securing the puncture device with micropore or sterile transparent polyurethane film (in case of a hospitalized client).¹⁷

The use of care protocols and sterile maximum barrier is recommended by several authors, mainly: hand hygiene; skin antisepsis with alcohol chlorhexidine 0.5% to 2%, the most effective way due to the microbicidal action of residual effect; proper dressing change; aseptic technique for accessing and changing needleless connectors and daily review of CVC requirement. In addition to these measures, educational strategies and training for health professionals, surveillance and evaluation of results, and institutional safety culture are also recommended.^{5,17,19-21}

The main indications for CVC-TI handling are related to any situation that requires access to the system, such as drug infusion, parenteral nutrition, blood components and other solutions, equipment or connector exchange, requiring the professional to strictly use aseptic techniques in order to prevent CVC-TI contamination.^{17,22-23}

Disinfection on surfaces of needleless connectors and intravascular access devices should be performed prior to any manipulation using appropriate mechanical friction antiseptic agent whose indicated solutions are 0.5% alcohol chlorhexidine or 70% alcohol in order to reduce number of microorganisms on its surface. Such measures involve the use of sterile maximum barrier, training and establishment of care handling routines are also indicated.^{5,17,22-23}

Based on the recommendations^{5,22-23} and considering the local reality, where no needleless connectors are used, the care measures chosen by the nurses regarding the handling of CVC-TI were the following: to perform mechanical friction in circular movements, three times, at the exit of the needle with alcohol-soaked gauze 70%, for five to 15 seconds, immediately after manipulating the infusion system, keeping the access doors protected with sterile gauze; perform the necessary procedure; and reconnect the connections keeping the system closed and protected.

Another practice used and frequently debated by the researchers is the maintenance of CVC permeability through a 0.9% saline solution, i.e. salinization. This practice consists of the effective

and routine positive pressure washing of the CVC-TI with a saline solution to fill its light in order to keep it clear even when not in use for up to 30 days (if there is no prescription/indication of CVC-TI fluid infusion for up to 90 days).^{5,24} Studies mention that, within up to three months, maintenance with a saline solution using the positive pressure technique does not interfere with CVC-TI permeability and allows even greater patient/client safety.^{5,25-27}

CVC-TI *flush* aims to remove possible deposits of fibrin, drugs, viscous products, blood components and other compounds that adhere inside and in the subcutaneous reservoir; thus, about 20 mL is recommended for effective CVC-TI washing. The literature also recommends that this washing be done before and after fluid infusion or blood collection.²⁵

Care with CVC-TI salinization was a necessity pointed out by the team because, prior to this study, such practice was not performed. Thus, after discussing the recommendations in the literature, the following precautions were listed: after infusion of prescribed fluids, without the need for a new infusion within 30 days, prepare a 0.9% saline solution, clamp the extensor of the needle and connect the 10 mL syringe, infusing the 20 mL at positive pressure, again clamping the extender. Immediately after, fix the CVC-TI using a sterile gauze folded in a small bandage and remove the needle, protecting the puncture site with an occlusive and/or compressive dressing of sterile gauze and micropore, in order to protect the punctured site, minimizing the possibility of infection.²⁸⁻²⁹

Washing CVC with a saline solution is strongly recommended in the literature, although studies do not show significant differences between its efficacy and the use of heparin solutions in maintaining CVC-TI permeability. However, there is evidence to support the use of physiological serum as enough solution to maintain catheter permeability, preventing the risks associated with heparin administration. Therefore, studies are urgently needed that reveal evidence on the best washing techniques, blocking volumes and indications.^{5,24-25}

It is noteworthy that, prior to this research, heparinization of the CVCs (filling their light with heparin solution to keep it clear) was routine in the study setting. However, the literature has shown that there are no significant differences between the efficacy of heparinized solutions and 0.9% saline solutions to maintain CVCs permeability in adults, and prophylactic heparin use has not been shown to decrease cases of catheter occlusion; therefore, its use is not recommended.^{5,24-25}

Although the use of the CVC-TI brings numerous benefits to the person undergoing cancer treatment, it is not free of complications, whether associated with the quality of the product or with the surgical procedure of implantation of the device or related to its handling and use.⁷

CVC-TI obstruction is one of the main non-infectious complications related to its handling/use, and depends on some factors, such as duration of CVC-TI implantation, access route, material, caliber and location of distal extremity, infused substances, history of previous implantations, patient coagulation parameter characteristics and other associated diseases. In cancer patients, the predisposition to thrombogenesis is considerably increased because, in addition to the underlying disease itself, there is also the use of certain drugs, and the presence of the CVC-TI itself can be considered another factor of vulnerability.⁴

It is noteworthy that there is an alteration in the blood reflux (minimum 3 mL) and in fluid infusion (minimum of 5 mL of saline solution), due to the formation of fibrin around the CVC-TI and even thrombi inside. Thus, even if this situation can be dealt with, removal of the device cannot always be avoided by setting the safest option for the patient/client.^{4-5,30}

In the oncology unit where this study was conducted, the care practice for CVC-TI obstruction situations involved the use of heparin and other empirical solutions, also previously mentioned in the literature for CVC-TI clearance. After knowing and discussing the new evidence and, considering the future possibility of agreement with the institution and other members of the multidisciplinary team, the nurses defined the following precautions: when observing the presence of signs of obstruction,

aspirate 2 mL of Alteplase and infuse into the CVC-TI;³¹ reassessing function after 30 minutes, if restored, aspirate from 4 mL to 5 mL of blood to remove possible residual clots, gently irrigating with 10 mL of 0.9% PS; if not restored, wait 120 minutes since last test³¹ and if the occlusion remains, repeat the process again, so that if the obstruction is maintained, medical evaluation is requested to define the next approach.^{5,31}

CVC clearance has been recommended using tissue Plasminogen Activator (t-PA) and, although fibrinolytic therapy is costly to service, its use brings about numerous clinical benefits to the cancer patient as it allows a rapid resolution of the obstruction.⁴⁻⁵

Studies have been conducted to demonstrate which drug is best suited for CVC clearance, among which Alteplase has achieved good results, approved in 2001 by the *Food and Drug Administration* (FDA) of the United States of America (USA).^{4-5,31}

As limitations of the study, before the first workshop, the nurses' lack of knowledge in their daily work of the need to apply evidence-based best practices was observed. However, after the reflections made during the workshops, this initial limitation was remedied. Another point to note was the unavailability, in principle, of the institution providing the materials needed to comply with the best practice recommendations; however, they are gradually being resolved. It is noteworthy that the main difficulty during the research was the limited availability of nurses' hours to participate in the workshops and the collection, organization and analysis of articles.

CONCLUSION

The analysis of the profile of clients with CVC-TI in the high complexity center in oncology study setting, as well as the institutional resources allied to the literature review, allowed the elaboration of the care protocol for the CVC-TI, based on the EBP.

The study, through a dialogical process, favored the methodological strategies. Professionals and researchers were involved throughout the process, which may be a favorable point for its implementation, as they assumed the status of actors in this collective construction.

The use of this care protocol for CVC-TI contributed to the improvement of nursing care. It is considered that further research may be performed, especially randomized controlled trials involving CVC-TI care.

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NOTES

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CONTRIBUTION OF AUTHORITY

Study Design: Fonseca DF, Oliveira PP.

Data collection: Fonseca DF, Nicoli LHS, Amaral RAC.

Analysis and interpretation of data: Fonseca DF, Oliveira PP.

Discussion of the results: Fonseca DF, Oliveira PP.

Writing and/or critical review of content: Fonseca DF, Oliveira PP, Rodrigues AB, Silveira EAA.

Review and final approval of the final version: Oliveira PP, Rodrigues AB, Silveira EAA.

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No any conflict of interest.

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CORRESPONDENCE AUTHOR

Deborah Franscielle da Fonseca

deborahfonseca@hotmail.com

