

**CONSTRUCTION OF A BUNDLE FOR PREVENTION OF BLOODSTREAM INFECTION
ASSOCIATED WITH CENTRAL VENOUS CATHETER**

**CONSTRUÇÃO DE UM BUNDLE PARA PREVENÇÃO DE INFECÇÃO DE CORRENTE
SANGUÍNEA ASSOCIADA AO CATETER VENOSO CENTRAL**

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ABSTRACT

Objective: The objective is to describe the construction of bundle for the prevention of bloodstream infection associated with central venous catheters in patients with multidrug-resistant germs. **Method:** Validation study by consensus among specialists, conceived in a university hospital. The work group consisted of 10 nurses from the sector and three from the institution's Infection Control Commission, two nursing students and a professor from a federal university. It was developed from January to March 2019. Information was collected through systematic registration of meetings. **Results:** A bundle was prepared to prevent bloodstream infection associated with a central venous catheter, establishing specific activities for each team member. The figure of the specialist, a highly qualified professional with a specific workload for the care of catheters, was instituted. **Conclusion:** In Brazil, few institutions have similar characteristics for the care of patients with GMR. The use of a protocol should qualify the care for these patients, improving safety in care and reducing morbidity and mortality due to nosocomial infection.

KeyWords: Catheter-Related Infections; Hospital Infection Control Program; Drug Resistance, Bacterial; Nursing care; Security measures; Nursing Methodology Research.

RESUMO

Objetivo: Objetiva-se descrever a construção de um *bundle* para prevenção de infecção de corrente sanguínea associada a cateter venoso central em pacientes com germes multirresistentes. **Método:** Estudo de validação por consenso entre especialistas, concebido em um hospital universitário. O grupo de trabalho foi composto por 10 enfermeiros do setor e três da Comissão de Controle de Infecção da instituição, um acadêmico de enfermagem e um professor de uma universidade federal. Foi desenvolvido de janeiro a março de 2019. As informações foram coletadas por meio de registro sistemático das reuniões. **Resultados:** Elaborou-se um *bundle* para prevenção de infecção de corrente sanguínea associada ao cateter venoso central estabelecendo atividades específicas para cada membro da equipe. Instituiu-se a figura do especialista, profissional altamente qualificado e com carga horária específica para o cuidado aos cateteres. **Conclusão:** No Brasil, poucas são as instituições que possuem características semelhantes para cuidados de pacientes portadores de GMR. A utilização de um protocolo deve qualificar o atendimento a estes pacientes, aprimorando a segurança no cuidado e reduzindo a morbimortalidade por infecção nosocomial. **Palavras-Chave:** Infecções Relacionadas a Cateter; Resistência Bacteriana a Antibióticos; Cuidados de Enfermagem; medidas de segurança; Pesquisa Metodológica em Enfermagem.

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INTRODUCTION

The central venous catheter (CVC) is an intravascular device indicated for the infusion of drugs, hypertonic or irritant solutions for administration in peripheral veins, drug incompatibility, parenteral nutrition, blood products and volume expanders; especially considering urgency in the need for infusion, it ends close to the heart or in one of the large vessels. The choice of the type of device varies according to the required length of stay, and can be classified as a short- or long-term catheter. In cases of prolonged use, the CVC is indicated, which has mechanisms that prevent bacterial colonization via extraluminal, whose installation is surgical(1-3).

With a possible length of stay of several weeks, CVCs are handled by different professionals on numerous occasions, exposing the patient to microorganisms. Although the use of these devices has therapeutic benefits, it is estimated that approximately 60% of the bacteremias related to health care are associated with some intravascular device, being one of the most frequent risk factors for bloodstream infections, especially short-term CVCs. Infections related to the use of these vascular accesses are classified as: Primary Bloodstream Infection associated with Central Venous Catheter (PBI-CVC) or CVC-related

infection(3-5).

For the Brazilian Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária*, ANVISA), the PBI-CVC corresponds to the Health Care-Associated Infection (HAI) with the greatest preventive potential, that is, the main type of infection that can be prevented. In addition, they result in increased hospital stay, increased institutional costs and significant mortality, bringing about severe systemic consequences to the patients. A strategy that can result in a decrease in PBI-CVCs is the surveillance of these infections, as well as the implementation of improvement strategies(3,6).

To reduce the infection rates, hospital institutions must institute sets of interventions, called bundles, during the insertion of the CVC, for its use and maintenance. Among the care measures, the Center for Disease Control and Prevention (CDC), the Institute for Healthcare Improvement (IHI) and the ANVISA suggest training of the professionals regarding care in the insertion and maintenance of CVCs, use of maximum barrier methods, disinfection of the connections of the catheter, cannula or valve connectors, visual inspection and daily palpation of the catheter insertion site for checking dressing conditions, and removal of CVCs without clinical indication, among others(3,7).

Publications with intervention research

studies showed results in reducing infection by the use of bundles. A pioneering study carried out in Michigan showed a sustained reduction for 18 months, with a zero rate of PBI associated with CVC after using a bundle with five preventive measures. Concomitantly, a survey conducted in the United Kingdom showed a reduction in the annual rate of PBI-CVC through the implementation of an insertion and maintenance bundle, in addition to the early removal of the CVC(8).

The Hospital Infection Control Commission (HICC) of a public hospital in southern Brazil started to monitor CVC-related infections as of 2008. Since then, this group has been making efforts to find possible reasons and establish preventive measures. In the institution's inpatient unit for patients with MRG, a significant peak of PBI was verified in 2018, totaling 25 infections, 15% of the hospital's total number of PBI. Patients with MRG can be more exposed to PBI by MRG due to contamination of the environment, furniture, bedding or the patient's own skin. For this reason, there is greater care with the skin, through the application of aqueous chlorhexidine after bathing, and with the environment(9).

A study carried out at the Marrakesh University Hospital verified that bacteremia and catheter-related infections were the second and third most commonly infections found, respectively. In addition, the mortality rate for

bacteria that had antimicrobial resistance was 12%(5). It is verified that patients with PBI caused by ESBL-producing enterobacteriaceae are nearly 57% more likely to die than those with PBI caused by a non-ESBL-producing strain, and more than half of the hospitalized patients who have acquired infections in the bloodstream by carbapenem-resistant enterobacteria die from infection(7).

Given the above, the need to implement measures to prevent PBI in this sector was detected, through a catheter maintenance bundle. This study is justified by the importance of producing and adding knowledge about the prevention of nosocomial infections, mainly in patients with MRG, since it was identified that, despite the perception that the use of CVC has been growing in inpatient units, studies in patients with MRG are still scarce.

This study is innovative for Nursing since it proposes the direct work of a nurse in the specific care of the CVCs in the sector, being a professional highly qualified and trained to manage care with the installation, removal and maintenance of this device, devoting six hours a week to these activities. It is understood that the decision to install and remove the catheter is made by the medical team; however, the Nursing staff invests many hours aimed at controlling and preventing contamination of these devices. Thus, the guiding question was “What care measures

must be included in a care protocol for the prevention of primary bloodstream infection associated with central venous catheters (CVCs) in patients with multidrug-resistant germs?”

The objective is to describe the creation of a bundle for the prevention of primary bloodstream infection associated with central venous catheters (CVCs) in patients with multidrug-resistant germs.

METHOD

A validation study through consensus among specialists, describing the creation of a bundle for the prevention of primary bloodstream infection associated with central venous catheters (CVCs) in patients with multidrug-resistant germs. This method allows reaching collective opinion or agreement among specialists regarding a specific phenomenon, and has been used in Nursing to define standards of practice(10).

The research took place in an inpatient unit for patients with MRG in a public and university hospital. It is a sector with 34 beds for hospitalization of clinical and surgical patients, of different medical specialties, with a Nursing team composed of 10 nurses and 38 nursing assistants and technicians, distributed in five work shifts. The institution receives residents and students from all health care fields.

The bundle was created by a working

group composed of 10 nurses from the sector, three from the institution's Infection Control Commission, one Nursing student, and one professor from a federal university. This group held periodic meetings in order to discuss each stage of the CVC care process, seeking to clarify doubts, in the light of examples from everyday care and evidence from the literature. The information was collected through the records of systematic meetings.

First, the Nursing team was heard to make a situational diagnosis with respect to catheter care, looking for weaknesses in the process and suggestions for improvement. Concomitantly, the authors observed the care provided. Subsequently, information about catheter care and experiences with prevention bundles were searched in the literature, in national and international databases. The data search was carried out in the Medical Literature Analysis and Retrieval System Online (MEDLINE via PubMed), the Virtual Health Library (*Biblioteca Virtual de Saúde*, BVS) and the Scientific Electronic Library Online (SCIELO) databases using the following descriptors: catheter-related infection, nursing care, catheter and central venous catheterization, using the Boolean operator AND. Subsequently, this bundle was created. The working group selected the care provided through a 100% consensus among the professionals.

The Regulatory Guidelines and Rules

for Research Involving Humans Beings, provided for in Resolution 466/2012 of the National Health Council(11), were complied with, and the project was approved by the Research Ethics Committee of the research institution under number 26051219.9.0000.5327. The authors signed a Term of Commitment for Data Use to have access to the minutes of the working meetings between experts, assuming the commitment to preserve the privacy and anonymity of those involved.

RESULTS

The result of this study was the creation of a bundle for the prevention of primary bloodstream infection associated with central venous catheters (CVCs) in patients with MRG. An advantage of this bundle was the insertion of a professional nurse, called a CVC specialist, who devoted 6 hours of his

weekly workday to take care of the catheters in the sector.

The moment of listening of the team and observing the care provided demonstrated that the professionals know the routines but carry them out with adaptations, violating aspects that can put the safety of care with CVC at risk. The routine CVC blood collection was verified for laboratory exams, which increases the handling of the catheter, the reduction in the rate of hand hygiene between the performance of hygiene care and the handling of the CVC, and the absence of antiseptics at the ends of the catheter in the installation of medications and solutions. Care for CVC ends up being one of the countless activities performed by nurses, reason why it is important to devote working hours of a professional to do so. The activities are described in Chart 1:

Chart 1: Description of the activities of the bundle for the prevention of primary bloodstream infection associated with central venous catheters (CVCs) in patients with MRG. PortoAlegre, RS, Brazil, 2019.

PROFESSIONALS	ACTIVITY
HICC	<ul style="list-style-type: none"> ● Awareness raising and training of the team; ● Periodic observation of hand hygiene; ● Monitoring of the indicators; ● Training of the specialist nurse; ● Monitoring of adherence to the bundle; ● Monthly monitoring of the indicators;

Nurses	<ul style="list-style-type: none"> ● Daily inspection of the insertion site; ● Assessment of the CVC conditions; ● Guidance of teams to reduce blood sample collections
	<p>from CVC for exams;</p> <ul style="list-style-type: none"> ● Supervision, monitoring and guidance of the Nursing team in handling the CVC; ● Detailed Nursing prescription of the care measures with the CVC; ● Recording the insertion date, conditions of the catheter addressing in the patient's record; ● Change of the QN dressing; ● Recording the catheter conditions on the institutional form for transferring care between the shifts; ● Communication of changes in the CVC to the HICC and medical staff;
Specialist	<ul style="list-style-type: none"> ● Weekly scheduled exchange of the dressing; ● Audit of the catheter and coverage conditions twice a week; ● Observation of the use of the catheter by the nursing technician; ● Recording the catheter conditions in the electronic medical record and in the care transfer form; ● Contact with the medical staff and the HICC to communicate situations that may violate patient safety, such as the presence of drainage, catheter without proper fixation or malfunction; ● Audit of adherence to the bundle; Training of the Nursing team at the bedside;
Nursing team	<ul style="list-style-type: none"> ● Hand hygiene before handling the CVC; ● Disinfection of the ends of the CVC with alcohol before using the CVC; ● Guidance to the patient and family on procedures performed and on CVC care; ● Observation of the catheter conditions;
Head of the sector	<ul style="list-style-type: none"> ● Assessment of the sector's indicators on a monthly basis. ● Creation of an online working group to communicate about CVCs; Informing the team about the results through images sent by an online messaging device; ● Encouraging maintenance of the measures; ● Providing supplies;

Multidisciplinary team	<ul style="list-style-type: none"> ● Meeting to discuss the clinical cases twice a week; ● Review of the need for CVC maintenance; ● Formal suggestion to the medical team for CVC removal.
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Source: The authors, 2021.

Awareness raising and training of the Nursing team occurred through shift meetings, which addressed the need for improvements in the work process to reduce the PBI-CVCs. The groups also provided data on the weaknesses of the current system. A hand hygiene workshop was also held, reinforcing the existing measures by the HICC, with an emphasis on the importance of the 5 moments, mainly hand hygiene before aseptic procedures.

From the data generated in the observations, all members of the Nursing team

started to receive monthly reports, which were prepared with figures and percentages, so that they were easy to understand. The information is provided through a message in a telephone app. This report is generated by the HICC and sent to the head of the unit, who sends it to the working groups.

Auditing the CVC conditions is not an isolated activity. Upon identification of inadequacies, the specialist corrects them, reducing the exposure time of the patient to the risk. Figure 1 shows the script used in the audits.

Figure 1: Script for auditing catheters in an inpatient unit for patients with multidrug-resistant germs. Porto Alegre, RS, Brazil, 2019.

1. Type of CVC	<input type="checkbox"/> CML <input type="checkbox"/> CDL <input type="checkbox"/> PICC <input type="checkbox"/> Shilley <input type="checkbox"/> CTL <input type="checkbox"/> Permicath <input type="checkbox"/> Hickmann/Broviac <input type="checkbox"/> Portocath
2. Insertion site	<input type="checkbox"/> Jugular <input type="checkbox"/> Subclavian <input type="checkbox"/> D <input type="checkbox"/> Femoral <input type="checkbox"/> Upper limb <input type="checkbox"/> E
3. Intact dressing that does not to be changed	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not observed
4. Type of coverage	<input type="checkbox"/> Semipermeable transparent film <input type="checkbox"/> Conventional (Gauze + Scotch tape) <input type="checkbox"/> Film + gauze insertion
5. Phlogistic signs at the insertion site	<input type="checkbox"/> Yes. Which? _____ <input type="checkbox"/> No <input type="checkbox"/> Not observed
6. Presence of blood at insertion	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not observed
7. Loose fixation points	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Does not apply <input type="checkbox"/> Not observed
8. Set of infusions with validity date	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Does not apply <input type="checkbox"/> Not observed
9. Residues in the infusion set (medications, TPN, blood)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Does not apply <input type="checkbox"/> Not observed
10. Catheter with signs of traction	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Does not apply <input type="checkbox"/> Not observed
11. Using TPN	<input type="checkbox"/> Yes <input type="checkbox"/> No Date: _____ Days of use: _____
12. A heparin route	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Does not apply <input type="checkbox"/> Not observed
13. Date of CVC insertion	_____/_____/_____
14. Post-search action/intervention	- solution of the problem -

Source: Search data, 2021.

The institution works with the systematization of Nursing care in a computerized system, with all stages of the process. For this patient, the “Risk of Infection” Nursing diagnosis related to the “Invasive Procedure” is used, and the

prescription of the care measures is shown in Chart 2. From the bundle, the nurses were instructed to carry out a more detailed prescription of the CVC care measures, emphasizing signs of infection.

Chart 2: Prescription of care measures for the patient with a central venous catheter. Porto Alegre, RS, Brazil, 2019.

Nursing diagnosis	Etiology	Care measures
Risk of Infection	Invasive Procedure	<ul style="list-style-type: none"> • Implement general care measures with venous catheters – CVC inserted in: • Observe the site and location of catheter insertion; • Communicate phlogisticsigns; • Dress the central venous catheter – catheter type: transparent film of: Disinfect the connections with alcoholsachet at each handling;
		<ul style="list-style-type: none"> • Change the occluder after each use of the CVC; • Protect the catheter with plastic so it does not to getwet in the bath.

Source: The authors, 2021.

Another advantage of this bundle was the holding of meetings to discuss cases, review the period of treatment and/or infusion of intravenous medications, and the possibility of early removal of the CVCs. In situations where the possibility of removing the device was verified, the nurse of the sector was responsible for contacting the medical team and suggesting the removal of

the CVC, guiding the resident student on the risks of infection.

DISCUSSION

The implementation of specific and targeted measures is proven to reduce the risk of PBI- CVC. An integrative review showed that the main focus of the bundles is still on

implementing measures to reduce the risk of infection when inserting the CVC and that there is no standard intervention time and number of actions. Nevertheless, reduction of bloodstream infection occurred in all studies analyzed, ranging from 26% to 100%(8).

Combined with the official recommendations, the use of creativity also brings benefits when using bundles. In a pediatric hematology, oncology and bone marrow transplantation unit in a tertiary level institution, the multidisciplinary team prepared the team and raised its awareness about the effects of a PBI on the lives of patients through posters spread throughout the unit, and later, applied a bundle. The adherence to CVC-related activities increased from 28.8% to 71.2%, with a reduction from 8 to 2 cases of PBI-CVC(12).

There is consensus in the literature regarding the importance of the nurse's role in preventing PBI-CVC. A meta-analysis that assessed the effectiveness of insertion and maintenance bundles in adult ICUs from different regions of the world demonstrated that, despite the economic differences between high- and low-income countries, there was a significant reduction in the PBI-CVC index. It emphasizes the empowerment of nurses to interrupt insertion procedures in cases of non-compliance with the respective bundle(13). In addition to that, nurses are the professionals who know the skills and

weaknesses of their team and are inserted in the group, facilitating awareness raising in the care with the CVC and influencing the adequacy of the processes. It was observed that professionals with little experience in the team need follow-up, in order to maintain safety in care.

Studies that assess or indicate the presence of a specialist nurse, specifically devoted to the care of the catheters, are still scarce in the literature. It is known that nurses have a high number of activities to perform in a short period of time and that this factor can interfere with the performance of appropriate care with the CVCs, as well as reducing the time for acquiring knowledge on the topic. Managerial activities require planning, organization, coordination and control so that the quality and safety of health care are guaranteed, and they depend on the Staffing, qualified human resources and material resources adjusted to the current demand(14). In this study, the presence of specific nurses for these activities certainly enabled greater attention to the care measures with the CVC and with the appropriate supervision of the Nursing team.

Adherence of the Nursing team to the changes that improve the care processes is extremely important for the expected result. The creation and validation of a bundle based on the practice values the professionals' actions, enables greater involvement in

reaching the institutional goals and, consequently, qualifies the service provided, offering greater safety to professionals and patients.

CONCLUSION

This article made it possible to describe the creation of a bundle for the prevention of PBI- CVC, offering some innovations, such as the presence of a professional with workload focused on catheter care, multidisciplinary discussion of the need to maintain the catheter and the empowerment of nurses as a strategy to implement measures aimed at reducing the risk of PBI- CVC.

The use of these measures has been proven to reduce the risk of infection. The next challenge is to maintain the measures in the bundle, which is a slow work that requires feedback. For that, a communication channel between all involved and the partnership between the HICC, the Nursing team and other professionals becomes necessary.

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