

ORIGINAL ARTICLE

Adoption of good practices in the maintenance of central venous catheter in a cardiovascular unit: cross-sectional study

HIGHLIGHTS

1. There was a high adherence rate in the maintenance of curatives.
2. Hand hygiene achieved low adherence.
3. Economic factors limit practices essential to preventing infections.
4. There is a need to improve the preventive care of BSI.

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ABSTRACT

Objective: Analyze the adherence of the nursing team to good practices related to the maintenance of the central venous catheter in cardiovascular units; and categorize the weaknesses, strengths, opportunities and threats of good practices in these units according to the SWOT matrix. **Method:** An observational, transversal, quantitative study with data collected in the cardiovascular units of the University Hospital of Rio de Janeiro, through clinical auditing, aiming at the care opportunities in the maintenance of the central catheter. Analysis by simple descriptive statistics. **Results:** The maintenance of curatives had the highest adhesion rate, hand hygiene and waiting for the drying of the alcohol solution after the scrub the hub presented the lowest percentages. **Conclusion:** The team adheres to some recommended practices, but the low adherence in hand hygiene and hub disinfection indicates the need for improvement in preventive care.

DESCRIPTORS: Central Venous Catheters; Cardiology Service, Hospital; Catheter-Related Infections; Patient Safety; Nursing Care.

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INTRODUCTION

The cardio-intensive units aim to assist critical patients with cardiovascular diseases, demanding continuous monitoring and high-complex technological resources. In these scenarios, the use of invasive devices, such as the central venous catheter (CVC), is frequent, although not limited to this environment, as the CVC is widely employed in other hospital units. Despite its relevance for treatment, the use of CVC is associated with important risks, such as bloodstream infections (BSI)¹.

BSI in Intensive Care Units (ICU) is a global problem that raises mortality, hospitalization time and healthcare costs. In Brazil, the laboratory-confirmed incidence of primary BSI in 2022 was 3.95 per 1,000 CVC/day in adult ICUs. Few studies evaluate the economic impact of these infections in the country, but estimates point out that the cost of each case can vary from 7,906 to 89,866 U.S. dollars²⁻³.

Despite the high incidence, the primary BSI presents a wide possibility of prevention by adopting evidence-based measures, such as adherence to the bundles (packages of good practice), which significantly contribute to both reducing infection rates and qualifying care³⁻⁴.

In this context, tools can be employed to evaluate risk factors for health-related complications, such as the SWOT matrix, which identifies strengths and weaknesses in the internal work environment, as well as external opportunities and threats, through four variables: Strengths, Weaknesses, Opportunities and Threats⁵⁻⁶.

Therefore, the study aims to analyze the adherence of the nursing team to good practices related to the maintenance of CVC in cardiovascular units; and categorize the weaknesses, strengths, opportunities and threats of good practices in these units according to the SWOT matrix.

METHOD

Observational, transversal and quantitative study, conducted according to the initiative Strengthening the Reporting of Observational Studies in Epidemiology (STROBE). The data collection took place between May and September 2024, in the morning period, at a large university hospital in Rio de Janeiro (RJ), in the clinical and surgical cardiovascular units. Clinical auditing with sampling was used for convenience, depending on the researcher's availability and observation opportunities, not setting up daily collection.

Nursing professionals who act in direct care to the patient using CVC, who agreed to participate in the study after submission and signature of the Terms of Free Informed Consent, were eligible as study population.

As inclusion criteria: nursing technicians and nurses from the clinical and surgical cardiovascular units who act directly in patient care. Exclusion criteria: nursing technicians and diarist nurses who work in the administrative and managerial areas of these sectors.

An instrument developed from the best practices described in the literature concerning the maintenance of CVC for the prevention of catheter-related bloodstream infection (CRBSI) was used^{3,7-9}. The checklist considered 15 verification opportunities, including the identification of the professional category responsible for care. The completion was

performed by the researcher during the direct observation of the care practice, and the variables analyzed are presented in Chart 1.

Chart 1. Variables observed. Rio de Janeiro, RJ, Brazil, 2024

Variables	
1. Professional category: nurse or nursing technician	
2. Hand hygiene: before and after handling the catheter, with alcohol solution for 20 to 30 seconds or with water and soap for 40 to 60 seconds	
Administration of medication	3. Realization of scrub the hub: with mechanical friction molding, 5 to 15 seconds with 0.5% alcohol chlorhexidine or 70% alcohol before accessing the connectors and lateral ejectors
	4. Wait for the solution to dry after scrub the hub before administering medication
	5. Performing flushing: with a minimum volume equivalent to twice the internal lumen of the catheter plus the extension for flushing (considered as a volume of 10ml), using only syringes with a diameter of 10 ml or more
	6. Use of a new sterile connector after the previous one has been removed or use of a valve connector
Curative	7. No dirt at the time of observation
	8. Made in aseptic technique: with gloves and sterile gases
	9. Use of Personal Protection Equipment (PPE): cap, gloves and mask during handling
	10. Use of alcoholic chlorhexidine as antiseptic solution
	11. Unidirectional movements: from the canulation area towards the ends
	12. Drying of alcohol solution: the professional should wait for the solution to evaporate before handling the catheter
	13. Occlusion of the curing: sterile gas and adhesive tape or sterile semipermeable transparent cover covering the insertion site
	14. Curative observed within the expiry period: 24 hours for gaze and tape and every 7 days for transparent film, whole, with no moisture or dirt
	15. Dated the curative performed

Source: The authors (2024).

The metrics were "compliant", "non-compliant" and "not applicable", according to the manipulation of the catheter by the professional.

During the study, the CVC manipulation of each professional was evaluated through direct observation by the researcher and, immediately after the observation, the data collection form was filled in.

For each manipulation of the CVC, the conformity or non-compliance of the checklist items regarding good practices for catheter maintenance was observed. It was considered compliant when the professional adhered to all the items described in the literature necessary for that observed practice.

Minimizing the occurrence of performance biases was a concern in this study, as participants could modify their behavior by knowing they were being observed. To reduce this risk, the data collection took place a few months after the signing of the Ethics and Research Committee and the observation of the manipulation of the CVC was conducted in a discrete manner, keeping it at a distance that allowed the visualization without generating embarrassment or an explicit sense of evaluation.

The results obtained were transported to a Microsoft Excel® spreadsheet. Simple descriptive statistical analysis was performed, using the absolute and relative values for the variables of the checklist. The results were categorized using the SWOT matrix (Figure 1).

		Aspect	
		Positive	Negative
Internal	S Strengths		W Weaknesses
	O Opportunities		T Threats
External			

Figure 1. SWOT matrix. Rio de Janeiro. RJ, Brasil, 2024

Source: Mendes VR, Santos EM, Santos ICJ, Silva IR, Silva LS, Silva CSO (2016)⁵.

For the execution of this matrix, one must make a list of everything that is/is appropriate or not. Subsequently, separate the internal factors – which the units can directly control – and external ones – that are out of the control of the sectors ¹⁰.

Strengths are the factors that stand out, which facilitate the operation of the sector; weaknesses such as what can interfere with the process, issues that can only be manipulated directly. Opportunities and threats are the factors that the environment provides, which are completely out of the institution's control, but which should be monitored closely.

In this study, the actions that presented a percentage equal to or greater than 70% were considered to conform to the best practices of CVC maintenance. This parameter was defined based on the standards established by entities that assess the quality of care, such as the National Accreditation Organization (ONA), which accredits health institutions that meet or exceed 80% of the quality and safety standards; and the Brazilian Health Regulatory Agency (ANVISA), which classifies as high compliance the percentages between 67% and 100% ¹¹⁻¹².

The study was approved by the Ethics and Research Committee, taking into account the determinations of the Guidelines and Regulatory Standards involving Human

Beings established by Resolutions 466/2012¹³ and 510/2016¹⁴ of the National Council of Health, with opinion number 6653959.

RESULTS

Of the 69 professionals who agreed to participate in the survey, 34 (49%) were nurses and 35 (51%) were nursing technicians. The sample consisted of 110 observation opportunities, considering that the same professional could be observed in more than one occasion.

The applied instrument considered 15 variables related to good CVC maintenance practices. Regarding hand hygiene prior to catheter manipulation, adherence was observed in only 5.5% of the occasions. The scrub the hub before the administration of medications was performed in 38.1%, while the waiting for drying of the solution was recorded in only 5.5%. As for the flushing before and after the administration of drugs, the conformity was 65%, and the change of the sterile connector occurred in 34.6%.

Regarding the care of the curative, 100% adherence was observed both in the aseptic technique and in the absence of dirt. The alcoholic chlorhexidine was used in 58.8% of the curative exchanges, the unidirectional movements were present in 76.4%, and the waiting for drying of the alcoholic solution before occlusion was observed in 64.7%. The occlusion of the CVC osteo with appropriate material showed 100% adherence. In addition, PPE use was recorded in 88.2% of the times.

Finally, the validity of the curative was respected in 95.5% of the occasions, and the insertion of the completion date occurred in 88.2%. The consolidated results are shown in Table 1. According to the conformities and non-conformities found in practices, an analysis applied to the SWOT matrix, described in Chart 2, was carried out.

Table 1. Frequency of observations related to adherence to good practices. Rio de Janeiro, RJ, Brazil, 2024

Variables	Total observations	N	%
Hand hygiene before handling CVC	110	6	5.5
Performing scrub the hub before administration of medication	76	29	38.1
Waiting for solution to dry after scrub the hub	76	6	5.5
Performing flushing before and after medication administration	40	26	65
Change of sterile connector after administration of medication	29	9	34.6
Implementation of curative in aseptic technique	34	34	100
Curative without dirt	34	34	100
Use of PPE	34	30	88.2
Use of alcoholic chlorhexidine in curative performance	34	20	58.8
Unidirectional movements in the realization of curative	34	26	76.4
Waiting for the drying of the alcohol solution before CVC osteo occlusion	34	22	64.7
Occlusion of the osteo and CVC with appropriate material	34	34	100
Curative observed within the expiry period	110	105	95.5
Inserted the date of the curative	34	30	88.2

Source: The authors (2024).

Chart 2. SWOT analysis of cardiovascular units regarding CVC manipulation. Rio de Janeiro, RJ, Brazil, 2024

Forces	Weaknesses
Presence of residents, increasing human resources in plantations	Shortage of adequate technologies and inputs Low adherence to some practices, compromising infection prevention
Professionals with experience in cardiointensive	
Appropriate team dimensioning for each plant	
Constant monitoring in the curative exchange	
Use of aseptic techniques in the conduct of curative	
Effective Occlusion of CVCs	
Use of PPEs for professional safety and prevention in the risk of transmission of infections	
University Hospital, which allows updating practices by teachers, students and residents	
Opportunities	Threats
Use of new technologies such as valve connectors and protective lid with alcohol	Shortage of funds for technology investment
Adhering team to work improvement	
Training in Service	
Updating according to the best evidence	

Source: The authors (2024).

DISCUSSION

Most of the observed professionals did not perform hand hygiene, or did not perform properly. Corroborating with this research, observational studies conducted in adult ICUs showed an adherence rate of only 8% and 23.98% of hand hygiene¹⁵⁻¹⁶.

The authors reinforce that hand hygiene is the simplest and most effective practice to reduce and prevent health care-related infections (HCAIs), however, insufficient adherence among professionals remains the main factor in the spread of these infections¹⁷.

An integrative review consisting of 27 articles points out that the low adherence to this practice is not only due to theoretical ignorance of the act, but also to the lack of incentive, overload of tasks, misunderstanding of the risks and structural deficiencies of the institution¹⁸.

Regarding the administration of medication, a study that evaluated care in the maintenance of peripheral catheters also obtained a high incidence of disconformity in disinfection of the connections, with only 10% of the observed practices in conformity¹⁹. Another study, conducted in times of COVID-19, demonstrated 46% adherence of the scrub the hub by the team¹⁵.

It is highlighted that disinfecting the connections before each manipulation using alcohol solution with mechanical friction for 5 to 15 seconds is effective in reducing intraluminal contamination and in preventing PBI. In addition, it is essential to respect the drying time of the solution, which is 5 seconds for alcohol and 20 seconds for alcoholic chlorhexidine⁸.

Additionally, the adhesion of the connector switch is critical to preventing infections and reducing the colonization of microorganisms, minimizing the risk of infections associated with the catheter²⁰. However, low adherence to this practice was observed in this study, becoming a weakness. This fact may have occurred due to a lack of sterile connector in the units observed.

Unlike what was found in this study, a study conducted in a teaching hospital located in Curitiba demonstrated 67% conformity for the sterile connector replacement after manipulation²¹.

It is emphasized that safe practice recommends replacing any single-use and sterile device with another of the same specification, as is the case with these connection occlusors, which once removed, should be discarded^{7,22}.

Regarding the conduct of flushing before and after administration of medication, studies present variation of practices and non-adherence of professionals in its implementation²³⁻²⁴.

Research that sought to understand the *flushing* procedure in nursing practices showed that 84.2% of nurses referred to performing it, but with different techniques. Despite this, there were inconsistencies in the washing solution, volume and size of the syringe²⁵.

Despite the lack of consensus on the best technique of flushing (continuous or pulsatile flow), its realization reduces the risk of thrombosis and precipitates, preventing catheter obstruction, which interrupts intravenous therapy and increases the risk of infection, since coagulated blood can serve as a conducive medium for the growth of microorganisms²⁶.

Regarding the implementation of the treatment, the results of this study are consistent with research conducted in a University Hospital in Fortaleza, which demonstrated the use of PPEs by nurses during the procedure, as well as the totality of the practice performed in the aseptic technique and the use of the recommended coverage. However, only 50% identified the curative²⁷.

Similarly, another study is similar to identifying the use of 0.5% alcoholic chlorhexidine for catheter osteo antiseptic in 86% of the observations. However, only 44% performed unidirectional movement and 20% waited for spontaneous drying, contrary to what was found in the current study¹⁵.

It should be noted that chlorhexidine is a germicidal with immediate action and prolonged residual effect, presenting low toxicity and poor absorption by the entire skin. When combined with alcohol, this action is intensified, making the alcoholic solution more effective. For this reason, it is recommended to use alcoholic chlorhexidine for curing CVC²⁸.

In addition, the literature also guides the use of PPE in the manipulation of CVC and the use of appropriate coverage as a strategy for BSI prevention. However, the delay in the exchange of coverage that loses its integrity or validity is associated with an increase in this infection^{29,3}.

There was low adherence to several practices essential for the prevention of CRBSI. In this context, the SWOT matrix is configured as a relevant tool to identify strengths, weaknesses, opportunities and institutional threats related to the subject, by allowing

a strategic analysis of the environments, in addition to offering subsidy for decision-making³⁰.

Among the limitations of the study are the use of a convenience sample, which may compromise the representativity of the results; in addition to the low availability of sterile connectors, a limitation of an institutional nature that may have influenced the results related to CVC maintenance practices.

CONCLUSION

The study made it possible to know the care of the nursing team related to the maintenance of CVC in the cardiovascular units. The analysis demonstrated that the team adheres to some recommended practices, such as performing curatives with aseptic technique and proper catheter occlusion – which were categorized as strengths. In contrast, low adherence was identified in practices such as hand hygiene and *hub* disinfection, indicating the need for improvements in preventive care.

The SWOT analysis allowed us to identify aspects that need to be evaluated and worked to reach compliance at vulnerability points. The presence of a qualified staff and the use of some safety practices strengthen assistance, but institutional and economic factors limit the adoption of essential practices to prevent infections.

It is suggested for further studies to conduct qualitative analysis to understand the reason for non-conformities in practices, especially hand hygiene and scrub the hub.

The study contributes to the possibility of improving the care practice, improving the aspects that need adjustments and strengthening those that already show good adherence. These actions directly impact patient safety, the quality of care and the reduction of complications related to venous access, as well as the reduction of hospital costs and hospitalization time.

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