

Evaluation of practices for the prevention and control of bloodstream infections in a government hospital*

AVALIAÇÃO DAS PRÁTICAS DE PREVENÇÃO E CONTROLE DE INFECÇÃO DA CORRENTE SANGUÍNEA EM UM HOSPITAL GOVERNAMENTAL

EVALUACIÓN DE LAS PRÁCTICAS DE PREVENCIÓN Y CONTROL DE INFECCIÓN DE LA CORRIENTE SANGUÍNEA EN UN HOSPITAL ESTATAL

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ABSTRACT

The aim of this study was to observe clinical procedures in order to evaluate the practices used for the control and prevention of bloodstream infections associated with short-term central venous catheters (BSI-ACVC). The study data came from 5877 assessments distributed among selected practices. The results revealed the following adherence rates among the practices selected: 91.6% for recording the indication and permanence time of the CVC, 51.5% for adhering to the care and maintenance of the dressing at the CVC insertion site and its devices, 10.7% for hand hygiene practices while performing procedures related to the CVC, and 0.0% for the practices related to the insertion of the central venous catheter (CVC). The results demonstrate the need for further elaboration of strategies that ensure sustainable compliance practices for prevention and control BSI-ACVC in the institution being assessed.

DESCRIPTORS

Catheters
Catheter-related infections
Cross infection

RESUMO

O objetivo deste estudo foi avaliar as práticas de prevenção e controle de infecção da corrente sanguínea associada ao cateter venoso central (ICS-ACVC) de curta permanência, por meio da aplicação de indicadores clínicos processuais. A amostra foi constituída por 5.877 avaliações distribuídas entre as práticas selecionadas. Obteve-se ampla variação de conformidade: 91,6% – registro de indicação e tempo de permanência do CVC; 51,5% – cuidados e manutenção do curativo da inserção do CVC e seus dispositivos; 10,7% – higienização das mãos na realização de procedimentos de cuidado e manutenção do CVC; 0,0% – inserção do cateter venoso central (CVC). Os resultados demonstram necessidade de elaboração de novas estratégias que assegurem conformidade duradoura para a maioria das práticas de prevenção e controle de ICS-ACVC avaliadas. Conclui-se pela vantagem na aplicação de avaliação processual, pela possibilidade de não somente identificar seus índices de conformidade em relação à melhor prática esperada, como também favorecer, sobremaneira, reconhecimento das situações específicas que contribuíram para os valores encontrados.

DESCRITORES

Cateteres
Infecções relacionadas a cateter
Infecção hospitalar

RESUMEN

El objetivo de este estudio fue evaluar las prácticas de control y prevención de la infección del torrente sanguíneo asociadas a catéter venoso central (ITS-ACVC) estancia de corta duración a través de la aplicación de los procedimientos clínicos. La muestra consistió en 5.877 cuotas distribuidas entre las prácticas seleccionadas. Los resultados mostraron que la conformidad de las prácticas seleccionadas fueron: 0,0% para práctica de la inserción del catéter venoso central (CVC), el 91,6% para la declaración de registro y permanencia de la catéter venoso central CVC, el 51,5% de adhesión al cuidado y mantenimiento la preparación de la inserción del CVC y sus dispositivos, el 10,7% en la práctica de higienización de manos en la realización de procedimientos para el cuidado y mantenimiento de la CVC seleccionado. Los resultados demuestran la necesidad de una mayor elaboración de estrategias que aseguren el cumplimiento de las prácticas sostenibles de prevención y control ITS-ACVC en la institución que se evalúa, la mayor parte de las prácticas.

DESCRIPTORES

Catéteres
Infecciones relacionadas con catéteres
Infección hospitalaria

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INTRODUCTION

Infections related to health care (IrHC) are still frequent complications in hospitalized patients. Bloodstream infections, one type of these infections, are commonly caused by intravascular devices, especially central venous catheters (CVC) for short stays. In the Intensive Care Unit (ICU), infection rates may be even higher. Because the CVC is retained longer, the patient has a greater chance of colonization, and CVCs are manipulated several times a day to administer fluids, total parenteral nutrition (TPN), drugs and blood products⁽¹⁾. There are effective measures for controlling and preventing BSI-ACVC that are recommended in international guidelines⁽¹⁾. The major question, however, is whether these measures are taken.

There is a broad consensus that the current process of epidemiological surveillance that dominates the control and prevention of IrHC, which focuses on acting retrospectively after events have occurred, is not enough to assess the quality of control and prevention practices⁽²⁾. Moreover, the information obtained about infection rates must be compared with reference data to stimulate greater infection control and effective interventions⁽³⁾.

Certain strategies have been used to implement adherence to IrHC prevention and control practices. One strategy is to introduce *bundles* of evidence-based best practices, combining a number of efforts by simultaneously executing several specific procedures⁽⁴⁾. Training and continuing education programs are also used. Though these interventions are significant, there are limited opportunities to adapt these strategies for the existing conditions where care is being delivered.

The question of care procedures qualification is a current demand in health care in general and, more recently, in IrHC. In 2005, the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the United States, under the consensus of the most important institutions involved in IrHC management (the Centers for Disease Control and Prevention, the Association of Professionals in Infection Control and Epidemiology, the Council of State and Territorial Epidemiologists, the Society for Healthcare Epidemiology of America, and the Association of Practitioners in Infection Control, among others), urged IrHC management programs to begin to work with evaluation systems that track the results of care, not hospital infections (HI) alone⁽⁵⁾.

One response has been the development of procedural or performance evaluations that include communication, accessibility, education, investigations, prescriptions, clinical interventions and other factors. In quality control interventions, the evaluation focuses on procedural aspects of

care, including timeliness, effectiveness and efficiency, adequacy, complications, and other factors. Thus, they focus more on the dynamic processes than on the results, allowing evaluators to analyze what, who, which, how and why⁽⁶⁾. In other words, the evaluation addresses the type of procedure, the professional who performs it, the resources that are used, how it is performed and the situations that determine its need. Thus, the procedural evaluation is a critical evaluation of quality that produces a sensitive measure of the quality of care by focusing on the factors that can contribute directly to improving results.

Seeking to meet the demand for evaluation systems related to controlling and preventing IrHC, a public policy project financed by the Foundation for Research Support of the State of São Paulo (FAPESP), based in the School of Nursing/USP and conducted in partnership with the Hospital Infection Division of the Epidemiological Surveillance Center of the Health Department of the São Paulo State was completed between 2003 and 2006. The project resulted in the Evaluation of the Quality of Control Practices for Hospital Infections Handbook, which was composed of 59 validated clinical evaluation indicators, predominantly addressing procedural items⁽⁷⁾.

...the current process of epidemiological surveillance that dominates the control and prevention of IrHC, (...), is not enough to assess the quality of control and prevention practices.

This study aims to evaluate the compliance with BSI-ACVC control and prevention practices by applying a group of process indicators from the handbook that are specifically related to the risk of BSI-ACVC.

Although the effective methods for controlling and preventing BSI-ACVC have been well established, the reality points to the need for research. In practice, the evidence demonstrates unsatisfactory levels of performance by health professionals. Thus, these indicators were constructed with the intent not only to develop a standardized measure of adherence to recommended practices but also to identify concrete issues that are interfering with best practices. These results can then contribute to interventions that lead to specific improvements.

METHODS

This was a cross-sectional observational study that evaluated adherence to the following best practices for the prevention and control of BSI-ACVC⁽¹⁾: 1) Appropriate insertion procedures for a short-term central venous catheter (i.e., percutaneous insertion, complete surgical scrub, expanded sterile field, use of antiseptic solution of vehicle alcoholic to prepare the patient's skin, occlusive dressing after catheter insertion, 2) Daily record of the indication for the CVC and the permanence time, 3) Adherence to care and maintenance dressing in the insertion of CVC and their associated devices (i.e., recording dressing changes on the CVC insertion, changing dressing with the

frequency recommended by the institution, disinfecting hubs and connectors with alcoholic chlorhexidine 0.5% before handling, exchanging infusion sets and transducers as recommended by the institution), 4) Adherence to recommended hand hygiene in situations related to vascular lines (i.e., during the exchange of the infusion system, medication administration, exchange and wound dressing and blood collection).

For the evaluation, we used procedural indicators that were previously constructed and validated. The indicators are available in the Evaluation of the Quality of Control Practices for Hospital Infections Handbook⁽⁷⁾, which includes operationalized constructs and allows users to establish levels of compliance with expected best practices. The construction of the evaluation allows evaluators to measure both general conformity and conformity with each practice component. General adherence is attained only when ALL of the components of each practice have been performed as expected for the SAME patient. In the case of hand hygiene, compliance was achieved when the professional sanitized his or her hands before and after a procedure using water and antiseptic soap or alcohol-based gel; the professional was considered non-compliant if he or she did not sanitize his or her hands or only sanitized hands before or after the procedure.

The casuistry offered opportunities to evaluate selected practices performed by physicians, nurses and auxiliary technicians on adult patients undergoing cardiothoracic surgery who were admitted to the surgical intensive care unit (S-ICU) in the surgical center of a public teaching hospital that specialized in cardiovascular diseases and had a CVC inserted. The definition of the sample began by assuming an ideal adherence of 80% (defined on the basis of evaluation studies of nursing procedures and practices for prevention and control of hospital infections⁽⁸⁻⁹⁾) using a one-tailed Rosner's test⁽¹⁰⁾. The sample was distributed between shifts in the morning, afternoon and evening for a total of 5877 assessments.

Accordingly to the guidelines of the indicators for these selected practices, evaluations were conducted mainly by direct observation (DO). Some were conducted by checking patients' records from August to December 2010 after receiving approval from the Ethics Committee for the Analysis of Research Projects of the Clinic Hospital of the Faculty of Medicine, University of São Paulo (CAPPesq/HCFMUSP) (protocol nº 0382/10). All of the professionals involved in the study were informed about the study and signed an informed consent form (ICF).

The instruments were pre-tested for accuracy. To measure accuracy, we calculated the intra-class correlation coefficient (ICC) and the Kappa statistic (k), which is used to evaluate the intensity of simultaneous agreement between two or more raters based on the number of

concordant responses on a single instrument or between the ratings of one observer using the same instrument at different times⁽¹¹⁾. In the test for this study, the same instruments were administered by two nurses who were previously trained to identify only the selected catheters and practices, register the information obtained about the practices conducted by health professionals in evaluation spreadsheets, not interfere with the practices and perform the evaluation discreetly. Based on a significance level of 5%, 80% power, the expected proportion of 80%, the expected proportion of agreement of 70% and the proportion of alternative concordance of 70%, the required sample size for each component of the four indicators observed was 108 observations for each evaluator. The results ranged from substantial to perfect agreement, and there was statistically significant agreement between the evaluators for all components evaluated ($p < 0.05$). After the validation of the instruments, the rest of the observations for the total sample were conducted by only one evaluator.

The evaluations were analyzed quantitatively, using absolute numbers and percentages, and the results are presented in tables and charts. To calculate the adherence rates of selected practices, we used the numerators and denominators recommended in the formulas that provide the operational definitions of these indicators. The denominators represent the total number of evaluated practices, and the numerators represent the total number of evaluated practices that were performed correctly. When pertinent, correlations between adherence and professional categories, work shifts and reasons for non-conformity were calculated using the Chi-square test. When this test could not be applied because the expected frequencies were less than five, the Likelihood Ratio Test (or in the case of a 2x2 table, Fisher's exact test) was used. The significance level was set at 5.0% ($p < 0.05$) for this analysis.

RESULTS

A total of 5877 evaluations were conducted, distributed among practices in the following proportions: 166 (2.8%) on the CVC indication and permanence records, 415 (7.1%) on the insertions of the CVC; 1986 (33.8%) on the care and maintenance of dressing of the CVC and its devices; 3310 (56.3%) hand sanitizations for selected procedures. The adherence rates and pertinent associations are described in the following sections.

The insertion of short-term CVC (Figure 1), conducted by the medical team in the surgery room, showed null general conformity (0.0%) because all cases involved non-adherence to one of its components: the absence of occlusive dressing after the insertion of the CVC. However, all other components reached full conformity (100%).

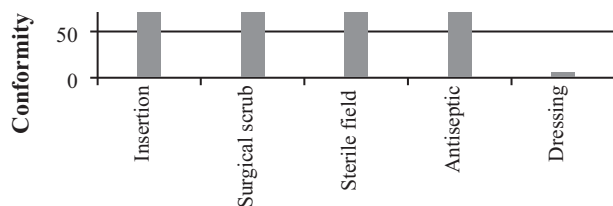


Figure 1 – Conformity with guidelines on the practice of inserting a short-term central venous catheter - São Paulo, 2010

In the evaluation of *recording the indication and permanence time of the short-term CVC* (Figure 2), the results indicated high adherence among the professionals.

It was not possible to calculate statistical correlations for these practices because they occur only once a day and are conducted by the same type of professional (i.e., physicians conduct insertions and record CVC indications, and nurses record the permanence time of CVC).

Overall adherence to the recommendation to provide *care and maintenance for the dressing of short-term CVC and its associated devices in conformity with the institution* was 51.5%. Each component of this indicator for each shift of work is shown in Table 1.

It appears that the general conformity score (below 80%) for this practice was principally due to the sanitization of hubs and connectors scores (below 40.0%) in all shifts. The scores for changing the infusion set and transducers and the frequency of dressing changes reached high levels of conformity (100.0% and 99.7%, respectively).

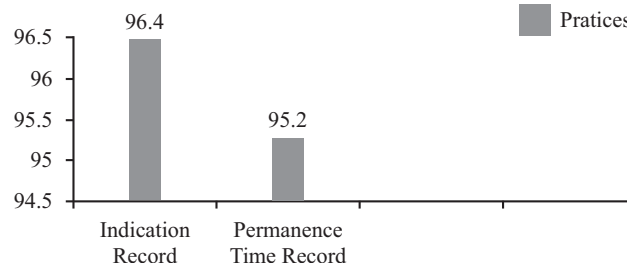


Figure 2 – Conformity with guidelines of recording the indication and permanence time of short-term central venous catheters - São Paulo, 2010.

Overall conformity with the practice of *hand sanitizing in selected procedures* was 10.7%, the lowest score among all the practices evaluated. Each component evaluated separately also had low adherence. Hand hygiene while changing and applying dressings had the highest conformity scores (21.1%), while the lowest scores were related to changing the infusion system (8.9%). Regarding work shifts, the greatest conformity was found in the morning (12.8%) and the lowest in the evening (8.4%); the difference between the shifts was significant, with $p < 0.05$. On all shifts, auxiliary nurses and nursing technicians were the most commonly observed professionals. These professionals also conducted the majority of the infusion system changes (67.0%), blood collection (69.0%) and drug administration (68.0%). However, nurses performed 97.3% of the dressing changes and applications, possibly due to the unit routine. The high frequency of procedures performed by auxiliary nurses and nursing technicians is to be expected because these professionals are the most numerous in the hospital (Table 2).

Table 1 - Conformity and non-conformity with the practice components included in the care and maintenance of short-term central venous catheter dressing and its devices, according to the work shift - São Paulo, 2010

Shift/Components	Conform		Did Not Conform		Total	
	N	%	n	%	N	%
Morning						
1. Dressing Changes Registered	--	--	--	--	--	--
2. Periodicity of Dressing changes	--	--	--	--	--	--
3. Hubs and connectors disinfected	128	38.7	203	61.3	331	100.0
4. Infusion set and transducers changed	331	100.0	0	0.0	331	100.0
Subtotal	459	69.3	203	30.7	662	100.0
Afternoon						
1. Dressing changes registered	--	--	--	--	--	--
2. Periodicity of Dressing changes	--	--	--	--	--	--
3. Hubs and connectors disinfected	103	31.1	228	68.9	331	100.0
4. Infusion set and transducers changed	--	--	--	--	--	--
Subtotal	103	31.1	228	68.9	331	100.0
Night						
1. Dressing changes registered	252	76.1	79	23.9	331	100.0
2. Periodicity of Dressing changes	330	99.7	1	0.3	331	100.0
3. Hubs and connectors disinfected	41	12.4	290	87.6	331	100.0
4. Infusion set and transducers changed	--	--	--	--	--	--
Subtotal	623	62.7	370	37.3	993	100.0
Total	1185	59.7	801	40.3	1986	100.0

*The infusion set and transducers were routinely changed in the morning, and the recording and frequency of dressing changes were routinely completed at night.

Table 2 - Conformity and non-conformity with hand sanitization practices according to professional category and selected procedures - São Paulo, 2010

Procedure	Professional Category				Total	P	
	Nurses		Auxiliary nurses and nursing technicians				
	n	%	n	%			
Infusion System Changes							
Yes	59	18.0	29	4.4	88	8.9	0.000 ^a
No	269	82.0	636	95.6	905	91.1	0.000 ^a
Total	328	100.0	665	100.0	993	100.0	
Blood collection							
Yes	66	21.4	35	5.1	101	10.2	0.000 ^a
No	242	78.6	650	94.9	892	89.8	0.000 ^a
Total	308	100.0	685	100.0	993	100.0	
Drugs Administration							
Yes	65	20.4	30	4.4	95	9.6	0.000 ^a
No	253	79.6	645	95.6	898	90.4	0.000 ^a
Total	318	100.0	675	100.0	993	100.0	
Changing dressings and applying dressings							
Yes	70	21.7	0	0.0	70	21.1	0.213 ^c
No	252	78.3	9	100.0	261	78.9	0.213 ^c
Total	322	100.0	9	100.0	331	100.0	

Table 2 also reveals that the rate of non-conformity with recommended hand sanitization practices was high among nurses (78.3% to 82.0%) but higher among auxiliary nurses and nurse technicians (94.9% to 100.0%) on all shifts, with a statistically significant difference between the teams ($P < 0.05$) for most practices.

The most frequent cause of non-conformity with hand sanitization recommendations was that the procedure was not carried out at all: this occurred during infusion system changes (65.2%), blood collection (62.6%), and drug administration (65.6%). For all of these practices, there were statistically significant differences between the professional categories ($p < 0.05$). During dressing changes and applications, the main cause of non-conformity was that professionals only practiced hand sanitization before the procedure (40.2%), and there was a statistically significant difference between the professional categories ($p < 0.05$).

DISCUSSION

Currently, there is substantial scientific evidence, clinical guidelines and government regulations that ground the recommendations for preventing and controlling IrHC. Although they are not sufficient to eradicate the problem, they can help recognize how and when it occurs and thereby generate improvements in clinical practice^(1,4,7). However, achieving high adherence rates has been a constant issue.

The procedural indicators measured in this study favored greatly the recognition of conformity of this

adherence. DO, which was used in most of the reviews, has several disadvantages, including the *Hawthorne* effect⁽¹²⁾, the training needed for evaluators, the required testing of concordance between evaluators, and the substantial time and cost. Nonetheless, it is considered the *gold standard* for monitoring care practices and is the practice most often used to evaluate hand sanitization practices⁽¹³⁾. It also has the advantage of allowing the analysis of the immediate conditions that favor or disfavor conformity; it can distinguish between the professional categories and the procedures involved, recognize the needs of each individual, and identify specific training needed for better adherence⁽¹³⁾.

According to the results, only the recording of the *indication and permanence of the short-term central venous catheter* reached the expected conformity of 80% in this study (91.6%). The recording of the permanence time of the CVC is important because these data allow health professionals to evaluate withdrawal or replacement needs. According to the literature, replacing the CVC at regular time intervals has not been an effective method for reducing the rates of BSI-ACVC, but if it is left for longer than 1-2 weeks, the rate of CVC-associated infection increases⁽¹⁴⁾.

The practice with the lowest conformity was the *insertion of CVC* (null conformity) because dressing the CVC insertion site did not occur in any of the evaluations. However, in the surgery center where this indicator was evaluated, CVC insertion is carried out with fully aseptic technique in a clean environment, and the catheter insertion is protected by the sterile field throughout the surgical procedure. Furthermore, the presence of a conventional

dressing (sterile gauze and adhesive tape) could invade the surgical field or become wet during surgery, further increasing the chances of colonization at the site of CVC insertion. One solution to this problem would be to use waterproof dressings (which can be used at this time), improving the quality of CVC insertion and contributing to the prevention and control of BSI-ACVC.

Care and maintenance of the short-term CVC curative and their devices achieved the highest overall conformity (51.5%), but the rate was below the level considered ideal (80%). This practice is extremely important because it prevents gateways to colonization by micro-organisms after CVC insertion. Only the changing of the infusion set and transducers and the periodicity of dressing achieved complete or nearly complete conformity (100.0% and 99.7%, respectively). The worst performance was observed for the disinfection of hubs and connectors (down 40.0%) on all shifts.

Infusion sets and transducers are responsible for maintaining the permeability of the monitoring system of central venous pressure (CVP) and infusing drugs, TPN, and blood products. The contamination of these systems is significantly reduced when the transducers are exchanged every 96 hours at maximum and the infusion set is exchanged every 24 to 76 hours, depending on its use^(1,15).

Institutional guidelines about the periodicity of dressing changes vary with the type of dressing. When performed with sterile gauze and adhesive tape, dressings must be changed every 24 hours; in the case of transparent film, dressings are changed every 7 days⁽¹⁵⁾. Transparent film, when applied correctly, allows continuous visual inspection of the CVC insertion site and demands less frequent changings than conventional gauze dressings⁽¹⁾.

In our study, we noted that the professionals exchanged dressings according to the institutional recommendation, therefore respecting the implementation stage of the Systematization of Nursing Care (SNC), which includes actions or interventions determined in the planning stage; however, this procedure was not registered in the medical record.

Disinfecting the hub before handling the CVC is relevant in the prevention of BSI. Alcoholic chlorhexidine 0.5% is the product of choice because various studies have shown that it is more efficient than other antiseptic of alcoholic vehicle^(1,4,16).

After the practices related to the insertion of the CVC, the conformity with hand-washing practices (HW) was the lowest (10.7%). The impact of HW on the occurrence of IrHC has been extensively studied, and evaluations of infection outbreaks have shown the importance of the cross-transmission of micro-organisms⁽¹⁷⁾. Although there is strong evidence of the reduction of transmission of micro-organisms and reduction of the incidence of IrHC, professionals still maintain a passive

attitude towards this public health problem⁽¹⁶⁾. It is a universal issue. According to the literature, there is great variability in HW adherence, with some rates even lower than those found in our investigation.

One study⁽¹⁷⁾ on HW practices as they relate to the prevention and control of ventilator-associated pneumonia (VAP) included 684 observations in an adult ICU and obtained exactly the same results that we obtained (10.7%). Another study⁽¹⁸⁾ that evaluated 1619 HW opportunities before and after procedures in two ICUs found inferior results (5%). Adherence to HW in an ICU, determined through DO of HW duration, methods, technique and use of gloves, found only 12.9% adherence⁽¹⁹⁾.

Only one study found high HW adherence and counteracts the low levels found in most other studies⁽²⁰⁾. This study evaluated the duration of HW and some aspects of the HW technique (using soap, using paper towels and the presence of jewelry) before and after 1035 procedures performed in inpatient units and four ICUs, and the researchers found an overall conformity rate of 76%. It was unclear, however, whether this general index considered HW both before and after the procedures.

In the absence of blood or body fluids on hands, using alcohol-based gel for HW is a good option because it is convenient, works rapidly to reduce the microbial count on the skin and causes less skin irritation. Other advantages include its immediate effectiveness, the lack of the need for a sink, the convenience of having it available near each patient, and the speed of using gel when there is not enough time for HW^(1,4). One study⁽⁹⁾ demonstrated that the use of alcohol-based gel improved the rate of HW from 48% (performed with soap and water) to 66% (with alcohol gel), and this improvement was associated with a significant decrease in the IrHC rate from 16,9% to 9.9%.

Multidisciplinary educational programs and comprehensive protocols can effectively reduce IrHC rates⁽²¹⁾. However, the World Health Organization states that educational programs aimed at HW as the only means of preventing hospital infections are usually not sustainable⁽¹⁵⁾. HW practices are influenced only in the short term, and thus, education programs should cover other preventive strategies⁽¹³⁾.

We would add that this is also due to the difficulty of creating generic solutions without analyzing the realities of specific situations that hinder adherence to care practices. Not applying dressings during a CVC insertion that is performed during surgery is an example found in the present study. Another example is the non-conformity with the disinfection of hubs and connectors; the failure to disinfect the devices before manipulating the catheter and the failure to use 70% alcohol for disinfection reveal the routine failures of the institution. Non-compliance with CVC dressing guidelines was due to the lack of a procedural description, but the dressings were changed in

alignment with the recommendations of the institution. Non-conformity with guidelines about dressing changes occurred because transparent film dressings were left for more than 7 days, beyond the time period recommended by the institution. In the case of HW, beyond the differences in conformity between the procedures, the most frequent cause of non-conformity was that it was not performed at any time, following up only after. In other words, HW was performed more frequently before the procedure than after the procedure. The differences observed between professional categories and work shifts at various times are significant, and they also represent specific situations.

CONCLUSION

In this study on conformity with control and prevention practices for BSI-ACVC, the rates obtained varied widely among the practices evaluated. We obtained the following adherence rates: 91.6% for registering the indication and permanence time of the CVC, 51.5% for the care and maintenance of CVC insertion dressings and associated devices, 10.7% for hand sanitization during procedures related to the CVC and 0.0% for insertion practices related to the central venous catheter (CVC). The results demonstrate the need to develop new strategies that ensure lasting compliance with these practices in the evaluated institution.

Conducting a procedural evaluation predominantly using a DO technique can be considered a great advantage because DO offers an opportunity not only to identify the levels of conformity with best practices but also to observe specific situations that contribute to the results. Even if the low conformity results from the literature can

be generalized to other institutions, the causes of low conformity cannot be the same in every situation.

One possible limitation of this study is that the Ethics Committee for the Analysis of Research Projects in the hospital where the study was conducted requested that the patients and health professionals involved provide informed consent. Although they were not informed which procedures were being evaluated, it led us to question whether the compliance rates would have been lower if they had not known about the evaluation.

However, it was possible to identify relevant factors to explain the adherence or non-adherence with the prevention and control practices for BSI-ACVC. Even when consensus standards have been established, they are not always followed or performed correctly.

Thus, the results do not refute the relevance of continuing educational interventions. However, when interventions are supported by a system of procedural evaluation, they certainly will be able to drive their efforts in a way that is more directly tailored to the circumstances in each environment. On the other hand, if procedural evaluations alone do not have direct results on the quality of care - and in this specific case, reduce BSI-ACVC rates - they are fundamental instruments that can offer initial diagnoses, identify necessary actions and correlate them with outcomes if the evaluation is applied repeatedly.

This research will contribute to further discussions about health care practice and to the creation of educational strategies aimed at improving the quality of care. In the case of this study, this can occur directly through better adherence to BSI-ACVC practices and indirectly through reductions in its occurrence.

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