



Preventive measures of infection related to peripheral venous catheter: adherence in intensive care

Medidas preventivas de infecção relacionada ao cateter venoso periférico: adesão em terapia intensiva

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Objective: to analyze the adherence of nursing professionals to preventive measures of infection by peripheral venous catheter. **Methods:** a cross-sectional study carried out in an adult intensive care unit with 47 nursing professionals. **Results:** statistically relevant measures for adherence to infection prevention were identified, such as double checking of drugs, verification of medication prior to administration, certification of allergy in patients prior to administration, separation of material prior to procedure, length of stay of the catheter for less than 72 hours, fixation exchange in 24 hours, actions related to the handling of the injection ports and connectors, and access salinization after administering solutions through the catheter. These measures were not yet fully added in the professional routines of the research subjects, despite professionals had stated they knew them (97.9%) and that the measures contributed to preventive actions (100.0%). **Conclusion:** the investigated nursing professionals showed low adherence to the preventive measures of infection in the peripheral venous catheters.

Descriptors: Catheter-Related Infections; Quality of Health Care; Cross Infection; Catheterization, Peripheral; Intensive Care Units.

Objetivo: analisar a adesão dos profissionais de enfermagem às medidas de prevenção de infecção por cateter venoso periférico. **Métodos:** estudo transversal, realizado em Unidade de Terapia Intensiva adulto, com 47 profissionais de enfermagem. **Resultados:** identificaram-se medidas estatisticamente relevantes para adesão à prevenção de infecções, como dupla checagem dos fármacos, verificação de medicamento antes de administrar, certificação de alergia em pacientes antes da administração, separação do material antes do procedimento, tempo de permanência do cateter inferior a 72 horas, troca da fixação em 24 horas, ações relacionadas ao manuseio das portas de injeção e conectores e salinização do acesso após administrar soluções pelo cateter. Verificou-se que essas medidas ainda não foram completamente adicionadas nas rotinas profissionais dos sujeitos da pesquisa, a despeito de terem afirmado conhecê-las (97,9%) e contribuir com ações preventivas (100,0%). **Conclusão:** os profissionais de enfermagem investigados apresentaram baixa adesão às medidas preventivas de infecção nos cateteres venosos periféricos.

Descritores: Infecções Relacionadas a Cateter; Qualidade da Assistência à Saúde; Infecção Hospitalar; Cateterismo Periférico; Unidades de Terapia Intensiva.

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Introduction

Peripheral venous punctures and the use of invasive devices are common practices in health care settings and present a high risk of health care-related infections that may prolong hospitalizations in Intensive Care Units within 20 days and in the wards, in 22 days⁽¹⁻²⁾.

According to the Centers for Disease Control and Prevention (CDC) and the Infusion Nurses Society (INS), millions of peripheral venous punctures are performed annually, and the use of peripheral venous catheters can lead to complications related to various risk factors. Thus, failures related to the maintenance of catheters can reach 69.0% of the cases, requiring a new process of venous punctures for insertion of a peripheral venous catheter in order to complete the therapy, which may result in health care-related infections⁽³⁻⁵⁾.

In a survey, researchers found that 70.0% of nosocomial infections are due to the use of the peripheral venous catheter; 30.0% of which could be prevented with standardized measures of care. In addition, the survey found an increase of 11.7% in the prevalence of infections in the use of catheter⁽⁶⁾.

Peripheral venous punctures aim at therapeutic (infusion of drugs and intravenous solutions) and diagnostic procedures (collection of biological material)⁽⁷⁻⁸⁾. Complications may be related to the use of a peripheral venous catheter, such as the origin of the drugs, the time of therapy, the characteristics of each patient, the professional's skills, the preparation of the puncture site, the type of catheter material, caliber, manipulation, and fixation of the venous catheter; in addition to local or systemic complications, resulting in increased hospitalization time and morbidity and mortality^(4,9-10).

Proper handling of catheters reduces the risk of infection. Therefore, it is recommended to use validated institutional protocols and the joint application of "bundles" of preventive measures aimed at reducing primary bloodstream infections⁽¹⁰⁾. The bundle rela-

ted to the peripheral venous catheter of measures of the National Agency of Sanitary Surveillance comprises five components: 1- hand hygiene; 2- maximum barrier precaution; 3- preparation of the skin with chlorhexidine gluconate; 4- selection of insertion site; and 5 - daily review of the need for catheter permanence⁽¹¹⁾.

However, reducing the incidence of complications related to this procedure and the occurrence of multiple/new punctures are obstacles for the nursing staff, which makes it difficult to improve the quality of care and patient safety⁽²⁾.

In view of the relevance of this problem, the objective was to analyze the adherence of nursing professionals to the measures of prevention of infection by peripheral venous catheter.

Methods

This cross-sectional study was carried out with 47 nursing professionals handling peripheral venous catheters in an adult intensive care unit of a public hospital in the interior of the state of São Paulo, Brazil.

Inclusion criteria were having a professional relationship with the health institution investigated, working directly to assist the users of the service, agreeing to participate in the study and signing the informed consent form. The exclusion criteria were workers who did not handle venous catheters (n=3) and those who were on leave (n=2), off or on vacation (n=10) at times of data collection.

To perform the data collection, the following instruments were used: a structured checklist for the evaluation of the practices of nursing professionals, created by the authors, based on the manuals of the National Health Surveillance Agency, in the guideline of the Centers for Disease Control and Prevention and in the practice standards in infusion therapy of Infusion Nurses Society, face-content validated by three area experts in order to ensure fidelity in reporting relevant information on infection prevention measures related to the peripheral venous catheter during

pre-puncture and post-puncture; and a sociodemographic questionnaire, to characterize the professionals of the study.

Data collection was performed in September, October, and November of 2018, in all work shifts at the Intensive Care Unit investigated, in two stages. In the first stage, the data were collected by convenience through systematic observation, in which nursing professionals were observed in more than one opportunity on the management of the peripheral venous catheter, such as puncture, medication administration, and maintenance of peripheral venous access. In the second stage, after completion of the observational data collection, the sociodemographic questionnaire was filled in by the nursing professionals who participated in the study, in order to characterize them, and it did not interfere in the first stage of the study.

The sociodemographic data were completed by each study participant. When for some reason they did not want to answer a specific question, they were instructed to put code 99 in the answer. Upon receiving the questionnaire answered, the researcher carefully checked whether the professional left no question unanswered and only one answer was scored for each question.

In incomplete cases, missing data was considered when the variable did not achieve a minimum of filling of 20.0% of the total, resulting in the exclusion of the results analysis. In this sense, the items of pre-puncture follow-up were excluded - justified by the low number of peripheral venous punctures observed. Therefore, the variables of the pre-puncture follow-up were not evaluated, but excluded from the analysis of this investigation. The variables were: performs double checking before the puncture; checks the need for puncture before executing; cleans the hands before the procedure; separates the material properly; applies tourniquet to the patient's limb correctly; selects the best puncture site starting with the back of the hand; prepares the place for performing the procedure, ensuring patient privacy; places personal protective equipment; opens materials using the correct

technique; positions the member at the puncture site; pats the vein before puncturing it; performs antiseptics with alcohol 70.0% or chlorhexidine 2.0%; type of antiseptic technique used; step-by-step puncture procedure; device gauge; location of the puncture; single puncture; reuses the device on the failure of the procedure. In the post-puncture follow-up, the following data were disregarded: reason for the exchange of fixation; length of stay of infusion pump device; identification of serum bottles.

The study participants were approached and had access to the data records only after the observation period to prevent the performance of actions other than that performed in the daily routine. When informed about the study, they were free to participate or not. The professionals agreed to participate, filled out the informed consent form and, subsequently, the sociodemographic information sheet.

For characterization of the sample and data representation, descriptive analysis was used, with absolute and relative frequency distribution measures for qualitative (categorical) variables, and measures of central tendency and dispersion for quantitative variables. The data were tabulated using the Microsoft Excel® program and the statistical analyzes through the Statistical Package for the Social Sciences, version 20.0. In order to verify the association of the variables with statistical significance, the non-parametric Chi-square test was adopted. For all variables, a significance level of 5% was adopted.

The project obtained authorization for development by the Certificate of Presentation for Ethical Appraisal nº 91172218,0,0000,5515 and opinion nº 2,848,911.

Results

To characterize the professionals participating in the study, Table 1 shows the sociodemographic information in absolute and relative frequency of qualitative variables.

Table 1 – Sociodemographic characteristics, absolute and relative frequency of qualitative variables (n=47)

Variable	n (%)
Sex	
Female	34 (72.3)
Male	13 (27.7)
Type of training	
Technical	26 (55.3)
Complete undergraduate degree	6 (12.8)
Incomplete undergraduate degree	6 (12.8)
Complete graduate degree	6 (12.8)
Incomplete graduate degree	3 (6.4)
Work shift	
Morning	10 (21.3)
Evening	11 (23.4)
Night	26 (55.3)
Believes to contribute to infection control actions	
Yes	47 (100.0)
No	-
Refers knowledge about infection measures	
Yes	46 (97.9)
No	1 (2.1)

In the sociodemographic characterization of the quantitative variables of the sample of professionals, the age ranged from 21 to 50 years (mean of 31.3), the training time ranged from one month to 18.8 years (mean of 7.5), the time of work in the training area ranged from one month to 18.8 years (mean of 6.4), the working time in the current institution ranged from one month to 21 years (mean of 5.2), and the time of work in the Intensive Care Unit ranged from one month to 18.1 years (mean 4.3).

The actions of peripheral venous catheterization were verified. Since the study was performed in an Intensive Care Unit with few opportunities for venipuncture, ten preventive measures of infection in pre-puncture follow-up were observed.

There was no professional adherence to post-puncture measurements: patient identification through double checking; verification of whether or not the patient has allergy before administering the drug; separation of material properly; performing

disinfection of cap and side injector prior to administering medications; and carrying out exchange of old cover with a new one. Thus, Table 2 lists the adherence of the professionals studied to the infection prevention measures, related to the post-puncture follow-up of the peripheral venous catheter, with the respective p-values.

Table 2 – Adherence to infection prevention measures related to post-puncture in the Intensive Care Unit investigated - absolute frequency and probability of significance - p (n=235)

Variable	n observed	p
Performs patient identification through double checking		
Yes	30	<0.001
No	205	
Checks the type of medication before administration		
Yes	161	<0.001
No	74	
Certifies that patient has no allergy before administering the drug		
Yes	12	
No	223	<0.001
Hygienizes the hands before the procedure		
Yes	206	<0.001
No	29	
Separates the material appropriately		
Yes	1	<0.001
No	234	
Length of stay of the peripheral venous catheter (hours)*		
<72	24	0.005
>72	8	
Exchange of fixation (hours)*		
<24	24	
>24	11	0.028
Performs disinfection of cap and side injector prior to administering medications		
Yes	7	<0.001
No	228	
Protects device cover for later reuse*		
Yes	176	<0.001
No	58	
Replaces old cover with new one*		
Yes	58	<0.001
No	176	
Performs catheter washing with 0.9% sodium chloride after administering medications*		
Yes	176	<0.001
No	58	
Length of stay of macro and micro device (hours)*		
<96	60	<0.001
>96	1	

*Variables with n <235 - execution of the action not observed with clarity

Discussion

A limitation of this study is the lack of data related to the pre-puncture period due to the few opportunities for peripheral punctures in the Intensive Care Unit environment. This is due to the fact that the vast majority of patients use a central venous catheter, making it difficult to generalize data obtained. However, studies such as these are relevant for assessing the degree of professional adherence to actions that minimize risks and point out areas of knowledge that must be addressed by institutional management vis-à-vis employees, in favor of improving the quality of care.

The results that obtained statistical significance as effective measures for prevention of infection related to the peripheral venous catheter in the Intensive Care Unit studied are described in the literature and are widely discussed in the bundles⁽¹¹⁾. However, these measures have not yet been fully incorporated in the professional routines of the research subjects, a situation that weakens the care, as it allows higher rates of infection⁽²⁾.

Double checking is a strategy developed to guarantee safety in medication administration and avoid errors, consisting of the conference of a procedure twice, by the same professional, at different times, or by two professionals. The performance of this procedure can be influenced by several situations, due to the difficulties present in the daily activities of professionals, such as the reduced number of the nursing staff⁽¹²⁾.

This situation undermines the effective implementation of this strategy. The nurse, with multiple skills and tasks, must strictly supervise the preparation and administration of medications, ensuring action and interruption before the failure. However, nurses often are not able to meet the demand of the team. This, the low frequency with which double checking was performed in the procedures of this study was notorious, making the assistance susceptible to errors.

In the literature, this strategy is effective in reducing the incidence of adverse events⁽¹²⁻¹³⁾.

The Regional Nursing Council of São Paulo and the Brazilian Network of Nursing and Patient Safety have published the most frequent types of errors related to drug administration in the health services: wrong medication and wrong patient. This reality was not found in the present study, however, drugs could have been erroneously administered because of the lack of double checking⁽¹³⁾.

In 2017, the World Health Organization (WHO) launched the “Global Patient Safety Challenge,” with the aim of verifying areas of significant risk for patient safety. Thus, recognizing the high risk of harm associated with drug use, the WHO proposed the third Global Patient Safety Challenge, with the theme “Harmless Medication”, aiming to reduce serious and preventable drug-related harm by 50.0% by developing safer and more efficient systems in the medication process: prescribing, dispensing, administering, monitoring, and usage⁽¹⁴⁾. In a research conducted in 2015⁽¹³⁾, the administration of the wrong medication was the second most common error, present in 62.5% of cases, followed by the drug given to the wrong patient 52.5%.

The observation of the medication administration process evidenced some steps that were not followed in certain administrations or even were not proceeded, for example, the consultation of the prescription before administering the medication. A research performed in neonatal intensive care unit⁽¹³⁾ showed that, in one of the verified units, in 12 out of the 50 observations, the professional consulted the prescription before administering a drug. In another unit searched, the prescription consultation was not performed at any time, as well as in this research. For this event to be minimized, there should be verification and identification of patients by health professionals before any procedure⁽¹⁵⁾.

In addition, related actions, such as certifying that the patient is not allergic, prior to administering

the drug (performed 12 times in this study), hygienizing the hands before handling the peripheral venous catheter (not observed in 29 situations), and separating the material properly before reaching the patient's bed (not verified in 234 actions) are inherent to professional practice and decrease the incidence of complications related to venous punctures, ensuring patient safety, if performed properly⁽²⁾.

Regarding the length of stay of the peripheral venous catheter, the National Agency for Sanitary Surveillance, the INS and the CDC recommend the replacement of the catheters only with clinical indication and not routinely from 72 to 96 hours. Systematic review, based on randomized clinical trials with adults, showed no difference in infection rates related to the use of peripheral venous catheter when the replacement is routine or by clinical indication⁽¹⁵⁻¹⁷⁾. The length of stay of the catheter for more than 72 hours may be related to the appearance of phlebitis, thrombophlebitis, and bacterial colonization, without substantial difference, compared to 96 hours of stay, according to a study published in 2018⁽²⁾.

The entire infusion system, from the solution vessel to the peripheral venous catheter insertion site, should be checked regularly for integrity, infusion accuracy, dressing expiration dates, and administration set. Local care, including skin antisepsis and dressing changes, should be performed at set intervals and immediately if the dressing is moist, loose or visibly dirty. In the present study, on 24 occasions, the fixation exchange was performed in the period of up to 24 hours (according to protocol of the institution where the study was developed), and in 11 occasions, in the period longer than 24 hours. For this purpose, the dressing should be labeled with the date it was made and the date of exchange, based on the institution's policies and procedures^(15,18).

On disinfection of connection surfaces - such as needleless connectors and injection ports - prior to washing procedures and venous catheter blocking with 0.9% sodium chloride (a practice observed only

seven times in this study and not performed in others 228 handling of peripheral venous catheters), the disinfection of the connectors is recommended before each entry into the device with asepsis technique⁽¹⁹⁾.

Needleless connectors and caps are potential sites of intraluminal microbiological contamination, requiring close adherence to infection prevention practices⁽¹⁶⁾. Disinfection of caps in peripheral catheters has limited evidence but should be performed. Once removed, the cap should be discarded and never reconnected, and should be replaced with new and sterile at each use, due to the inherent risk of infection. For each insertion of syringe in the connector, additional disinfection is required in the inlet. In this study, the caps were not disinfected in 228 opportunities, being stored for later reuse. It is believed that these behaviors are taken due to the lack of knowledge of the institution managers, lack of materials, or even the mistaken culture of professionals about such measures^(15,19).

It is also necessary to emphasize the absence of salinization after administering solutions through the catheter (not observed in 58 actions). This procedure is used to maintain the permeability of the catheter, and the non-use can obstruct the blood vessel, generating discomfort to the patient and, as a consequence, a new puncture. The venous catheters should be washed and aspirated for blood return before each infusion, thus evaluating their functioning and avoiding complications. After each infusion, it is necessary to wash the catheter again by removing the drug infused into the lumen of the catheter, reducing the risk of contact between incompatible medications^(2,15,19).

The nursing professionals involved in the study responded positively, taking measures for infection control (100.0%) and showing knowledge of the preventive measures of infection related to the peripheral venous catheter (97.9%). However, in practice, this knowledge was not observed, because the data obtained did not match the knowledge and effective contribution to the preventive measures mentioned.

The professional needs to rely on evidence through studies, guidelines, and use of protocols based on interventions to reduce the complications of the variability of professional practice, providing quality and reducing risks and complications of peripheral intravenous therapy, among them, the infection, with view to ensuring a safe and harmless nursing care for patients^(10,19).

Conclusion

The analysis of this study demonstrated a low adherence of the nursing professionals to the measures of prevention of infection by peripheral venous catheter: double checking of the drugs, verification of the medication before administering, certification of allergy in the patient before the administration, separation of the material before the procedure, length of stay of catheter for less than 72 hours, fixation exchange in 24 hours, actions related to the handling of the ports of injection of the connectors, and access salinization after administering solutions through the catheter.

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Collaborations

Alves APP contributed to the data collection. Camargo MAS, Cacciari P and Godoy S assisted with data analysis and interpretation and relevant critical review of intellectual content. Lanza VE and Montandon DS collaborated with project design, data analysis and interpretation, article writing, critical review of intellectual content and final approval of the version to be published.

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