

Nursing practices related to flushing in peripheral venous catheters: a descriptive study

Práticas de enfermagem relacionadas ao flushing em cateter venoso periférico: estudo descritivo

Prácticas de enfermería relacionadas con el lavado en catéteres venosos periféricos: estudio descriptivo

ABSTRACT

Objective: To analyze nursing practices related to flushing to prevent peripheral venous catheter obstruction. **Method:** Descriptive study, with application of a semi-structured questionnaire to 78 members of the nursing team, and observation of the clinical practices of medical clinic professionals regarding prevention of obstruction, during 30 days, using a checklist. **Results:** 89.7% of nursing professionals performed flushing in clinical practice. The push-pause technique was performed by 12.86% of the participants. The most used syringe was the 10ml (85.72%) one with 10ml of normal saline solution (52.86%). The push-pause technique was performed in 10.7% of the observations and catheter permeability evaluation in 3.6%. **Conclusion:** Flushing is used to prevent catheter obstruction in nursing practices, however, differences in technique, syringe size, volume of normal saline solution used, and times of performance were observed among professionals and those recommended by the literature.

Descriptors: Nursing; Peripheral Catheterization; Catheter Obstruction

RESUMO

Objetivo: Analisar as práticas de enfermagem relacionadas ao *flushing* para prevenção da obstrução do cateter venoso periférico. **Método:** Estudo descritivo com aplicação de questionário aos 78 profissionais de enfermagem e *checklist* durante a observação das práticas de enfermagem numa clínica médica, durante 30 dias. **Resultados:** 89,7% dos profissionais de enfermagem realizavam o *flushing* na prática clínica. A técnica de *push-pause* era realizada por 12,86% dos participantes. A seringa mais utilizada foi de 10ml (85,72%), com 10ml de solução fisiológica 0,9% (52,86%). A técnica *push-pause* foi realizada em 10,7% das observações e a avaliação da permeabilidade do cateter em 3,6%. **Conclusão:** O *flushing* é utilizado para prevenção da obstrução do cateter nas práticas de enfermagem, entretanto, verificou-se diferenças na técnica, tamanho da seringa, volume de solução fisiológica utilizada e momentos para realização entre os profissionais e o recomendado pela literatura.

Descritores: Enfermagem; Cateterismo Periférico; Obstrução do Cateter

RESUMEN

Objetivo: Analizar las prácticas de enfermería relacionadas con el *flushing* para prevenir la obstrucción del catéter venoso periférico. **Método:** Estudio descriptivo con aplicación de cuestionario a 78 profesionales de la enfermería y *checklist* durante la observación de las prácticas en una clínica médica, durante 30 días. **Resultados:** El 89,7% de los profesionales realizó el *flushing* en la práctica. El 12,86% de los participantes realizó la técnica de empuje-pausa. La jeringa más utilizada fue la de 10 ml (85,72%), con 10 ml de solución salina (52,86%). La técnica de empuje-pausa se realizó en el 10,7% de las observaciones, y la evaluación de la permeabilidad del catéter en el 3,6%. **Conclusión:** El *flushing* se utiliza para prevenir la obstrucción del catéter en las prácticas de enfermería, sin embargo, se verificaron diferencias en la técnica, el tamaño de la jeringa, el volumen de solución salina y los momentos de realización entre los profesionales y lo recomendado por la literatura.

Descritores: Enfermería; Cateterismo Periférico; Obstrucción del Catéter

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INTRODUCTION

Intravenous therapy is one of the most commonly used therapies in hospital settings and is implemented through a venous catheter, and the peripheral venous catheter (PVC) is one of the most commonly used ones in clinical nursing practice for the administration of drugs, blood products, nutritional components and blood collection for diagnostic purposes. However, the length of stay of the PVC does not exceed two days in most cases, being removed due to complications, phlebitis, infiltration and obstruction being the most common⁽¹⁻³⁾. To prevent and minimize these complications, it is necessary that the team be trained in the insertion, surveillance and removal of PVCs, in addition to documenting and intervening therapeutically, or collaboratively with the physician, if necessary, in any complications⁽⁴⁾.

Obstruction is a complication with an incidence rate of up to 50%. It is characterized by the inability to collect blood, infuse medication, and wash the PVC, and is caused by blood clots formed by the return of blood from the vein into the catheter lumen, mechanical problems of the device, and precipitation of incompatible medications in the catheter lumen^(1-2,5-7). Its occurrence results in temporary interruption of intravenous therapy due to the impossibility of administering any drug and the risk of infection and peripheral vascular trauma to the patient, related to the removal and insertion of a new device and the clotted blood in the lumen of the catheter being an ideal environment for the development of microorganisms. In addition, the insertion of a new catheter increases costs with materials, nursing care time, and causes anxiety, pain, and discomfort to the patient due to venous repuncture^(2,6-8).

To prevent obstruction and maintain PVC permeability, flushing of the PVC is recommended before and after administration of each drug, blood products, and blood component, after blood sampling, and for catheter maintenance^(2,5-7). Until recently, heparin solution was indicated for flushing the PVC, however, it is not recommended due to the risk of error in dosage caused by the dilution process and its availability in various concentrations, and the risk of causing unwanted effects, such as allergies and bleeding⁽⁸⁻⁹⁾. Currently, flushing with normal saline (0.9% sodium chloride) is recommended in PVC because of its low cost, because it is a safe solution for the

patient, does not require dilution, and because there is no significant difference between heparin and normal saline in terms of efficacy to maintain the patency of venous catheters⁽⁵⁻¹⁰⁾.

Although there are guidelines to guide the care for the maintenance of PVC⁽⁵⁾, the evidence points to a variation in nursing practices to prevent obstruction, especially those about flushing, such as volume, frequency and technique. Most of the time, this practice is based on the institution's policy, personal and colleague's work experience^(2-3,11-12). According to some authors, when there is no standardization in care, the risk of errors and complications increases considerably^(11,13).

Although flushing the PVC with normal saline is a simple, low-cost practice, recognized for its effectiveness in preventing venous catheter obstruction and contributing to the quality of care, there are still many disagreements among professionals, as well as lack of protocols in institutions due to the scarcity of studies addressing the effectiveness of this practice. Given this, the following research question was posed: What are the nursing practices related to flushing for the prevention of PVC obstruction in a teaching hospital?

Therefore, the present study aimed to analyze the clinical practices of nursing professionals related to flushing for prevention of PVC obstruction.

METHOD

This is a descriptive study conducted at a teaching hospital in Minas Gerais, Brazil, from March to April 2019, with members of the nursing team. Data were collected in two moments: first, a semi-structured questionnaire was used, and, second, a checklist was applied during the observation of the care performed by the nursing team to prevent PVC obstruction and perform the PVC flushing technique. The instruments were developed by the authors after an integrative literature review on the topic, and the following evidence was included: flushing using the push-pause and locking techniques, with a 10ml or larger syringe with normal saline and a volume of twice the priming of the catheter and its connections, and the moments for flushing (before, between and after the administration of the last medication and blood products or blood components; after peripheral venipuncture).

140 nursing professionals of the hospital studied were eligible to answer the questionnaire.

Recruitment took place in the workplace itself. Nurses, technicians, and nursing assistants who developed care activities with patients of the hospital under study were included, therefore, they performed the preparation and administration of intravenous drugs through the PVC. Sixty-two professionals were excluded, seven of them were on vacation, four on medical leave, two on maternity leave, three were away for other reasons, six for loss, because they did not answer more than 50% of the questionnaire and 40 did not accept to participate in the study by signing the informed consent form. Thus, the sample was composed of 78 nursing professionals.

The semi-structured questionnaire was answered in a meeting room of the institution, during working hours, in 10 to 20 minutes, and was composed of 20 open and closed questions, divided into two sections: 1st) questions about the experience and/or clinical practice of professionals regarding the performance of flushing in PVC, regarding the performance of the technique, times they performed the flushing, reason(s) why they did not perform it, size of the syringe used, volume of normal saline and knowledge about (inter)national recommendations on flushing; 2nd) characterization of the nursing staff: age, sex, time of work in the institution, time of professional practice, education and participation in training on venous catheter and flushing.

In a second instance, a checklist was given during 30 days (March to April 2019) during the observation of the clinical practices of nursing professionals regarding the prevention of PVC obstruction and flushing technique. The application of the checklist started at the nursing station where medication preparation was performed, followed in the patient's room during medication administration, until the return to the preparation room, at two main times of medication administration: daytime at 8:00 a.m. and afternoon at 2:00 p.m. Nurses and nursing technicians of a clinical medicine unit of the hospital under study and patients with medications administered through the PVC and who consented to participate in the study were included in the observation for applying the checklist. The exclusion criteria were other

healthcare professionals, nursing students, patients with central venous catheter and drugs administered by other routes exclusively. The sample was intentional composed of seven nursing technicians and two nurses, totalling 28 observations at different times.

The checklist was applied during medication preparation and administration through the PVC in patients. The following variables related to flushing in the PVC were assessed: 1) During medication preparation: preparation of the syringe with normal saline to perform the flushing; 2) During medication administration: interruption of the ongoing intravenous solution before medication administration; evaluation of the permeability of the PVC with normal saline, use of the push-pause technique (pulsatile technique), performance of the flushing with continuous pressure on the syringe plunger, use of the ongoing intravenous solution to flush the catheter after administering the last medication, use of the positive pressure technique (locking), use of the 10ml syringe to perform the flushing.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 23.0, through descriptive statistics (simple and relative frequency, measures of central tendency and dispersion).

The study met the standards set forth by Resolution 466/2012 and 510/2016 of the National Health Council, and was approved by the ethics committee and research with human beings (Opinion number: 2.965.478; CAAE: 99292918.8.0000.5153).

RESULTS

The age of the 78 professionals of the nursing team who answered the questionnaire ranged from 20 to 66 years, 37.5 being the mean, with higher frequency for the age group 20 to 40 years (64.1%). Most participants were female (n= 60; 76.9%), nursing technicians (n= 67; 85.9%), had worked at the institution for less than five years (n= 58; 74.4%). Most of them reported not having participated in training on venous catheter (n=56; 71.8%), however, they reported participating in training on flushing (n=46; 59%) (Table 1).

Table 1. Characterization of the nursing team, Minas Gerais - 2019

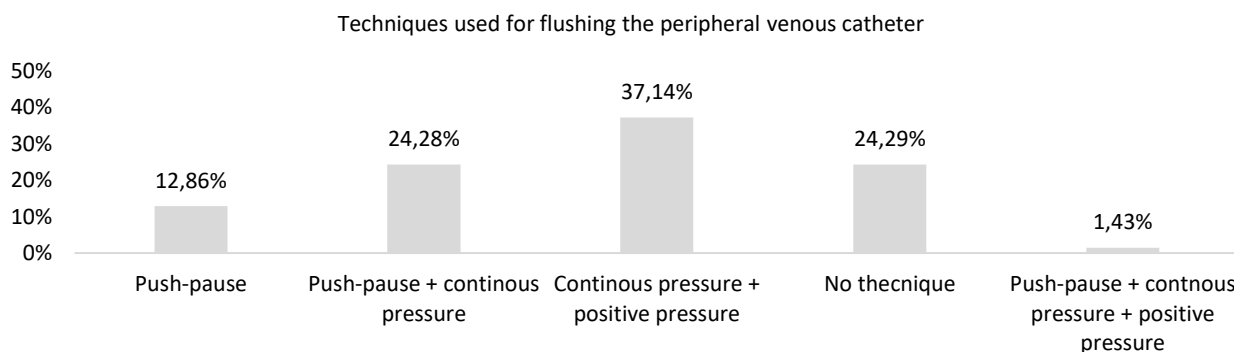
Features	n(%)
Age (years)	
20-40	50 (64.1)
41-60	24 (30.8)
>60	1 (1.3)
Did not answer	3 (3.8)
Sex	
Male	16 (20.5)
Female	60 (76.9)
Did not answer	2 (2.6)
Length of professional experience in the work unit	
Less than 1 year	38 (48.7)
Between 2 and 5 years	20 (25.7)
Between 6 and 10 years old	11 (14.1)
More than 10 years	6 (7.7)
Did not answer	3 (3.8)
Time of professional practice in nursing	
Less than 1 year	10 (12.9)
Between 2 and 5 years	11 (14.1)
Between 6 and 10 years old	26 (33.3)
More than 10 years	28 (35.9)
Did not answer	3 (3.8)
Schooling	
Nursing auxiliary	1 (1.3)
Nursing technician	67 (85.9)
Nurses	10 (12.8)
Participation in training on venous catheter	19 (24.4)
Did not answer	3 (3.8)
Participation in training on flushing	46 (59)

Source: Survey data, 2019.

Most participants reported performing the flushing technique in clinical practice (n= 70; 89.7%). Regarding the technique used to perform

flushing, push-pause was performed by only 12.86% of the participants (Figure 1).

Figure 1. Techniques used for flushing the peripheral venous catheter, Minas Gerais-2019

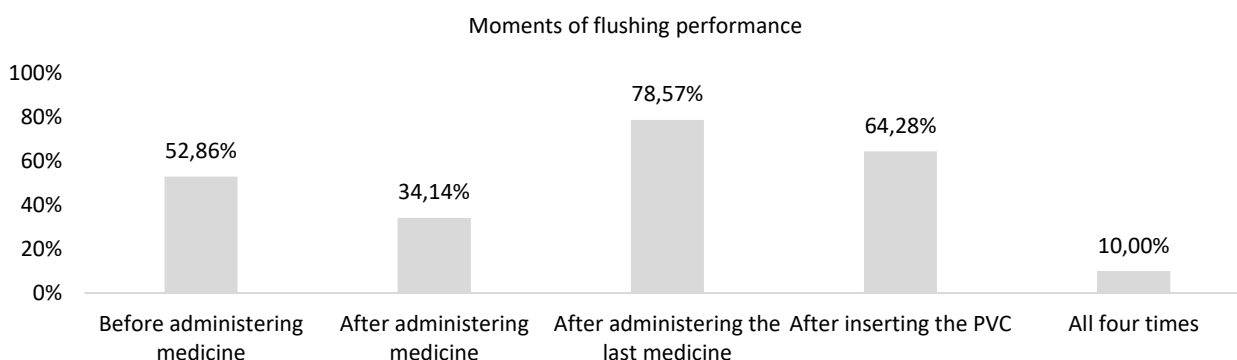


Source: Survey data, 2019.

Regarding the timing of flushing, only seven professionals (10%) performed the flushing in the four moments recommended by the literature, i.e., after the insertion of the PVC, before

administering any medication, after the administration of each medication and after the administration of the last medication (Figure 2).

Figure 2. Moments of flushing performance, Minas Gerais-2019



Source: Survey data, 2019.

The reasons why the eight professionals stated they did not perform flushing were lack of material available at the institution (n= 1; 12.5%), absence of protocol (n= 6; 75%) or other reasons not described (n=1; 12.5%).

Regarding the size of the syringe used for flushing, most professionals affirmed using the 10-mL syringe (n= 67; 85.89%). The 5 ml (n= 6; 7.70%) and 20 ml (n= 5; 6.41%) syringes were the least mentioned.

Most participants used 10 ml of normal saline to perform the flushing (n= 41; 52.58%), 34.61% used 5 ml (n= 27), 7.69% used 3 ml (n= 6) and 2.56% used 4 ml (n= 2) or 20 ml (n= 2). To keep the PVC filled with normal saline, most professionals used 10 ml (n= 42; 53.8%), 26.9% used 5 ml (n= 21), 6.4% used 3 ml (n= 5), and the remaining participants (n= 10; 12.9%) did not use, or other volumes, or did not answer.

Although there is no protocol in the institution about the flushing technique to prevent venous catheter obstruction, more than half of the nursing professionals (n= 53; 68%) stated they knew some (inter)national recommendation on flushing, 26.9% of professionals reported not knowing any recommendation (n= 21) and the remaining participants (n=4; 5.1%) did not answer this question.

During the application of the checklist, flushing was performed with the push-pause technique in three observations (10.7%). The evaluation of PVC permeability before the administration of the first medicine was observed once (3.6%). Most professionals used a 10 ml syringe to perform the flushing and with positive pressure, locking technique (82.1%) (Table 2).

Table 2: Nursing team adherence to practices to prevent peripheral venous catheter obstruction, Minas Gerais-2019.

Nursing practices to prevent obstruction in peripheral venous catheter	n (%)
During the preparation of medicines	
Preparation of syringe with normal saline to perform flushing	3 (10.7)
During administration of medicines	
Interruption of the ongoing administration of the intravenous solution	20 (71.4)
Evaluation of catheter permeability with normal saline before administration of the first medicine	1 (3.6)
Use of the push-pause technique after the last medicine	3 (10.7)
Performing flushing by pushing the syringe plunger	9 (32.1)
Use of the current intravenous solution to flush the catheter after administering the last medicine	3 (10.7)
Using the locking technique	23 (82.1)
Using the 10 ml syringe to perform flushing	8 (66.6)

Source: Survey data, 2019.

DISCUSSION

Venous catheters may become obstructed when there is inadequate monitoring or care of them. Obstruction may also occur when catheters are not kept filled, when they are not in use or when flushing⁽⁵⁾ is not performed. Flushing, as a method to prevent obstruction, increases the

catheter viability time, which generates significant advantages for the patient and the care provided^(7,14). In this study, most professionals reported performing flushing (89.7%), which is a positive aspect for the prevention of this complication. This finding is in line with another cross-sectional study recently conducted with

nursing professionals from Brazil and Portugal, whose rate of performing flushing was 84.2%⁽¹³⁾.

Only 12.86% of nursing professionals reported using the push-pause technique, the technique indicated to perform flushing⁽⁵⁾. According to the questionnaire (37.14%) and the checklist on the observation of practices (32.1%), most professionals used continuous pressure on the syringe plunger (laminar flow), maintaining positive pressure at the end of medicine administration. An experimental simulation study on venous catheter flushing revealed that the efficiency of catheter flushing is directly related to the type of flow performed, therefore, the intermittent flow (push-pause) allows the removal of fluids in the catheter lumen in less time and with greater efficiency when compared to the continuous/laminar flow (continuous pressure on the syringe plunger)⁽¹⁵⁾.

In order to flush the PVC and prevent obstruction, it is essential to perform flushing with the intermittent technique (push-pause), because it increases the effectiveness of cleaning the lumen of the catheter due to the greater shear force⁽¹⁶⁻¹⁸⁾. It is a simple and low-cost technique that is also efficient in preventing bacteraemia in the catheter, since it avoids accumulation of blood in the lumen of the catheter and the proliferation of microorganisms⁽¹⁹⁾.

In this study, 38.57% of the participants reported performing the locking technique (positive pressure), and this finding was confirmed in the checklist data in 32.1% of the observations of clinical practices. The locking technique consists in closing the infusion system connection (dual port connections or three-way stopcock, for example) connected to the catheter simultaneously with the administration of the final volume of the flushing solution, around 0.5ml. This action maintains positive pressure with the column of normal saline inside the catheter lumen, preventing blood return to the lumen and consequent obstruction if flushing is not performed immediately⁽⁵⁻⁶⁾.

In the present study, during observation of the practices, it was found that most professionals performed the flushing only after administration of the last medicine, and only 10% performed it in the four times recommended by the literature, that is, after the insertion of the PVC to remove the blood present in the lumen of the catheter during venipuncture, to assess the permeability of the catheter and check if it is correctly positioned in the patient's vein; before

the administration of any medication to assess catheter permeability; after the administration of each of the medication administered in the catheter, in order to avoid the interaction of incompatible medications; after the administration of the last medication to remove drug residues from the lumen of the catheter and ensure complete administration of the prescribed dose^(5,20); after the administration of blood components, after blood collection and every 8 to 12 hours when the PVC is not in use^(5,16). According to Goossens⁽⁶⁾ and the Infusion Nurses Society⁽⁵⁾, flushing with normal saline should be performed before administering the first drug in the patient's PVC in order to assess catheter permeability, then administering the drug and again flushing with normal saline to remove drug residues from the catheter lumen and avoid incompatibility between drugs or solutions.

Regarding the size of the syringe, the result of the present study corroborates what is recommended in the literature, that is, to use syringes of larger caliber, 10 ml or more, because they improve the result of the catheter flushing and cause less damage to the vein since they have low pressure^(5,16,21). Pre-filled syringes of 10 ml used in *flushing* increase permeability⁽¹¹⁾ and reduce the risk of damage to the catheter and consequent rupture in the patient's vein⁽⁶⁾. Pre-filled syringes have the same purpose as syringes prepared manually by the nursing professional; however, the former provide less manipulation, less nursing time in preparation and reduce the risk of contamination of the device or of the normal saline⁽⁵⁾, since they are pre-prepared by the pharmaceutical industry under controlled aseptic conditions, such as laminar flow hood and sterilization process.

In the present study, professionals did not take into account the priming of the PVC (lumen volume) and its extension to administer the normal saline, since the most used volumes were 10 ml (33.3%) and 5 ml (52.6%), similar to other studies^(2,7,11), contrary to the recommendation of the Infusion Nurses Society⁽⁵⁾ to use twice the internal volume of the catheter and its accessory extensions. However, it is worth mentioning that, when choosing the volume of solution, it is essential for the nursing professional to take into account the volume of the catheter lumen (priming) and its extensions (dual pathway extension, for example), the patient's age and fluid restrictions, and the characteristics of the drugs to be administered, since after infusion of

lipid solutions and blood components, for example, they may require a larger volume of normal saline to clean the catheter lumen, usually 20ml⁽⁵⁾, as well as after reflux of blood in the PVC lumen and its connections due to venipuncture or other reasons.

The Infusion Nurses Society⁽⁵⁾ recommends flushing with a volume of normal saline that is twice the volume of the catheter and the complementary device (priming), which can be an extension tube or three-way stopcock, for example. This amount generally ranges from 1 ml to 3 ml in one PVC, depending on the type of complementary device used. Larger volumes, 5 ml for the PVC and 10 ml for the central venous catheter are indicated to reduce the accumulation of fibrin, precipitated drugs or other substances in the lumen of the catheter. For Goossens⁽⁶⁾, the volume of solution to perform flushing in PVC can be 5 ml, due to the fact that the PVC has a small caliber.

Regarding the moment of flushing, size of the syringe and amount of normal saline, the results are similar to those found in the literature, with volume of solution and syringes of 2ml, 3ml, 5ml and 10ml^(2,7,11,13).

Although the professionals answered that they had participated in a training course on flushing (59%), it seems that this knowledge was not implemented in practice, since the observation of the practices showed that the push-pause technique was performed in only 10.7% of the observations, the use of the 10-ml syringe in 66.6% and the evaluation of catheter permeability with normal saline before the administration of the first drug in 3.6% of the observations. This absence of qualified care may be due to the lack of institutional protocol (75%) on flushing technique for prevention of venous catheters obstruction and consequently the lack of available material (12.5%) as evidenced by the questionnaire results. Although the best available evidence recognizes and recommends the use of flushing in practices to prevent venous catheter obstruction^(5-6,15-17), there is no transfer of this knowledge to clinical practice^(2,11-13,22). This fact may be due to the lack of strong evidence and clinical variability on the volume, frequency and technique of flushing, as documented in this study and others^(2,7,11,13,17), due to the insufficient number of nursing professionals in relation to the degree of dependence of patients and workload, resulting in lack of professional time to perform qualified care, in addition to the lack of knowledge

of the best evidence to recognize the flushing as a priority care, which impacts on care costs, nursing care time, quality of care and patient safety^(2,11).

CONCLUSION

Flushing is a nursing practice performed by most professionals, however, the lack of materials to implement the technique and institutional protocol were cited as complicating factors for adherence to the practice, resulting in divergence in practices regarding the moment of flushing, the technique used, the size of the syringe and amount of normal saline.

This study contributed to the reflection on clinical nursing practice by revealing the need for nursing services to update, standardize and disseminate their protocols on flushing and implement training for nursing professionals. In education, it reinforces the need for flushing and other contents related to intravenous therapy to be included in the menus of the basic subjects of nursing courses with a focus on prevention, patient safety, and quality of care. In addition, it presents contributions to research, indicating areas that need further studies, such as analysis of the effectiveness of the flushing technique, the different sizes of syringes, the different volumes of normal saline, and the push-pause technique, as well as pointing out the need to analyze flushing practices in other clinical realities of nursing practice.

The main limitations are this being a descriptive study, with a small sample of participants and of convenience, the reduced number of observations, data from a single institution, not allowing for the generalization of results, and the lack of analysis of risk factors for the occurrence of obstruction considering the different practices adopted in relation to the flushing technique, the volumes of normal saline, and syringe size used.

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