http://dx.doi.org/10.1590/0104-07072018002810017

INCIDENCE RATE AND THE USE OF FLUSHING IN THE PREVENTION OF OBSTRUCTIONS OF THE PERIPHERAL VENOUS CATHETER[1]

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[1] Article extracted from the dissertation - Nursing practices and patient safety in the vessel puncture process and in the administration of intravenous therapy, funded by the Coordination of Improvement of Higher Education Personnel - CAPES, Brazil (Case 0867/14-4).

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ABSTRACT

Objective: to evaluate the cumulative incidence of the peripheral venous catheter obstruction and to identify the use of flushing to prevent obstructions.

Method: mixed method, with a descriptive cohort study with monitoring of 110 patients from a medical clinic in Portugal. The data collection involved interviews with 22 nurses, documentary analysis and participant observation. Thematic analysis was performed on the qualitative findings and descriptive analysis was performed for the quantitative data.

Results: the cumulative incidence of obstruction was 50%. The thematic categories revealed that flushing is a nursing care for the prevention of venous catheter obstruction and is performed before and/or after the administration of the drugs. The volume of normal saline solution used in flushing ranged from 3 to 10 ml. There were also situations of non-adherence to flushing and factors that influenced this adherence, namely: the time to perform the care, the complexity and the dependence score of the patients, the workload and the number of nurses to provide care.

Conclusion: flushing is a nursing care for the prevention of peripheral venous catheter obstruction, however, the nursing practices for its implementation are not uniform regarding the frequency and volume of the normal saline solution. The lack of a nursing protocol, the complexity and dependence of the patients, the workload and the number of nurses are factors that are capable of influencing the adherence to the flushing practice and, consequently, the incidence of peripheral venous catheter obstruction and patient safety and quality of care.

DESCRIPTORS: Nursing. Nursing care. Catheter obstruction. Catheterization, peripheral. Vascular access devices. Risk factors.

TAXA DE INCIDÊNCIA E O USO DO *FLUSHING* NA PREVENÇÃO DAS OBSTRUÇÕES DE CATETER VENOSO PERIFÉRICO

RESUMO

Objetivo: avaliar a incidência cumulativa de obstrução do cateter venoso periférico e identificar o uso do *flushing* para prevenção das obstruções.

Método: método misto, com estudo de *coorte* descritivo com seguimento de 110 pacientes de uma clínica médica de Portugal. A coleta de dados envolveu entrevistas com 22 enfermeiros, análise documental e observação participante. Realizada análise temática dos achados qualitativos e análise descritiva para os dados quantitativos.

Resultados: a incidência cumulativa de obstrução foi 50%. As categorias temáticas desvelaram que o *flushing* era um cuidado para prevenção da obstrução do cateter venoso e realizado antes e/ou após a administração dos medicamentos. O volume de solução fisiológica utilizado no *flushing* variou entre 3 e 10 ml. Verificaram-se, também, situações de não adesão ao *flushing* e fatores que influenciavam nesta adesão, a saber: o tempo para realizar os cuidados, a complexidade e o grau de dependência dos pacientes, o volume de trabalho e o número de enfermeiros para prestar os cuidados.

Conclusão: o *flushing* é um cuidado de enfermagem para a prevenção da obstrução do cateter venoso periférico, no entanto, as práticas de enfermagem para implementação não são uniformes quanto a frequência e volume de solução fisiológica. A ausência de um protocolo de enfermagem, a complexidade e o grau de dependência dos pacientes, o volume de trabalho e o número de enfermeiros são fatores capazes de influenciar na adesão à prática do *flushing* e consequentemente na incidência de obstrução do cateter venoso periférico e na segurança do paciente e qualidade dos cuidados.

DESCRITORES: Enfermagem. Cuidados de enfermagem. Obstrução do cateter. Cateterismo periférico. Dispositivos de acesso vascular. Fatores de risco.

TAZA DE INCIDENCIA Y EL USO DO *FLUSHING* EN LA PREVENCIÓN DE LAS OBSTRUCCIONES DE CATÉTER VENOSO PERIFÉRICO

RESUMEN

Objetivo: evaluar la incidencia acumulativa de la obstrucción del catéter venoso periférico e identificar el uso de *flushing* para la prevención de las obstrucciones.

Método: método mixto, con estudio de *cohorte* descriptivo y con el seguimiento de 110 pacientes de una clínica médica de Portugal. La recolección de datos incluyó entrevistas con 22 enfermeros, análisis documental y observación participante. Se realizó el análisis temático de los hallazgos cualitativos y el análisis descriptivo para los datos cuantitativos.

Resultados: la incidencia acumulativa de la obstrucción fue del 50%. Las categorías temáticas desvelaron que el *flushing* era un cuidado para la prevención de la obstrucción del catéter venoso y era realizado antes y/o después de la administración de los medicamentos. El volumen de solución fisiológica utilizado en el *flushing* varió de 3 a 10 ml. Se verificaron, también, situaciones de no adhesión al *flushing* y factores que influenciaban esta adhesión. A saber: el tiempo para realizar los cuidados, la complejidad y el grado de dependencia de los pacientes, el volumen de trabajo y el número de enfermeros para prestar los cuidados.

Conclusión: el *flushing* es un cuidado de la enfermería para la prevención de la obstrucción del catéter venoso periférico. Sin embargo, las prácticas de enfermería para su implementación no son tan uniformes como la frecuencia y el volumen de la solución fisiológica. La ausencia de un protocolo de enfermería, la complejidad y el grado de dependencia de los pacientes, el volumen de trabajo y el número de enfermeros son factores capaces de influenciar la adhesión a la práctica del *flushing* y, consecuentemente, en la incidencia de obstrucción del catéter venoso periférico, en la seguridad del paciente y en la calidad de los cuidados.

DESCRIPTORES: Enfermería. Cuidados de la enfermería. Obstrucción del catéter. Cateterismo periférico. Dispositivos de acceso vascular. Factores de riesgo.

INTRODUCTION

Intravenous therapy is one of the most practiced clinical interventions in the hospital setting and implies nursing care that ensures treatment and quality of care.[1-2] Intravenous therapy involves a process that initiates with the choice of venous catheter according to the patient's characteristics, the prescribed therapy, the time of treatment, the nurse's skills, and the available material. It involves the catheter insertion, permeability, supervision, removal, and clinical assessment of the insertion site and adjacent areas after the catheter removal, in addition to patient preferences.[3]

The intravenous therapy implementation requires a constant level of knowledge and supervision in order to recognize possible complications such as obstruction, infection, phlebitis, infiltration, among others, and intervention with appropriate nursing care. The ones manipulating the venous catheters are mainly the nurses, since they are responsible for the placement of the peripheral insertion catheters, drug administration and maintenance of all types of venous catheters.[4-5]

The most common complications during the use of a venous catheter include obstruction, occurring in 2% to 22% of the cases in all age groups.[6-10] Obstruction is a clinical manifestation of a catheter malfunction and consists on the absence of blood reflux through the catheter and/or the inability to administer fluids by the catheter, usually caused by a blood clot, mechanical issues, or lipid or drugs intraluminal precipitation, resulting in catheter removal.[11-13]

The occurrence of an obstruction prevents the administration of intravenous therapy to the point of compromising the dose/minute infusion, plasma level and drug effect, since removal of the clogged catheter and a new catheterization is required. In addition, there is a risk of infection to the patient, since the clotted blood may be a culture medium for microorganisms.[12,14-15] Thus, it is critical to keep the venous catheter permeable.[12]

In view of the obstruction rate of vascular access devices and the negative impact on the patient and care, the Infusion Nurses Society[11] recommends evaluating the blood reflux before each infusion and flushing technique (SAS: normal saline solution - flushing, medication administration, followed by normal saline solution - flushing)[12] after administering each medication in order to prevent drug incompatibility, other complications and to maintain the permeability of the catheter. These recommendations have a low level of evidence (level IV or V).[11]

The evidence suggests that the normal saline solution is as effective as the solution containing heparin for maintaining the peripheral venous catheter (PVC) permeable,[12-13,16] with no increase in the risk of PVC obstruction or other complications, nor the reduction in the catheter permanence time.[13] The evidence for volume, frequency and flushing technique are considered weak.[7,16]

The following aspects justified this investigation: the performance of the flushing technique is a relevant care for nursing practices, as it is aimed to prevent PVC obstruction;[14] and the identification of

the incidence of obstruction allows assessing reality and decision making, in order to qualify the care practice. In view of these aspects, an investigation was carried out to evaluate the cumulative incidence of peripheral venous catheter obstruction, and to identify the use of flushing to prevent obstruction.

METHOD

This is a mixed-design study, with a descriptive cohort investigation (July to October/2015). The participants were patients admitted to a medical clinic service of a University Hospital of Portugal as well as the patients' nurses. As a data collection strategy, participant observation, document analysis and semi-structured interview were used. The latter started after two months of familiarization with the context.

For the descriptive cohort study, 121 patients admitted to the studied service were eligible. Patients over 18 years old were included, with intravenous therapy using safety intravenous catheters-PVC (the butterfly catheter is not used at the studied institution) and who agreed to participate in the study. Four patients with a central venous catheter and seven who didn't give consent were excluded. Thus, the final sample was composed of 110 patients that were followed up during the hospitalization and usage of the PVC, that is, until discharge, transfer or death, with a total of 82 days of follow up (July to October/2015).

Two instruments were used for data collection. Both were submitted to evaluation regarding appearance and content to four nurses with research experience in the matter and two nurses from the service where the study was carried out. The first instrument set up a document analysis and included the sociodemographic variables (gender and age) whereas variables related to the hospitalization (reason of hospitalization), clinics (basic diseases like hypertension and diabetes, dependence score of the patient) and drug administration through PVC were obtained from the patient medical record.

The second instrument was used to obtain the data from the cohort study and included the variables of safety intravenous catheters-PVC (insertion site, date and time of insertion and removal, catheter gauge and whether the removal reason was obstruction) and they were collected with nursing support, once that data was not available on the patient's chart. The nurses were instructed individually regarding registering and the way the obstruction was identified. The PVC obstruction was defined as the inability to use solutions,[16] or rather, impossibility to perform the flushing technique by administering the normal saline solution in the PVC.

The quantitative data was analyzed in the Statistical Package for the Social Sciences (SPSS) software, version 20, and presented by descriptive statistics, with absolute and relative frequencies and measure of central tendency and dispersion (medium, minimum and maximum values and interquartile values). The cumulative incidence of the obstruction considered the quotient between the number of patients who presented obstruction in the PVC during the study period and the total number of patients exposed to the PVC, multiplying by 100.[17]

The participant observation technique was applied from July/2015 to February/2016 to monitor the care performed by the nurses of the service during the administration of the intermittent medicines, or rather, fixed hours. It included nurses who performed care activities in the service for at least three months and who by signing agreed to participate voluntarily in the study. From the 30 nurses who were eligible for the participant observation, five were excluded due to having been transferred to other services during the period of study, two due to maternity leave, and one in the role of manager. Thus, 22 nurses participated in the participant observation.

The observation was conducted during the administration of the intermittent medications and began at the medication preparation room, followed by the administration and finished at the same room. The nursing practices related to the prevention of PVC obstruction at the time of intermittent medication administration were the main focus of the observation. The observations were conducted during the three working shifts and every day of the week, on an average of three hours a day (variation between 3h and 6h). Each nurse was observed under between five and ten medication administration situations. The findings were registered in field notes.

Another evidence source used to work with a sufficiently broad *corpus* under the nurses' perspective was the semi-structured interview. They were recorded and conducted in a private environment, aided by a script with guiding and driving questions, between 25 and 45 minutes. The questions approached the following aspects of the nursing practice: implemented care for the prevention of the PVC obstruction; guideline/protocols to conduct the flushing technique (frequency, volume and type of solution); factors that influenced the non-compliance of the prevention protocol; how the

nursing practices were conducted in the absence of protocols and/or where there was doubt; and the difficulties for a safe nursing practice. It is important to highlight that the lack of new information, the data repetition and the fulfillment of objectives were considered to limit the number of participants.[18] Therefore, out of the 22 nurses who participated in the study, only 16 participated in the interview, since data saturation was reached in the 14th interview. Still, the two remaining scheduled interviews were conducted.

The field notes of the participant observation and the interview reports were transcribed and exported to the NVivo® Pro, version 11 and submitted to thematic analysis.[19] The theme identification occurred in accordance with the meanings explicit in the data, following six stages:[19] 1) familiarization with the data through the transcription, reading and rereading of the data and registration of the initial ideas; 2) initial codes generation; 3) theme identification with code grouping in potential themes; 4) theme review and generation of a theme map analysis; 5) theme definition and designation; 6) report writing - selection of the excerpts that reflect the understanding of the theme. Two theme categories stemmed from the analysis.

After separate analysis of the qualitative and quantitative data, the results were mixed to compare and/or correlate the findings and, thus, determine convergences and divergences.

The study was approved by the Research Ethics Committee of the studied hospital (Ref: 020-15). To assure anonymity, the interview excerpts were codified by the letter E, followed by a numerical sequence (E1toE16). The excerpts stemming from the participants' observations were named by the acronym "Obs" for Observation and the participants were assigned only by nurse or patient.

RESULTS

In the analysis of the sociodemographic variables of the 110 monitored patients, the age median was 82 years old (18-96; Q1=77; Q3=86), with greater frequency to the age group between 80 and 96 years old (n=68). In the hospitalization variables, the main reason was due to an infectious process (73%) and the most frequent base pathologies were the non-communicable: arterial hypertension (61%), diabetes *mellitus* (37%), heart problems (34.5%), and neurological conditions (33.5%). The patients' dependence score in the self-care area was high (59%), moderate (14.5%), low (7%), or independent (19%). The hospitalization time median was nine days (1-49; Q1=6; Q3=14).

The PVC obstruction cumulative incidence, having the 110 patients as unit of analysis, was 50% (n=55). It was not possible to characterize the type of obstruction (blood clot, intraluminal precipitation of lipids and other medications) having in consideration the study observational methodology and the lack of a PVC lumen microscopic study.

The PVC's permanence time median until the identification of the obstruction was 41 hours, i.e., approximately 2 days (2-336 hours; Q1=18.5; Q3=72). Most of the obstructions occurred in the first 24 hours (36%) and between 25 and 48 hours (30%).

The PVC was inserted on the back of the hand (39.7%) and on the forearm (35.3%), on the antecubital fossa (10.5%), on the arm (9.3%) and on the lower limbs (5%). The 22gauge (59,5%) and 20gauge (37,5%) calibers were the ones most used. The antimicrobial (86,5%), specially the meropenem (22,5%) and the piperacillin/tazobactam (22%), followed by medications of the diuretic (58%), antacid (50%) and expectorant (30%) classes were the main therapeutic intravenous used in the PVCs.

The 22 nurses who participated in the interview and in the participant observations were female (82.5%), with median age of 31 years old (26-52 years; Q1=28; Q3=41). The median of the conclusion time for the nursing course was eight years (4-24 years; Q1=8; Q3=17). Only five nurses had been working in this service for less than a year (22%) and the median of the time at the service was five years (6 months-24 years, Q1=4; Q3=13).

With the support of participant observation, documental analysis and interview techniques, the following theme categories stood out: 1) the nursing practices and the prevention of the PVC obstruction; 2) The time and pressure to have things done.

The nursing practices and the prevention of the peripheral venous catheter obstruction

The flushing with normal saline solution was a nursing care conducted at the PVC with the aim of preventing catheter obstruction. However, situations of non-compliance to this practice were also observed, according to the following reports: [...]. [He/she] *administered two intravenous medications, one after the other, without flushing with normal saline solution before or after* [...](Obs.). *Verify the permeability of the catheter, disinfect and, if there is any doubt, clean it with normal saline solution,* [...]. *Of course, that is not always done, but it was the most appropriate* (E13).

The nurse evaluated the PVC through palpation and visualization of the insertion site and the permeability, flushed the catheter with a normal saline solution and I asked if what he was administering was a diuretic and the nurse answered: it is a normal saline solution to test the catheter, this way I know if it is obstructed or lost for another reason [...] (Obs.).

During the observations, it was noted that the nurses used a 3 ml, 5 ml or 10 ml volume of normal saline solution to implement the flushing technique and conduct it before and/or after administering the medications.

One of the rules of the Nursing Policy Manual available at the service instructed to verify medication compatibility, not to administer incompatible medications simultaneously, to use a normal saline solution to flush the catheter and to observe the presence of blood reflux through the catheter. The latter was not verified during the observation of the nursing practices and no instrument was found at the service regarding medication incompatibility. A book about medication preparation and intravenous administration[20] was the nurses' reference, but the information on incompatibility was very limited in this book, especially the reconstitution and dilution of medications. During the participant observation, also, no written protocol instructing and systematizing the flushing technique was identified. The findings were confirmed in the following nurses' reports during the interview: *we usually follow the Health System Central Administration* [ACSS - Administração Central do Sistema de Saúde] *rules and try to be guided by this and the good nursing practices. Now there is nothing about it at the service* [...] (E16). *Regarding the medication preparation, we also have a book that was written by a pharmacist from the institution, which is our guide* [...] (E7).

The time and the pressure to have things done

In the interviews, *time* was the word most used by the nurses to express their difficulty in implementing the flushing technique, according to the nurses' reports: *The time, the pressure to have things done, for example,* [...] *a person gets into that stress of* [...] *having to puncture, check glycaemia, because after that [the patient] will eat...yeah, there is the stress of having things done at the right time* [...] (E3). *If I can administer a medication and if it takes too long to get to the patient's foot, remove the system, administer the medication, flush the vein* [conduct the flushing technique], *put the system back on, if I know I lose a lot of time, I administer the medication and go away* (E7).

The nurses reflected and questioned their practices, sometimes neglected. Such situations were related to the complexity and to the dependence score of the patients, as well as to the amount of work and the number of patients, according to the following excerpts: [...].*We have a lot of care scheduled at the same time,* [...]. *This volume* [amount of work] [silence], *sometimes I think we skip some important steps, especially the flushing between medications* [conduction of the flushing technique] (E10). *Maybe we should have less allocated patients, that would already help because it is not that we have too many, four or five, but the problem is the kind of patient and the high number of care they need* (E5). [...]. *The fact that we work one night, that we are tired, that we have 14 patients, that we have to take care of hygiene, medication, that we have to be focused at 6am, to disinfect, administer the medication, flush* [conduct the flushing technique], *there it is, the lack of nurses, the work overload is what many times leads to bad practices, these terrible practices of ours* (E16).

DISCUSSION

The cumulative incidence of obstruction by patient (50%) was above other studies that showed this complication in adults with PVC (2% to 14%).[7-10,21-23]

According to the findings of the category "The nursing practices and the prevention of the PVC obstruction, the flushing technique with normal saline solution was a nursing care implemented by the nurses to evaluate and keep the PVC permeability and prevent the PVC obstruction. This practice was also documented in another study.[24] The intermittent usage of the flushing technique seems to increase the PVC staying in its place, when compared to the lack of flushing[12] and has showed similar results when compared to the solutions containing anticoagulants (heparin).[12-13,17]

Although the flushing technique is part of our nursing practices, no uniformity regarding the volume and moment could be verified, once the nurses used normal saline solutions of 3 ml, 5 ml and 10 ml at the PVC and in most situations before administering the medications in order to evaluate the catheter permeability, and in others circumstances before and after administering the medications. Similar results as to the flushing technique volume were documented in another study, being 10 ml the most used, followed by 5 ml.[24] This volume variation of the normal saline solution may be related to the lack of an institutional protocol to guide such practice. At the studied service, the rule available did not recommend the volume to be used in the flushing technique, instructing only the need to evaluate the

medications' incompatibility. Nevertheless, documents at the service that described which were the incompatible medications were not found. Another factor that may influence the lack of uniformity in the nursing practices is supported by the lack of strong evidence about the flushing volume. There are few recent experimental and randomized studies about the flushing technique frequency and volume in adults with PVC,[7] which do not show connection between the PVC obstruction and the administration of the flushing technique every 6 or 24 hours using a normal saline solution of 3 or 10 ml.

The catheter's flushing after each use is recommended since the proteins present on the catheter's wall are not totally removed after some time. To avoid the obstruction of long catheters and to improve the results, is it suggested, in combination with the flushing technique, the use of the push-pausetechnique.[14,25] Some factors justify the adoption of the flushing and the push-pause technique in the nursing practices with the PVC, namely: the high incidence of PVC obstruction shown in this and other studies;[6-10] the fact that the peripheral venous catheters are widely used in a hospital context for the administration of medication; the flushing technique being an already established care in the nursing practices for the prevention of PVC obstruction; and studies pointing out to positive results when the flushing technique is used.[12-13,24] However, the experimental studies are necessary to improve the evidence on the effectiveness of the flushing and push-pause techniques, the volume and the frequency of the normal saline solution on the prevention of the PVC obstruction.

Still in the "The nursing practices and the prevention of the PVC obstruction" category, the lack of compliance to the flushing technique was verified in many situations. The lack of compliance may have influenced the staying time of the catheter, because most of them were removed due to obstruction, especially in the first 48 hours after insertion (66%). The occurrence of PVC obstruction leads to the catheter's untimely removal, but it also implies pain and discomfort to the patient because of the need to insert a new catheter. Besides that, the catheter removal due to complications increases the nursing assistance time in a new procedure and has a financial impact with materials,[8] hence the need to implement nursing care for the prevention of PVC obstruction.

In the "The time and the pressure to have things done" category, factors with the potential to influence the non-compliance to the flushing technique arose, namely: the time available to conduct all the nursing care, including the flushing technique; the complexity and the patient dependence score; the amount of work; and the number of nurses. The advanced age of the patients (median of 82 years old and 62% of patients were between 80 and 96 years old) may be one of the variables with the potential to influence the degree of dependence for the patients' self-care activities, because most of the patients presented a high (59%) and moderate (14.5%) degree. Imbalance in the relation between the complexity, the patient dependence score (amount of work) and the number of nurses available to provide care may influence the compliance to the flushing technique and increase the probability of partial or total care omission,[26] contributing to a higher incidence of adverse events that could be avoided, namely the PVC obstruction.

Additionally, the nurses' clinical inexperience may also contribute to the omission of care and adverse events.[26] Nevertheless, in the present study, only five nurses worked at this service for less than a year (22%), which makes us infer that they had been, for some time, in touch with the same elements of the clinical context for experience acquisition naturally, something that has a fundamental role in the prevention of mistakes and unnecessary damage to the patient.[27]

Besides the clinical experience, other factors are capable of influencing the nurses' behavior and the results of care, such as: the standardization of a care protocol to conduct the flushing technique; the development of continuous education programs and of a safety culture; the periodic assessment of the quality indicators sensitive to nursing care and of the work conditions; the inclusion of the professionals in the assessment processes and the return of the results to them;[28-29] and an appropriate nurse-patient relation, considering the dependence score and the care complexity.[30]

The high dependence score of the patients for self-care activities, identified in this study (59%) linked to the fact that most patients are over 80 years old (62%), are other factors that may have contributed to a higher workload and influenced compliance to the flushing technique. However, the workload and the number of nurses were not an object of this study, needing, therefore, to be investigated as to their influence over the incidence of PVC obstruction and the omission of care, namely of the flushing technique, as care for the prevention of this adverse event.

As limitations to this study, the complexity of the studied phenomenon, the option for observa-

tional design and the fact that the study occurred at a single institution, not allowing for the generalization of the results, must be highlighted. Other limitations were the lack of a quantitative evaluation of the flushing technique omission situations, of the nurses' workload analysis and of the analysis of the association of these variables with the catheter obstruction. The evaluation and registration of the PVC obstruction having needed the service nurses support, despite the training conducted with all of them before the beginning of data collection, the patients' advanced age and the lack of laboratorial study to characterize the type of luminal PVC obstruction may have originated a bias. The small number of studies on this subject with PVCs restricted the discussion with other investigations.

CONCLUSION

The conduction of the flushing technique at the PVC with normal saline solution before and after the medication administration is a care used in the nursing practices aiming to evaluate, keep the permeability and prevent the PVC obstruction. The nursing practices variability about the frequency and volume of the normal saline solution used in the flushing technique identified in this study and in others, mark a gap in the scientific evidence about the theme. In face of this, a randomized clinical investigation to evaluate the effectiveness of these practices (frequency and volume of the normal saline solution) in the prevention of the PVC obstruction is suggested.

The lack of a protocol to guide the nursing practices, the complexity and the patients' dependence score linked to the workload and the number of nurses are the factors capable of influencing the nursing practices and the compliance to the flushing technique, which is a care aimed at the prevention of PVC obstruction.

The results of this study present new contributions to nursing, because they show that the PVC obstruction is an important quality indicator that is sensitive to nursing care, due to its high incidence (50%) and its occurrence requires the removal and insertion of a new catheter, having implications in the nursing assistance time, the patient's safety and in health costs. Besides that, the results point to a multifactorial problem, since the sociodemographic variables related to the patient, the variables of the nurse who provides care and the institution have the potential to influence the compliance to the flushing technique by the nurses, and consequently the PVC obstruction incidence.

Considering the quality of nursing care, the patient safety and well-being, we are suggesting a reflection on the nursing practices related to the PVC use and the administration of medication, with the objective of reducing the obstruction incidence of this catheter and, consequently, decreasing repeated punctures and the associated pain; the elaboration of a protocol for the usage of the flushing and push-pause techniques and its promotion through permanent educational activities with the nursing team; and the inclusion of the obstruction in the quality indicators sensitive to the nursing care, because the obstruction occurrence seems to be closely related to the standards of nursing care.

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Received: April 25, 2017
Appoved: December 05, 2017