REVISTA DE ENFERMAGEM REFERÊNCIA
homepage: https://rr.esenfc.pt/rr/
ISSNe: 2182.2883

REVIEW PAPER

Peripheral intravenous catheter flushing: a scoping review protocol

Flushing em cateteres venosos periféricos: um protocolo de scoping review

Lavado en catéteres venosos periféricos: un protocolo de revisión exploratoria

Pedro Parreira [1]
https://orcid.org/0000-0002-3880-6590

Inês A. Marques [2]
https://orcid.org/0000-0001-5690-3020

Paulo Santos-Costa[1]
https://orcid.org/0000-0003-0761-6548

Liliana B. Sousa[1]
https://orcid.org/0000-0002-8914-6975

Luciene Braga[3]
https://orcid.org/0000-0002-2297-395X

João Apóstolo[1]
https://orcid.org/0000-0002-3050-4264

Anabela Salgueiro-Oliveira[1]
https://orcid.org/0000-0002-8231-8279

[1] Unidade de Investigação em Ciências da Saúde: Enfermagem. Escola Superior de Enfermagem de Coimbra, Coimbra, Portugal

[2] Instituto de Pesquisa Clínica e Biomédica de Coimbra, Faculdade de Medicina, Universidade de Coimbra; Coimbra Portugal

[3] Universidade Federal de Viçosa, Viçosa, Brasil; luciene@daskaleas.com (l.B.)

Correspondence author:
Paulo Jorge dos Santos Costa
Email: paulocosta@esenfc.pt

Received: 08.10.19
Accepted: 08.11.19

Abstract

Context: Flushing of peripheral venous catheters (PVC) during intravenous administration is described as a preventive procedure for PVC-related complications. However, this practice is not adequately covered by international guidelines in terms of flushing volume, frequency and technique.
Objectives: To map the existing evidence within the scope of PVC flushing.
Review method: The scoping review protocol, based on the methodology proposed by Joanna Briggs Institute, was defined in order to answer the established questions, considering the criteria defined and the adequacy to the type of databases/repository to be used.
Presentation and interpretation of the results: The mapping of the evidences will allow to identify the typology of studies, the characteristics of PVCs and other information inherent to flushing practice, such as volume, frequency and technique.
Conclusion: It is expected that this review will be a starting point for the analysis and systematization of PVC flushing studies, allowing the identification of gaps and contributing to the optimization of this clinical practice, as well as to scientific research in this thematic scope.

Keywords: review; catheterization, peripheral; professional practice; standard of care

Resumo

Contexto: O *flushing* dos cateteres venosos periféricos (CVPs), aquando da administração intravenosa, encontra-se descrito como um procedimento preventivo das complicações associadas aos CVPs. Contudo, esta prática não se escontra convenientemente operacionalizada nas diretrizes internacionais em termos do volume da solução de *flushing*, frequência e técnica.
Objetivos: Mapear as evidências no âmbito do *flushing* dos CVPs.
Método de revisão: Foi definido o protocolo de *scoping review*, baseado na metodologia proposta pelo *Joanna Briggs Institute*, considerando os critérios definidos e a adequação às bases/repositórios propostos.
Apresentação e interpretação dos resultados: O mapeamento das evidências permitirá identificar os volumes, frequências e técnicas utilizadas na prática de *flushing*.
Conclusão: Prevê-se que esta revisão constitua um ponto de partida para a análise e sistematização dos estudos relativos às práticas de *flushing* dos CVPs, contribuindo não apenas para a otimização desta prática clínica, mas também para a investigação científica nesta temática**.**

Palavras-chave: revisão; cateterismo periférico; prática profissional; padrão de cuidado

Resumen

Contexto: El lavado de los catéteres venosos periféricos (CVP), durante la administración intravenosa, se describe como un procedimiento preventivo para las complicaciones asociadas con los CVP. Sin embargo, esta práctica no se encuentra convenientemente operacionalizada en las directrices internacionales, en lo que se refiere al volumen de la solución del lavado, la frecuencia y la técnica.
Objetivos: Mapear las evidencias en el ámbito del lavado de los CVP.
Método de revisión: Se definió el protocolo de revisión exploratoria, basado en la metodología propuesta por el *Joanna Briggs Institute*, considerando los criterios definidos y la adecuación con las bases/repositorios propuestos.
Presentación e interpretación de los resultados: El mapeado de las evidencias permitirá identificar los volúmenes, las frecuencias y las técnicas utilizadas en la práctica del lavado.
Conclusión: Se espera que esta revisión sea un punto de partida para el análisis y la sistematización de los estudios sobre las prácticas del lavado de los CVP, lo que contribuye no solo a la optimización de esta práctica clínica, sino también a la investigación científica sobre este tema.

Palabras clave: revisión; cateterismo periférico; práctica profesional; nivel de atención

How to cite this article: Parreira, P. M., Marques, I. A., Santos-Costa, P., Sousa, L. B., Braga, L. M., Apóstolo, J. A., & Salgueiro-Oliveira, A. (2020). Peripheral intravenous catheter flushing: a scoping review protocol. *Revista de Enfermagem Referência*, *5*(1), e19066. doi: 10.12707/RIV19066

Introduction

Peripheral intravenous catheters (PIVCs) are a widely used device for intravenous administration of drugs, fluids, nutrients, and blood products. It is estimated that around 70% of hospital patients require, at least, a PIVC, which translates into an annual consumption of approximately 330 million PIVCs in the United States of America (Keogh, Marsh, Higgins, Davies, & Rickard, 2014). In addition, it is estimated that more than 1,000 million PIVCs are inserted every year worldwide (Alexandrou et al., 2015). The European Centre for Disease Prevention and Control (ECDC, 2013) identified more than 50% of patients with a venous catheter, of whom 46.7% had a PIVC. In Portugal, 66.1% of patients require a PIVC (Pina, Paiva, Nogueira, & Silva, 2013).

Although it is a minimally invasive procedure, PIVC insertion has been associated with local and systemic complications of mechanical, chemical or infectious cause, such as occlusion, thrombosis, phlebitis, leakage, infiltration, and microbial colonization. Studies conducted in Portugal have found a significant incidence of PIVC-related complications, namely obstruction (72.7%), accidental removal (65.5%), local bacterial colonization (62.7%), infiltration (59.7%), phlebitis (43.2%), leakage (20.9%), and pain (11.5%; Braga, 2017; Nobre & Martins, 2018; Salgueiro-Oliveira, Parreira, & Veiga, 2012; Santos, 2014).

Thrombosis or phlebitis, as well as microbial growth at PIVC insertion site, can trigger nosocomial infections which, consequently, increase hospital length of stay, treatment costs, and mortality (Keogh et al., 2014). In addition, these complications influence the patient's psychological well-being because they require the use of a replacement device, increasing the patient's levels of anxiety, stress, and pain (Alexandrou et al., 2018).

PIVC insertion and maintenance should be performed by healthcare professionals, in this case nurses, based on the following international recommendations and guidelines for nursing practice: Standards for Infusion Therapy of the Royal College of Nursing (Royal College of Nursing, 2016); Infusion Therapy Standards of Practice of the Infusion Nurses Society (Gorski et al., 2016); Guidelines for the Prevention of Intravascular Catheter-Related Infections of the Centers for Disease Control and Prevention (O'Grady et al., 2011); Guideline for PIVC of the Queensland Health Department of Health (Queensland Government, Department of Health, 2018). These guidelines provide recommendations for the selection of PIVC insertion site and gauge and describe the specific procedures for PIVC maintenance and removal (Alexandrou et al., 2018; Bishop et al., 2007).

PIVC flushing is commonly recommended to (i) maintain catheter patency (catheter function), through the formation of blood clots; (ii) remove fibrin deposits from the catheter's lumen to prevent bacterial growth; (iii) clean the inner lumen between the sequential administration of drugs and solutions, reducing the risk of contact between incompatible substances (Gorski et al., 2016; Royal College of Nursing, 2016).

With regard to the volume of the flush solution, there is no consensus in the literature. Some of the international guidelines for nursing practice recommend using twice of the volume of the PIVC and connectors (Queensland Government, Department of Health, 2018; Royal College of Nursing, 2016), whereas other documents recommend that the volume should vary depending on variables such as catheter type and size, patient's age, and type of infusion/medication (Gorski et al., 2016; Royal College of Nursing, 2016).

As for frequency, some guidelines recommend that flushing should be performed before, between, and after the administration of solutions (Gorski et al., 2016). However, other guidelines recommend that flushing should be performed between and after intravenous administration (Royal College of Nursing, 2016) or after blood drawing (Queensland Government, Department of Health, 2018). Some guidelines recommend that catheters should be flushed at least every 8 hours or every 24 hours (Queensland Government, Department of Health, 2018).

As regards the most adequate flushing technique, Boord (2019) published a literature review that supports the use of pulsatile flushing for central vascular access devices based on an analysis of published experimental studies. However, no conclusions were drawn as to its specific use in PIVCs (Boord, 2019). The abovementioned guidelines mention the use of pulsatile flushing (Queensland Government, Department of Health, 2018; Royal College of Nursing, 2016) and positive pressure flushing (Gorski et al., 2016; Queensland Government, Department of Health, 2018; Royal College of Nursing, 2016).

In view of the above, although flushing is recognized as the most appropriate procedure for testing and maintaining catheter patency, there is a dispersion of knowledge in the literature on the volume, frequency, and technique to be used by healthcare professionals. This reality hampers the development of a systematic review for synthesizing the best available evidence on this topic, thus limiting the transfer of knowledge into clinical practice (Apóstolo, 2017).

With this in mind, an initial search was performed in MEDLINE (via PubMed), the Cochrane Database of Systematic Reviews, CINAHL (via EBSCO), and the JBI Database of Systematic Reviews, but no literature reviews were found on this topic. A search on the website of the Portuguese Directorate-General for Health (www.dgs.pt) found no standards/normative documents, guidelines or clinical decision trees for healthcare professionals on PIVCs. In Portugal, the latest official recommendations on this topic date back to the publication of the *Manual de Normas de Enfermagem: Procedimentos Técnicos* (Veiga et al., 2011) by the Central Administration of the Health System. However, this document includes no recommendations on PIVC flushing in the chapters on PIVC insertion and maintenance.

Therefore, this review intends to map the preclinical and clinical trials in the literature on PIVC flushing, focusing specifically on the volume of the flush solution, the frequency of flushing, and the technique used.

More specifically, this review aims to answer the following

questions: (i) what are the volumes described for PIVC flushing?; (ii) what are the frequencies described for PIVC flushing?; (iii) what are the techniques described for PIVC flushing?

Review method

The scoping review method, which was initially proposed by Arksey and O'Malley in 2005 and redefined in 2015 by the Joanna Briggs Institute, is used to map the evidence on the topic under analysis, allowing to both identify gaps and assess the quality of the studies in the literature (Tricco et al., 2016).

Search strategy and study identification

According to the methodology proposed by the Joanna Briggs Institute, eligibility criteria will be defined based on Population, Concept, and Context (Peters et al., 2015). Thus, this review will consider any studies including healthcare professionals and researchers who are competent in PIVC insertion and/or maintenance, as well as researchers who work in this field (Population). It will consider any studies focused on the volume, frequency or technique of flushing in PIVC maintenance (Concept), in clinical or laboratory settings, in any geographic region of the world (Context).

With regard to the type of study, this review will consider any studies developed in any context, either clinical, pre-clinical, laboratory, simulation environment, or others (for example, randomized controlled studies, case studies, quasi-experimental studies or observational studies). It will also consider any literature reviews, reports, theses or dissertations, among others, considered relevant to the review questions. It will include any studies written in English, Portuguese, Spanish or French, without time restriction.

The search strategy aims to identify both published and unpublished studies. To this end, a search will be performed in the online databases of MEDLINE (via PubMed), CINAHL (via EBSCO), SciELO, Scopus, LILACS, Cochrane Database of Systematic Reviews, and JBI Database of Systematic Reviews. The search for unpublished studies will be conducted in the Scientific Open Access Repositories of Portugal, the CAPES Theses Database, and OpenGrey.

A three-step search strategy will be used. First, a limited search of MEDLINE (via PubMed) and CINAHL (via EBSCO) will be undertaken to list the most commonly used words in the titles and abstracts of the studies developed on this topic, as well as the index terms (Table 1). Then, the words and terms will be combined in a single search strategy, adapted to the specificities of each database/repository used in the review. Finally, the list of references for each selected study will be analyzed for the inclusion of potential studies.

Table 1
Example of an initial search of MEDLINE (via PubMed)

Strategy	Number of records identified
Search (((((flush*[Title/Abstract]) OR rins*[Title/Abstract]) OR wash*[Title/Abstract]) OR patency[Title/Abstract])) AND ((((((((("peripheral venous catheter"[Title/Abstract]) OR "peripheral intravenous access"[Title/Abstract]) OR "venous line"[Title/Abstract]) OR cannula[Title/Abstract]) OR "vascular access device"[Title/Abstract]) OR "peripheral venous access"[Title/Abstract]) OR catheter[MeSH Major Topic]))))	1477

First, the search results will be exported to the reference manager *Mendeley Desktop* (version 1.19.3), which will be used to identify and remove duplicates. Then, the records will be screened based on title and abstract to assess study eligibility. This process will be developed by two independent reviewers, using a third reviewer to resolve any disagreements. All studies that meet the eligibility criteria will be read in full-text form. The screening results will be presented according to the recommendations of the PRISMA Extension for Scoping Reviews (Tricco et al., 2018).

Data extraction

Data will be extracted using an instrument developed by the researchers for this review (Table 2), which can be changed based on the purpose of the review. During this process, if necessary, the authors of the selected studies will be contacted for additional information. This process will be developed by two independent reviewers, using a third reviewer to resolve any disagreements.

Table 2
Instrument developed by the researchers for data extraction.

	Assessment instrument
Title	What is known about peripheral intravenous catheter (PIVC) flushing? Scoping review protocol
Review questions	i) what are the volumes described for PIVC flushing? ii) what are the frequencies described for PIVC flushing? iii) what are the techniques described for PIVC flushing?
Methodology (PCC mnemonic)	**Population** Studies including healthcare professionals who are competent in PIVC insertion/maintenance, as well as researchers working in this field. **Concept** Studies focused on volume, frequency or technique of flushing for PIVC maintenance. **Context** Any clinical or laboratory context in any geographical region of the world.
Details and characteristics extracted from the studies	Authors: _____ Year of publication: _____ Geographic location and clinical context: _____ Study type and design: _____ Research objectives and question: _____ Sample size: _____ Key concepts that relate to the review question: _____

Data synthesis
The evidence found in the literature will be presented in a descriptive format, considering the purpose and focus of the scoping review, using tables and charts whenever necessary. Data synthesis and presentation will be conducted independently by each one of the reviewers involved in the previous step. Subsequently, whenever necessary, the remaining research team members will be involved to obtain consensus on any disagreements. In order to answer the pre-defined review questions, tables and/or graphs will be elaborated with the data in Table 3.

Table 3
Data synthesis grid for the review questions.

Study	Study type	Design	Clinical setting	Administered intravenous therapy	Flushing		
					Volume	Technique	Frequency

Presentation and interpretation of results

The mapping of the evidence available in the literature on PIVC flushing will allow for the analysis and discussion of the type of studies, the characteristics of PIVCs, and the volumes, frequencies, and techniques used in flushing.

Conclusion

Despite being universally recognized as one of the best practices for PIVC maintenance, flushing is particularly important for reducing the number of potential PIVC-related complications. Flushing is not adequately covered in the literature, and there is no consensus between the scientific and professional community about the volume, frequency, and techniques used in flushing. Therefore, this scoping review intends to be a starting point for the analysis and systematization of the main body of evidence on this topic. This scoping review is expected to lead to new scientific developments, namely through the identification of potential systematic literature review questions on the effectiveness of flushing, with a significant impact in clinical practice. This review is also intended to substantiate the need for

the development of a new and improved line of research, as well as the optimization of study designs and research methodologies to be implemented in future studies.
Finally, given the increased focus on the technological and industrial development associated with vascular accesses and infusion therapy, this review is expected to contribute to the creation of innovative medical devices for maximizing the quality, safety, and efficacy of the care delivered to patients with PIVCs.

Author contribution

Conceptualization: Marques, I. A.; Santos-Costa, P.; Sousa, L. B.
Data curation: Marques, I. A.; Santos-Costa, P.; Sousa, L. B.
Writing – original draft preparation: Marques, I. A.; Santos-Costa, P.; Sousa, L. B.; Braga, L.
Writing – review and editing: Parreira, P.; Marques, I. A.; Santos-Costa, P.; Sousa, L. B.; Braga, L.; Apóstolo, A.; Salgueiro-Oliveira, A.
Supervision: Parreira, P.; Apóstolo, A.; Salgueiro-Oliveira, A.

Acknowledgments

The authors would like to acknowledge the Incentives System for Research and Technological Development (IS R&TD Co-promotion) for funding the project Seringa DUO (POCI-01-0247-FEDER-01604), from which this article is derived. The authors P.S.C. (SFRH/BD/136487/2018) and I.A.M. (SFRH/BD/136973/2018) would like to acknowledge the doctoral grant funded by the Portuguese Foundation for Science and Technology, IP (FCT), through funding from the POPH/FSE programs. The authors would also like to acknowledge the support of the Health Sciences Research Unit: Nursing (UICISA: E), hosted by the Nursing School of Coimbra (ESEnfC) and funded by FCT.

References

Alexandrou, E., Ray-Barruel, G., Carr, P. J., Frost, S. A., Inwood, S., Higgins, N., … OMG Study Group. (2018). Use of short peripheral intravenous catheters: Characteristics, management, and outcomes worldwide. *Journal of Hospital Medicine*, *13*(5), 1–7. doi:10.12788/jhm.3039

Alexandrou, E., Ray-Barruel, G., Carr, P. J., Frost, S., Inwood, S., Higgins, N., … Rickard, C. M. (2015). International prevalence of the use of peripheral intravenous catheters. *Journal of Hospital Medicine*, *10*(8), 530–533. doi:10.1002/jhm.2389

Apóstolo, J. (2017). *Síntese da evidência no contexto da translação da ciência*. Coimbra, Portugal: Escola Superior de Enfermagem de Coimbra.

Bishop, L., Dougherty, L., Bodenham, A., Mansi, J., Crowe, P., Kibbler, C., … Treleaven, J. (2007). Guidelines on the insertion and management of central venous access devices in adults. *International Journal of Laboratory Hematology*, *29*(4), 261–278. doi:10.1111/j.1751-553X.2007.00931.x

Boord, C. (2019). Pulsatile flushing. *Journal of Infusion Nursing*, *42*(1), 37–43. doi:10.1097/NAN.0000000000000311

Braga, L. (2017). *Práticas de enfermagem e a segurança do doente no processo de punção de vasos e na administração da terapêutica endovenosa* (Doctoral thesis). Universidade de Lisboa, Portugal.

European Centre for Disease Prevention and Control. (2013). *Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals*. Stockholm, Sweden: Author.

Gorski, L., Hadaway, L., Hagle, M. E., McGoldrick, M., Orr, M., & Doellman, D. (2016). Infusion therapy standards of practice. *Journal of Infusion Nursing*, *39*(1S), S1–S159. Retrieved from https://source.yiboshi.com/20170417/1492425631944540325.pdf

Keogh, S., Marsh, N., Higgins, N., Davies, K., & Rickard, C. (2014). A time and motion study of peripheral venous catheter flushing practice using manually prepared and prefilled flush syringes. *Journal of Infusion Nursing*, *37*(2), 96–101. doi:10.1097/NAN.0000000000000024

Nobre, A., & Martins, M. (2018). Prevalência de flebite da venopunção periférica: Fatores associados. *Revista de Enfermagem Referência, 4*(16), 127-138. doi:10.12707/RIV17058

O'Grady, N. P., Alexander, M., Burns, L. A., Dellinger, E. P., Garland, J., Heard, S. O., … Healthcare Infection Control Practices Advisory Committee. (2011). Guidelines for the prevention of intravascular catheter-related infections. *Clinical Infectious Diseases : An Official Publication of the Infectious Diseases Society of America*, *52*(9), e162-e193. doi:10.1093/cid/cir257

Peters, M. D., Godfrey, C. M., Khalil, H., McInerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. *International Journal of Evidence-Based Healthcare*, *13*(3), 141–146. doi:10.1097/XEB.0000000000000050

Pina, E., Paiva, J., Nogueira, P., & Silva, M. (2013). *Prevalência de infeção adquirida no hospital e do uso de antimicrobianos nos hospitais portugueses: Inquérito 2012*. Lisboa, Portugal: Direção-Geral da Saúde. Retrieved from https://www.dgs.pt/documentos-e-publicacoes/inquerito-de-prevalencia-de-infecao-adquirida-no-hospital-e-uso-de-antimicrobianos-nos-hospitais-portugueses-inquerito-2012-jpg.aspx

Queensland Government, Department of Health. (2018). Guidelines: Peripheral intravenous catheter. Retrieved from https://www.health.qld.gov.au/__data/assets/pdf_file/0025/444490/icare-pivc-guideline.pdf

Royal College of Nursing. (2016). *Standards for infusion therapy*. Retrieved from https://www.rcn.org.uk/professional-development/publications/pub-005704

Salgueiro-Oliveira, A., Parreira, P., & Veiga, P. (2012). Incidence of phlebitis in patients with peripheral intravenous catheters: The influence of some risk factors. *Australian Journal of Advanced Nursing, 30*(2), 32-39. Retrieved from http://www.ajan.com.au/Vol30/Issue2/4Salgueiro-Oliveira.pdf

Santos, D. (2014). *Cuidados de enfermagem no cateterismo venoso periférico: Impacte no perfil microbiológico* (Master's dissertation). Escola Superior de Enfermagem de Coimbra, Portugal. Retrieved from http://repositorio.esenfc.pt/?url=Y7B9hEzj

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., Kastner, M., … Straus, S. E. (2016). A scoping review on the conduct and reporting of scoping reviews. *BMC Medical Research Methodology*, *16*(1), 1–10. doi:10.1186/s12874-016-0116-4

Tricco, A., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., Levac, D., … Straus, S. E. (2018). PRISMA extension for scoping reviews: Checklist and explanation. *Annals Of Internal Medicine*, *169*(7), 467. doi:10.7326/m18-0850

Veiga, B., Henriques, E., Barata, F., Santos, F., Santos, I., Martins, M., … Silva, P. (2011). *Manual de normas de enfermagem: Procedimentos técnicos* (2ª ed.). Lisboa, Portugal: Administração Central do Sistema de Saúde.