ISSNe: 2182.2883 | ISSNp: 0874.0283
Available: https://doi.org/10.12707/RIV17058

RESEARCH PAPER (ORIGINAL)
ARTIGO DE INVESTIGAÇÃO (ORIGINAL)

Prevalence of peripheral intravenous catheter-related phlebitis: associated factors

Prevalência de flebite da venopunção periférica: fatores associados
Prevalencia de flebitis en la venopunción periférica: factores asociados

Alexandra Sofia Pires Nobre*; Matilde Delmina da Silva Martins**

Abstract

Background: Phlebitis is a major adverse event. It has a high prevalence, ranging from 25.8% to 55.6%, which makes it an epidemiologically relevant phenomenon.
Objective: To identify the prevalence of peripheral intravenous catheter-related phlebitis in patients admitted to a hospital unit in the North region of Portugal in May 2017, as well as to analyze its associated risk factors.
Methodology: Prospective cohort study. Data were collected in May 2017 at a hospital unit in the North region of Portugal using the Portuguese version of the Phlebitis Scale, as well as patients' medical records for the collection of sociodemographic and clinical data. The sample was composed of 58 patients.
Results: The participants had a mean age of 64 years, 53.4% of them were women, and the mean dwell time of the peripheral venous catheter (PVC) was 3.25 days. The prevalence of phlebitis was 36.7%, with a predominance of Grade 1 phlebitis (63%).
Conclusion: The occurrence of phlebitis was associated with the PVC dwell time. Further studies and interventions should be conducted to raise nurses' awareness of the importance of assessing the type and severity of phlebitis.

Keywords: catheterization, peripheral; phlebitis; nursing

Resumo

Enquadramento: A flebite apresenta-se como um evento adverso de importância epidemiológica, apontando valores entre 25,8% e 55,6%, considerados elevados.
Objetivo: Identificar a prevalência de flebite na venopunção periférica em doentes internados numa instituição de saúde do norte de Portugal, durante o mês de maio de 2017, e analisar os fatores de risco associados.
Metodologia: Estudo de coorte prospetivo. A recolha de dados decorreu no mês de maio de 2017, numa unidade hospitalar do norte de Portugal recorrendo à *Phlebitis Scale* versão portuguesa e ao processo clínico, para dados sociodemográficos e clínicos. A amostra ficou constituída por 58 doentes.
Resultados: Dos participantes, 53,4% eram do género feminino, com média de idade de 64 anos, a média de tempo de permanência do cateter venoso periférico (CVP) foi de 3,25 dias. A taxa de flebite foi de 36,7%, predominando o grau I (63%).
Conclusão: Associou-se a flebite ao tempo de permanência do CVP. Sugere-se a realização de outros estudos, e ações de sensibilização dos enfermeiros, para a necessidade de avaliação do tipo e grau de flebite.

Palavras-chave: cateterismo periférico; flebite; enfermagem

Resumen

Marco contextual: La flebitis se presenta como un evento adverso de importancia epidemiológica, con valores entre el 25,8% y el 55,6%, los cuales se consideran elevados.
Objetivo: Identificar la prevalencia de flebitis en la venopunción periférica en pacientes internados en una institución de salud en el norte de Portugal durante el mes de mayo de 2017, y analizar los factores de riesgo.
Metodología: Estudio de cohorte prospectivo. La recogida de datos se realizó en mayo de 2017 en un hospital en el norte de Portugal, para lo cual se utilizó la *Phlebitis Scale* versión portuguesa y el proceso clínico de datos sociodemográficos y clínicos. La muestra constó de 58 pacientes.
Resultados: De los participantes, el 53,4% era del género femenino, con una media de edad de 64 años. La media de tiempo de permanencia del catéter venoso periférico (CVP) fue de 3,25 días. La tasa de flebitis fue del 36,7%, con predominio del grado I (63%).
Conclusión: Se asoció la flebitis al tiempo de permanencia del CVP. Se sugiere realizar otros estudios, así como acciones de sensibilización de los enfermeros para responder a la necesidad de evaluación del tipo y grado de flebitis.

Palabras clave: cateterismo periférico; flebitis; enfermería

*RN, School of Health, Polytechnic Institute of Bragança, 5300-146, Bragança, Portugal [alexandra.nobre@sapo.pt]. Contribution to the article: literature search; data collection, treatment, analysis, and discussion; article writing. Adress for correspondence: Rua da Esperança Nº32, Macedo de Cavaleiros, 5340-304, Bragança, Portugal.
**Ph.D., Adjunct Professor, School of Health, Polytechnic Institute of Bragança, 5300-146, Bragança, Portugal [matildemartins@ipb-pt]. Contribution to the article: data analysis and discussion.

Received for publication: 27.06.17
Accepted for publication: 08.01.18

Introduction

Healthcare organizations are increasingly focused on maintaining or improving the quality of care delivery, which requires the implementation of effective, efficient, equitable, acceptable, and safe health-related interventions (Souza, Oliveira, Dias, & Nicola, 2015).

During hospitalization, patient's body defenses decrease as a result of diagnostic, monitoring, or therapeutic interventions that compromise or bypass the immune system, thus creating the conditions for infections (Direção-Geral da Saúde, 2015). Healthcare-associated infections (HAI) may be caused by infectious agents from endogenous or exogenous sources. Endogenous sources are body sites such as the skin, nose, mouth, gastrointestinal tract, or genital area that are normally inhabited by microorganisms. Exogenous sources are those external to the patient, such as health professionals, family members, and visitors, medical equipment and devices used in care delivery, or the surrounding environment (Direção-Geral da Saúde, 2009).

The methods for epidemiological surveillance of HAI include the development of incidence and prevalence studies. Incidence studies measure the number of new cases of HAI over time. Prevalence studies measure the number of patients with HAI during a certain period of time. Prevalence studies conducted in Portugal point to a hospital-acquired infection rate of 10.6%, which is above the European rate of 6.1%. Bloodstream infections accounted for 8.1% of HAI (Pina, Paiva, Nogueira, & Silva, 2013).

Nosocomial bloodstream infections (BSI) are among the major HAI, thus contributing to the increase in in-hospital mortality and morbidity rates, as well as in the costs associated with healthcare delivery (Direção-Geral da Saúde, 2015).

According to the Portuguese Directorate-General for Health, information on the main risk factors for BSI related to invasive devices is of utmost importance (Direção-Geral da Saúde, 2015).

Intravenous therapy requires the insertion of a catheter into a vein, and the peripheral venous catheter (PVC) is the most commonly used catheter because it provides access to the vascular system in a faster, less invasive, and less complex way (Enes, Optiz, Faro, & Pedreira, 2015).

These authors define phlebitis as one of the most common and severe local complications related to PVC use. It is characterized by inflammation of the vein wall and its symptoms include varying degrees of edema, pain, and erythema around the catheter insertion site or along the blood vessels, possibly evolving to a palpable fibrous cord, intense redness, tenderness, and fever.

The study of the risk factors for phlebitis in hospitalized patients is a priority and a valuable tool for the organizations because it can be an indicator of the quality of care and contribute to a more assertive decision-making process, thus facilitating the prevention of this complication (Souza et al., 2015). Therefore, this study aimed to identify the prevalence of peripheral intravenous catheter-related phlebitis in patients admitted to a hospital unit in the North region of Portugal in May 2017, as well as to analyze its associated risk factors.

Background

According to the practical handbook issued by the Ministry of Health, in collaboration with the Ricardo Jorge Institute, hospital-acquired infections worsen patients' functional disability and emotional stress and can sometimes lead to situations that reduce their quality of life. This practical handbook showed an increase of 8.2 days in mean hospital length-of-stay, ranging from 3 days for gynecological surgery, 9.9 days for general surgery, to 19.8 for orthopedic surgery (Direção-Geral da Saúde & Instituto Nacional de Saúde Dr. Ricardo Jorge, 2006).

Hospital-acquired infections are not present upon the patient's admission to the hospital and develop during hospitalization or after discharge, provided that the infection can be related to hospitalization or hospital procedures. Given that infections are not limited to the hospital environment, the term HAI has been considered more appropriate (Menegueti, Canini, Bellissimo-Rodrigues, & Laus, 2015).

Peripheral venipuncture is the most common invasive procedure among inpatients and requires technical competence and manual dex-

terity, knowledge of the anatomy and physiology of the vascular system, and knowledge of pharmacotherapy. This procedure has several purposes and periods of use and it is not a risk-free technique because it may result in local complications such as bruises, infiltration, leakage, PVC obstruction, and phlebitis (Urbanetto, Peixoto, & May, 2016).

According to O'Grady et al. (2011), the pathogenesis of intravenous catheter-related infections is associated with four routes for contamination: migration ofskin microorganisms (microbiota) at the PVC insertion site and colonization of the catheter; contamination of the catheter through direct contact with the professionals' hands or contaminated fluids and devices; hematogenous seeding of the catheter from an infection focus (respiratory, urinary, surgical wound); and through the administration of contaminated fluids, leading to systemic infection. Nurses are responsible for inserting the PVC and monitoring the patient through a range of interventions aimed at the prevention of complications. In addition, nurses are also responsible for removing the catheter if necessary and insert a new one to allow medication administration or another intended purpose (Oliveira & Parreira, 2010).

According to the National Survey on the Prevalence of Infection (*Inquérito Nacional de Prevalência de Infeção*), the PVC is the leading extrinsic risk factor for nosocomial infections. In a more recent survey, the presence of a PVC as an extrinsic risk factor increased the prevalence of nosocomial infections by 11.7%, when compared to the prevalence of 8.3% among patients without a catheter (Pina et al., 2013).

According to Souza et al. (2015, p. 115), phlebitis is defined as

> an inflammatory process developed in the intimal layer of a vein. Among other ways, phlebitis may be classified as follows: the most common type is mechanical phlebitis, related to the puncture or improper handling of the catheter or improper gauging of the vein; chemical phlebitis is related to infusion of drugs of extreme pH and osmolarity, or even very rapid infusion; infectious phlebitis is related to catheter contamination at the time of venipuncture, or the colonization of the intravenous therapy system in handling; and post-infusional phlebitis, which refers to the inflammation of a vessel which no longer displays the catheter *in situ* and which manifests 48 to 96 hours after its removal.

Regardless of its etiology, phlebitis should be classified according to grades using the Portuguese version of the Phlebitis Scale, which is an easy-to-use scale with five observation grades (Braga et al., 2016).

According to Martins (2008), risk factors for PVC-related infections include the thrombogenicity of the material, extended PVC dwell time, the insertion site, the technique and asepsis during the procedure, professionals' hand hygiene before catheter insertion and/or maintenance, as well as multiple patient-related factors, such as age and comorbidities.

Individuals are contaminated or infected due to their compromised defense mechanism, thus becoming susceptible hosts (Administração Regional de Saúde do Norte, 2013). As a result, the Centers for Disease Control and Prevention (CDC) and the Healthcare Infection Control Practices Advisory Committee (HICPAC) developed the Guidelines for the Prevention of Intravascular Catheter-Related Infections (Centro Europeu de Prevenção e Controlo das Doenças, 2011), and other recommendations were also produced in Europe (O' Grady et al., 2011). These recommendations focus on the following aspects: selection of the catheter; selection of the insertion site; aseptic technique and cutaneous antisepsis during catheter insertion, maintenance, and site care; catheter replacement strategies; and antibiotic prophylaxis (O'Grady et al., 2011).

The European Center for Disease Prevention and Control recommends that PVC insertion site should be daily and frequently monitored for signs of tenderness and pain, through surveillance and palpation in case of an opaque dressing or visual inspection in case of a transparent, semipermeable dressing (Centro Europeu de Prevenção e Controlo das Doenças, 2011). According to Oliveira and Parreira (2010), nurses are responsible for PVC insertion, maintenance, and optimization. Therefore, they must acquire skills to be able to identify the signs and symptoms of complications, as well as the risk factors for phlebitis.

Research Question

What is the prevalence of peripheral intravenous catheter-related phlebitis in patients admitted to a hospital unit in the North region of Portugal in May 2017, as well as the risk factors for phlebitis?

Methodology

A prospective, cohort study was designed to meet the study objectives. The target population was composed of patients with at least one PVC who were admitted to a hospital unit in the North region of Portugal.

The following patients were included in the sample: patients in the hospitalization ward during May 2017, with at least one PVC which had been inserted by a nurse at the hospitalization ward or operating room. Patients who had a PVC at the time of admission or inpatients without PVC were excluded. After the application of the inclusion and exclusion criteria, the final sample included 58 patients, with a total of 78 PVCs and 221 observation moments.

The researcher collected the data in May 2017, from Monday to Sunday, between 8 a.m. and 4 p.m..

Based on the guidelines for the prevention of PVC-related infections issued by the European Center for Disease Prevention and Control (Centro Europeu de Prevenção e Controlo das Doenças, 2011), the researcher elaborated an information table for data collection. This table included the patients' sociodemographic and clinical data (age, gender, diagnosis, and medical history), the observation of the insertion site, the direct observation of the procedures for catheter insertion, maintenance, and removal (catheter gauge, insertion site, nurse's hand hygiene, antiseptic solution used at the catheter site, type of dressing to secure the PVC, PVC dwell time, administration of intravenous (IV) medication, antibiotics, and/or other IV therapy, reason for PVC removal, and dressing status after PVC removal). The Portuguese version of the Phlebitis Scale was used to determine the presence or absence of phlebitis.

According to Braga et al. (2016), the Phlebitis Scale is composed of five observation grades of the signs and symptoms of phlebitis: Grade 0 – No symptoms; Grade 1 – Pain at access site or adjacent areas to the catheter during the administration of fluids or medication, OR erythema at access site, with or without pain; Grade 2 – Pain at access site AND edema AND erythema; Grade 3 – Pain at access site AND erythema OR edema, AND redness along the vein, AND palpable venous cord; and Grade 4 – pain at access site WITH erythema AND/OR edema, AND redness along the vein, AND palpable venous cord >2.5 cm in length, AND purulent drainage.

All ethical standards and participants' rights were complied with during the study, based on the Declaration of Helsinki and the Oviedo Convention. The authorization to use the data collection tool at the hospital unit under analysis was requested from the Chairman of the Board of Directors and the Ethics Committee. Upon their permission, the study was presented and explained to the Clinical Director, who was then asked to provide anonymous demographic and clinical information on the patients included in the study.

All participants were previously informed about the study and ensured that their participation was voluntary, that their data would remain confidential, and that they could withdraw from the study at any moment. Before data collection, participants were asked to sign an informed consent form, in which they agreed to participate in the study and authorized the use of the information obtained from their medical records. Data were encoded, inserted, and analyzed using a software to ensure the participants' anonymity.

Data were statistically analyzed using the IBM SPSS Statistics, version 21.0 software. Descriptive statistics were used to characterize the sample, namely participants' age, gender, medical history, type of surgery, number of observations per PVC, insertion site, catheter gauge, type of dressing used to secure the PVC, reason for removal, solution used for site disinfection, and solution used for nurses' hand hygiene. The mean scores between the development of phlebitis, the PVC dwell time, and patient's age were compared using the Student's *t*-test.

The type of surgery, medical history, gender, age, catheter gauge, hand hygiene, administration of IV therapy (fluids, antibiotics (ATB), and medication), type of dressing, insertion site, and PVC dwell time were compared using the chi-square test or Fisher's exact test.

Results

The sample was composed of 58 patients with a mean age of 64 years, 46.6% were men and 53.4% were women, 79.3% had a medical history, and 65.5% had undergone major surgery. On average, each patient had 1.53 PVCs (Table 1).

Table 1
Sample characterization according to gender, age, medical history, and type of surgery

		n	%	Age			
				Min	Max	X	*SD*
Gender	Male	27	46.6%	37	81	64.93	10.92
	Female	31	53.4%	35	84	63.19	10.90
	Total	58	100%	35	84	64.00	10.85
Medical history	Yes	46	79.3%				
	No	12	20.7%				
	Total	58	100%				
				No. of PVCs			
				Min	Max	X	*SD*
Type of surgery	Major	38	65.5%	1	7	1.53	1.33
	Minor	20	34.5%	1	2	1.05	0.22
	Total	58	100%	1	7	1.36	1.10

The veins in the back of the hand (52.6%) were the most common PVC insertion site, followed by the forearm and the antecubital fossa. The most commonly used PVCs were 18-gauge catheters (70.5%), followed by 20-gauge catheters (24.4%). The most common reasons for PVC removal were clinical discharge (35.9%) and nurse's decision (26.9%; Table 2).

Table 2
Sample distribution according to PVC insertion site, PVC gauge, and reason for PVC removal

		n	%
PVC insertion site	Veins in the back of the hand	41	52.6%
	Veins in the wrist	7	9.0%
	Veins in the forearm	10	12.8%
	Veins in the cubital fossa	12	15.4%
	Veins in the arm	8	10.2%
	Total	78	100%

PVC gauge	18G	55	70.5%
	20G	19	24.4%
	24G	4	5.1%
	Total	78	100%
Reason for PVC removal	Infiltration	15	19.2%
	Interruption of IV therapy	10	12.8%
	Leakage	3	3.8%
	Obstruction	1	1.4%
	Nurse's decision	21	26.9%
	Clinical discharge	28	35.9%
	Total	78	100%

Extended mean PVC dwell times (3.25 days) were observed in PVC leading to phlebitis, with a statistically significant difference (p = 0.008; Table 3).

Table 3
Distribution of mean PVC dwell times according to the development of phlebitis

PVC dwell time	Development of phlebitis		*t(p)*
	Yes	No	
n	81	140	
Mean	3.25	2.55	2.698 (0.008)
Standard deviation	2.08	1.38	

According to Table 4, the most common fluid therapy was the administration of glucose-polyelectrolyte solution, followed by saline solution. PVCs without any IV therapy were observed more than three times. With regard to PVCs that were observed once, the most common therapy was ATB prophylaxis (62.8%), which corresponds to the immediate postoperative period in which the unit's protocol foresees the IV administration of three doses of antibiotic and immediate interruption. All PVCs were used to administer ATBs (vancomycin). IV therapy was found mostly in the PVCs that were observed twice.

Table 4
Characterization of the maintenance therapy in the observation moments

		PVC with one obs. *n*(%)	PVC with two obs. *n*(%)	PVC with three obs. *n*(%)	PVC with four obs. *n*(%)
Fluid Therapy	Polyelectrolyte solution	4(5.1%)	1(1.3%)	0(0.0%)	0(0.0%)
	Glucose-polyelectrolyte solution	29(37.2%)	8(10.3%)	1(1.3%)	0(0.0%)
	Saline solution	20(25.6%)	12(15.4%)	0(0.0%)	0(0.0%)
	No maintenance therapy	25(32.1%)	53(67.9%)	44(56.4%)	24(30.8%)
	No PVC	0(0.0%)	4(5.1%)	33(42.3%)	54(69.2%)
	Total	78(100%)	78(100%)	78(100%)	78(100%)
ATB	Yes – ATB prophylaxis	49(62.8%)	0(0.0%)	0(0.0%)	0(0.0%)
	Yes – ATB therapy	19(24.4%)	19(24.4%)	10(12.8%)	5(6.4%)
	No	10(12.8%)	55(70.5%)	35(44.9%)	19(24.4%)
	No PVC	0(0.0%)	4(5.1%)	33(42.3%)	54(69.2%)
	Total	78(100%)	78(100%)	78(100%)	78(100%)
IV Therapy	Yes	50(64.1%)	16(20.5%)	1(1.3%)	0(0.0%)
	No	28(35.9%)	58(74.4%)	44(56.4%)	24(30.8%)
	No PVC	0(0.0%)	4(5.1%)	33(42.3%)	54(69.2%)
	Total	78(100%)	78(100%)	78(100%)	78(100%)

The transparent dressing was the most common type of dressing used to secure the PVC, followed by the hypoallergenic adhesive. However, some PVCs that were observed four times had both types of dressing. Most of the observed PVCs were dry, with a low prevalence of inadequately secured PVCs (Table 5).

Table 5
Characterization of the type of dressing in the observation moments

		PVC with one obs. *n*(%)	PVC with two obs. *n*(%)	PVC with three obs. *n*(%)	PVC with four obs. *n*(%)
Type of dressing	Transparent dressing	55(70.5%)	47(60.3%)	21(26.9%)	13(16.7%)
	Hypoallergenic adhesive	15(19.2%)	13(16.7%)	9(11.5%)	2(2.6%)
	Both	8(10.3%)	14(17.9%)	15(19.3%)	9(11.5%)
	No PVC	0(0.0%)	4(5.1%)	33(42.3%)	54(69.2%)
	Total	78(100%)	78(100%)	78(100%)	78(100%)

Dressing status	Wet	0(0.0%)	3(3.8%)	0(0.0%)	1(1.3%)
	Dry	69(88.5%)	50(64.1%)	21(26.9%)	8(10.3%)
	With visible blood	2(2.5%)	8(10.3%)	13(16.7%)	7(9.0%)
	Inadequately secured	7(9.0%)	13(16.7%)	11(14.1%)	8(10.2%)
	No PVC	0(0.0%)	4(5.1%)	33(42.3%)	54(69.2%)
	Total	78(100%)	78(100%)	78(100%)	78(100%)

Of the 221 observations, phlebitis was present in 81 PVCs, most of which were Grade 1 (63%), followed by Grade 2 (22.2%) and Grade 3 (14.8%). No PVCs developed Grade 4 phlebitis, for which reason this grade was not included in the table (Table 6).

Table 6
Sample distribution according to the presence and grade of phlebitis

		n	%
Phlebitis	Yes	81	36.7%
	No	140	63.3%
	Total	221	100%
	Grade 1	51	63.0%
	Grade 2	18	22.2%
	Grade 3	12	14.8%
	Total	81	100%

Discussion

Since the ward under analysis was an elective surgery unit, most of its inpatients were women (53.4%), which can be explained by the fact that women are affected by an increased bone loss due to decalcification resulting from hormonal imbalance. Nassaji-Zavareh and Ghorbani (2007) reported a higher incidence of phlebitis in women (31%), which the authors associated with hormonal differences between both genders.

The participants' mean age was 64 years. Patients who developed phlebitis were, on average, the oldest patients, which can be explained by age-related factors.

Of the 58 patients included in the study, 79.3% of them had a medical history, with hypertension and diabetes being the most common diseases. According to Pereira, Souza, Tipple, and Prado (2005), the knowledge of the patient's health/disease is a necessary condition to preserve homeostasis or trigger an infectious process; hence any underlying medical condition should be monitored. Nassaji-Zavareh and Ghorbani (2007) reported an incidence rate of phlebitis among patients with diabetes mellitus of 57.7%, which may be due to the fact that the endothelium damage caused by the disease increases the risk for phlebitis.

With regard to orthopedic diseases, most patients (65.5%) underwent major surgery, namely total knee arthroplasty (TKA), total hip arthroplasty (THA), and spine surgery with the purpose of relieving pain symptoms and recovering lost functionality and independence. On average, each of these patients required more than one PVC (1.53 PVCs).

Although nurses performed hand hygiene

using an alcohol-based solution before catheter insertion, a high rate of phlebitis was observed in all PVCs, which may be explained by inadequate compliance with hand hygiene procedures. It should be noted that the Guidelines for the Prevention of Intravascular Catheter-Related Infections recommend hand washing with soap and water or an alcohol-based solution before and after palpating the insertion site, before and after inserting the catheter, and during the assessment and maintenance of the insertion site.

Disinfection procedures were performed in 51.3% of insertion sites using 70% alcohol, which suggests an adequate adherence to best practices among the nurses of this orthopedic ward. Nurses use one of the three solutions recommended by the CDC and the Infusion Nurses Society for cutaneous antisepsis, namely 70% alcohol, tincture of iodine, or chlorhexidine, with the latter being the preferred antiseptic, except in children aged less than 2 months. According to the Infusion Diseases Society of America, the patient's skin must be previously cleaned, regardless of the antiseptic used, and drying times between must be observed before the contact with the skin.

The most common PVC insertion site was the veins in the back of the hand (52.6%), where veins are more visible, thus ensuring a more successful insertion. Souza et al. (2015) reported a higher prevalence of phlebitis in the back of the hand since the hand is very important for mobility purposes and has smaller and more sinuous blood vessels, with less hemodilution, which can increase irritation of the vein.

The most commonly used PVCs were 18-gauge catheters, which is ideal for therapeutic purposes because it is a moderate-sized gauge.

The main reasons for PVC removal were clinical discharge (35.9%) and the nurse's decision (26.9%).

The mean PVC dwell time was 3.25 days, which shows a statistically significant association ($p = 0.008$) between PVC dwell time and the occurrence of phlebitis.

On average, patients with phlebitis had longer PVC dwell times. The Infusion Nurses Society withdrew the recommendation to change the PVC routinely, at specific time intervals. Instead, nurses should only replace the PVC in case of clinical signs of phlebitis or parenteral nutrition.

The transparent dressing was the most common type of dressing used to secure the PVC. The main advantage of these dressings is that they allow for longer intervals between dressing changes because they allow the the catheter site to be monitored visually; however, the costs of this type of dressing are a significant disadvantage (Tertuliano, Borges, Fortunato, Oliveira, & Poveda, 2014).

In most of the PVCs observed, the dressing was dry. According to Capdevila (2013), the daily observation of the PVC and its removal at the first signs of phlebitis, as well as the removal of unnecessary PVCs after the interruption of the treatment and of PVCs inserted in the emergency unit contribute to reduce the rate of PVC-related infections.

Most patients receive maintenance therapy during the first 48 hours of the post-operative period. Glucose-polyelectrolyte solution is the most widely used therapy because it allows for the continuous flushing of the IV access, by preventing the accumulation of chemical residue in the cannula, and greater dilution of the medication.

As per the unit's protocol, patients are administered with antibiotic prophylaxis in the first 24 hours of the post-operative period and antibiotic therapy for 6 weeks if they develop a surgical site infection. Vancomycin, which is a glycopeptide antibiotic with a high level of toxicity, was the most commonly used antibiotic. A correct infusion time and adequate dilution are essential to decrease the osmolality and pH of the infusion. Urbanetto et al. (2016) reported a high incidence of phlebitis (33.3%) and post-infusion phlebitis among patients who were administered with vancomycin.

According to Capdevila (2013), the leading causes of phlebitis are associated with the irritation caused by medication, which results in chemical phlebitis.

In this study, the rate of phlebitis was 36.7%, which is well above the acceptable rate according to the Infusion Nurses Society standards.

Most phlebitides were Grade 1 (63%), which is in line with the results found by Magerote, Lima, Silva, Correia, and Secoli (2011) in a prospective cohort study. These authors re-

ported a phlebitis rate of 25.8%, in which most phelibits were Grade 1, followed by Grade 2 and Grade 3, and even Grade 4. Grade 4 phlebitis was not observed in this study, which may suggest that the PVC was removed before worsening into Grade 4.
Given the high rate of phlebitis among these patients, the results obtained in this study are worrying. Phlebitis can evolve into a BSI, which poses a problem for the nurses in the orthopedic ward of this hospital unit in the North region of Portugal. Therefore, it is essential to implement strategies for the prevention and early identification of signs for this complication.

Conclusion

The results show a high prevalence of phlebitis, particularly Grade 1 phlebitis. A statistically significant association was found between PVC dwell time and the occurrence of phlebitis. Therefore, PVC dwell time should be reduced whenever possible, and/or the PVCs should be inserted at a different site at the first signs of phlebitis, which can be assessed by nurses using the Portuguese version of the Phlebitis Scale. Further studies should be conducted using a larger sample with the purpose of fully understanding the topic under analysis, which will, in turn, contribute to the implementation of better practices.

References

Administração Regional de Saúde do Norte. (2013). *Programa de Prevenção e Controlo de Infeção e Resistência aos Antimicrobianos* (PPCIRA). Porto, Portugal: Autor.

Braga, L. M., Oliveira, A. S., Henriques, M. A., Rodrigues, M. A., Rodrigues, C. J., Pereira, S. A., & Parreira, P. M. (2016). Tradução e adaptação da Phlebitis Scale para a população portuguesa. *Revista de Enfermagem Referência*, *4*(11), 101-109. doi: 10.12707/RIV16048

Capdevila, J. A. (2013). El catéter periférico: El gran olvidado de la infección nosocomial. *Revista Española de Quimioterapia*, *26*(1), 13-17. Retrieved from http://seq.es/seq/0214-3429/26/1/capdevila.pdf

Centro Europeu de Prevenção e Controlo das Doenças. (2011). *ECDC: Excelência na prevenção e controlo das doenças infecciosas.* Retrieved from http://www.ecdc.europa.eu/pt/publications/Publications/1105_COR_ECDC_Brochure_2011.pdf

Direção-Geral da Saúde. (2009). *Programa Nacional de prevenção e controlo de infeção associada aos cuidados de saúde.* Lisboa, Portugal: Autor.

Direção-Geral da Saúde, & Instituto Nacional de Saúde Dr. Ricardo Jorge. (2006). *Recomendações para a prevenção da infecção associada aos dispositivos intravasculares.* Lisboa, Portugal: Autor.

Direção-Geral da Saúde. (2015). *Prevenção e Controlo de Infeções e de Resistência aos Antimicrobianos em números*. Lisboa, Portugal: Autor.

Enes, S., Optiz, S., Faro, A., & Pedreira, M. (2016). Phlebitis associated with peripheral intravenous catheters in adults admitted to hospital in the Western Brazilian Amazon. *Revista da Escola de Enfermagem da USP*, *4*(2), 263-271. doi: 10.1590/S0080-623420160000200012

Magerote, N., Lima, M., Silva, J., Correia, L., & Secoli, S. (2011). Associação entre flebite e retirada de cateteres intravenosos periféricos. *Texto Contexto Enfermagem*, *20*(3), 486-492. doi: 10.1590/S0104-07072011000300009

Martins, J. C. A. (2008). Investigação em Enfermagem: alguns apontamentos sobre a dimensão ética. *Pensar Enfermagem. Lisboa. ISSN 0873- 8904. Vol. 12, N.º 2, p. 62-66*

Menegueti, M. G., Canini, S. R., Bellissimo-Rodrigues, F., & Laus, A. M. (2015). Avaliação dos programas de controle de infecção hospitalar em serviços de saúde. *Revista Latino-Americana Enfermagem, 23*(1), 98-105. doi: 10.1590/0104-1169.0113.2530

Nassaji-Zavareh, M, & Ghorbani, R. (2007). Peripheral intravenous catheter-related phlebitis and related risk factors. *Singapore Medical Journal, 48*(8), 733-736. Retrieved from http://smj.sma.org.sg/4808/4808a4.pdf

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*, *52*(9), e162-e193. doi: 10.1093/cid/cir257

Oliveira, A. S., & Parreira, P. M. (2010). Intervenções de enfermagem e flebites decorrentes de cateteres venosos periféricos. Revisão da literatura. *Revista de Enfermagem Referência*, *3*(2), 137-147. doi: 10.12707/RIII1027

Pereira, M., Souza, A., Tipple, A., & Prado, M. (2005). A Infeção Hospitalar e as suas implicações para o cuidar da Enfermagem. *Texto Contexto Enfermagem*, *14*(2), 250-257 doi.10.1590/S0104-07072005000200013.

Pina, E., Paiva, J. A., Nogueira, P., & Silva, M. G. (2013). Prevalência de infeção adquirida no hospital e do uso

de antimicrobianos nos hospitais portugueses – Inquérito 2012. *Lisboa: Direção-Geral de Saúde.*

Souza, A. E., Oliveira, J. L., Dias, D. C., & Nicola, A. L. (2015). Prevalencia de flebitis en pacientes adultos ingresados en hospital universitario. *Revista RENE*, *16*(1), 114-122. doi: 10.15253/2175-6783.2015000100015

Tertuliano, A., Borges, J., Fortunato, R., Oliveira, A. L., & Poveda, V. (2014*).* Flebite em acessos venosos periféricos de pacientes de um Hospital do Vale do Paraíba. *REME - Rev Min Enferm*., *18*(2), 334-339 doi: 10.5935/1415-2762.20140026.

Urbanetto, J. S., Peixoto, C. G., & May, T. A. (2016). Incidência de flebites durante o uso e após a retirada de cateter intravenoso periférico. *Revista Latino-Americana de Enfermagem*, *24*, e2746 doi: 10.1590/1518-8345.0604.2746