

RESEARCH PAPER (ORIGINAL)

Incidence and type of peripheral vascular trauma in people undergoing diagnostic imaging exams

Incidência e tipo de traumatismo vascular periférico em pessoas submetidas a exames de diagnóstico por imagem

Incidencia y tipo de traumatismo vascular periférico en personas sometidas a exámenes de diagnóstico por imagen

Cristina Arreguy-Sena¹
 <https://orcid.org/0000-0002-5928-0495>
Romanda da Costa Pereira Barboza Lemos¹
 <https://orcid.org/0000-0003-2534-9359>
Marcos Antônio Gomes Brandão²
 <https://orcid.org/0000-0002-8368-8343>
Anabela de Sousa Salgueiro-Oliveira³
 <https://orcid.org/0000-0002-8231-8279>
Luciene Muniz Braga⁴
 <http://orcid.org/0000-0002-2297-395X>
Paula Krempser¹
 <https://orcid.org/0000-0003-4838-6873>

¹Federal University of Juiz de Fora, Minas Gerais, Brazil

²Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

³Health Sciences Research Unit: Nursing, Nursing School of Coimbra, Coimbra, Portugal

⁴Federal University of Viçosa Viçosa, Brazil

Corresponding author:

Romanda da Costa Pereira Barboza Lemos

Email: romanda.barboza@gmail.com

Received: 03.10.19

Accepted: 10.01.20

Abstract

Background: The venipuncture is a frequent procedure in nursing care, being necessary to map/identify possible related problems, taking into account the specificities of diagnostic examinations, to support care delivery.

Objective: Analyze the incidence and type of peripheral vascular trauma manifestations in people undergoing computed tomography and magnetic resonance imaging.

Methodology: Retrospective cohort of sectorial documents and prospective cohort with individuals punctured for computed tomography and magnetic resonance imaging with contrast. Data collected from June to December 2018, subject to descriptive statistics and incidence measurement.

Results: The study included 76 patients and 2,946 records of venipuncture evaluation forms. In the retrospective cohort, the incidence of extravasation of contrast was 8,4%. In the prospective cohort, the incidence of vascular trauma was 52,6%. The manifestations identified were erythema, vein dilation, blood residue, ecchymosis, and hardening.

Conclusion: The manifestations identified can be treated/minimized, being the nurse responsible for decision-making based on scientific evidence, aiming at patient safety and quality of nursing care.

Keywords: nursing; diagnostic imaging; veins; catheterization, peripheral; nursing diagnosis

Resumo

Enquadramento: A punção venosa é um procedimento frequente na assistência de enfermagem, sendo necessário mapear/identificar possíveis problemas relacionados, considerando as especificidades dos exames diagnósticos, para subsidiar a assistência.

Objetivo: Analisar a incidência e os tipos de manifestações de traumatismo vascular periférico em pessoas que realizaram tomografia computadorizada e ressonância magnética.

Metodologia: Coorte retrospectiva de documentos setoriais e coorte prospectiva com pessoas que foram punccionadas para realizar tomografia computadorizada e ressonância magnética com contraste. Dados colhidos entre junho e dezembro de 2018, tratados com estatística descritiva e cálculo da incidência.

Resultados: Participaram 76 usuários e 2.946 registros das fichas de punções venosas. Na coorte retrospectiva, a incidência de extravasamento de contraste foi de 8,4%. Na coorte prospectiva, a incidência de traumatismo vascular foi de 52,6%. As manifestações identificadas foram eritema, dilatação da veia, resíduo de sangue, equimose e endurecimento.

Conclusão: Identificadas manifestações que podem ser tratadas/minimizadas, cabendo ao enfermeiro a tomada de decisão baseada em evidências científicas que sustentem a prática, visando a segurança dos usuários e a qualificação do cuidado de enfermagem.

Palavras-chave: enfermagem; diagnóstico por imagem; veias; cateterismo periférico; diagnóstico de enfermagem

Resumen

Marco contextual: La venopunción es un procedimiento frecuente en la atención de enfermería, y es necesario mapear/identificar los posibles problemas relacionados, considerando las especificidades de las pruebas diagnósticas, para subvencionar la atención.

Objetivo: Analizar la incidencia y los tipos de manifestaciones de los traumatismos vasculares periféricos en personas sometidas a una tomografía computarizada y a una resonancia magnética.

Metodología: Cohorte retrospectiva de documentos sectoriales y cohorte prospectiva con personas que se sometieron a una punción para realizarse una tomografía computarizada y una resonancia magnética de contraste. Los datos recogidos entre junio y diciembre de 2018 se trataron con la estadística descriptiva y el cálculo de la incidencia.

Resultados: Participaron 76 usuarios y 2946 registros de las fichas de venopunción. En la cohorte retrospectiva, la incidencia de extravasación de contraste fue del 8,4%. En la cohorte prospectiva, la incidencia de traumatismo vascular fue del 52,6%. Las manifestaciones identificadas fueron eritema, dilatación de la vena, residuo de sangre, equimosis y endurecimiento.

Conclusión: Se identificaron manifestaciones que pueden ser tratadas/minimizadas, y el enfermero es responsable de tomar decisiones basadas en las pruebas científicas que respaldan la práctica, con el objetivo de mantener la seguridad de los pacientes y la calidad de los cuidados de enfermería.

Palabras clave: enfermería; diagnóstico por imagen; venas; cateterismo periférico; diagnóstico de enfermería



How to cite this article: Arreguy-Sena, C., Lemos, R. C., Brandão, M. A., Salgueiro-Oliveira, A. S., Braga, L. M., & Krempser, P. (2020). Incidence and type of peripheral vascular trauma in people undergoing diagnostic imaging exams. *Revista de Enfermagem Referência*, 5(2), e19061. doi: 10.12707/RIV19061



Introduction

The technological advances result in important changes at the global level, including achievements in the area of health. The creation of equipment assisted by X-ray, as in computed tomography (CT), and other types of radiation, as in magnetic resonance imaging (MRI) for the formation of human body images, facilitated the diagnosis of diseases so that an appropriate therapy could be achieved. The Imaging Diagnosis Unit (IDU) provides diagnostic support, being regarded as an essential area for the dynamics of health service functioning due to technical and scientific development, leading to efficient clinical and/or surgical decision-making processes which impact on the treatment and monitoring of patients (Sales, Oliveira, Spirandelli, & Cândido, 2010).

The image generated by the different types of radiation enables distinguishing anatomical structures according to their density and thickness, allowing their differentiation by natural contrast. However, some of these structures have similar densities, preventing their differentiation. As a result, artificial contrast media are used by intravascular administration and contribute to improving the quality of the images (Cruz, 2012).

The role of nurses in the area of imaging diagnosis is to ensure the quality of care provided to patients who are submitted to examinations, promoting the humanization of care. One of the tasks of the nursing team in IDUs for conducting examinations is to perform venipuncture and insertion of a peripheral venous catheter to facilitate the administration of contrast media. This invasive procedure requires professional skills, because of its scientific-technical complexity, and psychomotor ability (Oliveira et al., 2019). Although the venipuncture is considered a simple and common procedure in nursing care, local and systemic complications may occur at the puncture site and surrounding areas, which should be avoided and/or minimized (Danski, Johann, Vayego, Oliveira, & Lind, 2016).

The extravasation of contrast media is one of the most frequently reported types of trauma in IDUs, ranging between 0.1% and 1.2%. These rates are considered low but are associated with the severity of the event (Conner et al., 2017). Some intervening factors may influence the occurrence of extravasation of contrast media, for example, the caliber of intravascular catheters and also the drug infusion rate (Tamura et al., 2017).

The consulted literature did not provide records of incidence of other types of vascular trauma in venipunctures performed in IDUs, hence this research.

An effective venipuncture requires a nursing team with technical-scientific knowledge of anatomy, physiology, and microbiology. In addition, it is essential to adopt in clinical practice best practice recommendations and scientific evidence to ensure patient safety and the continuous training of nurses, aiming at excellent care quality and minimization of complications and damage (Melo et al., 2015). In view of this, the objective of this research was to analyze the incidence and types of manifestations of peripheral vascular trauma in individuals who underwent CT and MRI.

Background

The contrast media used in imaging examinations, also known as contrasts, are chemical substances that, according to their physical and chemical properties, allow their differentiation when compared to body structures. These properties are taken into account regarding their efficiency and safe administration to direct the care to be provided. Different types of substances act as contrasts, and the choice depends on the type of examination to be performed (Cruz, 2012).

The contrasts are considered irritating and vesicant substances, that is, they trigger an inflammatory reaction, pain, and even tissue necrosis in case of extravasation in tissue. High-pressure infusion, which occurs mainly in CT scans, enhances the risk of extravasation. For this reason, it is essential to ensure a previous intravascular route, with a size compatible with the infusion to prevent/minimize the occurrence of extravasation (Conner et al., 2017).

Besides extravasation, other local complications may occur after venipuncture, insertion and, dwell of a peripheral venous catheter, such as phlebitis, hardening, erythema, vein dilation, occlusion, nerve, tendon, or ligament damage, thrombosis, catheter displacement, hematoma, venous spasm, and local infection (Danski et al., 2016; Tamura et al., 2017).

Some factors may contribute to the occurrence of vascular trauma, such as the type of catheter used, the preparation of the puncture site, the type of infusion, the insertion technique, and the dwell time, in addition to the intrinsic characteristics of the person who will be punctured (Danski et al., 2016; Krempser, Arreguy-Sena, & Barbosa, 2013).

These local complications are called peripheral vascular trauma (PVT), defined as a lesion in a vein or adjacent tissue. Many of these injuries are likely to be minimized or even avoided with the adoption of some preventive measures, such as adjustments in pressure and duration of garroting during vein visualization/palpation, choice of the size of the catheter in accordance with the vessel caliber and the infusion rate, use of aseptic technique using a minimum amount of antiseptic, adequate fixation of the peripheral venous catheter, compression of the site by the time needed after catheter withdrawal, among others (Krempser et al., 2013).

The nursing diagnosis *risk of vascular trauma* guides nursing care on this topic and is considered a parameter to the assessment of the quality of care. This diagnosis confirms that it is possible to prevent/minimize the occurrence of vascular trauma, together with the adoption of preventive measures, which involve a reassessment of nursing care practice, justifying the development of research in this theme (Arreguy-Sena & Carvalho, 2009).

Research questions

What is the incidence and types of manifestations of peripheral vascular trauma identified in individuals who underwent CT and MRI in an IDU?



Methodology

The research was conducted in IDUs in a university hospital located in the Zona da Mata region of Minas Gerais State (Brazil), responsible for the provision of secondary health care, in collaboration with the Brazilian National Health System (SUS), where 2,000 exams per month, on average, were performed, of which 350 are CT scans, and 300 are MRIs.

A retrospective cohort of 2,946 records obtained through the peripheral venipuncture evaluation forms was conducted. These forms existed in the sector in 2016 and 2017, where the venipunctures performed were recorded, being that 10 people admitted in the sector were registered in each form. However, this form only contained information relating to the extravasation of contrast. The conduction of a prospective cohort became necessary to identify other types of vascular trauma that may occur in the venipunctures to CT scans and MRI. The cohort included 76 people who underwent venipuncture for CT and/or MRI, including also photographic records of the peripheral venipuncture site after the removal of the intravascular catheter.

The prospective cohort was performed with 76 persons only because, during the collection of data, there was a long period of undersupply of contrast, with the cancellation of examinations, hindering the continuation of data collection.

The inclusion criteria for the venipuncture evaluation forms were the following: all records relating to persons admitted to the IDU in the period between 30 September 2016 and 31 December 2017, when the form still existed in the sector. The exclusion criteria were documents unavailable during the data collection period and records of patients who were hospitalized when they were treated in the unit. The sample was gathered by census. Therefore there was no estimation of loss replacement.

For the segment of participants, an individual invitation was delivered to clients previously scheduled for a CT scan and/or MRI in an IDU. The inclusion criteria were: people ≥ 18 years old; people with no speech limitations that hindered free expression and data consistency; and people who required venipuncture for a CT scan and/or MRI in and IDU. The exclusion criteria were as follows: manifesting complications with risk of death during the examination.

Two instruments were created for data collection. One was

to collect the information contained in the venipuncture evaluation forms (gender, age, examination, puncture site, number of attempts, use of contrast media, and extravasation of contrast). The other was intended to guide the information to be collected in the monitoring of the punctures performed on patients (gender, age, skin color, personal income, marital status, level of education, religion, profession, and examination, intravenous device size, number of venipuncture attempts, characteristics of the venous network, and puncture site). The photographic records of venipunctures that comprised the prospective cohort were made after the removal of the intravascular catheter, characterizing the end of the examination. They were used to record the types of vascular trauma that occurred during the collection.

The data were collected with the support of the application Open Data Kit (ODK). The material obtained via ODK was sent to cloud storage and recorded in an Excel for Windows sheet to subsequently be treated according to the type of information obtained.

The data were imported from the Excel sheet to the IBM SPSS Statistics software, version 22.0, being analyzed according to descriptive statistics (frequency, percentage, and measures of central tendency and dispersion) and calculation of incidence.

All legal and ethical aspects of research involving humans were respected, and a favorable opinion was obtained (CAAE: 1 84973518.0.0000.514).

Results

The retrospective cohort consisted of 2,946 records obtained through the venipuncture evaluation forms. Most of the participants were female, aged between 48-57 years and 58-67 years (27.7% and 21.6%, respectively). The most frequently performed examination was CT (50.6%). The peripheral venipuncture was performed in 73.4% of the participants, the primary puncture site was the left upper limb (19.4%), with a median of one venipuncture attempt. It should be noted that, although most punctures were performed in the left upper limb (LUL), 1,524 records (70.4%) did not include information on the puncture site. The contrast was used in 54.5% of the participants. The incidence of extravasation of contrast was 8.4% (Table 1).

Table 1
 Characterization of the evaluation records of venipuncture sites in patients of IDU (n = 2946)

Variables	N	%	Variables	N	%	<i>Md</i> ± <i>SD</i> (min-max)
Gender			Age (years)*			
Female	1711	58.1	0 - 17	112	3.7	
Male	1235	41.9	18 - 27	183	6.2	
Total	2946	100	28 - 37	282	9.6	
			38 - 47	475	16.2	
			48 - 57	816	27.7	<i>Md</i> 52 ± 16.471
Examination			58 - 67	635	21.6	(02-96)
CT	1490	50.6	68 - 77	306	10.4	
MRI	1422	48.3	78 - 87	119	4	
CT + MRI	34	1.1	≥ 88	18	0.6	
Total	2946	100	Total	2.946	100	
Venipuncture			Venipuncture attempts			
Yes	2163	73.4	1	696	32.18	
No	783	26.6	2	77	3.56	
Total	2946	100	3	27	1.25	
Puncture site			4	3	0.14	
No record	1524	70.4	5	3	0.14	<i>Md</i> 1 ± 0.804
LUL	419	19.4	6	4	0.18	(1-11)
RUL	210	9.7	7	1	0.05	
others	10	0.5	11	1	0.05	
Total	2163	100	No record	1351	62.45	
Use of contrast			Total	2163	100	
Yes	1179	54.5	Extravasation of contrast			
No	984	45.5	Yes	99	8.4	
Total	2163	100	No	1080	91.6	
			Total	1179	100	

Note. IDU = Imaging diagnosis unit; CT = Computed tomography; MRI = Magnetic resonance imaging; LUL = Left upper limb; RUL = Right upper limb; *Md* = Median; *SD* = Standard deviation; Min = Minimum; Max = Maximum.

Seventy-six people participated in the prospective cohort. Women were predominant (59.2%), aged between 48 and 68 years (17.1% and 28.9%, respectively), with a median of 57.5 years. The most frequently performed examination was a CT scan with contrast (61.9%).

Table 2 presents the characterization of the peripheral venipunctures in the participants of the prospective cohort. The most frequently used was the 20-gauge peripheral venous catheter, with a successful first attempt (81.6%), predominantly in the left upper limb (68.4%). As regards the profile of the venous network of the participants, 86.9% of veins were classified as elastic and flexible; 38.2% of medium caliber; 98.7% as palpable; 80.3% with a straight path; 81.6% visible; 71.1% were

punctured in a joint; and 68.4% of the venipunctures were considered easy. It is important to mention that there was no manifestation of vascular trauma of the type infiltration/extravasation during the conduction of the prospective cohort.

The dwell time of the peripheral venous catheter, between the beginning of the venipuncture and the end of the examination for the patient's discharge, was around 30 minutes for CT scans and 1 hour for the MRI. The fixation and stabilization of peripheral venous catheter were performed with adhesive tape. After the withdrawal of the peripheral venous catheter, compression was performed at the insertion site, in all cases, followed by the placement of an occlusive dressing at the site of catheter insertion.

Table 2
 Characterization of the punctures performed in the prospective cohort (n = 76)

Variables	N	%	Variables	N	%	<i>Md</i> ± <i>SD</i> (min-max)
Caliber of device			Venipuncture attempts			
PVC 20G	47	61.9	1	62	81.6	<i>Md</i> 1.0±0.873 (1-5)
PVC 22G	22	28.9	2	8	10.5	
PVC 18G	5	6.6	≥3	6	7.9	
PVC 24G	2	1.6	Total	76	100	
Total	76	100	Type of peripheral vein			
Puncture site			Visible	62	81.6	
LUL	52	68.4	Invisible	14	18.4	
RUL	24	31.6	Total	76	100	
Total	76	100	Palpable	75	98.7	
			Unpalpable	1	1.3	
Type of peripheral vein			Total	76	100	
Medium caliber	29	38.2	Vein in joint	54	71.1	
High caliber	27	35.5		22	28.9	
Small caliber	20	26.3	Total	76	100	
Total	76	100	Easy-to-puncture vein	52	68.4	
Straight path	61	80.3	Difficult-to-puncture vein	24	31.6	
Tortuous path	15	19.7	Total	76	100	
Total	76	100				
Elasticity with flexibility	66	86.9				
Elasticity with hardening	10	13.1				
Total	76	100				

Note. PVC = Peripheral venous catheter; G = Gauge; *Md* = Median; *SD* = Standard deviation; Min = Minimum; Max = Maximum; LUL = Left upper limb; RUL = Right upper limb

Although there have been cases of extravasation of contrast during the prospective cohort, it was not possible to identify, with photographic records, the presence of other types of manifestations of vascular trauma resulting from venipunctures for examination purposes (Table 3). The incidence of vascular trauma was 52.6%. The manifesta-

tions of vascular trauma identified and documented using photographic records were: erythema (25%), vein dilation (17.1%), blood residue (13.2%), ecchymosis (9.2%), and hardening (3.9%). At least one manifestation of vascular trauma was found in 38.2% of peripheral venipuncture sites after the removal of the PVC.

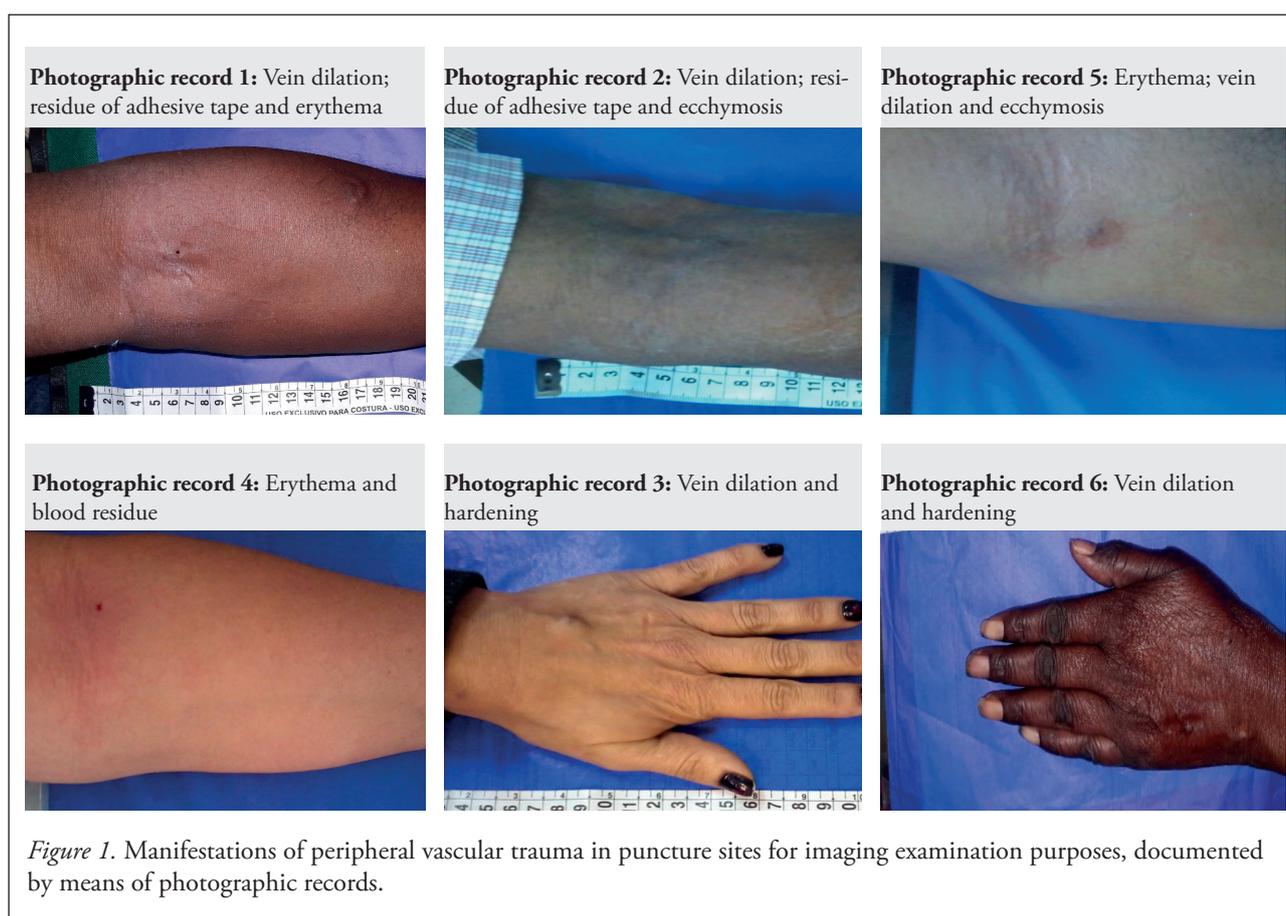
Table 3
 Characterization of the types of vascular trauma identified in this prospective cohort with photographic records

Variables	N	%	Variables	N	%	<i>Md</i> ± <i>SD</i> (min-max)
Vascular trauma			Number of traumas in a puncture			
Yes	40	52,6	0	36	47,4	<i>Md</i> 1.0 ± 0.719 (0-2)
No	36	47,4	1	29	38,2	
Total	76	100	2	11	14,4	
			Total	76	100	

Erythema		Ecchymosis			
Yes	19	25	Yes	7	9,2
No	57	75	No	69	90,8
Total	76	100	Total	76	100
Vein dilation		Hardening			
Yes	13	17,1	Yes	3	3,9
No	63	82,9	No	73	96,1
Total	76	100	Total	76	100
Blood residue					
Yes	10	13,2			
No	66	86,8			
Total	76	100			

Note. *Md* = Median; *SD* = Standard deviation; Min = Minimum; Max = Maximum.

Figure 1 presents the vascular trauma manifestations identified in participants included in the prospective cohort, by means of photographic records of the venipunctures.



Discussion

With regard to the participants' profile, both in the prospective and retrospective cohorts, women were predominant. According to Botton, Cúnico, and Strey (2017), women seek care more frequently, thus generating a higher rate of visits when compared to men.

The principal age range among the participants (48 to 68 years) reflects the aging of the Brazilian population,

reflected in the inversion of the population pyramid, which impacts the country's public health. A study that analyzed the challenges related to population aging and the planning of public policies (Miranda, Mendes, & Silva, 2016) showed that the country is still not prepared to meet the demands caused by the population aging. As a result, different areas are affected, including the health system, whose ongoing and multidisciplinary restructuring

will be necessary. The authors highlight the importance of providing specific public policies that ensure integral care to this population, with a focus on health promotion, disease prevention, and quality of life, taking into account the characteristics of aging so that older adults may remain integrated into society.

The peripheral venipuncture performed predominantly in the left upper limb in both cohorts can be due to the disposition of the furniture in the service room because the table for support of materials used for puncture is located to the left side of the puncture chair, or due to patient preference.

The search for visible, palpable veins of medium/large caliber, with a straight path, allows to the professional a higher probability of successful punctures, also indicating their predominance (Nobre & Martins, 2018; Oliveira et al., 2019). The choice of the peripheral venous catheter of larger caliber is justified by the particularities of examinations because the contrast media are administered with high flow (up to 5 mL/second), especially in CT scans, in which the volume reaches 100mL (Acauan & Rodrigues, 2015). The selection of the vein should be judicious, giving priority to those of a larger caliber. In addition, the physical and chemical properties of contrast media, such as viscosity, also show the need for large-caliber venipunctures, facilitating their tolerability. It is recommended the use of a flexible intravascular catheter with a caliber compatible with the size of the chosen vein, preferably of 18- and 20-gauge sizes (Pacheco Compañía, Gago Vidal, & Méndez Díaz, 2014).

The fixation and stabilization of intravascular catheters were performed with adhesive tape in the unit. The photographic records allowed identifying the glue residue of the adhesive on the skin of the participants, after removal of the intravascular catheter. The glue residue of adhesive tape is difficult to remove, being necessary to rub the skin. This can trigger trauma and reduction of the integrity of the skin of the patient.

The stabilization of the peripheral venous catheter prevents its movement within the blood vessel, preserving its integrity, and minimizes mechanical trauma. It is also essential to use covers to protect the catheter insertion site, reducing the possibility of bloodstream infection. The non-sterile adhesive tapes (standard tape and micro-porous tape) should not be used for stabilization and/or coverage of intravascular catheters because they can be easily contaminated, increasing the risk of infection (Marschall et al., 2014).

The dressing indicated to cover and secure the peripheral venous catheter should be sterile and may be semi-occlusive, using sterile gauze and tape, or using a sterile transparent dressing. The application of the transparent sterile adhesive is recommended because it allows the visualization of the catheter insertion site, facilitating its monitoring. The use of this type of adhesive facilitates immediate identification of different manifestations of vascular trauma, including infiltration/extravasation, the infusion can be interrupted at an early stage to detect small quantities of infiltration/extravasation (Bausone-Gazda, Lefaiver, & Walters 2010; Marschall et al., 2014).

The incidence of extravasation of contrast, found in the retrospective cohort, was higher than the values reported in another study, which ranged from 0.1% to 1.2% (Pacheco Compañía et al., 2014). The extravasation of contrast can occur during its hand administration or using an injection pump, with high or low flow rates. Since the administration of contrast is in bolus (hand-operated), the extravasation involves large volumes of contrast most times. The gadolinium contrast medium used in MRI is considered less toxic than the iodinated contrast medium used in TC. However, they do not usually cause more severe lesions because, in MRIs, the contrast is injected in smaller volumes than in CTs (Silva, Bitencourt, & Chojniak, 2018).

The physical-chemical properties of contrast media require the need for monitoring their infusion more frequently because characteristics such as viscosity and hyperosmolarity increase the chances of occurrence of extravasation (Rose & Choi, 2015).

The manifestations of vascular trauma identified were: erythema, vein dilation, blood residue, ecchymosis, and hardening. Similar results were found in a study conducted with people hospitalized in a medical clinic, whose incidence of vascular trauma was 56.52% (Danksi et al., 2015), with a predominance of phlebitis (36.54%), infiltration (23.08%), accidental catheter traction (17.31%), obstruction (15.38%), puncture site infection (3.85%), extravasation (1.92%), and thrombophlebitis (1.92%). In a Brazilian study performed with people admitted to an emergency service, the incidence of vascular trauma was 55% (Krempser et al., 2013), being identified by pain (38.9%), reduction of the functional capacity of the punctured limb or part of it (2.8%), edema (19.1%), hardening (6.9%), continuity/integrity solution (6.3%), hyperemia, ecchymosis, hematoma (20.8%), secretion at the catheter insertion site (0.7%) and increase or decrease in the local temperature (4.5%).

The manifestations found are consistent with the studies mentioned above because they characterize the very process of peripheral venipuncture and due to the presence of the catheter and the type of infused solution (Danksi et al., 2015; Krempser et al., 2013). For this reason, when it is not possible to prevent vascular trauma, actions should be taken to minimize their effects. Therefore, nurses should reflect on their practices and the nursing care involved in the process of peripheral venipuncture. Nursing care should be based on scientific evidence, aiming at a greater capacity to prevent vascular trauma, identify related signs and symptoms, after their onset, so that an adequate intervention can be carried out, taking into account the patient's safety.

An analysis of the possible limitations allows affirming that the reduced sample of participants of the prospective cohort and also the fact that the catheter insertion site has not been monitored for at least 48 hours after the end of the examination allowed only the identification of these manifestations, being that many of them are triggered by factors related with the specificities of examinations, and, therefore, cannot be changed by nurses.

It should be considered that the vulnerability of patients

who underwent venipuncture, using standardized classifications on the types of veins, to ensure that the chosen vein is the most appropriate to the type and characteristics of the drugs and infusion rate. The use of technological devices for visualization of veins, such as the ultrasound, facilitates the puncture of veins classified as difficult-to-puncture and allows choosing the most appropriate vein for each patient, supporting the decision-making process of nurses, ensuring safety in care (Oliveira, Danski, & Pedrolo 2016).

Conclusion

The incidence of extravasation of contrast, identified only in the retrospective cohort, was 8.4%. In the prospective cohort, the incidence of vascular trauma was 52.6%, and the following vascular trauma manifestations were identified: erythema (25%), vein dilation (17.1%), blood residue (13.2%), ecchymosis (9.2%), and hardening (3.9%).

The manifestations of vascular trauma identified can be treated or minimized with the use of suitable materials and new technologies available, such as the transparent adhesive tape for fixation and better visualization of the puncture site and the use of ultrasound for visualization and careful selection of veins. It is up to nurses to make decisions based on scientific evidence that supports their practice, with a view to the safety of patients and the quality of nursing care.

The results found supported the acquisition of new materials and technologies, leading to a change in institutional protocols for improvements in quality of care. It is necessary to carry out further studies to evaluate whether the technologies implemented have contributed to the improvement of results and also on the impact of each technology for nursing care.

Author contributions

Conceptualization: Krempser, P. A. S., Lemos, R. C. P. B., Arreguy-Sena, C.

Data Curation: Lemos, R. C. P. B., Arreguy-Sena, C.

Formal analysis: Lemos, R. C. P. B., Arreguy-Sena, C.

Funding acquisition: Lemos, R. C. P. B., Arreguy-Sena, C.

Investigation: Arreguy-Sena, C., Lemos, R. C. P. B.

Methodology: Arreguy-Sena, C., Lemos, R. C. P. B.

Project administration: Arreguy-Sena, C.

Resources: Lemos, R. C. P. B.

Software: Arreguy-Sena, C., Lemos, R. C. P. B.

Supervision: Arreguy-Sena, C.

Validation: Braga, L. M., Brandão, M. A. G., Salgueiro-Oliveira, Krempser, P.

Visualization: Braga, L. M., Krempser, P. A. S., Lemos, R. C. P. B., Arreguy-Sena, C.

Writing - original draft: Lemos, R. C. P. B., Arreguy-Sena, C.

Writing - review and editing: Braga, L. M., Brandão, M. A. G., Salgueiro-Oliveira, Krempser, P. A. S., Lemos, R. C. P. B., Arreguy-Sena, C.

References

- Acauan, L. V., & Rodrigues, M. C. (2015). Critérios de segurança na administração de contraste na angiogramografia cardíaca: Percepção da enfermagem. *Revista Rene*, 16(4), 504-513. doi: 10.15253/2175-6783.2015000400007
- Arreguy-Sena, C., & Carvalho, E. C. (2009). Risco para trauma vascular: Proposta do diagnóstico e validação por peritos. *Revista Brasileira de Enfermagem*, 62(1), 71-78. doi: 10.1590/S0034-71672009000100011
- Bausone-Gazda, D., Lefaiver, C. A., & Walters, S.-A. (2010). A randomized controlled trial to compare the complications of 2 peripheral intravenous catheter-stabilization systems. *Journal of Infusion Nursing*, 33(6), 371-384. doi: 10.1097/NAN.0b013e-3181f85be2
- Botton, A., Cúnico, S. D., & Strey, M. N. (2017). Diferenças de gênero no acesso aos serviços de saúde: Problematizações necessárias. *Mudanças – Psicologia da Saúde*, 25(1), 67-72. doi: 10.15603/2176-1019/mud.v25n1p67-72
- Conner, B., Ash, R., Allen, W., Brown, T., Hill, J., Hook, M., & Fishback, S. (2017). Preventing intravenous contrast extravasation in CT: A simple solution. *Journal of the American College of Radiology*, 14(10), 1326-1332. doi: 10.1016/j.jacr.2017.05.020
- Cruz, B. M. (2012). A desmistificação do uso dos contrastes radiopacos. *Publicatio UEPG: Ciências Biológicas e da Saúde*, 18(1), 39-43. doi: 10.5212/Publ.Biologicas.v.18i1.0005
- Danski, M. T., Johann, D. A., Vayego, S. A., Oliveira, G. R., & Lind, J. (2016). Complicações relacionadas ao uso do cateter venoso periférico: Ensaio clínico randomizado. *Acta Paulista de Enfermagem*, 29(1), 84-92. doi: 10.1590/1982-0194201600012
- Danski, M. T., Oliveira, G. L., Johann, D. A., Pedrolo, E., & Vayego, S. A. (2015). Incidência de complicações locais no cateterismo venoso periférico e fatores de risco associados. *Acta Paulista de Enfermagem*, 28(6), 517-523. doi: 10.1590/1982-0194201500087
- Krempser, P., Arreguy-Sena, C., & Barbosa, A. P. (2013). Características definidoras de trauma vascular periférico em urgência e emergência: Ocorrência e tipos. *Escola Anna Nery*, 17(1), 24-30. doi: 10.1590/S1414-81452013000100004
- Marschall, J., Mermel, L. A., Fakih, M., Hadaway, L., Kallen, A., O'Grady, N. P., . . . Yokoe, D. S. (2014). Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. *Infection Control and Hospital Epidemiology*, 35(7), 753-771. doi: 10.1086/676533
- Melo, E. M., Aragão, A. L., Pessoa, C. M., Lima, F. E., Barbosa, I. V., & Studart, R. M. (2015). Cuidados dispensados pela equipe de enfermagem durante o procedimento de punção venosa periférica. *Revista de Enfermagem UFPE On Line*, 9(3), 1022-1030. doi: 10.5205/reuol.7505-65182-1-RV.0903201502
- Miranda, G. M., Mendes, A. C., & Silva, A. L. (2016). Population aging in Brazil: Current and future social challenges and consequences. *Revista Brasileira de Geriatria e Gerontologia*, 19(3), 507-519. doi: 10.1590/1809-98232016019.150140
- Nobre, A. S., & Martins, M. D. (2018). Prevalência de flebite da venopunção periférica: Fatores associados. *Revista de Enfermagem Referência*, 4(16), 127-138. doi: 10.12707/RIV17058
- Oliveira, A. S., Costa, P. J., Graveto, J. M., Costa, F. J., Osório, N. I., Cosme, A. S., & Parreira, P. M. (2019). Práticas dos enfermeiros na cateterização intravenosa periférica: Um estudo descritivo. *Revista de Enfermagem Referência*, 4(21), 111-120. doi: 10.12707/RIV19006



- Oliveira, A. M., Danski, M. T., & Pedrolo, E. (2016). Inovação tecnológica para punção venosa periférica: Capacitação para uso da ultrassonografia. *Revista Brasileira de Enfermagem*, 69(6), 1052-1058. doi: 10.1590/0034-7167-2016-0125
- Pacheco Compañá, F. J., Gago Vidal, B., & Méndez Díaz, C. (2014). Extravasation of contrast media at the puncture site: Strategies for management. *Radiología (English Edition)*, 56(4), 295-302. doi: 10.1016/j.rxeng.2014.02.005
- Rose, T. A. Jr., & Choi, J. W. (2015). Intravenous imaging contrast media complications: The basics that every clinician needs to know. *The American Journal of Medicine*, 128(9), 943-949. doi: 10.1016/j.amjmed.2015.02.018
- Sales, O. P., Oliveira, C. C., Spirandelli, M., & Cândido, M. T. (2010). Practice nurses in Center of Image Diagnosis. *Journal of the Health Sciences Institute*, 28(4), 325-328. Retrieved from http://adm.online.unip.br/img_ead_dp/44071.PDF
- Silva, H. C., Bitencourt, A. G., & Chojniak, R. (2018). Extravasation of iodinated contrast medium in cancer patients undergoing computed tomography. *Radiologia Brasileira*, 51(4), 236-241. doi: 10.1590/0100-3984.2017.0064
- Tamura, A., Kato, K., Kamata, M., Suzuki, T., Suzuki, M., Nakayama, M., . . . Ehara, S. (2017). Selection of peripheral intravenous catheters with 24-gauge side-holes versus those with 22-gauge end-hole for MDCT: A prospective randomized study. *European Journal of Radiology*, 87, 8-12. doi: 10.1016/j.ejrad.2016.12.005

