

## **Intravenous Heparin Administration in Peripheral Venous Access: a practice based on the prevention of hemorrhagic events**

## **Administração de Heparina Intravenosa em Acesso Venoso Periférico: prática baseada na prevenção de eventos hemorrágicos**

**Flavia Giron Camerini<sup>1</sup>**

**Cintia Silva Fassarela<sup>2</sup>**

**Danielle de Mendonça Henrique<sup>3</sup>**

**Vanessa Galdino de Paula<sup>4</sup>**

**Lolita Dopico da Silva<sup>5</sup>**

1. Nurse. PhD in Nursing. Adjunct Professor, Department of Medical-Surgical Nursing, Faculty of Nursing, State University of Rio de Janeiro (UERJ). Invited Professor of the Specialization Course in Intensive Nursing at UERJ. Rio de Janeiro, RJ, Brazil. E-mail: fcamerini@gmail.com. Corresponding author.

2. Nurse. PhD in Nursing. Adjunct Professor and Member of the Structuring Teaching Nucleus (NDE) of the Undergraduate Nursing Course at the University of Grande Rio (UNIGRANRIO). Assistant Professor at the Faculty of Nursing at the State University of Rio de Janeiro (UERJ). Rio de Janeiro, RJ, Brazil. E-mail: cintiafassarella@gmail.com.

3. Nurse. PhD in Nursing. Adjunct Professor, Department of Medical-Surgical Nursing, Faculty of Nursing, State University of Rio de Janeiro (UERJ). Member of the Board of Directors of Sociedade Brasileira de Queimadura - Regional Rio de Janeiro (Management 2015-2016). Assistant nurse at the Burn Treatment Center of the Federal Hospital of Andaraí (HFA). Rio de Janeiro, RJ, Brazil. E-mail: danimendh@gmail.com.

4. Nurse. Master's Degree in Nursing from the Alfredo Pinto Nursing School of the Federal University of the State of Rio de Janeiro (EEAP / UNIRIO). Assistant Professor, Department of Medical-Surgical Nursing. E-mail: vanegalpa@gmail.com.

5. Nurse. PhD in Nursing. Adjunct Professor, Department of Medical-Surgical Nursing, Faculty of Nursing, State University of Rio de Janeiro (UERJ). Collaborator of the Ministry of Health in the area of Nursing. Email: lolita.dopico@gmail.com



**Abstract**

The aim of the study was to associate the occurrence and severity of hemorrhagic events with infusion devices used in anticoagulated patients with sodium heparin. It is a retrospective cohort study, performed by medical record analysis. Data collection took place in 2014 and 867 medical records of two intensive and one semi-intensive units of a public university hospital in Rio de Janeiro were investigated. The Bleeding Academic Research Consortium (BARC) scale was used to evaluate the hemorrhagic event severity, and to associate the hemorrhagic event occurrence with intravenous devices, the relative risk (RR) was calculated. In the study, the hemorrhagic event rate was 21.5% (CI = 13.5-31.5). Patients with peripheral venous access presented a 1.35 times greater risk of bleeding in the skin when compared to patients with central venous access. Patients with central venous access, already presented 1.29 times more risk of bleeding at puncture site when compared to patients with peripheral access. It is suggested that heparin is primarily infused with peripheral venous access, since the complications resulting from hemorrhagic events at the puncture site are more severe when compared to hemorrhagic skin events.

**Keywords:** Nursing Care; Vascular Access Devices; Hemorrhage; Anticoagulants.

**Resumo**

O objetivo do estudo foi associar a ocorrência e a gravidade de eventos hemorrágicos com dispositivos infusionais utilizados nos pacientes anticoagulados com heparina sódica. Trata-se de um estudo de coorte retrospectivo, realizado por análise de prontuário. A coleta de dados ocorreu em 2014 e foram investigados 867 prontuários de duas unidades intensivas e uma semi-intensiva, de um hospital público universitário do Rio de Janeiro. Para avaliar a gravidade do evento hemorrágico, foi utilizada a escala de *Bleeding Academic Research Consortium* (BARC), e para associar a ocorrência do evento hemorrágico com dispositivos intravenosos, foi calculado o risco relativo (RR). No estudo, a taxa de eventos hemorrágicos foi de 21,5% (IC=13,5-31,5). Os pacientes com acesso venoso periférico apresentaram 1,35 vezes mais risco de sangramento na pele quando comparados a pacientes com acesso venoso central. Já pacientes com acesso venoso central apresentaram 1,29 vezes mais risco de sangramento em sítio de punção quando comparados a pacientes com acesso periférico. Sugere-se que a heparina seja prioritariamente infundida em acesso venoso periférico, pois as complicações decorrentes de eventos hemorrágicos no sítio de punção são mais graves quando comparadas a eventos hemorrágicos de pele.

**Palavras-chave:** Cuidados de Enfermagem; Dispositivos de Acesso Vascular; Hemorragia; Anticoagulantes.

## Introduction

The occurrence of hemorrhagic events in anticoagulated patients is of concern, because depending on their origin and the amount of blood involved, they may potentiate hemodynamic and ventilatory instability, increase mortality, length of stay in the intensive care unit, and require intervention measures <sup>(1)</sup>.

The occurrence of hemorrhage is a known risk of therapy with continuous infusion of sodium heparin. It is estimated that hemorrhagic events associated with the use of anticoagulants can occur anywhere in the body and range in frequency between 5.0% and 14.2% of patients who taking this medication <sup>(2-3)</sup>.

In general, critically ill patients with continuous heparin infusion undergo multiple invasive procedures, including central or peripheral venipuncture for the infusion of the drug. Most invasive devices used in intensive care are inserted or handled by nurses on a daily basis. In this sense, it is necessary that they seek solutions that can contribute to reducing the occurrence of hemorrhagic events related to heparin infusion, increasing safety and minimizing the negative impact on the patient, nursing team and institution <sup>(1-4)</sup>.

This research is relevant in clinical practice, since it is estimated that in the Intensive Care Unit (ICU), from 5.0 to 10.0% of hospitalized patients present some type of important bleeding. Associated with this, although the hemorrhagic risk of patients in heparin sodium

therapy does not seem very high (5.0 - 14.2%), the impact of this event on prognosis makes it necessary to seek solutions that may contribute to reduce the occurrence of this event <sup>(4-5)</sup>.

The contribution of this study is based on the fact that it is incumbent on the nurses to insert and maintain several invasive devices, so knowing which devices (central or peripheral) are more related to the bleeding, can contribute to a specific and safer care planning for anticoagulated patients. In addition, it supports and increases the autonomy of nurses in decision making, which aims to prevent bleeding events that may compromise the clinical evolution of the patient.

Thus, this research aimed to associate the occurrence and severity of hemorrhagic events with infusion devices used in anticoagulated patients with sodium heparin.

## Method

This is a retrospective cohort study, based on documentary analysis of medical records. Data collection took place in 2014 and 867 medical records of the years 2012 and 2013 were investigated. In the studied unit, the hemorrhagic event rate was not available and the information on how many patients used sodium heparin was dispensed, therefore we chose to investigate all records that met the selection criteria in a two-year period.

The following inclusion criteria were applied: patients older than 18 years old; hospitalization period greater than or equal to two days; completed registration of discharge or death; and receiving sodium heparin by continuous intravenous infusion. Patients who used anticoagulant prior to the use of intravenous heparin were excluded from the study. After applying the selection criteria, the final sample of the study was 79 patients.

To assist in the identification of patients who presented hemorrhagic events, the screening criteria proposed by the Institute for Healthcare Improvement <sup>(4)</sup> were applied to track Adverse Drug Events. The identifier used was Activated Partial Thromboplastin Time (PTT) greater than 100 seconds.

The study was developed in a large public hospital, located in the city of Rio de Janeiro, which belongs to the Sentinela Network. Two intensive units (one cardiological and one general) and a semi-intensive (surgical) were studied.

Data regarding the type of devices (central and peripheral), the occurrence, location and severity of bleeding were evaluated.

To evaluate the severity of the hemorrhagic event, the Bleeding Academic Research Consortium - BARC <sup>(5)</sup> evaluation scale was used. It is an international consensus that classifies hemorrhagic events. This scale stratifies bleeding on a scale of 0 (no bleeding) to 5 (fatal bleeding).

The data were collected from clinical evolutions, water balance sheets, laboratory tests, medical prescription, and patient identification data.

The data obtained were organized into spreadsheets in Microsoft Excel<sup>®</sup>, and later transferred to the IBM SPSS<sup>®</sup> Statistical Data Editor program, for statistical testing. In order to guarantee the quality control of the data typed, the process of double typing was used, counting on two independent typists.

Study variables (central or peripheral device and bleeding severity) were submitted to non-parametric statistical treatments and to association measures. To quantify how much more likely the occurrence of the hemorrhagic event was to occur in patients with central or peripheral intravenous devices, the relative risk (RR) was calculated, which is a measure of association between the occurrence of the disease in the exposed and non-exposed: values lower than one suggest exposure protection and values greater than one suggest a deleterious effect of exposure <sup>(6)</sup>. All RR calculations were made in 2x2 table, through the OpenEpi<sup>®</sup> software, which is available for free on the internet.

Fisher's exact test was used to calculate the relative risk for the analysis of classified data (nominal or ordinal), non-parametric, when the sizes of the two independent samples were small <sup>(7)</sup>. For all analyzes, a confidence level of 95% ( $p < 0.05$ ) was adopted.

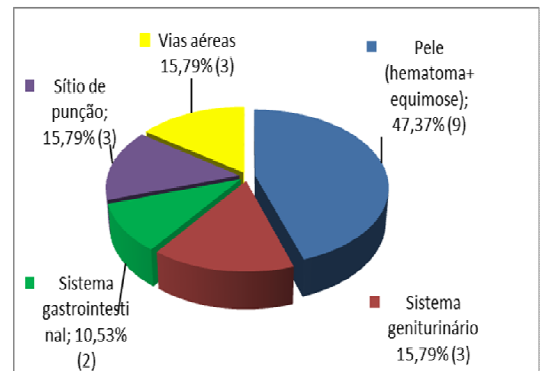
The study complied with the formal requirements contained in national and international standards that regulate research involving human subjects. The project was approved by the Ethics and Research Committee under No. 3083/2011, according to the Declaration of Helsinki revised in 2000 and Resolution 466/12 of the National Health Council (CNS).

## Results

Out of the 79 patients who received continuous infusion of heparin, 21.5% (n = 17) of them experienced some type of hemorrhagic event. With a confidence interval ranging from 13.5% to 31.5%, with a significance level of 95.0%.

It is noteworthy that some patients presented more than one type of bleeding, totaling 20 hemorrhagic events among the 17 patients.

The most common types of hemorrhagic events were in the skin (47.37%), corresponding to hematomas and ecchymoses, followed by bleeding at the puncture site (15.79%), airways (15.79%) and genitourinary system (15.79%). The site that presented the lowest occurrence of bleeding was in the gastrointestinal system (10.53%).



Source: research data

Regarding the severity of hemorrhagic events, according to BARC classification criteria, 40% (n = 8) of the bleedings were type 1, characterized by being small and not requiring intervention or hospital admission, and that most bleeding events (55%) are type 2. Skin bleeds, represented by the presence of hematoma and ecchymosis, were mostly (77%) classified as BARC type 1. However, puncture site bleeds, were mostly (67%) classified as BARC type 2.

After identifying the location and severity of the hemorrhagic event found in the patients, the bleeding was associated with the presence of a peripheral and central venous catheter.

**Table 1.** Type of bleeding related to infusion devices in patients with hemorrhagic events. Rio de Janeiro, RJ, Brazil, 2014

**Figure 1.** Type and frequency of hemorrhagic events (n = 20). Rio de Janeiro, RJ, Brazil, 2014.

Tipo de sangramento	Dispositivo			
	Acesso venoso periférico (AVP)		Acesso venoso central (AVC)	
	f	%	f	%
Pele (n=9)	7	77,78	2	22,22
Sítio de punção (n=3)	2	66,67	1	33,33

Source: research data

Of the patients who presented bleeding in the skin, 77.78% (n = 7) had peripheral venous access and 22.22% (n = 2) had central venous access. In order to analyze if there is a positive association between the intravenous device used and the type of hemorrhagic event, RR was calculated.

**Table 2.** Measures of association between the infusion devices used and the type of bleeding. Rio de Janeiro, RJ, Brazil, 2014.

Dispositivo	Tipo de sangramento	p valor	Risco Relativo (RR)	The most common sites of hemorrhagic events were those located on the skin (47.37%), corresponding to hematoma and ecchymoses, followed by bleeding at the puncture site.
Acesso venoso periférico	Pele	0,517	1,35	Hemorrhagic events in the skin were evidenced by the presence of bruises and ecchymoses, which affect the blood vessels and most often are caused by physical trauma. The size of both the hematoma and the bruise varies according to the volume of extravasated blood. Most of these events are painless, when small. However, when the amount of extravasated blood is greater, they can be painful and the symptoms will depend on the location <sup>(8)</sup> .
	Sítio de punção	0,630	0,77	
Acesso venoso central	Pele	0,517	0,74	
	Sítio de punção	0,630	1,29	

Source: research data

It was evidenced that the occurrence of skin bleeding is positively associated with the use of peripheral venous access (RR = 1.35); that is, patients with AVP are 1.35 times more likely to have hematoma / bruise when

compared to patients with central venous access.

The occurrence of skin bleeding in patients with central venous access presented an RR = 0.74, which suggests a protective measure.

## Discussion

The rate of hemorrhage related to continuous heparin infusion (21.5%) is high when purchased at the rate described in the literature (5- 14%)<sup>(2-3)</sup>. However, it should be taken into account that this study had as a setting high complexity sectors that attend critical patients, which may have contributed to the increase in the rate of hemorrhagic events, since critical patients present characteristics that make them more susceptible to the occurrence of hemorrhagic events such as old age and other risk factors<sup>(6-7)</sup>.

The hemorrhagic events located in the puncture sites were characterized by bleeding in deep and peripheral access. This type of event corresponded to 15.79% (n = 3) of the hemorrhagic events found in patients who used sodium heparin.

All patients taking intravenous sodium heparin should have peripheral or central venous access exclusively to the use of this medicinal product. The use of anticoagulant, especially of the heparin type, associated to the presence of an intravenously, increases the risk of puncture site bleeding; therefore, nurses must perform some specific care to prevent this undesirable event<sup>(9)</sup>.

When choosing for heparin infusion, the most common veins that are looked for in peripheral venous access are the veins of the back of the hand and the forearm, always giving preference primarily to the more distal sites. The veins located in the antecubital fossae are used less frequently, because they are the most calibrous and also the most troublesome, since they are located in the arm fold)<sup>(10-11)</sup>.

If the option of infusion of heparin sodium occurs in central venous access, the most common sites of installation of these catheters are the subclavian and internal jugular veins, and may also be inserted into the basilic and femoral veins<sup>(10)</sup>.

According to the literature<sup>(11-12)</sup>, puncture of the subclavian vein is related to the lower rate of infection in prolonged periods. It

can be obtained by the infra and clavicular pathways, the latter being associated with the lowest rate of complications related to pneumothorax, or arterial puncture.

It is known that, in general, the choice of venous access is based on the professional's experience, on the ease of obtaining venous access, on the clinical conditions of the patient, on the expected duration of catheter stay and on measures to prevent bloodstream infection<sup>(13)</sup>.

Regarding the severity of hemorrhagic events, the BARC classification was extremely useful in the present study, since 55% of the hemorrhagic events found in patients under continuous infusion of sodium heparin were classified as BARC 2. In other words, it is observed that the events are of moderate severity, which may lead to increased mortality and require some intervention. In this sense, it is up to the nurse to try to identify early the clinical signs of these events, so that they do not evolve to BARC classification 3.

The data indicate that skin bleeds, represented by the presence of bruising, were in the majority (77%) classified as BARC type 1. However, puncture site bleeds were mostly (66%) classified as BARC type 2. In other words, puncture site bleeds are classified more severely when compared to skin bleeds.

When the risk of bleeding was associated with the intravenous device used, it was evidenced that the risk of bleeding at the puncture site, patients with central venous

access, had a positive association (RR = 1.29), that is, patients with stroke have a 1.29 times higher risk of bleeding at the puncture site when compared to patients with peripheral access. The use of peripheral venous access related to the occurrence of puncture site bleeding presented a RR = 0.77 (RR <1), which suggests a protection of the device-related event. Therefore, patients with central venous access have a higher risk of puncture site bleeding and patients with peripheral venous access have a higher risk of bleeding of the skin (hematoma and bruising).

In this sense, this study suggests that heparin is preferentially infused with peripheral venous access, since the complications resulting from hemorrhagic events at the puncture site are more severe (BARC = 2) when compared to hemorrhagic skin events (BARC = 1).

In addition, in order to avoid bleeding at the peripheral catheter puncture site, the nurse has autonomy and must make the appropriate choice of puncture site, choose a smaller caliber catheter and perform a correct catheter stabilization<sup>(9)</sup>.

In addition to choosing the peripheral catheter, it is recommended to avoid bleeding at the puncture site, that some nursing care should be performed, such as an appropriate choice of puncture site, caliber of the catheter according to the vein to be punctured and the correct stabilization of the catheter<sup>(14)</sup>.

## Conclusion

This study suggests the use of sodium heparin in peripheral venous access because it is associated with bleeding events of smaller magnitude when compared to a central intravenous device.

Overall, regardless of the site of the bleeding, it has been found that there is a positive association between bleeding and intravenous devices. Thus, when it comes to infusing heparin, it is essential that nurses perform the procedures for patient safety and have autonomy to use it.

It is understood that the type of data presents itself as an inherent innovation in the technique of data collection, since the quality of the data depends on the quality of the records of the medical records. The size of the population is also presented as a limitation, because data were collected after two years of hospitalization, the number of patients receiving sodium heparin was reduced (n = 79), which may be justified because heparin is a potentially dangerous drug and its use is restricted to a small population with very specific indications.

However, it is noted that adverse events are rare, difficult to detect and in the analysis it is difficult to exercise control over the confounding factors. Therefore, it is understood that this type of study and these associations guide nursing care based on scientific evidence and suggest that nurses, with the aim of reducing the occurrence of hemorrhagic events, be cautious in



manipulating central venous catheters in patients with sodium heparin.

## References

1. Pimenta REF, Yoshida WB, Rollo HA, Sobreira ML, Bertanha M, Mariúba JVO et al. Heparin induced thrombocytopenia in a patient with acute arterial occlusion. *J Vasc Bras.* 2016; 15(2):138-41.
2. Beccaria LM, Rezende FF, Barbosa TG, Rodrigues ACS, Faria JIL, Melara SVG. Double nursing check and presence of hematoma in patients with anticoagulant therapy. *Arq Ciênc Saúde.* 2016; 23(2): 65-70.
3. Camerini FG, Silva LD. Characteristics of patients receiving sodium heparin: basing a safe care nursing. *Rev Enferm UERJ.* 2014; 22(2):175-81.
4. Mortaro A, Moretti F, Pascu D, Tessari L, Tardivo S, Pancheri S, et al. Adverse events detection through global trigger tool methodology: results from a 5-year study in an Italian Hospital and opportunities to improve interrater reliability. *J Patient Safe.* 2017; 6.
5. Gómez R, Mendoza F, Charry P, Calderón L, Castro P, Hurtado E et al. Factors associated with the presence of bleeding classified by the Bleeding Academic Research Consortium in patients with acute coronary syndrome undergoing percutaneous coronary intervention. *Revista Colombiana de Cardiología.* 2017; 24(1):15-25.
6. Ahouagi AE, Simoni CR, Azevedo EA, Silva EV, Nascimento MMG, Rosa MB et al. Heparin: Medication errors, risks and safe practices in use. *Bol ISMP Brasil [Internet].* 2013 [citado em 2016 jun 10]; 2: 2312-7. Disponível em: <http://www.ismp-brasil.org/site/wp-content/uploads/2015/07/V2N5.pdf>.
7. Morais J. Bleeding, the Achilles' heel in patients treated with Anticoagulants. Approach in patients with atrial fibrillation. *Rev Port Cardiol.* 2012; 31(Supl.1):32-7.
8. Camerini FG, Silva LD, Henrique DM, Andrade KBS, Almeida LF. Occurrence of hemorrhagic events related to invasive devices manipulated by nursing in anticoagulated patients. *Rev Rene.* 2017; 18(4):437-44.
9. Danski MTR, Mingorance P, Johann DA, Vayego SA, Lind J. Incidence of local complications and risk factors associated with peripheral intravenous catheter in neonates. *Rev Esc Enferm USP.* 2016; 50(1):22-8.
10. Rocha IRO, Oliveira MHB, Bengtson KL, Alves AMN, Brito MVH. Handmade model for training of peripheral vascular access. *J Vasc Bras.* 2017; 21(1):1-4.
11. Oliveira FT, Ferreira MMF, Araújo STC, Bessa ATT, Moraes ACB, Stipp MAC. Positive Deviance as a strategy in the prevention and control of bloodstream infections in intensive care. *Rev Esc Enferm USP.* 2017; 51:e03212.
12. Duarte TAC, Alencar TD, Custódio N, Fonseca BO, Silva RFA. Preventive measures in the practices of hemodialysis catheter insertion and manipulation: observational study. *Rev Enferm Atual.* 2017; 81(19):62-7.
13. Urbanetto JS, Muniz FOM, Silva RM, Freitas APC, Oliveira APR, Santos JCR. Incidence of post-infusional phlebitis and phlebitis in hospitalized adults. *Rev Gaúcha Enferm.* 2017; 38(2):e58793.
14. Souza AEER, Oliveira JLC, Dias DC, Nicola AL. Quality of nursing care in peripheral intravenous therapy: analysis by indicators. *Cogitare Enferm.* 2014; 19(3):521-27.

