



Occurrence of hemorrhagic events related to invasive devices manipulated by nursing in anticoagulated patients*

Ocorrência de eventos hemorrágicos relacionados aos dispositivos invasivos manipulados pela enfermagem em pacientes anticoagulados

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Objective: to verify the occurrence of hemorrhagic events related to invasive devices manipulated by nursing in anticoagulated patients. **Methods:** retrospective cohort study, with analysis of medical records. A total of 867 medical records were investigated, from which a sample of 79 patients who received continuous infusion of sodium heparin was selected. The types of hemorrhagic events and the different invasive devices were submitted to non-parametric statistical treatments and to the association tests. **Results:** the most common types of hemorrhagic events occurred in the skin (47.4%); puncture site (15.8%); airways (15.8%); genitourinary system (15.8%) and gastrointestinal system (10.5%). Patients with nasoenteral catheters had a 15.8-fold higher risk of gastrointestinal bleeding ($p=0.032$). **Conclusion:** the rate of bleeding events (21.5%) was high, and more frequent in the skin. Patients with nasoenteral catheters have a higher risk of gastrointestinal bleeding and patients with indwelling bladder catheters have a seven-fold increased risk of hematuria.

Descriptors: Nursing Care; Hemorrhage; Anticoagulants.

Objetivo: verificar a ocorrência de eventos hemorrágicos relacionados aos dispositivos invasivos manipulados pela enfermagem em pacientes anticoagulados. **Métodos:** estudo de coorte retrospectivo, com análise em prontuário. Foram investigados 867 prontuários, encontrando-se uma amostra de 79 pacientes que fizeram uso de heparina sódica em infusão contínua. Os tipos de eventos hemorrágicos e os diferentes dispositivos invasivos foram submetidos aos tratamentos estatísticos não paramétricos e às medidas de associação. **Resultados:** os tipos de eventos hemorrágicos mais comuns foram na pele (47,4%); sítio de punção (15,8%); nas vias aéreas (15,8%); no sistema geniturinário (15,8%) e no sistema gastrointestinal (10,5%). Pacientes com cateter nasoenteral têm 15,8 vezes mais risco de sangramento do trato gastrointestinal ($p=0,032$) **Conclusão:** a taxa de eventos hemorrágicos (21,5%) foi elevada e mais frequente na pele. Pacientes com cateter nasoenteral têm maior risco de sangramento gastrointestinal e com cateter vesical de demora têm sete vezes mais risco de hematúria.

Descritores: Cuidados de Enfermagem; Hemorragia; Anticoagulantes.

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Introduction

Hemorrhagic events in critical patients are reason of concern because, depending on their origin and the volume of blood involved, they may potentiate the hemodynamic and ventilatory instability, increase risk of death and length of stay in the intensive care unit, and require interventions⁽¹⁾.

The literature acknowledges that the occurrence of bleeding is a known risk of therapy with continuous infusion of sodium heparin. Hemorrhagic events associated with the use of anticoagulants are estimated to occur in any part of the body and affect between 5.0% and 14.2% of patients taking this medication⁽²⁻³⁾.

In general, critical anticoagulated patients undergo multiple invasive procedures such as venous and arterial puncture, passage of enteral catheters, among others. Most invasive devices used in intensive care are inserted and manipulated by nurses in daily basis. In this sense, it is necessary that nurses seek solutions to contribute to reduce the occurrence of these adverse events, increasing safety and minimizing the negative impact on the patient, the nursing team and the institution^(1,4).

The present research is relevant to clinical practice because it is estimated that 5 to 10.0% of Intensive Care Unit patients present some form of important bleeding. Associated with this, although the hemorrhagic risk of patients receiving heparin sodium therapy does not seem very high (5-14.2%), the impact of this bleeding on the prognosis makes it necessary to look for solutions to reduce the occurrence of this event⁽⁴⁻⁵⁾.

The contribution of this publication is based on the fact that it is incumbent on the nurse to insert and maintain several invasive devices. Knowing which devices are most associated with the occurrence of bleeding may contribute to a specific and safer care planning for anticoagulated patients. Furthermore, such study will make possible to increase the autonomy of nurses in decision making, in order to prevent hemor-

rhagic events that may compromise the clinical evolution of the patient.

Thus, this research aimed to verify the occurrence of hemorrhagic events related to invasive devices manipulated by nursing in anticoagulated patients.

Methods

This is a retrospective cohort study based on documentary analysis of medical records. Data collection took place in 2013 and 867 medical records from 2011 and 2012 were investigated. Due to the lack of previous data on the use of heparin and the occurrence of hemorrhagic events, we decided to investigate all medical records that met the criteria in a two-year interval.

The selection criteria proposed by the Institute for Healthcare Improvement⁽⁶⁾ for screening Adverse Drug Events were applied, namely: patients older than 18 years; length of hospitalization greater than or equal to two days; complete registration of discharge or death; and administration of sodium heparin through continuous intravenous infusion. Patients who used anticoagulants prior to the use of intravenous heparin were excluded. After applying the selection criteria, the final sample of the study was composed of 79 patients.

The study was developed in a large public hospital, located in the city of Rio de Janeiro, belonging to the Sentinela Network. Medical records from two intensive units (one cardiologic and the other with a general profile) and one semi-intensive (surgical) unit were examined. We decided to use all the hospital units that receive critical patients because we believed that the patient's clinical severity in the studied universe would allow the amplification of the data collected, guaranteeing a reasonable sample and increasing the reliability and validity of the results.

The technique used for data collection was documentary analysis based on original documents that had not received analytical treatment, thus being con-

sidered primary sources. The instrument of data collection was prepared to contemplate all the objectives of the thesis from which this article originated. However, in order to answer the objectives proposed in the present paper, data on the types of devices, and the occurrence and the type of bleeding were used. The data were collected from clinical evolutions, hydric balance records, laboratory tests, medical prescriptions, and patient identification data.

The data collection took place in two stages: in the first moment, all the medical records (n=867) of the patients that were hospitalized in the period studied were retrospectively located; among these records, those with continuous infusion of sodium heparin were selected (n=87). In a second moment, all medical records of patients who used heparin were read and analyzed in a systematized manner.

During data collection, eight irreplaceable losses occurred, most of them due to incomplete recording (n=7) and one due to the non-location of the record in the archive sector (n=1). Thus, seventy-nine charts of patients who received continuous infusion of sodium heparin were analyzed.

The data obtained were organized in Microsoft Excel® spreadsheets and later transferred to the Statistical Package for the Social Sciences for statistical tests. 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 (invasive device and type of bleeding) were submitted to non-parametric statistical treatments and to association tests. To quantify how much more likely the occurrence of the hemorrhagic event is among patients with invasive devices, the relative risk was calculated. This is a measure of association between the occurrence of a disease in exposed and non-exposed patients (values smaller than one suggest protection against exposure and values greater than one suggest a deleterious effect of exposure)⁽⁷⁾. All relative risk calculations were done in a 2x2 table, using the OpenEpi® program available free of charge on the internet.

In the calculation of the relative risk, the p-value was obtained by the Fisher's exact test, used to analyze discrete (nominal or ordinal) and non-parametric data⁽⁸⁾. A confidence level of 95.0% (p<0.05) was adopted in all analyses.

The study complied with the formal requirements contained in the national and international regulatory standards for research involving human beings.

Results

Among all patients who received continuous infusion of heparin, the occurrence of hemorrhagic event presented a rate of 21.5% (n=17), with confidence interval ranging from 13.5% to 31.5%. 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 occurred in the skin (47.4%), corresponding to hematoma and ecchymosis, followed by bleeding at the puncture site, in the airways and genitourinary system (15.8%). The site that presented the lowest occurrence of bleeding was the gastrointestinal system (10.5%).

During the data collection, it was evident that all patients studied, underwent some invasive nursing procedures besides the continuous infusion of sodium heparin. Since invasive procedures increase the risk of hemorrhagic events, we considered necessary to identify the nursing procedures performed and the device used, which is shown in Table 1.

Table 1 - Type of bleeding related to invasive devices in patients with hemorrhagic events (n=17)

Type of bleeding	Nasoenteral catheter	Indwelling bladder catheter	Peripheral venous access	Central venous access
	n(%)	n(%)	n(%)	n(%)
Skin (n=9)	-	4 (44.4)	7 (77.8)	2 (22.2)
Genitourinary (n=3)	1 (33.3)	2 (66.7)	1 (33.3)	2 (67.7)
Puncture site (n=3)	-	3 (100.0)	2 (66.7)	1 (33.3)
Airway (n=3)	3 (100.0)	2 (66.7)	2 (66.7)	1 (33.3)
Gastrointestinal (n=2)	2 (100.0)	2 (100.0)	-	2 (100.0)

Table 1 shows that 77.8% (n=7) of the patients with hemorrhagic skin event (hematoma/ecchymosis) had peripheral venous access. More than half (66.7%) of the patients with bleeding in the genitourinary system used a indwelling bladder catheter. Two patients (66.7%) with bleeding in the puncture site had peripheral access. All patients with bleeding in the airway or gastrointestinal tract used a nasoenteral catheter.

In order to identify if there is an association between the device used in the patient and the type of hemorrhagic event, we calculated the relative risk, which is obtained through the ratio between the site of the hemorrhagic event in the exposed patients and those not exposed to the devices. The p-value expresses the statistical significance related to the exposure (device use) and to the bleeding site (Table 2).

Table 2 - Association tests between the devices used and the type of bleeding

Device	Type of bleeding	p	Relative Risk	95% CI*
Nasoenteral catheter	Airway	0.554	1.3	(0.16; 13.47)
	Gastrointestinal	0.032	15.8	(0.85; 11.03)
Indwelling bladder catheter	Genitourinary	0.078	7.0	(0.75; 62.77)
Peripheral venous access	Skin	0.517	1.4	(0.30; 6.00)
	Puncture site	0.630	0.8	(0.07; 8.08)
Central venous access	Skin	0.517	0.7	(0.16; 3.29)
	Puncture site	0.630	1.3	(0.12; 13.57)

*CI = Confidence interval

Patients who used nasoenteral catheters present a statistically significant relationship related to the occurrence of bleeding of the gastrointestinal tract. Patients with nasoenteral catheters had a 15.8-fold higher risk of gastrointestinal bleeding compared to patients without nasoenteral catheters. Although there was no significant difference between the occurrence of airway bleeding and nasoenteral catheter use, the relative risk between exposure and bleeding was greater than 1, suggesting a deleterious effect on exposure. In other words, patients with nasoenteral catheters have a 1.3-fold higher risk of airway bleed-

ing when compared to patients without a nasoenteral catheter.

As for the use of indwelling bladder catheter and its relation with the occurrence of genitourinary bleeding, the study showed that patients with this device have a seven-fold higher risk of hematuria when compared to patients without it.

The use of peripheral venous access related to the occurrence of bleeding at the puncture site presents a relative risk of less than one, what suggests a protection of the event related to the device, i.e. patients with peripheral access have less risk of bleeding at the puncture site (the risk in non-exposed patients is greater than those exposed).

The occurrence of skin bleeding had a positive association with the use of peripheral venous access. Patients with peripheral access had a 1.4-fold higher risk of hematoma/ecchymosis when compared to patients with central venous access.

Unlike the peripheral device, patients with central venous access are positively associated with the occurrence of bleeding at the puncture site and this suggests a protection related to the occurrence of skin bleeding. In other words, patients with peripheral venous access have a higher risk of bleeding in the skin when compared to patients with central venous access.

Although associations point to a broad confidence interval, it is understood that hemorrhagic events are rare and difficult to detect and control due to the confounding factors inherent in their occurrence. Thus, the possibility of bias in the association of the event (outcome) with the presence of the devices (exposure) cannot be ruled out.

Discussion

We understand that this study presents limitations that deserve to be highlighted. The first is inherent to the technique of data collection; the quality of the data depends directly on the quality of the information on the medical records. The size of the population

is also a limitation, because although data from two years of hospitalization were collected, the number of patients receiving sodium heparin is low ($n=79$), probably because of the fact that heparin is a potentially dangerous medicine and its use is restricted to a small population with well-defined indications.

It is estimated that hemorrhagic events associated with the use of anticoagulants affect between 5.0% and 14.2% of critically ill patients^(2-3,9). The rate of hemorrhagic events related to continuous infusion of heparin in this study is high when compared to the rate described in the literature. However, it should be taken into account that this study was based on a hospital environment with high complexity sectors that assist critical patients; this may have increased the rate of hemorrhagic events, as critical patients present characteristics, such as advanced age and other risk factors, that make them more susceptible to their occurrence⁽¹⁰⁻¹²⁾.

Regarding the type of bleeding, the majority of hemorrhagic events identified on the skin (35.0%) were small bleeds that did not require intervention. However, skin bleeds may range from small bruising, of little clinical relevance, to extensive hematoma with hemodynamic repercussion. Therefore, when there is a hematoma, continued solution may be produced, which, although not likely to cause mortality, may lead to morbidity due to an increased risk of infection⁽¹³⁻¹⁴⁾.

Hemorrhagic events at puncture sites were characterized by the presence of bleeding in deep and peripheral access. All patients receiving intravenous sodium heparin should have a peripheral or central venous access exclusive to the use of this medicinal product. The use of anticoagulant, mainly of the heparin type, associated with the presence of a venous route increases the risk of bleeding at the puncture site; therefore, nurses have autonomy and should perform specific care measures, such as choosing a smaller venous catheter, to prevent this undesirable event⁽¹⁵⁾.

We identified that the use of peripheral venous access has a positive association with the occurrence of skin bleeding and that the use of central venous access is positively associated with bleeding at the puncture site. Therefore, it is evident that patients with central venous access have a higher risk of bleeding at the puncture site and patients with peripheral venous access have a higher risk of bleeding in the skin (hematoma and bruising).

In this sense, it is recommended that heparin be preferentially infused into peripheral venous access, because based on the Bleeding Academic Research Consortium (BARC) classification⁽¹⁶⁾, the complications resulting from hemorrhagic events at the puncture site are more severe (BARC=2) when compared to skin hemorrhagic events (BARC=1). In addition, in order to avoid bleeding at the peripheral catheter puncture site, nurses have autonomy and must make the appropriate choice of puncture site, choose a catheter with smaller caliber, and correctly stabilize the catheter⁽¹⁵⁾.

The occurrence of hemorrhagic events in the airways presented a lower rate compared to a study performed with anesthetized patients, 15.7% and 20.0%, respectively⁽¹⁷⁾. Among the numerous types of airway bleeding, only the presence of epistaxis and hemoptysis were identified. The passage of the nasointestinal catheter showed a rate of occurrence of epistaxis of 17.0%. The literature indicates that anticoagulated patients treated with sodium heparin are more prone to epistaxis, but discontinuation of treatment and reversal of anticoagulation are controversial in the control of epistaxis.

Thus, it is important that nurses have autonomy and try to quantify the intensity and frequency of the epistaxis during physical examination: whether it is a single and isolated episode or recurrent episodes; whether it is uni or bilateral; what is the dosage of heparin used; and whether there is any association

with any other anticoagulant medication. Besides assessing the patient's general condition, nurses must check mucosal color, hydration, pulse, and blood pressure⁽¹⁸⁾.

It was evident that all patients with airway bleeding had nasoenteric catheter and that the use of this device, associated with the use of continuous infusion of heparin increases by 1.3 times the risk of airway bleeding. According to the literature, epistaxis is usually an infrequent complication associated with feeding catheters; however, it may become highly significant in patients with hemorrhagic disorders⁽¹⁷⁻¹⁸⁾.

In events of gastrointestinal tract bleeding, it was not possible to investigate the type of bleeding in the data collection, but it is known that the main hemorrhagic events of this system are characterized by high digestive hemorrhage and low digestive hemorrhage⁽¹⁹⁾. When caring for patients with nasoenteral catheter using anticoagulant agents, nurses should know that this patients have an increased risk of bleeding and require more attention in the early signs of bleeding that can be indicated during the physical examination by abdominal distension or pain, bowel frequency and velocity, fecal characteristics and odor, anemia and hemodynamic instability.

With regard to hemorrhagic events identified in the genitourinary system, we believe that hematuria in patients using sodium heparin was caused by ureteral hemorrhages due to lesions to the urethral meatus. Although the studied patients were anticoagulated with heparin, the rate of hematuria found (15.7%) was similar to that reported in another study with adolescents, with 14.7% (CI 95% 14.67-14.73)⁽²⁰⁾.

To reduce the occurrence of hemorrhagic events in the genitourinary system in patients with continuous infusion of heparin, it is recommended to avoid the use of indwelling bladder catheters and to measure the urine output by using hospital potty or by weighing the diapers. However, in cases of greater severity, in which the measurement of the strict urina-

ry output is indicated, the nurse should choose smaller probes, routinely observe the early signs of hematuria, place the bladder catheter properly (in the thigh in women and in the suprapubic region in men), and in cases of already established hematuria, the removal of clots should be promoted by washing the device with heated saline solution to avoid obstructions⁽¹⁴⁾.

In view of the above, the practical applicability of the study is evident since it demonstrates a causal relationship of the devices with the occurrence of bleeding. It is understood that these associations guide and contribute to nursing care, since they suggest that nurses, aiming to prevent the occurrence of hemorrhagic event, need to be cautious when performing these invasive procedures in patients with sodium heparin.

Conclusion

The rate of hemorrhagic events (21.5%) was high. The most common types of hemorrhagic events were identified on the skin (47.4%); and at the puncture site, in the airways, in the genitourinary system (15.8%) and in the gastrointestinal system (10.5%). By associating the invasive device with the occurrence of bleeding, it was shown that patients with nasoenteral catheters have significantly higher risk of bleeding in the gastrointestinal tract. Patients with indwelling bladder catheters have a seven-fold higher risk of hematuria.

Collaborations

Camerini FG and Silva LD contributed to the conception and design, analysis and interpretation of the data. Henrique DM, Andrade KBS and Almeida LF contributed to the writing of the manuscript, relevant critical revision of the intellectual content and final approval of the version to be published.

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