Original Article

Incidence of phlebitis and post-infusion phlebitis in hospitalised adults

Incidência de flebite e flebite pós-infusional em adultos hospitalizados

Incidencia de flebitis y flebitis después de la infusión en adultos hospitalizados

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ABSTRACT

Objective: to determine the incidence of phlebitis during and after the use of peripheral intravenous catheter (PIC), and analyse the association of this complication with risk factors.

Methods: cohort study with 165 adult patients admitted to a university hospital in Porto Alegre, totalling 447 accesses, from December 2014 to February 2015. Data were collected on a daily basis and analysed by means of descriptive and analytical statistics.

Results: The incidence of phlebitis during PIC was 7.15% and the incidence of post-infusion phlebitis was 22.9%. Phlebitis during catheter use was associated with the use of Amoxicillin + Clavulanic Acid. The grade of post-infusion phlebitis was associated with age and use of Amoxicillin + Clavulanic Acid, Tramadol Hydrochloride, and Amphotericin.

Conclusion: The incidence of post-infusion phlebitis proved to be an important indicator to analyse the quality of the healthcare setting.

Keywords: Phlebitis. Catheters. Patient safety. Nursing.

RESUMO

Objetivo: Avaliar a incidência de flebite durante o uso de cateter intravenoso periférico (CIP) e pós-infusional e analisar a associação com fatores de risco em pacientes hospitalizados.

Método: Estudo de coorte com 165 pacientes adultos internados em hospital universitário de Porto Alegre que totalizaram 447 acessos no período de dezembro 2014 a fevereiro 2015. A coleta dos dados foi diária, e a análise dos dados ocorreu pela estatística descritiva e analítica.

Resultados: A incidência de flebite durante o uso do CIP foi de 7,15% e de flebite pós-infusional, 22,9%. A flebite durante o uso do cateter associou-se com a Amoxicilina + Ácido Clavulânico. A flebite pós-infusional apresentou associação do grau de gravidade com a idade e com o uso de Amoxacilina + Ácido Clavulânico, Cloridrato de Tramadol e Anfotericina.

Conclusão: A incidência de flebite pós-infusional mostrou-se um indicador importante para a análise do cenário da qualidade da assistência em saúde.

Palavras-chave: Flebite. Cateteres. Segurança do paciente. Enfermagem.

RESUMEN

Objetivo: Evaluar la incidencia de flebitis en el uso de catéter periférico intravenoso (CIP) y posinfusional y analizar la asociación con los factores de riesgo en pacientes hospitalizados.

Método: Estudio de cohorte con 165 pacientes adultos ingresados en un hospital universitario de Porto Alegre, que ascendió a 447 accesos de diciembre 2014 a febrero de 2015. La recolección de datos fue diaria y el análisis de datos fue mediante estadística descriptiva y analítica.

Resultados: La incidencia de flebitis durante el uso de catéter periférico intravenoso fue del 7,15% y de la flebitis posinfusional fue del 22,9%. La flebitis durante el uso del catéter se asoció con el uso de Amoxicilina + Ácido clavulánico. La flebitis posinfusional presentó una asociación del grado de gravedad con la edad, y con el uso de Amoxicilina + Ácido clavulánico, Clorhidrato de tramadol y Anfotericina.

Conclusión: La incidencia de flebitis posinfuncional mostró ser un indicador importante para el análisis del escenario de la calidad de atención en salud.

Palabras clave: Flebitis. Catéteres. Seguridad del paciente. Enfermería.

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INTRODUCTION

Students enrolled in assisted practice or internships provided by undergraduate nursing courses soon observe the importance of using peripheral intravenous catheter (PIC) for intravenous therapy. However, intravenous access can cause complications, such as phlebitis in the PIC puncture site.

Phlebitis is the inflammation of the vein and it can be caused by mechanical, chemical or bacterial processes[1-2]. The characteristics of phlebitis are pain, oedema, hardening and hyperaemia[2]. It can evolve to palpable fibrous cord with or without purulent discharge in the catheter insertion site[2]. Post-infusion phlebitis is the inflammation of the vein that occurs after infusion and removal of the catheter, and it is normally identified within 48 hours after removal of the PIC[1-2].

Phlebitis is classified by assessing the signs and symptoms, and classification consists of four grades of severity: Grade I – erythema with or without local pain; Grade II – pain, with erythema and/or oedema; Grade III – pain, with erythema and/or oedema, with hardening and palpable fibrous cord; Grade IV – pain, with erythema and/or oedema, with hardening and palpable fibrous cord larger than 1 inch (2.54cm), with purulent discharge[1-3].

The predisposition of patients to develop phlebitis is influenced by the insertion technique, the anatomy of the insertion site, the size and type of the device, number of insertions, catheters in the site for more than 72 hours, severity of the disease and pre-existing infections, irritant drugs, and concentration of the infusion[1-2]. In a given population, the acceptable rate of phlebitis should be 5% or less[2-3]. In the hospital setting, phlebitis is one of the most frequent complications and considered one of the main faults of infusion. Once phlebitis is identified, intravenous treatment must be interrupted since it can compromise the patients' health and even extend the hospital stay[4].

Phlebitis can cause other conditions, such as thrombophlebitis and infections in the blood stream[1,5], that also compromise patient safety and violate the goals established by the National Patient Safety Programme of Brazil[6].

In Brazilian studies, the incidence of phlebitis was 10.5%[7], 25.8%[4], 31.6%[8], and 55.6%[9]. We did not find any Brazilian or international publication reporting the incidence of post-infusion phlebitis. There is only one record of post-infusion phlebitis as one of the types of phlebitis[1-2,10]. Failure to investigate phlebitis in research or clinical practices can lead to incorrect results regarding the indicators of the incidence of phlebitis.

Consequently, the research question was: Are the risk factors and incidence of post-infusion phlebitis similar to those of phlebitis during PIC? To answer this question, the aim of this study was to assess the incidence of phlebitis during PIC and post infusion, and to analyse its association with risk factors among hospitalised patients.

METHOD

This is a cohort study conducted at a clinical and surgical unit of a university hospital of Porto Alegre, RS, Brazil, from December 2014 to February 2015, for a total of 86 collection days.

The study population consisted of 381 patients. The criteria for exclusion were patients under 18 (21), patients who did not use PIC (128), patients subjected to measures of epidemiologic obstruction (14), patients with an altered level of consciousness (45), and patients who refused to participate in the study (08). The sample consisted of 165 patients who met the criterion of PIC use in the first 24 hours after admission at the unit. All new punctures performed on patients who were already inserted in the research during admission were considered, totalling 447 accesses. The PIC were changed in the case of loss or routine replacement.

Data were collected using an instrument with variables related to the patients (age, sex, skin colour) and the inserted PIC (anatomical location, calibre, type of PIC, permanence time, number of inserted PIC, fixation, maintenance, visualisation of the insertion site, record of insertion date, and administered pharmaceutical drugs).

To establish a relationship between the drugs and the occurrence of phlebitis, the medical prescriptions of the patients were assessed during permanence of the PIC. The medication was analysed according to the pharmaceutical class, number of medication classes, and joint use of medication (two or more). In relation to the classes, the pharmaceutical drugs were divided into the following: drugs that affect kidney and cardiovascular functions, drugs that act on the central nervous system, opioid and non-opioid analgesics, antihistamine drugs, drugs that act on the blood and blood forming organs, hormones and hormone antagonists, steroidal anti-inflammatory drugs, nonsteroidal anti-inflammatory drugs, antibacterial drugs + associations, anti-viral drugs, antifungal drugs, antiparasitic drugs, anti protozoal drugs, antineoplastic drugs, bronchodilators + associations, co-dilators + associations, electrolytes/mineral supplements/vitamins/glucose used in immunomodu-

lation, drugs that act on bone metabolism, and drugs that affect gastrointestinal function[11].

Data were collected by a trained team that used a manual for support. Collection occurred in two specific occasions: on the day the PIC was inserted, and every day until the PIC was removed; and immediately after the PIC was removed, and every day for up to 96 hours. The insertion site was inspected and palpated every day to identify possible signs of phlebitis during the use and after removal of the PIC. When signs or symptoms of phlebitis were identified, the nurse responsible for the unit was notified.

The incidence density of phlebitis was calculated by applying the formula used in Brazil for this purpose[12], adapted for phlebitis during the use of PIC: (number of cases of phlebitis during the use of PIC in the period/ number of patients per day with peripheral venous access in the period) x 100; and for post-infusion phlebitis: (number of cases of phlebitis after removal of the PIC in the period/number of patients per day accompanied for up to 96 hours after removal of the PIC in the period) x 100. The average number of patients with PIC per day was 11.8, which totals 1016 patients in 86 days of monitoring. The average number of patients monitored after removal of the PIC per day was 10.7, totalling 888 patients during 83 days of monitoring.

The incidence of phlebitis during the use of the PIC was calculated using the formula: (number of cases of phlebitis during the use of PIC in the period/number of patients with peripheral venous access in the period) x 100; and for the incidence of post-infusion phlebitis: (number of cases of phlebitis after removal of the PIC in the period/number of patients monitored up to 96 hours after removal of the PIC in the period/number of patients monitored up to 96 hours after removal of the PIC in the period) x 100.

A specific code was attributed to each item of the form. The data were subsequently transferred to an Excel® 2010 Windows XP® spreadsheet by double entry, checked for inconsistencies, and exported to Statistical Package for the Social Science (SPSS) software version 20.0 for statistical analysis. The data were analysed using descriptive statistics (absolute frequency, relative frequency, and variability) and inferential statistics by means of the Chi-Square test with Monte Carlo simulation at a significance level of $p < 0.05$.

The study complied with the ethics precepts of Resolution 196/96 (in force at the time of project approval) and 466/2012, and approved by the research ethics committee of the PUCRS, with protocol number OF. CEP–1082/07. The patients who met the inclusion criteria and accepted to participate in the research were informed of the objective of the study, the voluntary nature of participation, and the approval of the ethics committee, after which they signed two copies of an informed consent statement.

RESULTS

The study sample consisted of 165 patients. Of these patients, 73 (44.2%) were men and 92 (55.8%) were women. Their average age was 59.9 ± 19.7 years, with a median of 61 (19 - 95) years. In terms of age per age group, 58 (35.2%) of the patients were 71 to 95 years old, 56 patients (33.9%) were 49 to 70 years old, and 51 patients (30.9%) were 18 to 48 years old. In terms of skin colour, 124 (75.2%) of the patients were white, 26 (15.8%) had brown skin, and 15 (9.1%) had black skin.

Table 1 – Frequency of phlebitis and grades of phlebitis during use of PIC and after removal of PIC (post-infusion). Porto Alegre, RS/Brazil

	Frequency	%
Phlebitis during use of PIC (n = 447 PIC)		
Yes	32	7.2
No	415	92.8
Grade during use of PIC (n = 32)		
I	26	81.2
II	3	9.4
III	3	9.4
IV	-	-
Post-infusion phlebitis (n = 358 CIP)		
Yes	82	23.0
No	276	77.0
Grade post-infusion phlebitis (n = 82)		
I	39	47.0
II	12	15.0
III	28	34.0
IV	3	4.0

Source: Research data, 2015.

The research participants were submitted to the insertion of 447 (100%) mandrel-type PICs. The puncture sites were forearm, with 164 (36.7%), back of hand, with 106 (23.7%), cubital fossa, with 105 (23.5%), wrist, with 56 (12.5%), arm, with 12 (2.7%), foot, with three (0.7%), and jugular, with one (0.2%).

Regarding the calibre, there was a higher frequency of 22 gauge (G), with 229 (51.2%), followed by 24 G calibre, with 94 (21%), 20 G with 16 (3.6%), and 18 G with 10 (2.2%). The calibre could not be identified in 98 (21.9%) of the punctures due to lack of records or use of a non-transparent dressing to fix the catheter. In terms of PIC maintenance, saline access was used in 362 (81%) of the punctures, while continuous intravenous infusion was used in only 85 (19%) of the punctures.

The average number of PICs per patient during admission was 2.3±1.3, and there was no concomitant use of PIC. Of this number, 165 (36.9%) used a PIC; 112 (25.1%) used two PICs; 88 (19.7%) used three PICs; 50 (11.2%) used four PICs; 20 (4.5%) used five PICs; nine (2%) used six PICs; and three (0.7%) used seven PICs. In relation to PIC permanence, the average time was 58.9 ± 26.9 hours, with a median of 72 (24 - 168) hours. Most of the PICs remained in the patients for ≤ 72 hours (n = 386; 86.3%), and the other PICs remained for > 72 hours (n = 61; 13.7%).

Table 1 shows the frequency of phlebitis during use of the PIC and after removal (post-infusion) of the PIC.

During the use of the PIC, the frequency of phlebitis was 32 (7.2%) puncture sites, and 26 (81.2%) of these cases exhibited Grade 1 phlebitis. The frequency of post-infusion phlebitis was 82 (23%) of the cases, of which 39 cases (47.0%) exhibited Grade 1 phlebitis (Table 1).

The incidence density of phlebitis during the use of the PIC and post infusion was calculated separately to ensure a clear and specific analysis for both occasions. The data used to obtain the result of phlebitis during PIC were the 32 cases of phlebitis found in the study divided by the number of patients/day (1016) submitted to this risk (patients using PIC). The results of the division were multiplied by 100 and reached an incidence density of 3.14%. In the case of post-infusion phlebitis, the 82 cases of phlebitis were divided by the number of patients/day (888) submitted to the risk (up to 96 hours of monitoring after removal of the PIC). The result was multiplied by 100, which produced an incidence density of 9.23%.

A comparison of these findings with those of other national and international studies showed that the incidence of phlebitis during PIC use ((32 phlebitis/447 PIC) x 100) was 7.15%, which the incidence of post-infusion phlebitis ((82 phlebitis/358 CIP) x 100) was de 22.9%.

Table 2 shows the results of the association analysis of the socio-demographic characteristics with the occurrence of phlebitis and its grades during PIC.

Table 2 – Socio-demographic data and their association with phlebitis and grades of phlebitis during PIC. Porto Alegre, RS/Brazil. n = 447 PICs

	Phlebitis during PIC		p	Grade			p
	Yes n(%)	No n(%)		I n(%)	II n(%)	III n(%)	
Age							
19 to 48 years	13(9.4)	125(90.6)		10(76.9)	1(7.7)	2(15.4)	
49 to 70 years	10(6.0)	157(94.0)	0.461*	8(80)	1(10.0)	1(10.0)	0.944**
71 to 95 years	9(6.3)	133(93.7)		8(88.9)	1(11.1)	-	
Sex							
Male	17(8.5)	183(91.5)	0.322*	13(76.5)	1(5.9)	3(17.6)	0.404**
Female	15(6.1)	232(93.9)		13(86.7)	2(13.3)	-	
Skin colour							
White	25(8.1)	283(91.9)		23(92.0)	2(8.0)	-	
Brown	3(3.4)	84(96.6)	0.343**	2(66.7)	-	1(33.3)	0.008**
Black	4(7.7)	48(92.3)		1(25.0)	1(25.0)	2(50.0)	

Source: research data, 2015.
* Pearson's Chi-Square ** Fisher's Exact test

Table 3 – Data of the association of phlebitis and grades of phlebitis during PIC with risk factors related to PIC and medication. Porto Alegre, RS/Brazil. n = 447 CIPs

	Phlebitis use of PIC		p	Grade			p
	Yes n(%)	No n(%)		I n(%)	II n(%)	III n(%)	
Total PIC							
One	10(6.1)	155(93.9)		8(80.0)	1(10.0)	1(10.0)	
Twos	10(8.9)	102(91.1)		8(80.0)	1(10.0)	1(10.0)	
Three	8(9.1)	80(90.9)		7(87.5)	-	1(12.5)	
Four	3(6.0)	47(94.0)	0.925**	2(66.7)	1(33.3)	-	0.876**
Five	1(5.0)	19(95.0)		1(100.0)	-	-	
Six	-	9(100.0)		-	-	-	
Seven	-	3(100.0)		-	-	-	
Permanence of PIC							
24 hours	6(5.5)	103(94.5)		5(83.3)	1(16.7)	-	
48 hours	9(8.4)	98(91.6)		5(55.6)	2(22.2)	2(22.2)	
72 hours	13(7.6)	157(92.4)		12(92.3)	-	1(7.7)	
96 hours	4(8.2)	45(91.8)	0.937**	4(100.0)	-	-	0.276**
120 hours	-	6(100.0)		-	-	-	
144 hours	-	3(100.0)		-	-	-	
168 hours	-	3(100.0)		-	-	-	
PIC site							
Jugular	-	1(100.0)		-	-	-	
Arm	-	12(100.0)		-	-	-	
Cubital Fossa	3(2.9)	102(97.1)		3(100.0)	-	-	
Forearm	15(9.1)	149(90.9)	0.327**	12(80.0)	-	3(20.0)	0.208**
Wrist	6(10.7)	50(89.3)		4(66.7)	2(33.3)	-	
Back hand	8(7.5)	98(92.5)		7(87.5)	1(12.5)	-	
Foot	-	3(100.0)		-	-	-	
PIC calibre							
24 Gauge	4(4.3)	90(95.7)		4(100.0)	-	-	
22 Gauge	20(8.7)	209(91.3)		14(70.0)	3(15.0)	3(15.0)	
20 Gauge	-	16(100.0)	0.212**	-	-	-	0.853**
18 Gauge	2(20.0)	8(80.0)		2(100.0)	-	-	
Unidentified	6(6.1)	92(93.9)		6(100.0)	-	-	
PIC maintenance							
Saline	26(7.2)	336(92.8)	0.968*	23(88.5)	1(3.8)	2(7.7)	0.059**
Serotherapy	6(7.1)	79(92.9)		3(50.0)	2(33.3)	1(16.7)	
N' medication classes							
None	9(8.9)	92(91.1)		8(88.9)	-	1(11.1)	
One	13(7.6)	157(92.4)		10(76.9)	2(15.4)	1(7.7)	
Twos	8(7.0)	106(93.0)	0.531**	7(87.5)	1(12.5)	-	0.374**
Three	1(2.0)	50(98.0)		-	-	1(100.0)	
Four	1(10.0)	9(90.0)		1(100.0)	-	-	
Five	-	1(100.0)		-	-	-	
Nº medication per PIC							
Up to two	26(7.4)	325(92.6)	0.697*	22(84.6)	2(7.7)	2(7.7)	0.308**
From three to seven	6(6.3)	90(93.8)		4(66.7)	1(16.7)	1(16.7)	

Source: research data, 2015.
*Pearson's Chi Square; ** Fisher's Exact Test; Nº – Number; PIC-Peripheral Intravenous Catheter.

With regard the occurrence of phlebitis, a similar distribution was observed among the patient with phlebitis in terms of age, sex, and skin colour, with no statistical significance. In relation to grade, the previous analysis was repeated with age and sex. In this case, a statistical significance was observed for skin colour, showing the white and brown skin were associated with Grade I phlebitis and black skin was associated with Grade III phlebitis (Table 2).

Table 3 shows the results of the non-statistical association of the risk factors with phlebitis and grade of phlebitis during PIC.

The data were similarly distributed between the patients regarding total number of PIC, PIC permanence, PIC site, and calibre of PIC, maintenance of PIC, number of medication classes, and number of medication per PIC. In terms of phlebitis grade, there was also a similar distribution between the patient with phlebitis, with a limit value (p = 0.059) in the PIC maintenance variable (Table 3).

The individual analysis of the medication revealed a statistical significance (p = 0.009) for Amoxicillin + Clavulanic Acid with the occurrence of phlebitis during the PIC. In terms of the grade of phlebitis during PIC, none of the medication showed a significant association.

Table 4 shows the results of the association analysis of the socio-demographic characteristics of the patients with the occurrence of phlebitis and its grades after removal of the PIC.

The occurrence of phlebitis revealed a similar distribution between the patients who had phlebitis in relation to age, sex and skin colour, with no statistical significance. In relation to grades, the same analysis was repeated with sex and skin colour. However, there was a statistical significance for age, where the patients in the 19 to 48 age group and the patients in the 71 to 95 age group associated with Grade I phlebitis, while the patients in the 49 to 70 age group associated with Grade III (Table 4).

Table 5 presents the results of the statistical association of the risk factors with phlebitis and grade of phlebitis after removal of the PIC.

Post-infusion phlebitis was not associated with any of the risk factors related to the catheter or number of drugs used. The same occurred with the grades of phlebitis (Table 5).

However, in the individual analysis of the use of medication, Tramadol Hydrochloride, Amoxicillin + Clavulanic Acid, and Amphotericin showed a statistical significance (p = 0.049) for the occurrence of post-infusion phlebitis. In the association analysis of the classes of medication with post-infusion phlebitis, there was a positive association (p = 0.0032) to the antifungal drugs, the anti-inflammatory drugs, and the drugs that act on the blood. With regard the grade of post-infusion phlebitis, none of the medication or medication classes showed a significant association.

Table 4 – Socio-demographic data and their association with phlebitis and its grades after removal of the PIC (post-infusion phlebitis). Porto Alegre, RS/Brazil. n = 358 CIPs

	Post-infusion phlebitis		p	Grade				p
	Yes n(%)	No n(%)		I n(%)	II n(%)	III n(%)	IV n(%)	
Age								
19 to 48 years	29(26.9)	79(73.1)		12(41.4)	7(24.1)	8(27.6)	2(6.9)	
49 to 70 years	31(22)	110(78)	0.474*	14(45.2)	1(3.2)	16(51.6)	-	0.046**
71 to 95 years	22(20.2)	87(79.8)		13(59.1)	4(18.2)	4(18.2)	1(4.5)	
Sex								
Male	41(26.1)	116(73.9)	0.202*	18(43.9)	7(17.1)	16(39)	-	0.275**
Female	41(20.4)	160(79.6)		21(51.2)	5(12.2)	12(29.3)	3(7.3)	
Skin colour								
White	53(21.8)	190(78.2)		28(52.8)	8(15.1)	14(26.4)	3(5.7)	
Brown	18(23.7)	58(76.3)	0.657*	5(27.8)	3(16.7)	10(55.6)	-	0.293**
Black	11(28.2)	28(71.0)		6(54.5)	1(9.1)	4(36.4)	-	

Source: research data, 2015.
* Pearson's Chi-Square; ** Fisher's Exact Test.

Table 5 – Data of the association of phlebitis and grade of phlebitis after removal of the PIC (post-infusion phlebitis) with the risk factors for phlebitis. Porto Alegre, RS/Brazil. n = 358 CIPs

	Post-infusion phlebitis		p	Grade				p
	Yes n(%)	No n(%)		I n(%)	II n(%)	III n(%)	IV n(%)	
Total PIC								
One	27(19,9)	109(80,1)		12(44,4)	4(14,8)	9(33,3)	2(7,4)	
Two	24(24,5)	74(75,5)		12(50,0)	2(8,3)	9(37,5)	1(4,2)	
Three	17(26,6)	47(73,4)		7(41,2)	3(17,6)	7(41,2)	-	0,210 **
Four	7(20,6)	27(79,4)	0,878**	6(85,7)	-	1(14,3)	-	
Five	5(31,3)	11(68,8)		2(40,0)	1(20,0)	2(40,0)	-	
Six	2(22,2)	7(77,8)		-	2(100,0)	-	-	
Seven	-	1(100)		-	-	-	-	
Permanence of PIC								
24 hours	17(19,5)	70(80,5)		9(52,9)	2(11,8)	6(35,3)	-	
48 hours	26(33,8)	51(66,2)		13(50,0)	6(23,1)	7(26,9)	-	
72 hours	31(21,1)	116(78,9)		12(38,7)	3(9,7)	13(41,9)	3(9,7)	0,611 **
96 hours	7(17,9)	32(82,1)	0,163**	4(57,1)	1(14,3)	2(28,6)	-	
120 hours	-	5(100,0)		-	-	-	-	
144 hours	-	1(100,0)		-	-	-	-	
168 hours	1(50,0)	1(50,0)		1(100,0)	-	-	-	
PIC site								
Jugular	1(100,0)	-		1(100,0)	-	-	-	
Arm	1(12,5)	7(87,5)		1(100,0)	-	-	-	
Cubital Fossa	21(24,4)	65(75,6)		12(57,1)	3(14,3)	6(28,6)	-	0,291 **
Forearm	35(26,7)	96(73,3)	0,163**	10(28,6)	5(14,3)	18(51,4)	2(5,7)	
Wrist	5(10,9)	41(89,1)		2(40,0)	2(40,0)	1(20,0)	-	
Back of Hand	19(22,4)	66(77,6)		13(68,4)	2(10,5)	3(15,8)	1(5,3)	
Foot	-	1(100,0)		-	-	-	-	
PIC Calibre								
24 Gauge	21(26,9)	57(73,1)		10(47,6)	2(9,5)	9(42,9)	-	
22 Gauge	41(22,3)	143(77,7)		23(56,1)	6(14,6)	12(29,3)	-	0,073 **
20 Gauge	5(38,5)	8(61,5)	0,460**	2(40,0)	-	2(40)	1(20,0)	
18 Gauge	1(16,7)	5(83,3)		-	1(100)	-	-	
Unidentified	14(18,2)	63(81,8)		4(28,6)	3(21,4)	5(35,7)	2(14,3)	
PIC Maintenance								
Saline	71(24.2)	222(75.8)	0.205*	31(43.7)	10(14.1)	27(38)	3(4.2)	0.190 **
Serotherapy	11(16.9)	54(83.1)		8(72.7)	2(18.2)	1(9.1)	-	
Nº Medication Classes								
None	20(25.6)	58(74.4)		14(70.0)	1(5.0)	4(20.0)	1(5.0)	
One	25(18.9)	107(81.1)		10(40.0)	5(20.0)	9(36.0)	1(4.0)	
Two	25(25.5)	73(74.5)	0.400**	8(32.0)	4(160)	12(48.0)	1(4.0)	0.319 **
Three	9(22.5)	31(77.5)		7(77.8)	1(11.1)	1(11.1)	-	
Four	2(22.2)	7(77.8)		-	1(50.0)	1(50.0)	-	
Five	1(100.0)	-		-	-	1(100.0)	-	
Nº Medication per PIC								
Up to two	62(22.1)	219(77.9)	0.469*	28(45.2)	9(14.5)	22(35.5)	3(4.8)	0.742 **
From three to seven	20(26.0)	57(74.0)		11(55.0)	3(15.0)	6(30.0)	-	

Source: research data.
*Pearson's Chi-Squared; ** Fisher's Exact Test; Nº – Number; PIC-Peripheral Intravenous Catheter.

DISCUSSION

In the present study, we observed that the incidence density of phlebitis during PIC was 3.14%, and 9.23% for post-infusion phlebitis. In Brazil, only one study found lower values, with a density incidence of 1.25% for phlebitis during PIC and 1.38% for post-infusion phlebitis[13]. When data analysis is based on incidence, the results (7.15% for phlebitis during PIC) are lower than those of other studies, which recorded incidences of 8.5%[14], 10.5%[4], 25.8%[7], and 59.1%[15], and higher than a study that recorded an incidence of 4%[16]. With the exception of the latter record, the values found are above the recommendation of the Infusion Nurses Society that establishes that the acceptable rate of phlebitis for a given population is up to 5%[2]. The incidence of 22.9% of post-infusion phlebitis cannot be compared because no studies with this analysis were found.

This scarcity of studies suggests a deficit of knowledge on this type of phlebitis and the importance of monitoring, by the nursing team, the puncture site after removal of the PIC.

In Brazil, the reference for the indicator of the incidence of phlebitis[12] considers the number of patients per day in the assessed period that are exposed to the risk of inflammation (incidence density), while international references[1-2] consider the total number of patients with catheters inserted (incidence). Applying the values in different formulas without understanding them can give the false impression that the results are being underestimated in the Brazilian indicator[12] or overestimated in the international formula[1,2]. It is therefore important to discuss these aspects for all data to be compared correctly.

Scientific nursing literature points to several risk factors for the occurrence of phlebitis[1-2,15,17]. In this study, however, there was no association with the variable validated in literature, except in the case of grade of phlebitis during PIC with skin colour and some drugs, when analysed individually, with phlebitis during PIC and after its removal. Another study found a greater frequency of phlebitis in white people (58.4%), although the statistical association between exposure and outcome was not analysed[8].

Regarding the site chosen to insert the device, the forearm (36.7%) was the preference of the nursing team due to the presence of long and large veins that enable the insertion of catheters with higher calibres[7,18]. A study shows that there is no indication of the ideal anatomic region to reduce the risk of phlebitis. Most of the punctures were performed with a 22 G PIC (51.2%), which may have reduced the occurrence of phlebitis, as pointed out in another study[4].

Studies show that advanced age is a predisposing factor of phlebitis[10,19], which also became evident in this study after analysing the grade of post-infusion phlebitis and its association with the age of patients.

Studies that assessed the permanence time of the intravenous device in the insertion site show that changes are recommended every 72 to 96 hours or, in the case of an incidence of phlebitis that exceeds 5%, every 48 hours[2,17]. Studies found that a PIC permanence time ≥ 72 hours is associated with phlebitis[9,13,15].

Contrarily, a systematic review with 4,895 patients that sought to assess possible results of the routine change of catheter and when changes are clinically indicated, did not find evidence that the recommendation to change the catheter every 72 to 96 hours leads to better results[17]. This frequency reduces the number of punctures, minimises patient discomfort and unnecessary suffering, and preserved skin integrity. To reduce complications related to the insertion site, the access should be removed when clinically indicated, and assessed at each change of shift to identify possible signs of inflammation, infiltration and/or obstruction[2,16-17].

This study did not find an association of PIC permanence with the occurrence of phlebitis. Descriptively, it shows that the occurrence of phlebitis was in accesses that remained for up to 96 hours, although catheters that remained for longer periods did not exhibit phlebitis during PIC. In the post-infusion phlebitis analysis, however, there was a concentration of the event in punctures where the PIC remained for up to 48 hours and one case of phlebitis in a PIC with a permanence of 168 hours.

Analysis of the evolution of grade of phlebitis showed that the phlebitis that occurred during the use of PIC only reached a Grade III evolution, unlike post-infusion phlebitis that evolved to Grade IV. A study conducted at the Clinical Hospital of the Universidade Estadual de Campinas[4] found that 25% of the cases of phlebitis evolved to Grade IV. In this study, only 0.7%, of the cases of phlebitis evolved to Grade IV.

With regard to medication, studies conducted in the United States of America[20] and Colombia[14] showed that antibiotics (p=0.002) are associated with phlebitis. This study revealed that the classes of mediation associated with the occurrence of post-infusion phlebitis were antifungal drugs, anti-inflammatory drugs, and those that act on the blood. The drugs Tramadol Hydrochloride, Amoxicil-

lin + Clavulanic Acid, and Amphotericin were also associated with this type of phlebitis.

In relation to the pH of the medication, the more acid the drug, the greater the risk of chemical phlebitis[17]. This information is supported by the pH of the Tramadol Hydrochloride (pH 5.5 to 6.3) and Amphotericin (pH 6.0 to 7.5), but not with the pH of Amoxicillin + Clavulanic Acid (pH 8.0 and 10)[5].

The limitation of this study lies in the fact that investigations of phlebitis reveal data that contradicts the risk factors. Also, the quantification of the occurrence of this condition can be confusing since the term "incidence" in studies does not always reflect the calculation format, which reveals the need to further discuss this subject.

CONCLUSION

This investigation reveals that post-infusion phlebitis has a higher incidence and different associated risk factors than phlebitis during PIC. The incidence of post-infusion phlebitis greatly exceeds the incidence of phlebitis during PIC and the incidence recommended by the international institutions. Another extremely relevant aspect is the need to align the indicated formula to calculate the incidence in Brazil (that actually portrays incidence density rather than incidence) to allow comparisons between studies and indicators of national and international institutions.

Risk factors that are extensively mentioned in literature as being related to phlebitis, such as permanence and calibre of the PIC, puncture site, and use of most medication, were not associated with phlebitis in this study. This reveals that new variables must be effectively studied to understand the etiology of this condition, which, in most cases can be prevented, during intravenous therapy.

The influence of PIC permanence, especially on the occurrence of phlebitis, must be further investigated since the national guidelines, primarily those of the National Health Inspection Agency, recommend changes every 72-96 hours, although they also report that this recommendation needs further studies.

In addition, post-infusion phlebitis is not monitored in the studies and probably in the healthcare institutions since the only publication in literature that could be used to compare the results with this study is from this same research group. This indicates a considerable fault in the results of phlebitis control indicators since they only consider phlebitis during PIC.

We suggest additional research to provide further insight into the aspects described in this study, which would allow nurses at the front line of intravenous therapy and the multi-professional team to understand and minimise this event that compromises the safety of patients during hospitalisation.

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