Original article

PREVALENCE OF PHLEBITIS RELATED TO THE USE OF PERIPHERAL INTRAVENOUS DEVICES IN CHILDREN

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ABSTRACT: Objective: To assess the prevalence of phlebitis, related to the use of peripheral intravenous devices in children in a teaching hospital. Method: A quantitative, descriptive and retrospective study, based in data taken from the phlebitis notification form related to peripheral intravenous therapy, in June 2011 – June 2014, in a pediatric intensive care unit in the city of Curitiba, in the Brazilian state of Paraná (PR). Results: Of a total of 1306 catheters, 339 cases of phlebitis were notified (prevalence of 26%) in the three-year period. The prevalence of phlebitis was 34% in children aged from 0 to 2 years and was 30.2% (n=179) among female children. Regarding the classification of the cases of phlebitis, 82.6% (n=280) were Grade 1, and the mean dwell-time of the device was 49.92 ± 43.19 hours. Conclusion: The data presented here demonstrate a high prevalence of phlebitis in pediatric patients, and the need to seek measures capable of reducing these events.
DESCRIPTORS: Patient safety; Phlebitis; Pediatric nursing; Catheterization, peripheral.

PREVALÊNCIA DE FLEBITE RELACIONADA AO USO DE DISPOSITIVOS INTRAVENOSOS PERIFÉRICOS EM CRIANÇAS

RESUMO: Objetivo: Avaliar a prevalência de flebite relacionada ao uso de dispositivos intravenosos periféricos em crianças em um hospital universitário. Método: Estudo descritivo e retrospectivo, quantitativo, com base em dados provenientes da ficha de notificação de flebite relacionada à terapia intravenosa periférica, no período de junho de 2011 a junho de 2014, da unidade de terapia intensiva pediátrica, na cidade de Curitiba-PR. Resultados: De um total de 1306 cateteres, foram notificados 339 casos de flebite (prevalência de 26%) no período de três anos. A prevalência de flebite foi de 34% nas crianças de 0 a 2 anos e de 30,2% (n=179) no sexo feminino. Quanto à classificação das flebites 82,6% (n=280) eram de Grau 1 e o tempo médio de permanência do dispositivo foi de 49,92 ± 43,19 horas. Conclusão: Os dados apresentados demonstram alta prevalência de flebite em pacientes pediátricos e a necessidade de buscar medidas que reduzam esses eventos.
DESCRITORES: Segurança do paciente; Flebite; Enfermagem pediátrica; Cateterismo venoso periférico.

PREVALENCIA DE FLEBITIS RELACIONADA AL USO DE DISPOSITIVOS INTRAVENOSOS PERIFÉRICOS EN NIÑOS

RESUMEN: Objetivo: Evaluar la prevalencia de flebitis relacionada al uso de dispositivos intravenosos periféricos en niños, en un hospital universitario. Métodos: Estudio descriptivo y retrospectivo, cuantitativo, basado en datos obtenidos de ficha de notificación de flebitis relacionada a terapia intravenosa periférica, desde junio de 2011 a junio de 2014, en unidad de terapia intensiva pediátrica, ciudad de Curitiba-PR. Resultados: Sobre un total de 1306 catéteres, fueron notificados 339 casos de flebitis (prevalencia del 26%) en un lapso de tres años. La prevalencia de flebitis fue del 34% en niños de 0 a 2 años y de 30,2% (n=179) en el sexo femenino. Respecto a la clasificación de las flebitis, 82,6% (n=280) fueron de Grado 1, y el tiempo medio de permanencia del dispositivo fue de 49,92 ± 43,19 horas. Conclusión: Los datos presentados demuestran alta prevalencia de flebitis en pacientes pediátricos, y la necesidad de buscar medidas reductoras de tales eventos.
DESCRIPTORES: Seguridad del Paciente; Flebitis; Enfermería Pediátrica; Cateterismo Venoso Periférico.

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INTRODUCTION

The use of peripheral intravenous devices (PIVD) in pediatrics is a frequent practice in the hospital environment, being necessary for the administration of drugs and fluids intravenously[1]. Complications resulting from intravenous therapy (IVT) are unwanted, although common, results, related to various risk factors such as the nature of the drugs, the duration of the therapy, each patient's individual characteristics, the professional's technical skill, the puncture site, the type and bore of the PIVD used, and the handling and fixation of the venous access, among other issues[2-4].

Phlebitis is one of the complications of IVT. Although it is not characterized as the most frequent complication in the pediatric population[5], it has important consequences for the patients. Data on phlebitis in this population is incipient; however, there are reports of prevalence of this health issue in the Brazilian population of 2.7%[5], 3.8%[6] and even 63% of patients with PIVD[7]. Its main signs and symptoms are pain, erythema, heat, edema, induration, palpable venous cord, purulent exudate and slow infusion speed[8]. Phlebitis is classified in grades 0 to 4, according to its severity[9], and can be of mechanical, chemical or infectious etiology[8].

In pediatric patients, IVT constitutes a challenge, due to this population's specific characteristics. Factors such as greater capillary weakness, venous network with narrow-bore vessels and which are difficult to see, increased adiposity, little cooperation on the part of the child and parents' stress increase the situation's complexity. This ranges from the procedure of venipuncture, which becomes more difficult and takes more time, through to the appropriate fixation, use and maintenance of the PIVD[1]. Furthermore, one can observe higher incidence of complications related to IVT in younger children, particularly those below one year of age, in comparison with children aged over five years old[10].

In this regard, reducing the incidence of complications, and the occurrence of multiple/new punctures is a major challenge for the nursing team; there is an urgent need to respond to these issues in seeking improvement in the quality of care and in patient safety. Bearing in mind the higher rates of failure/complications related to IVT reported in the literature, this study aims to assess the prevalence of phlebitis related to the use of PIVD in children in a teaching hospital in the city of Curitiba, in the Brazilian state of Paraná (PR).

METHOD

This is a retrospective, descriptive study, with a quantitative approach. The source of secondary data was the phlebitis notification forms related to peripheral intravenous therapy in the pediatric intensive care unit (PICU) of a teaching hospital in the South of Brazil. The data collection period was July – December 2014.

All of the phlebitis notification forms from the PICU were included, from June 2011, when the unit was set up, through to June 2014. This unit admits children with ages varying from 29 days through to 14 years. There were no exclusion criteria.

All the data from the phlebitis notification forms were analyzed and tabulated. The phlebitis notification form contains information referent to the patient and to the adverse event/incident involving IVT or the PIVD, such as the date of occurrence and date of the venipuncture, the medications being used, the type of device used, the individual risk factors involved and a phlebitis classification table. The patients' medical records were consulted for additional information and characterization of the sample regarding their sociodemographic and clinical profile.

The evaluation of the insertion site was undertaken by the nurses from the unit, and used the Maddox Scale for classification of the grade of the phlebitis, as follows: Grade 0 – No pain, erythema, swelling, induration, or palpable venous cord; Grade 1 – Painful IV site, no erythema, swelling, induration, or palpable venous cord; Grade 2 - Painful IV site, some erythema and/or swelling, no induration or palpable venous cord); Grade 3 – Painful IV site, with erythema, swelling, induration and palpable venous cord[11].

The prevalence of phlebitis was calculated using the following formula: (number of cases of phlebitis / number of patients/day with peripheral access) x 100[12]. The data were tabulated and quantified in graphs and tables, using Microsoft Excel® and GraphPad Prism 4®. They were later analyzed using descriptive statistics and the results were presented in the form of absolute values and percentages.

The study complied with ethical precepts and was approved on 11 June 2014 by the Research Ethics Committee of the Department of Health Sciences, under Opinion N. 722356/2014.

RESULTS

In June 2011 – June 2014, there were 871 hospitalizations in the PICU, according to the data provided by the Strategy and Planning Service (SEPLAN) of the hospital where the study was undertaken. A total of 1306 flexible peripheral catheters were used, equivalent to a mean of 1.5 catheters per patient per period of inpatient treatment.

In this same period, 339 cases of phlebitis were recorded in the PICU's notification forms. Of these, 52.8% (n = 179) affected female patients. Age varied between a minimum of 29 days old and a maximum of 14 years. 52.5% (n = 178) were aged between 0 and 2 years old, followed by 19.5% (n = 66) aged between 5 and 10 years old. Regarding the reasons for inpatient treatment, the main causes were respiratory diseases (36.3%, n = 123), hematological diseases (9.5%, n = 32) and metabolic disorders (9.2%, n = 31) (Table 1). The mean duration of stay in the unit was 11 days, although this varied between a minimum of 1 and a maximum of 59 days.

Table 1 - Characterization of the sample, according to clinical and sociodemographic profile. Curitiba, PR, Brazil, 2011-2014

Variable	n	%
Sex		
Male	160	47.2
Female	179	52.8
Total	339	100
Age		
0 to 2 years	178	52.5
2 to 5 years	47	13.9
5 to 10 years	66	19.5
> 10 years	48	14.1
Total	339	100
Reason for Inpatient Treatment		
Respiratory diseases	123	36.3
Cardiovascular diseases	9	2.7
Hematological diseases	32	9.5
Metabolic disorders	31	9.2
Neoplasias	26	7.7
Surgery	27	7.9
Neurological diseases	22	6.5
Gastrointestinal diseases	13	3.8
Septic shock	10	2.9
Infectious/contagious diseases	18	5.3
Rare syndromes	28	8.2
Total	339	100

The prevalence of phlebitis in this period was of 26% (339 notifications, in 1306 catheters). A prevalence was observed in female children (30.2%, n = 179). Regarding age, a prevalence was ascertained among 0 to 2 years (34.5%, n = 178) (Table 2).

Table 2 - Prevalence of phlebitis in relation to sex and age range. Curitiba, PR, Brazil, 2011-2014

	Patients		Catheters used		Cases of Phlebitis	Prevalence
Sex	n	%	n	%	N	%
Male	476	56.7	714	54.7	160	22.4
Female	395	45.3	592	45.3	179	30.2
Total	871	100	1306	100	339	-
Gen. prevalence	-	-	-	-	-	26
Age						
0 ≥ 2 years	344	39.5	516	39.5	178	34.5
2 ≥ 5 years	125	14.4	187	14.3	47	25.13
5 ≥ 10 years	174	20	261	20	66	25.3
> 10 years	228	26.2	342	26.2	48	14
Total	871	100	1306	100	339	-

Considering the cases of notification of phlebitis with regard to the classification, the highest number of occurrences (82.6%, n = 280) was of phlebitis Grade 1 (Figure 1).

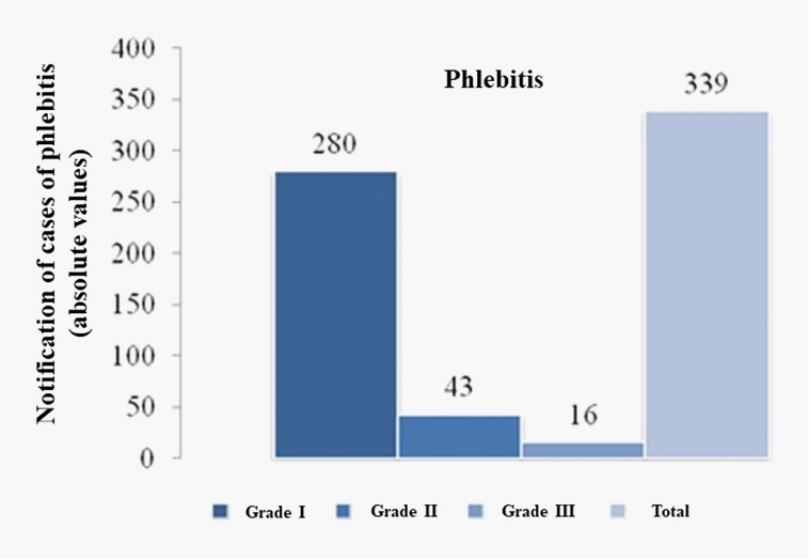

Figure 1 - Classification of the notified cases of phlebitis. Curitiba, PR, Brazil, 2011-2014

The most frequent type of therapy was 'continuous', corresponding to 83.1% (n = 282) of the devices used. The dwell-time of the peripheral intravenous devices was evaluated in hours; the mean was 49.92 ± 43.19 hours, with a minimum of 1 hour and a maximum of 278 hours. Most of the catheters (34.3%, n = 116) remained in place for a period between 24 and 48 hours. A significant number of devices (23.3% n = 79) was removed in less than 24 hours (Table 3).

Table 3 - Variables related to the peripheral intravenous device. Curitiba, PR, Brazil, 2011-2014

Variable	Type of peripheral intravenous device					
	Flexible (polyurethane)		Rigid		Total	
Type of Therapy	**n**	**%**	**n**	**%**	**n**	**%**
Continuous	280	82.5	2	0.6		
Intermittent	55	16.3	2	0.6		
Total	335	98.8	4	1.2	339	100
Dwell-time of the Peripheral Intravenous Device						
< 24 hours	77	22.7	2	0.6		
24 to 48 hours	115	34	1	0.3		
48 to 72 hours	46	13.5	-	-		
72 to 96 hours	25	7.4	-	-		
> 96 hours	28	8.2	-	-		
Not identified	44	13	1	0.3		
Total	335	98.8	4	1.2	339	100

Regarding the drugs or therapeutic solutions administered, the most frequent were electrolyte solutions (51.3%, n = 174), followed by the association of two or more drugs (13%, n = 44), including sedatives, vasoactive drugs and antimicrobial drugs, or each of these in isolation (Table 4).

Table 4 - Therapeutic solutions found in the notifications of phlebitis. Curitiba, PR, Brazil, 2011-2014

Therapeutic solution or medication	n	%
Electrolytes	174	51.3
Sedatives	21	6.2
Vasoactive drugs	16	4.7
Antimicrobials	15	4.5
Corticoids	7	2
Bronchodilators	7	2
Total Parenteral Nutrition	6	1.8
Blood products	3	0.9
Anticonvulsants	3	0.9
Analgesics	2	0.6
Association of two or more drugs	44	13
Other drugs	6	1.8
Not identified	35	10.3
Total	339	100

DISCUSSION

The Infusion Nurses Society (INS) establishes the international standards for the documentation of intravenous therapy. These include not only the classic signs and symptoms of phlebitis, but also information related to the population of which the patient is part. One must consider the risk factors, the type of therapy and types of drug used, the method of administration/infusion, the preparation of

the puncture site, the type of device, the prevention of complications, the interventions undertaken, and the patient's response to the treatment, among others[9].

As we used the PICU's phlebitis notification form for data collection, we observed that more detailed information on the patient's condition was lacking – such as the bore of the device used, the puncture site and the type of fixation of the venous access.

The Brazilian National Health Surveillance Agency (ANVISA) recommends that health institutions should monitor adverse events which occur in patients[13]. The nurse has a fundamental role in the process of managing and maintaining intravenous therapy, which – if undertaken and recorded appropriately – has a direct impact on reducing cases of phlebitis[14]. For this, it is necessary for complete records to be organized in specific documentation on all aspects of IVT, allowing the identification of all the possible factors which led to an incident, as stipulated by Resolution N. 514 of the Federal Council of Nursing[15].

One study undertaken in a private pediatric hospital, in the period before and after a process of hospital accreditation, showed a reduction in the incidence of phlebitis, which is considered an indicator of the quality of care provided, from approximately 23 cases in every 100 patients with a peripheral intravenous catheter, to approximately zero – with sporadic events over a five-year period. The authors emphasized that this reduction may be due to the implementation of institutional protocols and care guidelines in the institution during the accreditation process[16]. As a result, the importance is demonstrated of instituting care routines as a tool for the prevention of phlebitis.

The results of the present study demonstrate a prevalence of phlebitis of 26% in children. The literature varies widely in this aspect, with some works reporting rates of phlebitis of 1.5%[4], 2.7%[5], 3.8%[6], between 8.4% and 40.5%[17], 63%[7,18] and even 71%[19]. It is emphasized that this great divergence between studies is owed to the diagnostic criteria used and to the context of each institution studied. The INS stipulates that the rates of prevalence of phlebitis should not go beyond 5%, in any population[9]. In this regard, improving the processes related to IVT in all aspects with a view to reduction of complications and improvement of success rates continues to be a challenge for health institutions – and in particular for Nursing.

Upon analyzing the prevalence of phlebitis by age, it was evidenced that there is a greater number of cases of this complication in children aged up to two years old, which corroborates the literature, in which complications from PIVD are observed more in younger patients[10]. A separate study with 80 children, however, did not show a relation between age and the degree of phlebitis presented(18). In relation to gender, females present a greater prevalence of phlebitis, this data also being found in a study which assessed predisposing factors for phlebitis associated with PIVD[5].

With regard to the PIVDs' dwell-time, both the Center for Disease Control and Prevention (CDC) and the Brazilian National Health Surveillance Agency (ANVISA) recommend that changing peripheral catheters in pediatric patients should be undertaken only when clinically indicated, and not routinely every 72 to 96 hours[2,20]. One updating systematic review, based in randomized clinical trials in adults, also showed there to be no significant difference in the rates of infection of the blood stream or of phlebitis related to the use of peripheral venous catheters when the exchanging is undertaken routinely, between 72–96 hours, or when it is undertaken only when clinically indicated[21].

One recent study undertaken in children showed failure rates with PIVDs of approximately 25%, due to complications; the devices' mean dwell-time was 29 hours[4]. The same study, unlike the previous studies, indicated phlebitis as the fourth most common cause of removal of the catheter. The most common cause was infiltration, followed by accidental removal, and by occlusion[4]. In the present study, the mean dwell-time for the catheter was from 49.92 ± 43.19 hours, which is higher than the data found in the above-mentioned study. Although this data denotes the PIVDs' greater viability/success, it may have been a contributing factor to the greater prevalence of phlebitis in this study. Most devices remained in place for between 24 and 48 hours, but a certain number (22%) were removed within 24 hours.

One relevant data is that the use of drugs which have pH and osmolarity which are very different from those of the blood leads to increased risk for phlebitis[22]. In this study, among the drugs which were being used at the time of notification, stress is placed on the use of electrolytes, the association

of one or more drugs, sedatives, vasoactive drugs and antimicrobials. Corroborating our findings, other studies have found associations between the infusion of phenytoin, manitol[20], antibiotics[7,23-24], potassium chloride[19,24] and hypertonic solutions[24] with cases of phlebitis.

Knowing the drugs' pH, quantity and the appropriate diluent is important in order to minimize the risks of phlebitis, given that the more acid the drug is, the more it is necessary to dilute the drug in the highest volume possible clinically tolerated by the patient[7,25]. Various studies in the literature have emphasized that antimicrobial agents have an acid pH and are responsible for a large proportion of processes of phlebitis with chemical etiology in children[5,7,22].

One systematic review study evidenced that cases of phlebitis in children are related to the dilution and infusion of drugs undertaken inadequately, as well as to the administration of more than one drug with irritant potential for the vein through the same venous access – factors which contribute to the occurrence of this complication. As a result, emphasis is placed on the need to institute protocols for the dilution and reconstitution of drugs, with a view to acting preventively[26]. This context corroborates the data found in the present study, and may be related to the high prevalence of phlebitis in the population studied.

The present study found a prevalence of phlebitis at 26%, above the level recommended in the literature. However, it was evidenced that 82.6% of the cases of phlebitis notified were Grade 1, not entailing greater severity for the the cases. One prospective study undertaken with 80 children identified Grade 1 phlebitis as the most frequent, with 46.25% (n = 37), although it also presented high levels of Grade 2 phlebitis (23.75%)[19]. The importance is highlighted of constant vigilance and observance of the PIVD, with a view to identifying the signs and symptoms of phlebitis at an early stage, and thus to minimize the harm to the patient.

As a limitation of the study, it was observed that the instrument used for notifying phlebitis did not contain data such as the size of the device, the dressing applied, the puncture site and professional responsible for the procedure, which made it impossible to carry out a better evaluation of the adverse events. Moreover, the different diagnostic criteria used in the studies make it difficult to compare and discuss the results found.

CONCLUSION

The prevalence of phlebitis in the present study was high (26%), with prevalence in female children and in children younger than two years old. It is, therefore, fundamental to seek measures which may reduce these events, in order to ensure quality care and to reduce the need for multiple punctures, the pain of the patients and the family members, and the duration of inpatient treatment and hospital costs, among other variables.

The data presented show the need for improvements in the instrument for notifying cases of phlebitis, and in the professional practice, with the aim of achieving the goals recommended by the INS. In this regard, knowing the technologies which are used, the drugs and their interactions with other drugs and the recommended infusion time and volume, as well as adopting aseptic techniques, choosing the catheter bore and puncture site appropriately, and using the best scientific evidence, could contribute to success in reducing phlebitis related to the use of PIVD. The implantation of institutional protocols and care guidelines, which aim to prevent phlebitis, are essential for safe care.

Considering that phlebitis is an adverse event which it is possible to prevent, nurses have a central role in care involving intravenous therapy. This research contributes to reflection on, and the search for improvements in, the care for children with PIVDs.

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