Factors associated with peripheral intravenous catheterization failure in children with cancer

Fatores associados ao insucesso da cateterização intravenosa periférica em crianças com câncer

Factores asociados al fracaso del cateterismo intravenoso periférico en niños con cáncer

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Abstract

Objective: To estimate the prevalence of peripheral intravenous catheter insertion failure in children with cancer and its association with demographic, clinical, catheterization and previously used intravenous therapy characteristics.

Methods: This is a cross-sectional and exploratory study conducted at the pediatric oncology clinic of a public hospital. Data from the observation of 130 peripheral intravenous catheterizations and medical records of children were used. We analyzed the demographic and clinical characteristics of peripheral intravenous catheterization and intravenous therapy used and its relationship with catheterization failure. Poisson regression with robust variance was used to determine the factors associated with the outcome studied, considering $p<0.05$.

Results: The prevalence of failure was 38.5% and was statistically associated with length of stay (PR=1.6; 95%CI 1.05-2.56), previous prolonged intravenous therapy use (PR=2.1; 95%CI % 1.32-3.20), history of extravasation (PR=1.99; 95%CI 1.15-3.28) and child agitation (PR=1.41; 95%CI 1.02-1.94).

Conclusion: There was a high prevalence of peripheral intravenous catheterization failure in children with cancer, associated with length of hospitalization greater than or equal to eight days, previous prolonged IVT use, history of extravasation and child agitation during catheter insertion.

Resumo

Objetivo: Estimar a prevalência de insucesso na inserção de cateteres intravenosos periféricos em crianças com câncer e sua associação com características demográficas, clínicas, da cateterização e terapia intravenosa utilizada previamente.

Métodos: Estudo de corte transversal e exploratório realizado na unidade de clínica oncológica pediátrica de um hospital público. Foram utilizados dados provenientes da observação de 130 cateterizações intravenosas periféricas e prontuários das crianças. Analisadas as características demográficas, clínicas, da cateterização intravenosa periférica e terapia intravenosa utilizada e sua relação com o insucesso da cateterização. Utilizou-se regressão de Poisson com variância robusta para determinar os fatores associados ao desfecho estudado, considerando $p<0,05$.

Resultados: A prevalência do insucesso foi de 38,5% e esteve estatisticamente associada ao tempo de hospitalização (RP=1,6; IC95% 1,05-2,56), uso de terapia intravenosa prévia prolongada (RP=2,1; IC95% 1,32-3,20), antecedente de extravasamento (RP=1,99; IC95% 1,15-3,28) e agitação da criança (RP=1,41; IC95% 1,02-1,94).

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Conflicts of interest: nothing to declare.

Conclusão: Observou-se elevada prevalência de insucesso da cateterização intravenosa periférica em crianças com câncer, associada ao tempo de hospitalização maior ou igual a oito dias, uso de TIV prévia prolongada, antecedente de extravasamento e agitação da criança durante a inserção do cateter.

Resumen

Objetivo: Estimar la prevalencia de fracaso en la inserción de catéteres intravenosos periféricos en niños con cáncer y su relación con características demográficas, clínicas, del cateterismo y de terapia intravenosa previamente utilizada.

Métodos: Estudio de corte transversal y exploratorio realizado en la unidad de clínica oncológica pediátrica de un hospital público. Se utilizaron datos provenientes de la observación de 130 cateterismos intravenosos periféricos y las historias clínicas de los niños. Se analizaron las características demográficas, clínicas, del cateterismo intravenoso periférico y terapia intravenosa utilizada y su relación con el fracaso del cateterismo. Se utilizó regresión de Poisson con varianza robusta para determinar los factores asociados al evento estudiado, considerando $p<0,05$.

Resultados: La prevalencia del fracaso fue del 38,5 % y estuvo estadísticamente relacionada con el tiempo de internación (RP=1,6; IC95% 1,05-2,56), el uso de terapia intravenosa previa prolongada (RP=2,1; IC95% 1,32-3,20), antecedentes de extravasación (RP=1,99; IC95% 1,15-3,28) y la agitación del niño (RP=1,41; IC95% 1,02-1,94).

Conclusión: Se observó una elevada prevalencia de fracaso del cateterismo intravenoso periférico en niños con cáncer, relacionada con el tiempo de internación mayor o igual a ocho días, el uso de TIV previa prolongada, antecedentes de extravasación y agitación del niño durante la inserción del catéter.

Introduction

In Brazil, childhood cancer represents the first cause of death (8% of the total) by disease in children and adolescents aged 1 to 19 years, with the estimate of new cases for the year 2020 of 8,460, according to data from the Brazilian National Cancer Institute (INCA - *Instituto Nacional de Câncer*).[1] The systemic treatment of cancer together with radiotherapy and surgery are important steps for cure,[2] highlighting chemotherapeutic drug administration, mostly intravenously.[3] In addition to the occurrence of side effects associated with chemotherapy drug use, such as pain, nausea, vomiting and neutropenia, children with cancer need drug administration to reduce symptoms, replace electrolytes, blood components[4] and sometimes antibiotics when hospitalized.

Intravenous catheters are considered essential instruments in the treatment of patients with cancer. There are different types available on the market, which can be peripheral or central, and the choice between them is determined by several factors that equate the cost/benefit ratio, such as characteristics of the prescribed chemotherapy protocol, venous network integrity, duration of treatment,[5] drug classification as irritant or vesicant, hydrogen potential,[6] in addition to patient preferences.[5]

Knowing that treatments and support therapies for children with cancer are complex and diverse, with cycles of infusions compatible with peripheral or central veins,[7] preserving the peripheral venous network and ensuring vascular health becomes essential since the beginning of treatment, since it allows access to this body structure in an easier way in case of future needs.

However, in children, intravenous catheterization is more difficult[8,9] due to poor cooperation and reduced availability of vascular access,[8,9] especially during chemotherapy. This difficulty can also result from acute conditions that interfere with blood circulation, such as dehydration or shock. These conditions can lead to peripheral intravenous catheterization (PIC) failure, defined as the need for more than one catheterization attempt.[10]

These multiple attempts result in venous network depletion, and make peripheral veins progressively difficult to access,[11,12] as well as delaying prescribed therapy,[12,13] causing stress, pain, and suffering for the child and family members. and in the long term, may be associated with fear of needle procedures,[14] a reality experienced in children with cancer.

However, the prevalence of PIC failure is little explored in research with children with cancer. Research highlights the need to develop further investigations in the field of predicting risk factors for PIC failure in patients undergoing peripherally administered chemotherapy.[14]

Recognizing such risk factors at the beginning of cancer treatment may contribute to the identification of the group of children vulnerable to the

occurrence of PIC failure, offering scientific support for technology-assisted insertion for vessel visualization or for the use of another type of catheter immediately, innovating care and improving the experience of children and their families[15] and vascular trauma.

Therefore, the study in children and adolescents with cancer is justified by the chronic nature of the disease and the harmful physicochemical characteristic of most drugs and solutions used throughout the therapeutic process, because catheterizing a vessel can become a challenging procedure due to previous damage to the intima of the veins of these children, and sometimes it can take several attempts.

That said, the question is: what is the prevalence of PIC failure in the first puncture attempt in children with cancer? What factors are associated with the prevalence of PIC failure at first attempt? Thus, the present study aimed to estimate the prevalence of failure at first attempt to insert peripheral intravenous catheters in children with cancer and its association with demographic, clinical, catheterization and intravenous therapy (IVT) characteristics used.

Methods

This is cross-sectional, analytical and exploratory research. It was carried out with children hospitalized in the oncology clinic unit of a referral hospital for the treatment of childhood cancer located in the state of Bahia.

The sample was established for convenience, leading to assessment of 130 PIC, considering the period in which the researchers remained in the field of collection. The impossibility of sample calculation was due to the absence of studies on predisposing factors to PIC failure in children with cancer until this manuscript was arranged and the impossibility of developing a pilot study, considering the lack of research funding.

Children who required PIC for implementing IVT as part of their treatment, who were clinically stable, between 29 days of life and 10 years of age and with an elective indication for PIC with a needle device, participated in the research. Children with medical prescription only for serum without electrolytes, in situations of contact or respiratory precautions, due to the impossibility of access by the researchers, and the PIC performed during the night shift or on weekends, as it does not allow the researchers to remain in these periods, were not included.

Children and adolescents who agreed to participate in the research signed the Assent Consent Form, as well as the Informed Consent Form was signed by their parents or guardians.

Data were collected from April 2015 to December 2016. A team of five researchers qualified to approach family members and children obtained the necessary information by applying the form to develop the research.

The form developed for this research was prepared through studies on the subject,[12,17,18] which contained the following primary data: venous network conditions such as visibility (described as visible and not visible), palpability (described as palpable and non-palpable), path (described as straight or devious), mobility (described as fixed and mobile) and depth (described as superficial and deep), catheter gauge (described as 22 Gauge and 20 Gauge), method of catheter insertion (described as direct and indirect), child agitation due to intense movement of limbs (described as yes or no) and number of PIC attempts (described as number of times the puncture was performed) obtained by the researchers through non-participant observation of PIC in each selected child.

The following variables were collected in the medical records: diagnosis, age (calculation of the difference between date of birth and date of data collection), nutritional status (described as malnourished or eutrophic, being assessed by a unit nutritionist with Body Mass Index (BMI) and skinfold), length of stay (difference between admission date and data collection date), previously used IVT (described as yes or no) and history of complications (described as yes or no), if yes, investigated history of obstruction (described as yes or no), history of infiltration (described as yes or no), history

of phlebitis (described as yes or no) and history of extravasation (described as yes or no). Other information was asked to companion and child, according to their level of cognitive development: sex (described as female and male), race/color (described as white or black or mixed race), history of prematurity (described as yes or no), type of previously used catheter (described as peripheral intravenous catheter and central intravenous catheter), history of difficulty for PIC (described as yes or no, being considered difficult venous network when more than one attempt to obtain it).

The exposure variables were: demographic and clinical data, PIC characteristics, prolonged IVT use (we considered those previously used for more than seven days), occurrence of complications (described as yes or no) and the outcome variable was puncture failure, determined by failure to obtain intravenous access at first attempt, resistance to catheter progression, confirmed by the absence of visualization of blood return along the catheter cannula or free infusion of 2 ml of 0.9% sodium chloride,[9] with no change in insertion site inspection and palpation.

The PICs were performed by mid-level professionals, nursing technicians, using the Standard Operating Procedure of the researched unit. We used a catheter over a needle, with a safety system and a cannula made of polyurethane, a double common extender filled with 0.9% sodium chloride, a 10 ml syringe containing this same solution and a sterile rayon and polyester covering for hub and catheter covering stabilization.

The collected data were double-entered into the Statistical Package for Social Sciences (SPSS) version 22.0. To describe the variables, absolute and relative frequencies were used, the numerical ones being presented through their measures of central tendency (median) and dispersion (interquartile range), because the normal distribution of these variables was not verified with the application of the Shapiro Wilk test.

Age was numerically assessed in the descriptive analysis as it is characterized as ordinal; however, to verify the statistical effect and because it is a comparative study, the categorization was carried out: children under 6 years old (preschool phase) between 7 and 10 years old (school phase), which corroborates the performance of multiple analysis with the other qualitative variables. As for race/color, the cluster between black and brown individuals is justified by considering dark skin, which is a factor of difficult venous access, according to the DIVA score,[8] also contributing to the performance of dichotomous multiple analysis.

The assessment of independent associations between exposure and outcome variables was performed by calculating the prevalence ratio (PR) and their respective 95% Confidence Intervals and 5% significance level, using Pearson's chi-square tests (X^2). In this stage of analysis, variables with a value of $p \leq 0.20$ were selected for testing in the multiple model, given that this statistical value is close to significance, considering the possibility of interference from other factors, which when analyzed in a isolated is not checked. In the multiple analysis, Poisson regression with robust variance was performed and the modeling was achieved when the variables presented a significance level of 5%.

The research was approved by the Research Ethics Committee under Opinion 841.612 and CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 34172014.7.0000.0053.

Results

A total of 130 PIC, performed in 51 children, were included in the research. No participant was excluded, according to the criteria described. Regarding demographic characteristics, the children had a median age of 56 months and an interquartile range of 50 months, regarding the length of hospitalization, the median was two days and the interquartile range was 5 days. Most were female (54.9%), race/color identified by parents as being black or brown (66.7%), eutrophic (90.2%) and (±11.2) and 11.8% had a history of prematurity.

The most frequent types of neoplasms were: groups I (Leukemias, myeloproliferative diseases and myelodysplastic diseases), II (Lymphomas and reticuloendothelial neoplasms), III (Central

Table 1. Bivariate analysis of demographic, clinical, and previous IVT characteristics associated with PIC failure in children with cancer

Variables	PIC failure Yes (n= 50) n(%)	No n=80 n(%)	PR	CI	p-value
Age					
Up to 6 years	44(41.5)	62(58.5)	1.7	0.80-3.44	0.133*
≥ to 7 years	6(25)	18(75)			
Sex					
Female	26(40)	39(60)	1.1	0.70-1.67	0.718*
Male	24(36.9)	41(63.1)			
Race/color					
White	17 (37)	29(63)	0.9	0.60-1.50	0.794*
Black/brown	33(39.3)	51(60.7)			
Nutritional status[a]					
Undernourished	8(50)	8(50)	1.4	0.80-2.4	0.291*
Eutrophic	41(36.3)	72(63.7)			
History of prematurity					
Yes	7(36.8)	12(63.2)	1	0.50-1.80	0.875*
No	43(38.7)	68(61.3)			
Length of stay (days)					
Equal or greater than 8 days	19(59.4)	13(40.6)	1.9	1.25-2.82	0.005*
Up to 7 days	31(31.6)	67(68.4)			
Type of catheter used previously					
Peripheral intravenous catheter	40(36.7)	69(63.3)	0.8	0.47-1.40	0.482*
Peripheral and central catheter	9(45)	11(55)			
History of difficulty to perform the PIC					
Yes	32(47.1)	36(52.9)	1.6	1.02-2.60	0.035*
No	18(29)	44(71.1)			
Prolonged peripheral IVT use					
Yes	19(59.4)	13(40.6)	1.9	1.25-2.82	0.005*
No	31(31.6)	67(68.4)			
History of complications prior to current IVT[b,c]					
Yes	42(38.9)	66(61.1)	1.1	0.60-2.11	0.742*
No	7(35)	13(65)			
History of phlebitis[b,c]					
Yes	15(37.5)	25(62.5)	0.9	0.60-1.60	0.820*
No	27(39.7)	41(60.3)			
History of infiltration[b,c]					
Yes	37(39.8)	56(60.2)	1.2	0.60-2.55	0.634*
No	5(33.3)	10(66.7)			
History of extravasation[b,c]					
Yes	14(63.6)	8(36.4)	2.0	1.30-3.03	0.008*
No	28(32.6)	58(67.4)			
History of catheter obstruction[b,c]					
Yes	24(40)	36(60)	1.1	0.70-1.72	0.791*
No	18(37.5)	30(62.5)			

*Pearson's x^2; a - It was not possible to identify the type of catheter previously used in a PIC; b - It was not possible to identify the history of complications prior to the current IVT in two PIC; c - 20 children had no history of complications prior to the current IVT.

Nervous System and miscellany of intracranial and intraspinal neoplasms), VI (Kidney tumors), IX (Soft tissue and other extraosseous sarcomas, soft tissue sarcomas) and XII (Other malignant and unspecified neoplasms) were identified in the children studied. The most prevalent diagnoses were those of Group I (47%) followed by groups XII (19.6%) and III (17.6%).

The prevalence of failure in the studied sample was 38.5%. In the bivariate analysis of clinical characteristics and IVT previously used by children, PIC failure was statistically associated with length of stay (p=0.005), history of difficulty in performing PIC (p=0.035), previous prolonged IVT use (p=0.005) and history of extravasation during the hospitalization period (p=0.008). Demographic and other characteristics of a clinical nature and of the IVT used previously were not associated with the researched outcome (Table 1).

Among the characteristics of the PIC performed, in the bivariate analysis, it was observed that there was an association between child agitation during this procedure and failure (p=0.005). The other variables related to the catheterization performed on the child were not different between the groups studied (Table 2).

Table 2. Associations between characteristics related to current PIC with PIC failure in children at the oncology clinic of a pediatric hospital

Variables	PIC failure Yes (n= 50) n(%)	No n=80 n(%)	PR	CI	p-value
Vein visibility[d]					
Not visible	18(51.4)	17(48.6)	1.6	1.01-2.40	0.055*
Visible	31(33)	63(67)			
Vein palpability					
Not palpable	14(43.8)	18(56.3)	1.2	0.80-2.00	0.438*
Palpable	35(36.1)	62(63.9)			
Vein route					
Devious	21(48.8)	22(51.2)	1.5	1.00-2.40	0.060*
Straight	27(31.8)	58(68.2)			
Venous network depth[d]					
Shallow	37(35.6)	67(64.4)	0.7	0.50-1.20	0.251*
Deep	12(48)	13(52)			
Venous network mobility[c]					
Fixed	27(32.5)	56(67.5)	0.7	0.45-1.10	0.115*
Mobile	21(46.7)	24(53.3)			
Catheter gauge					
20 (G)	-(-)	-(-)	-	-	-
22 (G)	17(30.4)	39(69.6)	0.7	0.42-1.80	0.090*
24 (G)	33(45.2)	40(54.8)			
Puncture method[d]					
Direct	40(37)	68(63)	0.9	0.50-1.50	0.615*
Indirect	9(42.9)	12(57.1)			
Child agitation during PIC					
Yes	30(51.7)	28(48.3)	1.9	1.20-2.91	0.005*
No	20(27.8)	52(72.2)			

*Pearson's x^2; c - It was not possible to identify the vein route and mobility in two PICs; d - It was not possible to identify the vein puncture method, visibility, palpability and depth in a PIC.

It is noted that, when recruiting variables with a p-value <0.20 in the bivariate analysis (age, length of stay, history of difficulty in inserting the PIC, previous prolonged IVT use, history of extravasation, vein route, vein mobility, catheter gauge and child agitation), length of stay, previous prolonged IVT use, history of extravasation and child agitation continued to explain PIC failure of in the multiple analysis (Table 3).

Table 3. Poisson regression of variables associated with the occurrence of PIC failure in children at the oncology clinic of a pediatric hospital

Variables	PIC failure at first attempt		
	PR	CI	p-value
Length of stay			
Equal or greater than 8 days	1.64	1.05-2.56	0.031
Up to 7 days			
Previous prolonged IVT use (>7 days)			
Yes	2.1	1.32-3.20	0.001
No			
History of extravasation			
Yes	1.99	1.15-3.28	0.013
No			
Child agitation during PIC			
Yes	1.41	1.02-1.94	0.038
No			

Discussion

Research indicates that failure at first PIC attempt in children ranges from 10.4 to 91%,[10,14,16,18-24] corroborating the findings of this investigation.

The prevalence of failure was almost twice as high in children with hospitalization time longer than eight days compared to those with a shorter time. However, this association was not observed in a study conducted in Morocco.[14]

In general, children hospitalized for a long period of time, depending on the medical diagnosis, receive, through intravenous catheters, electrolytes in high concentration,[25] antibiotics,[25,26] anticonvulsants[25] and in addition to these, in those undergoing cancer treatment, chemotherapeutic drugs stand out, many of which are classified as hypertonic, with harmful potential due to their irritating or vesicant properties.

Several drugs mentioned above are classified as high risk for occurrence of complications, when administered via peripheral veins[27-29] due to hydrogen potential (pH) less than 5 or greater than 9 not as well as osmolarity greater than 600 mmOsm/L.[30] Such characteristics irritate the child's vascular endothelium, predisposing it to the occurrence of local complications associated with venous network throughout IVT, infiltration, extravasation and depletion throughout the children's hospitalization period,[27-31] demanding new and repeated PIC attempts.

It is considered that, in general, most of these attempts are performed blindly, without the aid of technologies to visualize the venous network, until the blood flow is satisfactory and all possible insertion sites have been exhausted,[32] which will cause peripheral venous network depletion, and in this condition the child will be referred to as having a venous network of difficult access.

The veins will become invisible and impalpable, conditions associated, in most cases, with PIC failure.[19,21] Thus, throughout treatment, children are exposed to the deleterious effects of depletion of their venous network due to the difficulty in obtaining a peripheral route for the continuity of their therapy, affecting vascular health in terms of peripheral vein preservation.[14]

History of difficulty in catheterization, even though not confirmed as a predictor variable for failure in this research, deserves attention in the daily clinical practice of pediatric nurses, as an international study identified it as a factor related to the need for multiple attempts.[10] Its presence suggests repeated exposure to multiple PIC attempts, which lead to venous fragility,[13] bruising, sclerosis, and venous exhaustion, which makes successful PIC more difficult.[14]

In this regard, the prolonged hospitalization time and the infusion of the various drugs and solutions already mentioned, potentiate the occurrence of a history of difficulty for catheterization, which, together with the presence of predisposing factors for the failure of this procedure, lead to infiltration.[17,25,26]

Infiltrations also can occur, when drugs or irritating solutions are used for more than 96 hours,[17,25] and adequate vein selection, correct catheter hub stabilization as essential measures for the prevention

of this complication and catheter removal when clinically indicated are essential.[33]

After exhaustive PIC attempts and the impossibility of obtaining a peripheral access, the professionals involved in the performance of this procedure request, in most cases, a medical assessment regarding the possibility of inserting a central catheter. According to a national survey, the previous use of this type of catheter and under the conditions mentioned, i.e., recommended late, is a predisposing factor for PIC failure.[16]

The prevalence of failure was twice as high in children who used IVT for a long time, which was not observed in a study carried out in São Paulo.[16] Another national study observed that prolonged IVT use was associated with the occurrence of complications in children,[31] as infiltration, which allows the peripheral venous network depletion.

Previous peripheral IVT use is also associated with the time of use of drugs considered vesicants and/or irritants such as chemotherapy[14] that cause damage to the vascular endothelium, resulting from complications such as phlebitis and repeated PIC attempts.

However, according to meta-analysis result, there is no clarity on the difference in the rate of catheter-related bloodstream infection, thrombophlebitis, and pain in patients whose catheters were removed by clinical indication or routine replacement, but increased likelihood of infiltration.[33]

Having a history of extravasation doubled the prevalence of PIC failure, as did the history of infiltration[17] or local complications.[7] It is noteworthy that the last two studies mentioned did not inform what the previous complications would be.

As the multiple attempts of catheterizations, the occurrence of extravasation and history of any of the local complications associated with IVT use cause damage to the vascular endothelium, generating depletion of the children's venous network and the difficulty of future PIC attempts.

In this research, the prevalence of failure in children who were agitated during PIC was almost twice as high as in those who remained calmer. It is known that the various PIC attempts cause fear and anxiety in children,[34] which, associated with the difficult peripheral intravenous access already identified, affect the success of catheterization,[13] exposing them to a painful experience.

Therefore, children with a difficult venous network tend to react with stress and intense suffering during this procedure, remaining more agitated as a form of protest. However, agitation was not associated with failure in an investigation carried out in São Paulo.[20]

The data from the present research point to the need for innovations in the clinical practice of nursing professionals with regard to using clinical tools that can be used to predict the risk of PIC failure, such as the DIVA-Score,[8] used in children, regardless of the reason for their hospitalization.

The DIVA score instrument use as a clinical tool to identify children can bring benefits aiming to maximize efficacy and treatment. This soft technology assesses age, skin color, history of prematurity, vein visibility and palpability. In this score, children with scores greater than or equal to 4 are classified as difficult venous network and have the possibility of failure at first catheterization attempt,[8] requiring the help of some technology to visualize the venous network.

Among these, there is the application of dry heat before PIC, indicated as a clinical resource that can provide the success of this procedure and reduce the pain perceived by children.[30] Another possibility would be equipment such as ultrasound, or those that emit light close to infrared, infrared or transillumination such as the Venoscope®, which contribute to improve vein visibility.

None of the methods mentioned above are available in the research unit, and their incorporation is recommended according to the local reality, contributing to the quality, excellence and safety of care for children with difficult venous network.

This research requires interpretation in light of some limitations: it was a single-center cross-sectional study in which it was not possible to perform a sample size calculation, and the difficulty of understanding whether children with cancer have different characteristics from those with other health problems for PIC failure due to lack of previous publications. The child agitation variable was based only on the observer's perception of the upper and

lower limb movements. The skill or experience of the professionals who performed the procedures was not taken into account.

The gap in the literature on the prevalence of failure in children with cancer made it difficult to discuss the data, which required a comparison with research results carried out with children with other health conditions.

However, the findings of this research may contribute to the formation of scientific evidence for the transformation of the clinical practice of professionals involved in IVT in children with cancer regarding the use of technologies that can facilitate assessing the venous network and the PIC of those classified as difficult to catheterize.

Moreover, as it deals with exploratory data of the researched context, future investigations may use the prevalence of PIC failure in children with cancer estimated in this investigation, using this parameter in decision-making regarding the sample size.

Conclusion

The findings of this research alert to the high prevalence of PIC failure in children with cancer in a hospital in a city in the state of Bahia, Brazil, associated with hospitalization time greater than or equal to eight days, previous prolonged IVT use, history of extravasation and child agitation during catheter insertion.

Collaborations

Santos LM, Santos ILB, Santos AS, Gomes e Silva CS, Vendramim P and Avelar AFM contributed to study design, data analysis and interpretation, article writing, relevant critical review of the intellectual content and approval of the final version to be published.

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