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RESEARCH

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CHARACTERISTICS OF CHILDREN WITH CANCER AND FAILURE OF PERIPHERAL INTRAVENOUS CATHETERIZATION

Características de crianças com câncer e insucesso da cateterização intravenosa periférica

Características de los niños con cáncer y fracaso de la cateterización intravenosa periférica

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ABSTRACT

Objective: To describe demographic, clinical, prior intravenous therapy and peripheral intravenous catheterization characteristics in children with cancer and procedural failure. **Method:** this is a cross-sectional descriptive study of 18 children with peripheral intravenous puncture failure hospitalized at the pediatric oncology clinic of Hospital Estadual da Criança, in Feira de Santana-Bahia, between April 2015 and December 2016 **Results:** failure was observed in 11.7% of the children. The majority were 01 to 49 months, brown, male, eutrophic, and the main reason for failure was transfixation of the vein. The predisposing factors related to failure were a history of difficulty in insertion of a peripheral intravenous catheter, a complication prior to intravenous therapy, previous hospitalization and previous infiltration. **Conclusion:** the percentage of failure of the peripheral intravenous puncture is similar to the values found in studies on the context, related to the profile of the children, the therapy used, and the predisposing factors.

Descriptors: Pediatric nursing, Peripheral catheterization, Patient safety, Child, Intravenous infusions.

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RESUMO

Objetivo: Descrever características demográficas, clínicas, da terapia intravenosa prévia e cateterização intravenosa periférica em crianças com câncer e insucesso do procedimento. **Método:** trata-se de um estudo descritivo do tipo transversal, realizado com 18 crianças com insucesso da punção intravenosa periférica, internadas na clínica oncológica pediátrica do Hospital Estadual da Criança, em Feira de Santana-Bahia, entre Abril de 2015 e Dezembro de 2016. **Resultados:** evidenciou-se o insucesso em 11,7% das crianças. A maioria tinha 01 a 49 meses, pardas, sexo masculino, eutróficas, e o principal motivo de insucesso foi transfixação da veia. Os fatores predisponentes relativos ao insucesso foram história de dificuldade de inserção de cateter intravenoso periférico, complicação anterior à terapia intravenosa, internação anterior e antecedente de infiltração. **Conclusão:** o percentual de insucesso da punção intravenosa periférica é semelhante aos valores encontrados em estudos sobre o contexto, relacionado com o perfil das crianças, a terapia utilizada, e os fatores predisponentes.

Descritores: Enfermagem pediátrica; Cateterismo periférico; Segurança do paciente; Criança; Infusões intravenosas.

RESUMEN

Objetivo: Describir características demográficas, clínicas, de la terapia intravenosa previa y cateterización intravenosa periférica en niños con cáncer y fracaso del procedimiento. **Método:** se trata de un estudio descriptivo del tipo transversal, realizado con 18 niños con fracaso de la punción intravenosa periférica, internados en la clínica oncológica pediátrica del Hospital Estadual del Niño, en Feira de Santana-Bahía, entre abril de 2015 y diciembre de 2016. **Resultados:** se evidenció el fracaso en el 11,7% de los niños. La mayoría tenía entre 01 y 49 meses, pardas, sexo masculino, eutróficas, y el principal motivo de fracaso fue la transfixación de la vena. Los factores predisponentes relativos al fracaso fueron historia de dificultad de inserción de catéter intravenoso periférico, complicación anterior a la terapia intravenosa, internación anterior y antecedente de infiltración. **Conclusión:** el porcentaje de fracaso de la punción intravenosa periférica es similar a los valores encontrados en estudios sobre el contexto, relacionado con el perfil de los niños, la terapia utilizada, y los factores predisponentes.

Descriptorios: Enfermería pediátrica; Cateterismo periférico; Seguridad del paciente; Infantil; Infusión intravenosa.

INTRODUCTION

Cancer is characterized by the uncontrolled proliferation of abnormal cells that invade tissues and organs.¹ In Brazil, according to the Ministry of Health, cancer is the second disease of deaths in children and adolescents.^{2,3} Soon after the diagnosis is confirmed disease, it is necessary to start treatment.

The treatment of cancer in children, due to its complexity, will be instituted especially based on their demographic and clinical characteristics, the type of tumor, the location and the degree of disease stage, being comprised in three main modalities: chemotherapy, radiotherapy and surgery, with antineoplastic chemotherapy being the most frequent.^{4,6}

For chemotherapy therapy, the peripheral intravenous route is the most used due to the serum level of antineoplastic drugs and rapid absorption. However, complications associated with this administration may arise, making

visualization and venipuncture difficult, since the drugs used can be irritating or vesicating.⁴

For the administration of intravenous chemotherapy, the invasive procedure often performed in the clinical practice of cancer units is peripheral intravenous catheterization (CIP).⁹

In Brazil, according to the data report referring to adverse events notified to Anvisa in the period from January 2014 to July 2017 in the Health Surveillance Notification System (NOTIVISA), there were 5,240 notifications of incidents related to health care involving the venous catheter.⁸

It is noteworthy that the child during chemotherapy treatment can present several complications, such as infiltration and leakage, phlebitis, obstruction of the catheter cannula, accidental loss or infection at the insertion site, which will require the removal of the intravenous device, the temporary suspension of the infusion of the prescribed intravenous therapy (IVT) and the realization of new attempts to IPC.^{4,11}

However, the procedure may fail, in the first attempt to insert the catheter cannula, exposing the child to several other attempts, which will result in stress, pain, suffering and potential for the occurrence of future local complications.^{10,11}

Often, in clinical practice, the venous network of the child with cancer will be impaired, with regard to the parameters of visibility, palpability and quantity of vessels available for use of IVT, characterizing the difficult venous network, which will generally potentiate the failure of the CIP for not allowing access to the venous network on the first attempt.

Therefore, some factors may contribute to the puncture failure on the first attempt, such as a history of difficulty in inserting PIC, complication prior to the current IVT, occurrence of previous hospitalization, use of prolonged peripheral IVT, antecedent of infiltration, clinical profile of the child and therapy.¹⁰

For this reason, knowing the characteristics of hospitalized children who are unsuccessful in PIC becomes essential for nursing professionals, given the possibility of implementing care that can reduce the occurrence of this event, with examples of technologies that can improve the visualization of veins with the potential to use IVT.⁷

That said, the question was asked: what are the demographic, clinical, characteristics of previous TIV and PIC currently used in children with cancer and PIC failure?

In view of the above, this study aimed to: describe demographic, clinical, characteristics of previous TIV and PIC in children with cancer and PIP failure.

MATERIALS AND METHOD

It is an excerpt from a larger research, entitled "Safety of the pediatric patient and his family: study of technologies and adverse events related to peripheral intravascular

therapy”. To this end, a cross-sectional study with a descriptive aspect was carried out with 18 children who failed peripheral intravenous puncture (PIP), admitted to the pediatric oncology clinic unit of the Hospital Estadual da Criança (HEC) in the city of Feira de Santana, Bahia and that was carried out from April 2015 to December 2016.

These children were selected according to the following inclusion criteria: clinical stability, indication for IPC with needle catheter and age between 29 days of life and incomplete 16 years. Children hospitalized in isolation units were excluded because collectors were not allowed into the environment, and those who used the peripheral venous catheter concomitantly with a central one.

Data were collected by students of the nursing course at a public state university in Bahia during the day shifts and during the week, after due qualification for the application of the data collection instrument and CIP observation. This procedure was performed by members of the team of nursing technicians from the pediatric oncology unit of the studied hospital.

The studied variables were obtained through the application of a form designed to collect data at the time of the PIC and consult the medical records of each child. The form contained demographic, clinical, previously used TIV data and the currently performed CIP.

Children’s demographic and clinical variables were considered age in months, sex, race / skin color, nutritional condition, child agitation during IPC, vascular disease and previous hospitalizations.

The variables related to previous TIV were: history of difficulty in inserting IPC; Prolonged peripheral IVT; history of complications prior to the current IVT; history of phlebitis; infiltration history; previous leakage; previous obstruction and the type of catheter used previously.

Among the variables related to the current IPC, information was collected on the catheter gauge (described in Gauge [G]), puncture method (direct or indirect), use of a tourniquet, type of catheter used (Teflon or polyurethane), location of performance of the PIC, vein shape (curved or rectilinear), vein mobility (fixed or mobile), vein depth, number of PIC attempts (described as 1, 2, 3, 4 or more attempts) and reason for the failure of the first and last peripheral venipuncture (PVP) (hematoma, vessel transfixation, ineffective puncture, catheter obstruction or others).

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS), version 22.0, and a descriptive analysis of the data was performed, with qualitative variables by absolute frequency (n) and relative frequency (%).

This study was duly approved by the institution’s Research Ethics Committee under CAAE number: 344172014.7.0000.0053. The children were included in the study after agreement and signature of the Free and Informed Consent Term (ICF) by their parents and a term

of consent for them, when indicated.

RESULTS

PIP was unsuccessful in 11.7% of children. The main reasons for failure related to the performance of the PIC in the studied children were: transfixation of the vein and ineffective puncture.

The children’s distributions were made based on the children’s demographic and clinical characteristics, the previous TIV and the current PIP, respectively, shown in tables 1, 2, 3 and 4.

Table 1 - Demographic characteristics of children at the oncology clinic. *Feira de Santana, BA, Brazil, 2018.*

Variable	n = (18) (%)
Age in months	
Up to 49	11 (61.5)
From 50 up to 99	4 (22.4)
From 100 up to 149	2 (11.1)
From 150 up to 199	1 (5.6)
Gender	
Female	8 (44.4)
Male	10 (55.6)
Race/skin color	
White	7 (38.9)
Black	2 (11.1)
Brown	9 (50)

According to **Table 1**, when analyzing the variables related to children, it was observed that the majority of children were aged between one and 49 months, with brown skin color and belonging to the male sex.

Table 2 - Clinical characteristics of children from the oncology clinic. *Feira de Santana, BA, Brazil, 2018*

Variable	n = (18) (%)
Nutritional condition	
Eutrophic	14 (77.8)
Malnourished	3 (16.7)
Obese	1 (5.6)
Child hyperactivity	
Yes	13 (72.2)
No	5 (27.8)
Previous hospitalizations	
Yes	14 (77.8)
No	4 (22.4)

Regarding the clinical characteristics, it was evident that most children were eutrophic and agitated. It is noteworthy that none of the children studied had vascular disease and that the occurrence of previous hospitalization was reported by the companions.

Table 3 - Characteristics of previous TIV. *Feira de Santana, BA, Brazil, 2018*

Variable	n = (18) (%)
History of difficulty in inserting IPC	
Yes	12 (66.7)
No	6 (33.3)
Complication prior to the current TIV	
Yes	14 (77.8)
No	3 (16.7)
Prolonged peripheral IVT	
Yes	10 (55.6)
No	8 (44.4)
Type of catheter used previously	
CIP	16 (88.9)
CIP + CVC	1 (5.6)
CIP + PICC	1 (5.6)

History of infiltration	
Yes	13 (72.2)
No	1 (5.6)
History of phlebitis	
Yes	3 (16.7)
No	11 (61.1)
History of overflow	
Yes	3 (16.7)
No	11 (61.1)
History of obstruction	
Yes	6 (33.3)
No	8 (44.4)

The predominant characteristics of the previous IVT used in children are the history of difficulty in inserting IPC, a complication prior to the current IVT, prolonged peripheral IVT and the type of catheter most used previously was the IPC. When analyzing the antecedents for the presence of phlebitis, infiltration, leakage and obstruction, a higher frequency of infiltration was observed.

Table 4 - Clinical characteristics of the current IPC. *Feira de Santana, BA, Brazil, 2018*

Variable	n = (18) (%)
Catheter gauge	
22	cinco (27.8)
24	13 (72.2)
Puncture method	
Direct	12 (66.7)
Indirect	cinco (27.8)
Use of tourniquet	
Yes	17 (98.7)
Type of catheter used	
Teflon	sete (38.9)
Polyurethane	10 (55.6)
Movable vein	
Yes	11 (61.1)
No	cinco (27.8)
Rectilinear vein	
Yes	nove (50)
No	sete (38.9)
Vein depth	
Shallow	10 (55.6)
Deep	sete (38.9)
Place of CIP	
MSD	quatro (22.2)
MSE	oito (44.4)
MID	quatro (22.2)
MIE	um (5.6)
Number of CIP attempts	
2	sete (38.9)
3	cinco (27.8)
4 or more	quatro (22.2)
Reason for failure of the first and last	
Vein transfixation	nove (50)
Ineffective puncture	sete (38.9)
Others	dois (11.1)

According to **table 4**, analyzing the variables related to the current PIP, it was observed that the most used puncture method was the direct puncture, with the aid of a tourniquet, with a polyurethane and 24-gauge catheter.

Regarding the characteristics of the children's venous network, which showed an association with failure in PIP, it was noted that most children had a mobile, rectilinear and superficial vein.

DISCUSSION

In this study, we investigated the demographic, clinical, characteristics of prior TIV and CIP in children with cancer related to failure in CIP in the first attempt. It was proven that failure in the CIP was present in 11.7% of the children studied, a percentage similar to studies developed in other countries.¹² Possibly the factors that led to failure

are related to the clinical profile of the children studied, as they are patients with oncological profile and presenting venous network with difficulty for venous access.

The most prevalent reason for failure in PIC and in half of the children was transfixation of the vein. Therefore, the importance of preventing this undesirable effect is highlighted through the identification of the reasons for the failure of the procedure, which helps the nursing professional in the correct handling of techniques that prevent the occurrence of this complication.¹⁰

Factors such as age, skin color and sex did not facilitate the results of failure, since there was no evidence of failure in the IPC related to these characteristics.⁹ In a study developed with children and adolescents undergoing IPC through ultrasound, it showed greater number of IPC use in male, eutrophic, white-skinned children.¹² Even though, other authors report that females and black color make it difficult to obtain venous access¹⁰, and due to the smaller diameter of the veins and of the difficulty found in analyzing the child's venous network.¹⁴

As for the children's clinical history, the most frequent variables that made it difficult to perform the PIC were: agitation and the occurrence of previous hospitalization, in agreement with studies that report that such conditions can cause failure in the procedure.¹² The child's agitation is configured -excessive motor activity and possibly a predisposing factor for the occurrence of puncture failure, requiring the catheter to be properly stabilized. Due to the oncological profile of the children under study, the occurrence of previous hospitalization is possibly associated with the continuity of chemotherapy treatment or with the appearance of complications associated with the therapeutic route.

In a study developed in four general public hospitals in the city of Rio de Janeiro, with a predominance of children with chronic diseases, of the 170 hospitalizations, the use of IPC occurred in 91% of hospitalized children, configuring the procedure as one of the main reasons for pediatric readmission due to the child's exposure to various risks.¹³ Thus, corroborating the results of previous hospitalizations in the current study.

Another clinical variable that was represented in this group was the condition of nutrition. Most children who failed during venipuncture had an eutrophic condition, an aspect that was not found in other studies. Malnutrition can result from inappropriate dietary consumption and be able to cause capillary fragility and decrease the turgor of the child's tissues, resulting in difficulties in obtaining the IPC. Probably, the eutrophic state of the children in the current study remained frequent due to the adequate promotion of diet during hospitalization in the oncology unit under the care of the multidisciplinary team. Therefore, not corroborating for other studies.¹⁶

Regarding the variables related to previous IVT, it was evidenced that a history of complication prior to the current

IVT and difficulty in inserting IPC are frequent factors for IPC failure, in agreement with another study that reports an increase in IPC failure. due to a prevalence of 2.58, referring to a history of complications prior to the current IVT and a higher prevalence of complications related to the difficulties encountered in the insertion of the PIC.⁹

A study carried out with 338 children and adolescents who underwent IVT in the pediatric surgical unit of a university hospital in the city of São Paulo, showed that patients who used intravenous drug therapy have a high chance of complications, awakening the possibility of having an injured venous network, in contrast to other studies carried out with children that did not show previous complications related to the failure of the PIC, however it was noted, in the present study, that previous infiltration was above the range analyzed in the national pediatric literature.^{14,18, 19}

Infiltration is a complication that causes discomfort and the need to submit the child to a new PIP, especially in cases of prolonged hospitalization.²³ Supposedly, there was a discrepancy in the results obtained in comparison with the literature because they are oncological children, who they are subjected to treatments with medications and irritating and vesicant solutions, which can interfere in obtaining the CIP.

Regarding the current IPC, it was observed that most children were submitted to the direct puncture method, with the help of a 24-gauge polyurethane tourniquet and catheter, however, such aspects were not frequent in the results of PIP failure, since the tourniquet has the ability to compress the venous path favoring the visualization of the venous network and the 24-gauge catheter is the smallest diameter catheter in the category.²³

Considering the characteristics found in the venous network of the children studied, there was a higher frequency of mobile veins. This condition is characterized by difficulty in obtaining venous access, since factors such as visualization and the type of blood vessel are considered in the process of venipuncture, corroborating the results of failure in the PIP of this study.²⁴

Therefore, paying attention to the main factors that predispose the child, with an oncological profile, to the failure of PIP in the first attempt, leads the nursing professional to adopt measures that take into account the importance of preventing damage and promoting health care.

CONCLUSION

Data analysis in this study revealed the failure to obtain IPC in children aged one to 49 months, brown, male, eutrophic and hyperactive. None of the children studied had vascular disease and most had a history of difficulty in inserting IPC, a complication prior to the current IVT, occurrence of previous hospitalization, use of prolonged

peripheral IVT and a history of infiltration.

Therefore, the presentation of one or more of the characteristics mentioned in the study is related to the failure outcome. Therefore, recognizing the characteristics of the children, the clinical history, the materials to be used and the predisposing factors for the occurrence of failure to obtain the CIP, are fundamental to promote quality and harm-free health care, thus establishing relevance for the promotion of nursing care.

The limitation of this study is believed to be the scarcity of scientific studies related to children with cancer profile submitted to IPC, the performance of the study in a single field of study and the number of patients in the sample because despite being large, the failure rates were low. In view of this, the need to build and develop new multicenter studies on the occurrence of failure in the first attempt to insert peripheral intravascular devices in children considering children with different characteristics is emphasized, in order to obtain better results.

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