

Peripherally inserted central catheter obstruction in packed red blood cell transfusions in neonates

Obstrução do cateter central de inserção periférica nas transfusões de concentrado de hemácias em neonatos

Obstrucción de catéter central insertado periféricamente en transfusiones de concentrado de glóbulos rojos en neonatos

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ABSTRACT

Objectives: to estimate incidence and free time of peripherally inserted central catheter obstruction in newborns undergoing red blood cell transfusion in the first 24 hours after the procedure. **Methods:** a longitudinal study, carried out with neonates in Neonatal Intensive Care Unit at a teaching hospital in Paraná, between January and July 2019. The sample consisted of 46 transfusion events performed in neonates through a peripherally inserted central catheter. Analysis performed according to descriptive statistics. **Results:** thirty-one catheters were analyzed, inserted in 24 neonates, through which 46 red blood cell transfusions were performed. Most neonates were male, gestational age <32 weeks, weight <1,500 grams, hospitalized mainly for prematurity. Among the 31 catheters, one (3.2%) presented obstruction after transfusion. **Conclusions:** The occurrence of obstructions immediately after transfusion was low and the catheters remained complication free for the next 24 hours. **Descriptors:** Central Venous Catheterization; Erythrocyte Transfusion; Evidence-Based Practice; Neonatal Nursing; Newborn.

RESUMO

Objetivos: estimar incidência e tempo livre de obstrução do cateter central de inserção periférica em recém-nascidos submetidos à transfusão de hemácias nas primeiras 24 horas após o procedimento. **Métodos:** estudo longitudinal, realizado com neonatos em Unidade de Terapia Intensiva Neonatal em hospital de ensino do Paraná, entre janeiro e julho de 2019. Amostra foi composta por 46 eventos de transfusões realizadas em neonatos pelo cateter central de inserção periférica. Análise realizada segundo estatística descritiva. **Resultados:** foram analisados 31 cateteres, inseridos em 24 neonatos, por meio dos quais foram realizadas 46 transfusões de hemácias. A maioria dos neonatos era do sexo masculino, idade gestacional <32 semanas, peso <1.500 gramas, internados principalmente por prematuridade. Dentre os 31 cateteres, um (3,2%) apresentou obstrução após a transfusão. **Conclusões:** A ocorrência de obstruções imediatamente após transfusão foi baixa e os cateteres permaneceram livres da complicação nas 24h seguintes. **Descritores:** Cateterismo Venoso Central; Enfermagem Neonatal; Prática Baseada em Evidências; Recém-Nascido; Transfusão de Eritrócitos.

RESUMEN

Objetivos: estimar la incidencia y el tiempo libre de obstrucción del catéter central de inserción periférica en recién nacido sometidos a transfusión de glóbulos rojos en las primeras 24 horas después del procedimiento. **Métodos:** estudio longitudinal, realizado con neonatos en la Unidad de Cuidados Intensivos Neonatales de un hospital escuela de Paraná, entre enero y julio de 2019. La muestra estuvo compuesta por 46 eventos transfusionales realizados en neonatos a través de un catéter central de inserción periférica. Análisis realizado según estadística descriptiva. **Resultados:** se analizaron 31 catéteres, insertados en 24 neonatos, a través de los cuales se realizaron 46 transfusiones de glóbulos rojos. La mayoría de los recién nacidos eran varones, edad gestacional <32 semanas, peso <1.500 gramos, hospitalizados principalmente por prematuridad. Entre los 31 catéteres, uno (3,2%) presentó obstrucción 15 minutos después del final después de la transfusión. **Conclusiones:** La ocurrencia de obstrucciones inmediatamente después de la transfusión fue baja y los catéteres permanecieron libres de complicaciones durante las siguientes 24 horas. **Descritores:** Cateterismo Venoso Central; Enfermería Neonatal; Práctica Clínica Basada en la Evidencia; Recién Nacido; Transfusión de Eritrocitos.

INTRODUCTION

Neonatal care has had an important evolution provided by the advancement of technology and scientific knowledge in Neonatal Intensive Care Units (NICUs), allowing the survival and development of premature newborns (NBs), previously considered unfeasible. In this environment, NBs constantly need red blood cell transfusions, especially very premature babies (< 32 weeks of gestation) and extremely low birth weight babies (<1,000 g), with about 40% and 90% of these NBs, respectively, are subjected to in minimum one red blood cell transfusion during the hospital stay. This procedure, associated with other neonatal intravenous therapy needs, culminates in the indication and use of intravenous catheters of various types⁽¹⁻⁴⁾.

Among the most used devices in the NICU, the peripherally inserted central catheter (PICC) has been recognized as one of the main choices, this is due to the characteristics related to insertion, which has high success rates, being less invasive, having high cost-benefit ratio when compared to other central catheters, and reduced non-elective removal due to complications⁽⁵⁻⁷⁾. For NBs, the available catheters shown are French gauge 1 (Fr), polyurethane mono lumen, 1.9 Fr mono lumen in polyurethane or silicone and/or 2.0 Fr, mono lumen in silicone or polyurethane or double lumen used in polyurethane, the last two calibers being the most used. Despite all the benefits, the use of PICCs is not without risk, and the decision on the type of material used to make the catheter and the number of lumens should consider the possibility of different complications⁽⁷⁾.

Among the various complications, obstruction, characterized by occlusion of the catheter lumen, is one of the most frequent mechanics complications that result in unplanned removal of catheters reaching from 11 to 50% of them. It can be caused by the formation of thrombi, tip of the poorly positioned catheter, precipitation of medications and the presence of microorganisms in its lower end^(5,8).

In this sense, in neonatal clinical practice, the infusion of some solutions through the PICC is discouraged, given the catheter characteristics, such as long extension and small diameter, which can interfere with the infusion flow and increase obstruction rates, especially when solutions with higher density or viscosity are administered, as in the case of blood components. However, depending on the therapeutic need of the patient and the absence of peripheral vessels for insertion of short catheters exclusively for transfusion, the PICC can be used as an alternative to this therapy⁽⁸⁻⁹⁾.

A retrospective study, whose objective was to assess the occurrence of obstruction after the administration of red blood cells in preterm NB through 1Fr PICC, identified the incidence of catheter obstruction of 2.6% of transfusion cases⁽¹⁰⁾. Another study, which compared transfusions of packed red blood cells (pRBCs) using PICC 1 and 2 Fr and peripheral venous catheter, found no evidence of obstruction⁽¹¹⁾.

Existing evidence on erythrocyte transfusion in the PICC and its relationship with occurrence of obstruction are rare. When performed, the studies are directed to tests in laboratory to relate the occurrence of hemolysis with the rate of infusion of the blood, catheters and equipment used for infusion⁽¹²⁻¹⁴⁾.

Therefore, it is of fundamental importance to carry out studies that deepen the knowledge about the relationship that can be established between PICC obstruction and infusion of pRBC, with a view to producing evidence that can guide the practice of neonatal nursing about the care of the NB admitted to the NICU.

OBJECTIVES

To estimate the incidence of PICC obstruction in neonates undergoing transfusion of CH on the first day after the procedure, as well as evaluating the PICC obstruction-free time after transfusion.

METHODS

Ethical aspects

The research was developed in accordance with Resolution No. 466, of December 12, 2012, of the National Health Council, and approved by the Research Ethics Committee of the institution. For insertion of PICCs, it is already routine for the service involved to obtain prior consent from parents or responsible for performing invasive procedures. Once the CCIPs have been entered, when there was an indication of pRBC transfusion, the Free and Informed Consent Term was obtained (TCI) for inclusion of the NB in the research.

Study design, period, and location

This is a longitudinal clinical study, guided by the STROBE tool, with the outcome of PICC obstruction during and after pRBC transfusion. Data collection took place between January and July 2019, being carried out with NBs in a NICU of a university hospital in Curitiba, Paraná, composed of 30 active beds, among which 10 beds are from the NICU, 15 beds in the Intermediate Neonatal Care Unit (INCU) and 5 beds in the Kangaroo Neonatal Intermediate Care Unit (KaNICU). NBs were consecutively included in the study, once they met the established eligibility criteria, and were followed from the beginning of pRBC transfusion until 24 hours after its completion.

Population and sample

The sample consisted of NB admitted to the NICU who showed an indication of pRBC transfusion concomitant with the period of PICC use. The following inclusion criteria were established: NBs admitted to the NICU; of both sexes; using PICC with prescription of pRBC transfusion. Exclusion criteria were: pRBC transfusions prescribed to NBs with a single PICC, mono-lumen; and who were receiving vasoactive drug or total parenteral nutrition (TPN) with osmolarity above 900 mOsm in the same catheter, since the PICC was being used for continuous infusions of solutions for which the use of peripheral intravenous catheters is contraindicated, it was impossible to use this PICC for transfusions.

A probabilistic sample was adopted based on the need for pRBC transfusion in NBs using PICCs, and calculated based on the estimated prevalence of PICC obstruction in the unit of 3.5% in 2018 and 18% in the literature⁽⁵⁾, assuming an effect magnitude of 15%, a significance level of 10% and a confidence level of 90%, being estimated at 46 pRBC transfusion events.

Search protocol

Participant inclusion occurred after assessing patients' eligibility criteria by the researcher and/or collaborator and the signature of the ICF by patients' guardians.

Before data collection, nurses were trained with a focus on carrying out the research and retraining the nursing team on the procedures

of research and reinforcements related to the catheter maintenance protocol already in force at the institution. Data were collected in the period between the beginning of the pRBC transfusion until 24 hours after its termination, by means of observation and obtaining information recorded in the medical record of the patients. A structured instrument containing the study variables was used. This instrument was completed by the nurse in charge of transfusion before and during the procedure, and after transfusion, by the researcher.

Sociodemographic and clinical variables related to PICC, pRBC and intravenous therapy were investigated, as well as those related to the outcome. The sociodemographic characteristics and clinics surveyed were gestational age at birth, mode of delivery, birth weight, race, sex, length of stay and diagnosis on admission. Variables related to CCIP included Catheter gauge, insertion site, location of catheter tip verified by X-ray after insertion, number of transfusions, number of catheters per patient and previous obstructions. Variables related to pRBC and infusion were also collected, from the moment of transfusion to 24 hours subsequent treatments, including information on the age of the red blood cells, characteristics of the therapy intravenous, such as amounts and types of solutions and medications in use.

The outcome variable was PICC obstruction, identified through the catheter permeability test during and after the administration of red blood cells, considering the first 24 hours after transfusion.

The permeability test was performed according to the institutional protocol. Thus, catheter flushing was performed with one (1) ml of saline solution with 10mL syringe and using the swirling technique, and obstruction was observed when there was impediment of serum infusion. Thus, in the presence of an infusion pump occlusion alarm, during transfusion and after its completion, the nurse in charge of the procedure performed the catheter permeability test, as described above.

The PICCs used during the research were from the same manufacturer and consisted of polyurethane. All transfusions were performed within a period of 2 to 4 hours, with use of infusion pump, of the same model and manufacturer, whose infusion rate has been adjusted from according to the volume of pRBC and the prescribed infusion time.

Thus, pRBC bags used were all irradiated and sent by the blood bank to the unit in a thermal box, where the equipment was coupled to the bags, filled and installed in the infusion pumps that were held at the same height position on the bench with relative to the newborn in the heated incubator. All pRBCs were type O, most of them O-, and with a median age of 7.5 days (1 to 25 days). It is noteworthy that, at the time of transfusion, the catheters were used exclusively for this purpose.

Analysis of results, and statistics

The analysis of descriptive data determined measures of central tendency and dispersion, expressed as means and standard deviation (mean + SD) for continuous variables of symmetrical distribution, and in medians, minimum and maximum values (median, minimum - maximum) for those with asymmetric distribution. Categorical variables were expressed as absolute and relative frequencies. To estimate the obstruction-free catheter time, a Kaplan-Meyer curve was constructed. Data were collected

between January and July 2019, when the stipulated sample was reached, and were stored and analyzed using Microsoft Excel® 2010 and STATISTICA v. 10.0 (Statsoft®).

RESULTS

During the data collection period, 28 NBs were assessed according to the previously established eligibility criteria, including 26 NBs (92.8%), who used 33 PICCs. Of this total, 2 NBs who used 2 PICCs were excluded, resulting in a final sample of 31 PICCs in 24 NBs and 46 pRBC transfusions. Infants were mostly male (70.8%), born to Caucasian mothers (75.0%), cesarean (66.7%), with gestational age less than 32 weeks (66.7%) and weight < 1,500 g (62.5%). As for clinical diagnoses, prematurity predominated (70.8%) followed by malformation (20.8%) (Table 1). Of the 70.8% premature infants, 66.6% also had respiratory conditions.

Table 1 - Characteristics of newborns and peripherally inserted central catheter procedures performed in a Neonatal Intensive Care Unit, Curitiba, Paraná, Brazil, 2019

	n (%)
Characteristics of newborns (n=24)	
Gestational age	
<28	7 (29.1)
28 to 32.6	9 (37.5)
33 to 36.6	1 (4.2)
37 to > 37	7 (29.2)
Weight	
500 to <1,000 g	8 (33.3)
1,000 to < 1,500 g	7 (29.2)
1,500 to < 2,000 g	2 (8.3)
2,000 to < 2,500 g	1 (4.3)
2,500 to < 3,000 g	2 (8.3)
> 3,000 g	4 (16.7)
Clinical diagnosis	
Prematurity	17 (70.8)
Malformations	5 (20.8)
Respiratory problems	1 (4.2)
Others	1 (4.2)
PICC procedure characteristics (n=31)	
No. of PICC used by NBs during hospitalization	
1	20 (83.3)
2	2 (8.3)
3	1 (4.2)
4	1 (4.2)
Insertion site	
Cephalic region	7 (22.6)
RUL	4 (13.0)
LUL	6 (19.3)
Right jugular	3 (9.7)
RLL	5 (16.1)
LLL	6 (19.3)
Tip location	
Central	25 (80.6)
Peripheral	6 (19.4)

PICC – peripherally inserted central catheter; NB – newborn; RUL – right upper limb; LUL – left upper limb; RLL – right lower limb; LLL – left lower limb.

Regarding the PICC procedure, 83.3% of neonates underwent the insertion of only one catheter, and 16.7% received more than one catheter, which were inserted during hospitalization. All PICCs were 2.0-caliber mono-lumen Fr. The percentage of insertion of catheters in vessels of the lower limbs (35.4%) and upper limbs (32.3%) was similar, and the vessels in the cephalic and cervical

regions (26.3%) were less used for PICC insertion. Most PICCs (80.6%) had their tips lodged centrally (superior or inferior vena cava) at the time of transfusion (confirmation performed by X-ray after insertion of PICC), and 06 catheters were peripherally maintained in the brachiocephalic and/or subclavian vein. (Table 1).

At the time of transfusions, NBs' lifetime had a median of 20 days, ranging from two to 120 days, and the weight had a median of 1,382.5 g, ranging from 500 to 4,285 g. The median length of hospital stay was 19.5 days, ranging from two to 120 days. Regarding the red blood cells' age, the median was seven and a half days, ranging from one to 25 days. Catheters were mostly used (54.8%) for two intravenous solutions, in addition to pRBCs, with a predominance of drugs (71.0%), followed by a basic plan (BP), which consists of a solution of 5% glucose serum 5% or distilled water, plus 50% glucose, 20% sodium chloride, 19.1% potassium chloride and 10% calcium gluconate in specific proportions for each neonate, related to weight and hydroelectrolytic characteristics, (42.0%) and TPN (38.7%). Among the total drugs (n=21), the most infused were antimicrobials (47.6%) followed by vasoactive, sedative/analgesic and other drugs (23.8%, 19.1% and 9.5%), respectively (Table 2).

Table 2 – Intravenous solutions used by neonates in a Neonatal Intensive Care Unit, Curitiba, Paraná, Brazil, 2019

Intravenous solutions	n (%)
Number of infusions per PICC	
None	1 (3.2)
One	9 (29.0)
Two	17 (54.8)
Three	2 (6.5)
Four	2 (6.5)
Type of infusion	
Drug	22 (71.0)
BP	13 (42.0)
TPN	12 (38.7)
SS	07 (26.6)
Other	4 (13.0)
Association of PICC infusions	
Association of TPN with drugs BP, SS and others	10 (32.2)
Association of BP with drugs, SS and others	07 (22.5)
Association of SS with drugs and others	04 (12.9)
BP only	4 (12.9)
Drugs only	2 (6.4)
TPN only	2 (6.4)
SS only	1 (3.2)
Frequency of flushing up to 24 hours after transfusion	
Twice	2 (6.4)
Three times	12 (38.7)
Four times	11 (35.5)
Five times	6 (19.4)
Number of transfusions per PICC	
One	23 (74.1)
Two	3 (9.7)
Three	4 (13.0)
Four	0 (0)
Five	1 (3.2)

Note: N = 31

PICC – peripherally inserted central catheter; TPN – total parenteral nutrition; BP – basic plan; SS – saline solution.

Regarding the number of transfusions per catheter, in most PICCs (74.1%), there was only one transfusion, and there was transfusion, which was performed on the first day of PICC insertion, and transfusion on day 81 of the catheter; thus, pRBC transfusions

occurred after 5.5 days of PICC insertion. It is noteworthy that, in catheters that received more than one transfusion, the minimum interval between transfusions was 24 hours, and the maximum was 26 days. In all (100%) PICCs, the flushing procedure was performed within 24 hours after pRBC transfusions. It is noteworthy that, in one case, a PICC was only permeabilized with physiological solution, because, at the research site, after the suspension of intravenous therapy, the catheters are routinely kept permeabilized for up to 48 hours (Table 2).

Regarding obstruction, of the 46 transfusion events, in only one case (2.2%) there was PICC obstruction, identified by the audible alarm of the infusion pump, indicating distal occlusion and verified by the catheter permeability test. In this case, the PICC had been inserted in an eight-day-old neonate, in the lower limb, and properly positioned in the central region for 24 hours, having been used before and after pRBC transfusion for BP infusion. The obstruction occurred 15 minutes after the end of red blood cell administration. According to the Kaplan-Meier curve, the probability of the catheter remaining unobstructed for 24 hours after transfusion was 97.8% (Figure 1).

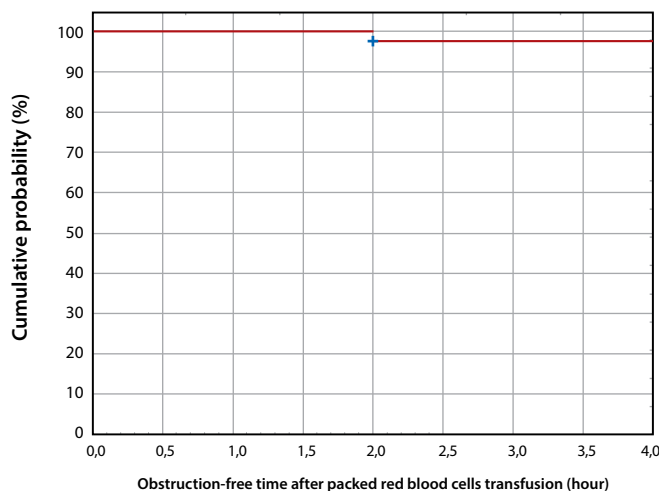


Figure 1 – Analysis of occurrence of catheter obstruction after packed red blood cell transfusion in a Neonatal Intensive Care Unit, Curitiba, Paraná, Brazil, 2019

DISCUSSION

In this study, most of NBs were male, premature gestational age, low birth weight and cesarean. The literature addresses that there is an unexplained intrinsic risk in males for premature birth, standing out as those who most need blood transfusion⁽¹⁵⁻¹⁶⁾. Gestational age and low weight corroborate a study that presented a mean birth of 30.56 weeks and classification of the NB with very low weight⁽¹⁵⁾. Regarding the type of childbirth, there was similarity when compared to other studies⁽¹⁶⁻¹⁹⁾. It is noteworthy that the type of childbirth may be related to the specialized assistance that the service where the research was carried out makes available, with reference action for high-risk pregnant women with fetal malformation.

The predominant reason for hospitalization was prematurity, which is considered clinical vulnerability, due to the immaturity of organs and systems, leading to a greater susceptibility to

complications, in particular respiratory diseases resulting from immaturity pulmonary⁽²⁰⁻²¹⁾, corroborating the results of this research.

The most used insertion sites were the peripheral limbs (lower and upper), this result partially corroborates with studies analyzed^(20,22-23), that presented the majority of PICCs inserted in the upper limbs. The choice for the upper limbs stems from the ease of positioning and puncture, reduced number of valves, larger vessels with favorable anatomy, due to the shorter path to the vena cava^(20-21,24). However, the neonatal population presents alternative sites for central and peripheral venous catheter insertion, with risk similar associated, so it is recommended to use the best available vessel, indifferent from the extremities^(5,8,25). In the unit where the research was conducted, when NBs are hospitalized, the nursing team already reserves one of the upper members for the possible need for PICC, however, the choice of insertion site is assessed by a nurse who performs the procedure, and the decision is made according to the best available vessel. In this research, the only catheter that obstructed in the observed period was inserted in the left lower limb, which was in a central position at the time of transfusion.

Regarding the catheter tip location, in this study, the majority (80.6%) presented central positioning at the time of transfusion. Inadequate location of the PICC tip can restrict or prevent its use, since there is a correlation between the position of the tip and the occurrence of infiltration, extravasation, tissue injury, formation of fibrin and venous thrombosis, with consequent obstruction⁽²⁰⁾. It is important to highlight that, at the study site, catheters kept in a non-central position are assessed daily and are used for solutions and drugs that do not require central infusion.

Studies show that PICCs are used for a mean of more than three intravenous solutions⁽²²⁾, with drugs and TPN being the most infused solutions^(23,25), similar to the findings of this research, when considering pRBC administration. However, the infusion of more than three intravenous solutions also pose a risk for unscheduled catheter removal, by to obstruction and rupture⁽²⁶⁾.

Obstruction can have several causes, such as thrombus formation (thrombotic), due to the reflux of blood at its tip, allowing intraluminal fibrin formation and, consequently, total PICC obstruction and drug precipitation (non-thrombotic), among others^(5,27). The occurrence of this complication, as one of the main causes of unplanned removal of the CCIP, results in a professional inference about the risks related to the infusion of blood components in the catheter, mainly pRBC.

When assessing the rate of PICC obstruction in this research, an incidence of obstruction of 2.2% was found after pRBC infusion. Austrian researchers have demonstrated the safety of pRBC transfusion irradiated in PICC caliber 1Fr. They showed that there was no clinical signs of related hemolysis, nor increased risk of obstruction, as only one catheter of the sample of 38 cases presented this complication. In this case, there was a concomitant infusion of pRBC to TPN, which constitutes a risk factor⁽¹⁰⁾. In an experimental study conducted in a university hospital in Geneva, whose objective was to demonstrate the safety of pRBC transfusions through PICC 1 and 2 Fr, compared with transfusions through the peripheral venous catheter, no statistically significant differences were found between the control and experimental groups and no evidence of obstruction⁽¹¹⁾. The authors highlight the need to develop prospective studies that evaluate different

variables, so that the catheter caliber may not be identified as the only interfering factor in the obstruction of the catheter, with the need for deepening of the topic.

Regarding the length of hospitalization, the median was 19.5 days, coinciding with the mean life of neonates, which was 20 days, corroborating the literature found, which states that the highest incidence of transfusion occurs in the first 14 days⁽²⁸⁾, when there is greater cardiorespiratory instability and spoliation by the collection of laboratory tests is more frequent, causing significant blood loss from phlebotomy⁽²⁹⁾.

Considering the case of the PICC that obstructed, whose NB was on the eighth day of life and hospitalization, researchers report that, due to the levels of some prothrombotic and antithrombotics proteins being higher and lower (respectively) in neonates the general fibrinolytic activity of these patients may be reduced, which could lead to thrombus formation and predispose to catheter obstruction⁽²⁷⁾. Thus, this case confirms what the literature indicates, the sample homogeneity makes it necessary to relativize this information, since only one case obstructed despite the similarity between the patients studied.

When the blood components are analyzed, it is known that the storage time of the red blood cells affects one of the factors that determine blood viscosity, the ability to deformability of these cells, because the younger they are, the more flexible they are, and this property facilitates the passage of red blood cells through the small catheter⁽³⁰⁾. In this research, the average time of erythrocyte storage was seven and a half days, ranging from one to 25 days. According to researchers, the period of storage of red blood cells of up to ten days is considered short, and the erythrocytes, consequently, considered young, while the period above 25 days is considered prolonged⁽¹³⁾.

In the case of the obstructed PICC, the red blood cells' age was 22 days, whose period of storage is not considered prolonged, however, red blood cells are no longer considered young. However, in a study with a similar objective to this research, catheter obstruction was identified with infusion of red blood cells aged between five and nine days, that is, considered young⁽¹⁰⁾.

The hematocrit of pRBC bags is another determinant of blood viscosity, i.e., the higher the hematocrit, the more viscous the blood, and this can increase blood flow resistance, reducing the infusion rate, and as a result, blood stasis favors catheter obstruction⁽¹⁴⁾. However, the hematocrit value of pRBC bags is not routinely provided by the blood banks at the time of dispensing the bags. In the institution where this research was carried out, none of the bags had a hematocrit value, so that it was not possible to associate this value with the obstruction that occurred.

Regarding the number of solutions infused in the same catheter, the literature indicates that the infusion of three or more solutions in the same catheter route is a risk factor for obstruction, due to drug interactions⁽²⁶⁾. It is also recommended that the infusion be exclusive without adding other solutions or medications to the infused blood product^(14,31). In this study, the number of transfusions was not identified as an association factor for the occurrence of obstruction of the PICC, as the only case occurred in the first and only CH transfusion.

Therefore, it is noteworthy that proper catheter maintenance is essential. Researchers recommend performing pulsatile washing,

which is more effective in removing solid deposits than continuous discharge⁽⁷⁾. Its periodic realization makes it possible to remove proteins from the wall

inside the catheter, which may remain partially on the catheter wall after a period of⁽³²⁾.

The protocol followed in this research followed national and international recommendations.

on the performance of catheter washing, already instituted at the study site, with its performance before and after the transfusion, as well as during the day after the procedure, totaling four washes after the end of the pRBC infusion. The assessment and maintenance of catheter patency were assured and, therefore, it was not possible to establish a correlation between washing and obstruction identified in a PICC after pRBC transfusion.

To ensure proper use of the catheter, nursing care supported by evidence-based practice is essential to provide safety and quality of the services provided. Therefore, nurses need to know the materials and/or equipment they use daily, as the success of the therapy is associated with several criteria, such as the technical expertise to establish the best device combined with the planned intravenous therapy, in addition to the capacity for clinical judgment and decision making, considering the risk-benefit ratio, in order to achieve excellence in care for these extremely vulnerable patients⁽³³⁻³⁴⁾.

Study limitations

The lack of information regarding the quality of the pRBC bags used, such as the hematocrit value, made it difficult to deepen the

analysis of the only identified case of obstruction, which could be considered a limitation of this research.

Contributions to nursing

The results of this research can contribute more effectively to the planning of actions related to transfusion therapy by NICU professionals, providing an important advance in the construction of evidence that can help nurses in decision-making in situations, such as the difficulty of peripheral venous access in NBs and the need for pRBC transfusion.

CONCLUSIONS

The incidence of PICC obstruction after pRBC transfusion was 2.2%, and the probability of catheter free of this complication was 97.8% in the 24 hours following transfusion. In this study, the PICC can be used safely with regard to catheter obstruction, however randomized, controlled, multicenter studies with larger samples are needed to also assess this and other risks that may arise from practices adopted for transfusion therapy in NBs.

SUPPLEMENTARY MATERIAL

Cunha, MGB. Peripherally inserted central catheter in packed red blood cell transfusion in neonates. 2020. Dissertation (Master's) – Universidade Federal do Paraná. Graduate Program in Nursing. Available from: <https://hdl.handle.net/1884/67220>

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