

## ORIGINAL ARTICLE

**PLACEMENT OF PERIPHERALLY INSERTED CENTRAL CATHETERS IN ADOLESCENTS BY NURSES**

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**ABSTRACT**

**Objective:** To analyze the profile of peripherally inserted central catheters placement in adolescents admitted to a University Hospital of Rio de Janeiro by trained nurses.

**Method:** Documentary, descriptive, retrospective and quantitative study conducted between January 2007 and December 2015. The sample consisted of 68 medical records of adolescents. Medical records of adolescents aged 12-18 years available from the medical archive service and containing information about the process of placement of PICC catheters. The medical records of the patients transferred to other health centers and whose catheters were not removed in the institution were excluded.

**Results:** Of all the catheters inserted, 48 were placed in male adolescents diagnosed with onco-hematological disease, and chemotherapy was the predominant therapeutic indication.


**Conclusion:** The present study contributed to improve the knowledge about the use of this type of catheter, which will be useful in future studies and in professional training.

**DESCRIPTORS:** Nursing; Adolescent; Peripheral catheterization; Central Venous Catheterization.


**HOW TO REFERENCE THIS ARTICLE:** Reis NSP, Santos MFG, Leite DC, Gomes HF, Peres EM, Perez Junior EF. Placement of peripherally inserted central catheters in adolescents by nurses. Cogitare enferm. [Internet]. 2019 [access "insert day, month and year"]; 24. Available at: <http://dx.doi.org/10.5380/ce.v24i0.55639>.



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## ARTIGO ORIGINAL / ARTÍCULO ORIGINAL

**IMPLANTAÇÃO DE CATETER CENTRAL DE INSERÇÃO PERIFÉRICA POR ENFERMEIROS EM ADOLESCENTES****RESUMO**

*Objetivo:* analisar o perfil do processo de implantação do Cateter Central de Inserção Periférica, por enfermeiros capacitados, em adolescentes atendidos em um Hospital Universitário do Rio de Janeiro.

*Método:* estudo documental, descritivo, retrospectivo, de abordagem quantitativa, realizado entre janeiro de 2007 e dezembro de 2015. A amostra constituiu-se de 68 prontuários de adolescentes. Foram selecionados prontuários de adolescentes de 12 a 18 anos disponíveis no serviço de arquivo médico e que continham informações acerca do processo de implantação do cateter, e excluídos os dos pacientes que foram transferidos e não retiraram o cateter na instituição.

*Resultados:* constatou-se que 48 dos cateteres foram implantados em adolescentes do sexo masculino como diagnóstico médico doença onco-hematológica tendo como indicação terapêutica predominante a quimioterapia.

*Conclusão:* O estudo contribuiu para a ampliação do conhecimento sobre o uso deste cateter, além de proporcionar subsídios para a realização de pesquisas e capacitação profissional.

**DESCRIPTORES:** Enfermagem; Adolescente; Cateterismo periférico; Cateterismo Venoso Central.

**IMPLANTACIÓN DE CATÉTER CENTRAL DE INSERCIÓN PERIFÉRICA POR ENFERMEROS EN ADOLESCENTES****RESUMEN:**

*Objetivo:* evaluar el perfil del proceso de implantación del Catéter Central de Inserción Periférica, por enfermeros habilitados, en adolescentes atendidos en un Hospital Universitario de Rio de Janeiro.

*Método:* estudio documental, descriptivo, retrospectivo, de abordaje cuantitativo, que se realizó entre enero de 2007 y diciembre de 2015. La muestra se constituyó de 68 prontuarios de adolescentes. Se seleccionaron prontuarios de adolescentes de 12 a 18 años disponibles en el servicio de archivo médico, los cuales contenían informaciones acerca del proceso de implantación del catéter; fueron excluidos los de los pacientes que se desplazaron y no quitaron el catéter en el hospital.

*Resultados:* se constató que 48 de los catéteres fueron implantados en adolescentes del sexo masculino como diagnóstico médico de enfermedad onco hematológica que tuvieron como indicación terapéutica predominante la quimioterapia.

*Conclusión:* el estudio contribuyó para la ampliación del conocimiento sobre el uso del catéter, además de proporcionar subsidios para la realización de investigaciones y perfeccionamiento profesional.

**DESCRIPTORES:** Enfermería; Adolescente; Cateterismo periférico; Cateterismo Venoso Central.

## INTRODUCTION

The peripherally inserted central catheter (PICC) is an intravenous device (of the semi-implantable type) of long duration inserted through a superficial vein of an upper or lower extremity and advanced to the distal third of the superior vena cava or proximal third of the inferior vena cava, with characteristics of a central catheter, and with a maximum dwell time of two years and six months<sup>(1-3)</sup>.

The PICC is the most cost effective central venous catheter. It is cheaper, involves fewer risks, does not require an operating room, and can be inserted even in the hospital bed or at home. A chest x-ray confirms the position of the PICC at the time of the procedure. It responds efficiently to intravenous treatments with extreme pH and osmolality<sup>(1-4)</sup>.

The main benefits of using the catheter are preservation of the venous capital, safe administration of certain drugs, and reduced patient exposure to pain. The PICC also has lower risk of contamination and longer dwell time compared to other intravascular devices<sup>(5)</sup>.

In addition to its cost-effectiveness benefits, it should be emphasized that the process of placement is a minimally invasive bedside procedure that can be performed by trained nurses. In Brazil, guidelines and regulatory standards for placement and manipulation of PICCs by nurses are defined by the Federal Nursing Council (COFEN), through Resolution 258 of 2001, article 1, which authorizes nurses to place peripherally inserted central catheters (PICC) in patients, and in article 2, which stipulates that nurses must have professional training and/or qualification to perform such procedures<sup>(6)</sup>.

Since the promulgation of the aforementioned Resolution, nurses have been safely performing this activity clinical practice. It is worth noting that many advances have occurred in care related to PICC placement, with the production of scientific knowledge in the nursing area, which has contributed to the improvement of professional qualification and to an increasingly safe and effective clinical practice<sup>(7)</sup>.

A Korean study on the work of nurses specialized in PICC placement found that the infusion therapies for which nurses had to insert the PICC were effective and safe, with relatively low complication rates, demonstrating the important role of these professionals in the expansion of the use of this catheter<sup>(8)</sup>.

Also, regarding knowledge about the indication of catheter use, studies demonstrate the importance of the use of PICCs in cancer patients, in order to mitigate the physical suffering of patients with different vulnerabilities due to hospitalization and the sickening process. Thus, the PICC is a safe option for patients on intravenous therapy (IT), contributing to the improvement of their quality of life<sup>(7-9)</sup>.

However, although studies in newborn babies, children and adults admitted to intensive care report the use of PICC as a routine practice<sup>(10-12)</sup>, studies on the use of this type of catheter in hospitalized adolescents are very recent.

Thus, the present study aims to analyze the process of PICC placement by trained nurses in adolescents admitted to a University Hospital in Rio de Janeiro, Brazil, with the purpose of making available to interested parties the experience developed in this service that integrates the healthcare network.

The present study was conducted in a ward that provides integral health care to adolescents, and is aimed to identify the profile of Peripherally Inserted Central Catheters (PICCs) placement.

## METHOD

Retrospective documentary study of quantitative approach on the process of insertion of Peripherally Inserted Central Catheters (PICCs), conducted from January 2007 to December 2015, in an adolescent ward of a university hospital of the State of Rio de Janeiro. The ward has 16 beds (8 female and 8 male beds) and provides integral care to 12-18 year-olds.

The study setting is a referral center for hospitalization of adolescents of both genders whose clinical conditions or conditions after surgical procedure require diagnostic investigation and treatment, except for adolescents in labor or during a psychotic episode.

In the referred hospital care is provided by a multidisciplinary team composed of Nursing, Medicine, Nutrition, Social Work, Psychology and Physical Therapy professionals. However, according to COFEN Resolution No. 258/2001, nurses are responsible for the placement and maintenance of PICCs in patients when there is clinical indication for the procedure. It should be noted that the decision to insert a PICC is jointly made with the medical staff, and the procedure follows the regulations and protocols established by the institution <sup>(6)</sup>.

Adolescents undergoing PICC placement are advised and guided on maintenance and monitored by a nurse or nursing resident. Dressing changes and other procedures are performed every seven days or whenever necessary.

The study sample consisted of 68 medical records of adolescents who underwent peripherally inserted central catheter placement and were monitored in the service from PICC insertion to removal.

The inclusion criteria were as follows: medical records of adolescents aged 12-18 years available in the medical archive service and which contained information about the PICC insertion process. Medical records of patients who were transferred to another center and whose PICCs were not removed in the institution were excluded.

Data collection took place from July to September 2016 through analysis of medical records and printed material of the sector regarding the insertion and maintenance of PICCs in adolescents.

The printed form used for this procedure is completed, signed and stamped by the nurse responsible for PICC insertion and/ or removal. For the purposes of this study, the variables assessed were gender, age and medical diagnosis, according to the International Classification of Diseases-ICD 10, clinical indication, puncture site, dwell time and reason for removal.

The data collected was typed and stored in an Excel electronic spreadsheet program, and descriptive statistics and frequency distribution of the numerical variable of the study were performed. The results were discussed in the light of available scientific literature.

In order to meet the ethical criteria, the study was submitted to the Research Ethics Committee of the institution and approved under statement no 1,645,428. As this is a retrospective documentary study that involves analysis of local medical records and printed forms, there was no need for signing the Free and Informed Consent form.

## RESULTS

Of the 68 records of adolescents who underwent catheter implantation, 48 (71%) concerned male individuals. As for the age range, the minimum and maximum ages were respectively 12 and 18 years, with a mean of 14.6 years and a standard deviation of 2.7 years.

Mapping of the medical diagnosis of patients who underwent the procedure showed a predominance of onco-hematological diseases, especially leukemia and lymphomas represented by 31 (46%) cases, as shown in Table 1.

Table 1 – Medical diagnoses (ICD10) of hospitalized adolescents who had PICCs inserted (N=67)\*, Rio de Janeiro, RJ, Brazil, 2007-2015.

Variables	n	%
Leukemias	17	25
Lymphoma	14	21
Osteomyelitis	12	18
Septic Arthritis	1	1.5
External ventricular bypass + fungal infection	2	3
Cystic fibrosis	3	4.5
Myelomeningocele + neurogenic bladder	1	1.5
Endocarditis + sepsis	1	1.5
Human acquired immunodeficiency virus + cryptococcal meningitis	1	1.5
Acute facial paralysis + infected sacral lesion	1	1.5
Acquired immunodeficiency virus + pulmonary infection	1	1.5
Lymphadenomegaly to be clarified	3	4.5
Actinomycosis	1	1.5
Congenital neurosyphilis	2	3
Severe bone marrow aplasia + tonsillitis	1	1.5
Disseminated paracoccidioidomycosis	2	3
Non-specific tumor	2	0.3
Hepatomegaly and splenomegaly	1	1.5
Late Puerperium + Dress Syndrome	1	1.5
TOTAL	67	100

Source: Study data

\* There was no record of the medical diagnosis of one (1) patient.

Some indications for catheter insertion were administration of chemotherapy alone in 28 (41%) cases or associated with antibiotic therapy or amphotericin B in three (4%) cases, demonstrating that chemotherapy was the purpose in 31 (45%) cases. The other indications were antibiotic therapy in 27 (39%) cases, administration of amphotericin B in five (7%) cases, infusion of thymoglobulin in one (1%) case, and four (5%) catheters had no documentation regarding indication.

Regarding the veins of choice, the most prevalent were brachial, cephalic and basilic veins in 50 (73%) PICC placements, while the jugular vein was used in 14 (21%) placements. As for the other four (6%) catheters, there was no information about the punctured veins.

Assessment of the dwell time revealed that in 41 (60%) of the 68 inserted catheters, there was no information on the date of removal of the devices. Also, only one catheter had a dwell time of 0 day and failed to progress. Thus, its removal was indicated. The other 26 inserted catheters are described in Figure 1:

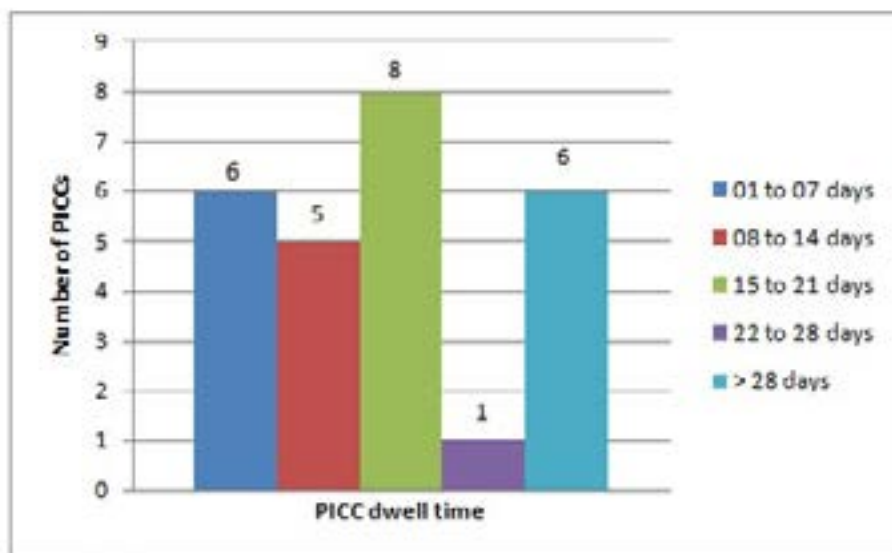


Figure 1 – Dwell time in days of PICCs inserted in hospitalized adolescents that were recorded (N=26), Rio de Janeiro, RJ, Brazil, 2007-2015

Assessment of the variable that caused PICC removal revealed that such cause was not recorded in 36 (53%) of the cases. However, among the other reasons for removal, which occurred in 32 (47%) cases, the most prevalent were therapy completion and catheter occlusion, both in eight (25%) cases, followed by catheter-related problems (catheter fracture) in seven (22%) cases; catheter dislocation and the onset of infectious complications in four (12.5%) cases, and only one (3%) case in which there was no progression of the catheter.

## DISCUSSION

Oncological diseases, especially hematological disorders, were the main diagnoses of adolescents who have undergone PICC placement in the analyzed period. Such condition may be related to the fact that these pathologies have high incidence and prevalence rates in adolescents in Brazil, with malignant neoplasms of the lymphatic and hematopoietic tissues accounting for about 50% of cancer deaths in the age group of 10 to 14 years, and 40% among adolescents aged 15-19 years<sup>(13)</sup>.

Therefore, recent data from the National Cancer Institute José Gomes Alencar da Silva (INCA)<sup>(10)</sup> confirm an average percentage of incidence of cancer of 3% in the population of children and adolescents (0-19 years), with the highest frequency of leukemia detected in the following age groups: 0-14 years (33.2%) and 0-19 years (25.6%). Lymphomas have a frequency of 13.6% in the age group 0-19 years, while the median mean incidence rates in the same age range was 139.99 per million, with a peak in adolescents aged 15-19 years<sup>(14-15)</sup>.

Regarding the treatment of oncological diseases, the establishment of long-term venous access is essential, since it generates confidence during the infusion of vesicant and irritant chemotherapeutic agents. The main indications for PICC use in the study setting concerned the administration of antineoplastic chemotherapy<sup>(16)</sup>.

Regarding the indication of the PICC as a safe route for the administration of parenteral solutions, our data corroborates such indication because given the high incidence of diagnoses of onco-hematological diseases in the study population, a long-term treatment that uses irritant and vesicant chemotherapeutic drugs is required<sup>(17)</sup>.



It should be stressed that the PICC is considered an effective venous access because it provides a safe route for administration of antibiotics, total parenteral nutrition and chemotherapy, as well as low infection rates<sup>(5,18)</sup>, thus allowing the prevention of infusion-related adverse events and patient safety.

The results of the study indicated that the administration of chemotherapy alone or associated with antibiotic therapy or amphotericin B were the main indications for the insertion of PICC. A neonatology study, diametrically opposed to these findings, showed that the main drugs administered through the peripheral insertion central catheter are Total Parenteral Nutrition (TPN) with simultaneous and continuous administration of heparin<sup>(19)</sup>.

The most common complications resulting from PICC insertion in cancer patients include skin allergies, followed by catheter occlusion and accidental removal and, to a lesser extent, upper limb venous thrombosis and bloodstream infection<sup>(20)</sup>.

The present study found that the main causes of PICC removal were therapy completion and catheter obstruction, followed by catheter-related problems (fracture), dislocation and the onset of infectious complications.

The site of insertion of the PICC also deserves consideration. A study indicates that, in order to ensure the ideal conditions for insertion, the vein to be punctured must be carefully examined: one should check whether it is palpable, with an appropriate caliber, as well as skin integrity at the site of puncture, without bruising, edema, signs of infection or anatomical disorders<sup>(21)</sup>.

Some authors<sup>(10,21)</sup> reported that the most indicated veins are the basilic and cephalic veins because they have a smaller number of valves, larger caliber, favorable anatomical characteristics, which facilitates dressing application and changes. Also, these veins are closer to the superior vena cava. These reasons explain the large incidence of catheter insertion through these veins.

Analysis of the dwell time revealed that most catheters were inserted for more than 15 days. Brazilian studies described PICCs inserted in children for 11- 14 days<sup>(10,22)</sup>. Therefore, the data obtained corroborates the positive analysis of the national reality.

In Asia, the experience of PICC insertion in patients with hematological diseases was described in a study that analyzed the safety of these procedures. The referred study found that total duration of catheterization was 8,089 days, with a mean duration of 57 days, and that chemotherapy was administered through 107 catheters of the total 142 catheters inserted<sup>(16)</sup>.

The reasons for unscheduled removal of the catheter, that is, prior to completion of the drug therapy, included obstruction, problems such as catheter fracture, dislocation, infection and non-progression of the catheter. Regarding occlusion, some studies reported that in most cases the catheters were not flushed with sterile normal saline 0.9%, which is recommended to ensure the permeability of the catheter and prevent clotting and fibrin sheath formation, or drug precipitation among incompatible medications, and emphasized the need for training of the nursing team<sup>(23-24)</sup>.

In addition to the aforementioned causes for unscheduled catheter removals, malposition of the catheter tip also deserves mention. Some studies stress the need for confirmation of proper catheter placement after its insertion and of catheter fixation and daily assessments in order to confirm the proper position and/or removal of the PICC<sup>(10, 22-25)</sup>.

Regarding bloodstream infection, studies indicate that the longer the dwell time, the greater the risk of infection, and indicate the implementation of the following measures for prevention: use of transparent dressings, use of aseptic and antiseptic agents, and permanent training and updating of the health team responsible for manipulating PICC lines<sup>(10,22-24)</sup>.

Non-progression of the catheter or its difficult insertion is still referred to in studies as a possible occurrence in PICC insertion, and the possible causes for this are as follows: excessive bleeding, obstruction by venous valves, anomalous pulmonary venous return, resistance related to vasospasm, sclerosis, malposition of catheter or patient, vein bifurcation or previous venous dissection<sup>(21-26)</sup>.

As for the limitations of this study, we stress the lack of documentation in the health service, which result in inaccurate data, especially regarding the variables dwell time and reason for PICC removal.

## CONCLUSION

Analysis of the profile of PICC placement in adolescents based on data available in the medical records of the January 2007- December 2015 period showed that the adolescents who underwent PICC placement were affected by oncological diseases, particularly of hematologic origin.

The main indication for PICC placement was the need for a safe and long-term intravenous route for administration of irritant and vesicant drugs.

The findings of this study suggest that PICC placement in the population investigated was safe for the administration of chemotherapy, since the device, with a dwell time of more than 15 days, can be characterized as a long-term catheter that can be used during the entire therapy period.

Despite the undeniable advantages of these catheters, complications such as occlusion, fracture, dislocation and non-progression of the catheter, as well as infection, have been detected, and thus the devices had to be removed.

It is hoped that the findings of this study will contribute to stimulate and encourage nurses of public and private health services to invest in their professional training in insertion, manipulation and maintenance of Peripherally Inserted Central Catheters-(PICC), in order to deliver the best possible care to their patients. The contribution of the use of PICCs to reduce costs with other materials and inputs in the healthcare context should also be stressed.

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Received: 09/07/2017

Finalized: 17/12/2018

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