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**CUIDADOS DE ENFERMAGEM AO CATETER VENOSO CENTRAL DE INSERÇÃO PERIFÉRICA: REVISÃO SCOPING**  
**NURSING CARE TO THE PERIPHERALLY INSERTED CENTRAL VENOUS CATETER: SCOPING REVIEW**  
**CUIDADOS DE ENFERMERÍA DEL CATÉTER VENOSO CENTRAL DE INSERCIÓN PERIFÉRICA: REVISIÓN SCOPING**

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## RESUMO

**Introdução:** A administração de terapêutica endovenosa é parte integrante da prática clínica diária dos enfermeiros, que necessitam de ter conhecimento atualizado dos cuidados a ter na inserção, manutenção e remoção dos mesmos. O cateter venoso central de inserção periférica (PICC) é uma das alternativas ao cateter venoso periférico (CVP), permitindo a administração de qualquer tipo de medicação, incluindo irritantes e/ou vesicantes, uma vez que a localização da sua ponta se encontra numa veia central.

**Objetivo:** Mapear a evidência científica sobre os cuidados de enfermagem inerentes à inserção, manutenção e remoção do PICC em adultos.

**Métodos:** Esta revisão scoping foi realizada baseada nas recomendações da Joanna Briggs Institute e escrita de acordo com o Preferred Reporting Items for Systematic reviews and Meta- Analyses Extension for Scoping Reviews (PRISMA – ScR). A questão de investigação deste estudo é: "Quais são os cuidados de enfermagem inerentes à inserção, manutenção e remoção do cateter venoso central de inserção periférica em adultos?". A pesquisa foi realizada em janeiro de 2023.

**Resultados:** Foram incluídos 13 estudos para a revisão, sendo que todos salientaram a importância dos cuidados de enfermagem ao PICC, as suas vantagens e complicações e como evitá-las. O PICC tem menor incidência de complicações que outros acessos venosos.

**Conclusão:** O PICC é um dispositivo de acesso vascular seguro, com inúmeras vantagens, sendo necessária mais formação aos profissionais de saúde, para que possa ser utilizado nos diversos contextos.

**Palavras-chave:** cateterismo periférico; cateter PICC; cuidados de enfermagem; dispositivo de acesso vascular

## ABSTRACT

**Introduction:** The administration of intravenous therapy is an integral part of the daily clinical practice of nurses, and they need to have up-to-date knowledge of the insertion, maintenance, and removal of the same. The peripherally inserted central venous catheter (PICC) is one of the alternatives to the peripheral venous catheter (CVP), allowing the administration of any type of medication, including irritants and/or vesicants since the location of its tip is in a central vein.

**Objective:** To map the scientific evidence on nursing care inherent to the insertion, maintenance, and removal of PICC in adults

**Methods:** This scoping review was based on the recommendations of the Joanna Briggs Institute and was written according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA – ScR). The research question in this study is: "What is the nursing care inherent to the insertion, maintenance, and removal of peripherally inserted central venous catheters in adults?". The survey was conducted in January 2023.

**Results:** A total of 13 studies were included in the review, all of which emphasized the importance of nursing care to the PICC, their advantages, complications, and how to avoid them. PICC has a lower incidence of complications than other venous accesses.

**Conclusion:** PICC is a safe vascular access device with numerous advantages, requiring more training for health professionals so that it can be used in different contexts.

**Keywords:** catheterization, peripheral; catheterization, PICC line; nursing care; vascular access devices

## RESUMEN

**Introducción:** La administración de terapia intravenosa es parte integral de la práctica clínica diaria del enfermero, teniendo así conocimientos actualizados sobre los cuidados que debe tener al insertarlos, mantenerlos y retirarlos. El catéter venoso central de inserción periférica (PICC) es una de las alternativas al catéter venoso periférico (PVC), permitiendo la administración de cualquier tipo de medicamento, incluidos irritantes y/o vesicantes, ya que la ubicación de su punta se ubica en una vena central.

**Objetivo:** Mapear la evidencia científica sobre los cuidados de enfermería inherentes a la inserción, mantenimiento y extracción del PICC en adultos

**Métodos** Esta revisión de alcance se llevó a cabo con base en las recomendaciones del Instituto Joanna Briggs y se redactó de acuerdo con los elementos de informe preferidos para revisiones sistemáticas y la extensión de meta análisis para revisiones de alcance (PRISMA – ScR). La pregunta de investigación de este estudio es: "Cuáles son los cuidados de enfermería inherentes a la inserción, mantenimiento y extracción de catéteres venosos centrales insertados periféricamente en adultos?". La investigación se llevó a cabo en enero de 2023.

**Resultados:** Se incluyeron 13 estudios para la revisión y todos destacaron la importancia de los cuidados de enfermería PICC, sus ventajas y complicaciones y cómo evitarlas. PICC tiene una menor incidencia de complicaciones que otros accesos venosos.

**Conclusión:** El PICC es un dispositivo de acceso vascular seguro, con numerosas ventajas, que requiere una mayor formación de los profesionales sanitarios para que pueda ser utilizado en diferentes contextos.

**Palabras Clave:** cateterismo periférico; catéter PICC; cuidados de enfermería; dispositivo de acceso vascular

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## INTRODUCTION

The administration of intravenous therapy through a central venous catheter (CVC) is an integral part of nurses' daily clinical practice, which is why they must keep their knowledge about its insertion, maintenance, and infection prevention up to date to reduce possible complications. The choice of vascular access must consider several factors, such as the therapy to be administered, expected treatment time, the condition of the patient's peripheral venous network, and the patient's capacity for collaboration. The peripherally inserted central venous catheter (PICC) is one of the alternatives to the peripheral venous catheter (PVC), allowing the administration of any type of medication, including irritants and/or vesicants since the location of its tip is in a central vein (Santos et al., 2022).

The information about the nursing interventions on PICC in adults is spread out, which makes evidence-based practice difficult. Preliminary research conducted in the Cochrane Database of Systematic Reviews, Medline, Pubmed, JBI, and Cinahl databases indicated that there are no published or ongoing scoping reviews on this topic. So, this study aims to map the scientific evidence on nursing care inherent to the insertion, maintenance, and removal of peripherally inserted central venous catheters in adults. The question that guided this research was: What is the nursing care inherent to the insertion, maintenance, and removal of peripherally inserted central venous catheters in adults?

## 1. LITERATURE REVIEW

For the administration of intravenous therapy, there are different types of vascular access, depending on the characteristics of the patient, the treatment, and the skills of the healthcare professional. Midline catheters, like PICCs, are inserted into the basilic or cephalic vein. However, the location of the catheter tip differs from that of the PICC, with the tip of the Midline catheter being located at the axillary level. These devices do not allow the administration of irritant or vesicant therapy, parenteral nutrition, and chemotherapy. The fully implanted tunneled central venous access is access implanted in the subcutaneous tissue of the chest, containing a reservoir for injection or aspiration, and the reservoir is connected to a catheter and subsequently to a deep vein, providing central venous access. This type of device can be implanted for months. Non-tunneled CVCs are used when treatment duration varies between 7-14 days. They are inserted by direct puncture and cannulation of the jugular, subclavian, or femoral vein. The tunneled CVC differs from the non-tunneled one in that the insertion site in the skin and the venipuncture site are separated by a few centimeters; that is, they have a portion placed under the skin, which reduces the risk of bloodstream infection and allows better care at the insertion site (Chopra et al., 2015).

Before selecting the vein to be punctured, an assessment of the vascular network is necessary, using ultrasound, so that a catheter caliber suitable for the caliber of the vein can be selected. In adults, insertion is generally performed in large, deep veins of the upper limbs: basilic, brachial, and cephalic. Before puncturing, it is important that, through ultrasound, we identify the median nerve and the brachial artery to avoid accidental damage to these structures (Moureau, 2019).

## 2. METHODS

Taking into consideration the review research question and the objectives outlined, a Scoping Review was carried out. The recommendations of the Joanna Briggs Institute (JBI) for this type of review were followed, enabling its application through the Preferred Reporting Items for Systematic Reviews Statement (PRISMA-ScR) checklist to answer the research question (Trico et al., 2018). The research question in this study is: "What is the nursing care inherent to the insertion, maintenance, and removal of peripherally inserted central venous catheters in adults?". The Boolean sentence used in the research was ("catheterization, peripheral" OR "peripheral catheterization" OR PICC) AND ("central venous catheters" OR "central venous catheter") AND "nursing."

### 2.1. Inclusion and exclusion criteria

The mnemonic PCC (Population, Concept, and Context) was used to define the inclusion criteria for articles in accordance with the same recommendations (Peters et al., 2020).

Population- studies carried out with patients with PICC over 18 years of age. No restrictions on gender, ethnicity, medical condition, or other personal characteristics were applied.

Concept- studies on nurse intervention in PICC insertion, maintenance, and removal.

Context- The review was aimed at the hospital context.

### 2.2 Type of studies

Quantitative, qualitative, and mixed primary studies, narrative reviews, protocols, and secondary studies that answered the research question were considered eligible. Studies in English, Spanish, French, German, and Portuguese were included, with publication dates from January 2015 to January 2023. The choice of the start date for inclusion of the studies took into account

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the date of standard no. 022/2015 updated on 08/29/2022 of the *Direção Geral da Saúde* (DGS) “Bundle of Interventions for the Prevention of Infection Related to Central Venous Catheter”. As exclusion criteria, editorials and studies that referred to the use of PICC in neonatal or pediatric patients or that did not allow access to full text were discarded.

### 2.3 Research strategy and study selection process

The research was carried out in the databases B-on, Pubmed, Cinahl Complete, Web of Science, RCAAP, e Ebsco using the following terms “central venous catheters,” “peripheral catheterization,” “PICC,” and “nursing.”

The items found were extracted into the Mendeley application, and duplicates were removed.

The selection of studies was carried out by two independent reviewers (SB and SF). This selection took place in two stages. Initially, the titles and abstracts were analyzed, eliminating those that did not meet the inclusion criteria. In a second phase, the studies that answered the research question were retrieved in full and analyzed. The data was subsequently extracted and grouped into a table accompanied by a narrative synthesis to achieve the objective of the review.

All these operations are represented in PRISMA, Figure 1, adapted from Page et al. (2021).

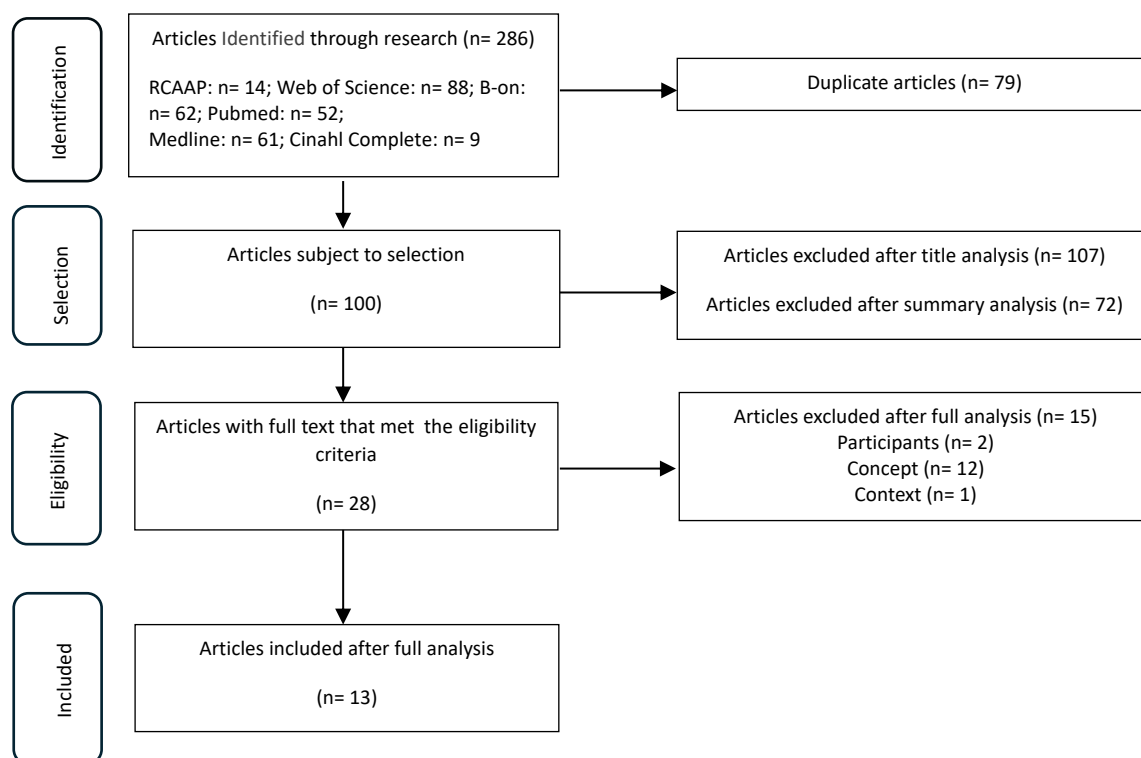


Figure 1 -Flow diagram of study sorting, selection and inclusion (Page et al., 2021)

### 3. RESULTS

A total of 13 studies were eligible for this review. The data are summarized in Table 1. From the analysis of published studies, it appears that the year with the most publications was 2018 (n=4), followed by 2020, 2021, and 2022 (n=2, each) and 2015, 2016, and 2019 (n=1, each). Regarding the location of the studies, the majority were carried out in China (n=5), followed by Spain (n=4), Portugal (n=2), Germany (n=1) and Colombia (n=1). With regard to study methodology, the most frequent are cohort studies (n=4) and literature reviews (n=4), one of which is a systematic literature review, followed by observational studies (n=2), study case-control (n=1), qualitative focus group study (n=1) and mixed study (n=1).

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**Table 1 - Characteristics of the studies included in the review**

Author/Year/country	Objectives	Type of study	Results
Lv et al., 2022 China	To explore the epidemiological characteristics of CLABSI and evaluate whether PICC has a protective effect on them	Retrospective cohort study	The CLABSI rate was 1.8/1000 catheter days. This value reached the peak on the 4th day after placement, decreasing between the 5th and 8th day. After the 9th day the value gradually increased again
Wan et al., 2022 China	To investigate PICC Complications in 4 Chinese Hospitals	Retrospective cohort study	67.3% of patients had a complication or adverse event due to PICC, with CLABSI (28.1%) and thrombosis (20.7%) being the most common. Only 22% of PICC removals were due to complications. Of these, 12.9% were removed due to occlusion and 5.8% due to infection at the insertion site
Oliveira et al., 2021 Portugal	To explore the benefits of using PICC in patients receiving intravenous antibiotic therapy for long periods compared to PVC, in a cardiology service	Qualitative study: focus group	The PICC has several advantages: reducing the number of venipunctures, reducing discomfort for the patient and reducing complications, such as CLABSI. Disadvantages include the fact that it is a PICC with only one lumen
Zhu, W., Liu, J., Qian, H., Wu, Y. & Xu, C., 2021 China	To explore the effect that nursing care has on PICC length of stay, complications and dependence on self-care in patients undergoing chemotherapy	Prospective cohort study	Before specialized care, there were no statistically significant differences between the control group and the experimental group in terms of responsibility for self-care, self-concept, and health literacy. After the intervention, these rates were higher in the observational group. The observational group had a lower incidence of complications, longer catheter dwell time and a higher level of nurses' satisfaction
Estrada-Orozco, K., Cantor-Cruz, F., Larrotta-Castillo, D., Diaz-Rios, S. & Ruiz-Cardozo, M., 2020 Colombia	To identify the safest and most efficient interventions in CVC insertion and maintenance, preventing central venous catheter-associated bloodstream infection (CLABSI)	Literature review	12 studies were selected. These described the indications for CVC or PICC insertion, the care to be taken prior to placement and in its maintenance, the use of analgesia, preparation of the field, in order to prevent complications.
Silva et al., 2020 Spain	To compare the safety of using PICC compared to other vascular accesses, specifically in the administration of antibiotic therapy	Retrospective case control study	The rate of CLABSI in the PICC group is lower than in the control group (0.2 Vs 7.7 events per 100 catheter days, $P < 0.001$ ). Regarding the relationship between the incidence of CLABSI and the time since catheter implantation, differences ( $P \leq 0.001$ ) were also observed in the first 3 weeks of treatment. In the second week of treatment, only one patient in the PICC group (2.1%) developed CLABSI compared to 19 (38.8%) in the control group ( $P < 0.001$ )
Braga et al., 2019 Portugal	To understand nursing practices related to PVC and analyze the incidence of complications while the venous catheter is in the patient	Mixed study, including case study, cross-sectional study, cohort study and focus group	Nursing practices are influenced by the decisions of the medical team, the age and characteristics of the patient's venous network, the availability of other catheters by the institution and the low level of knowledge of nurses regarding care in the insertion, maintenance and removal of the PICC. Obstruction was identified as a complication of PICC (22.2%). The following benefits of PICC were identified: safe administration of medications and reduction of pain, number of venous punctures and complications
Duwadi, S., Zhao, Q. & Budal, B., 2018 China	To identify existing evidence on PICC care, possible complications and preventive measures	Literature review	The main complications identified were CLABSI, thrombosis and obstruction. In order to reduce complications, aseptic technique must be used both when inserting and maintaining the PICC. The introduction must be guided by ultrasound and confirmed with x-ray
Lacostena-Pérez, M., Escar, A. & Alós, A., 2018 Spain	To evaluate the incidence and type of complications related to PICC, from its insertion to its removal	Prospective observational study	The complication with the highest incidence was suspected CLABSI (17.36%), followed by phlebitis (9.03%)
Pan et al., 2018 China	To evaluate nursing interventions to minimize PICC occlusions and develop recommendations to prevent PICC occlusions and removals	Systematic literature review	30 studies were included. Nurses' knowledge was associated with PICC occlusion, while PICC material had no statistically significant association. The use of heparin and/or heparin and saline solution reduces the risk of PICC obstruction
Timsit et al., 2018 Germany	To identify existing evidence on the epidemiology and diagnosis of complications from central accesses and arterial catheters in intensive care units	Literature review	Puncture of the femoral vein should be avoided, as it has a greater risk of infection. PICC insertion and care require aseptic technique and must be inserted using an ultrasound-guided technique. Nurses have an important role not only in the care itself but also in promoting good practices and teaching patients about catheter care

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Author/Year/country	Objectives	Type of study	Results
Bravo et al., 2016 Spain	To evaluate the evolution of complications associated with PICC in a group of patients	Retrospective cohort study	The patients were all treated according to the same protocol. The incidence of complications was 2 cases/1000 catheter days. The most relevant complications were CLABSI and thrombosis (0.17 cases/1000 catheter days each). The most frequent cause for PICC removal was its migration (5.80%)
García et al., 2015 Spain	To investigate PICC complications in hematology patients, after implementing a multidisciplinary program	Prospective observational study	No serious insertion complications were observed. The complications identified were obstruction (13.6%), infection (6.8%) and thrombosis (4.5%). Serious complications were lower than in previous studies (11.36%)

#### 4. DISCUSSION

Before opting for PICC insertion, in order to prevent complications, an assessment of the patient must be carried out, taking into account their history, allergies, previous procedures, and ability to collaborate in the treatment (Estrada-Orozco et al., 2020; Braga et al., 2019). These results are corroborated by Moureau & Chopra (2016), highlighting that a correct initial assessment prevents several complications. In addition to this initial assessment, it is necessary to teach and explain the procedure to the patient so that it becomes an integral part of their care process, thus increasing their responsibility for the treatment. Education should be started before catheter insertion and reinforced afterward, with several advantages: increasing catheter dwell time, reducing complications, and increasing nurses' satisfaction (Zhu et al., 2021). This care cooperation between nurse and patient leads to a decrease in the rate of CLABSI (Estrada-Orozco et al., 2020; Silva et al., 2020), is considered one of the interventions to reduce complications associated with PICC by the Center for Disease Control and Prevention (CDC) (2017).

Regarding cancer patients, one of the studies (Estrada-Orozco et al., 2020) states that depending on the risk assessment, prophylactic antibiotic therapy and an antimicrobial-coated catheter may be indicated. However, according to CDC recommendations (2017), there is no indication for the administration of prophylactic antibiotic therapy before or during the insertion of vascular access for the prevention of CLABSI. This discrepancy may be due to the fact that the CDC guidelines do not take into account the specificity of cancer patients and their increased risk of infection.

One of the factors that most studies focus on is the need for a vascular access team (Silva et al., 2020; Braga et al., 2019; Oliveira et al., 2021; Pan et al., 2018; García et al., 2015; Duwadi et al., 2018; Timsit et al., 2018; Bravo et al., 2016; Lacostena-Pérez et al., 2018), trained professionals (Oliveira et al., 2021; Pan et al., 2018; Duwadi et al., 2018; Bravo et al., 2016) and well-designed protocols (Braga et al., 2019; Duwadi et al., 2018; Timsit et al., 2018; al., 2018; Bravo et al., 2016) in order to reduce complications associated with PICC. Moureau (2019) share the same opinion, arguing that each hospital institution should have a trained, specialized multidisciplinary team that carries out patient assessment, inserts the PICC, and subsequently requires the training of other team professionals who will perform device maintenance. Another point highlighted by several studies is the importance of a multidisciplinary approach and teamwork, contributing to safe nursing practice since the cooperation of more experienced and trained professionals makes it possible to reduce venipuncture attempts and consequent complications (Braga et al., 2019; Oliveira et al., 2021; The CDC (2017), DGS (2022) and Rupp & Karnatak (2018) emphasizes the same idea, with one of the recommendations being to teach health professionals about the indications and care to be taken when inserting, maintaining and removing vascular accesses and intervention bundles to reduce and control CLABSI.

PICC insertion requires an aseptic technique. The insertion site must be disinfected with 2% chlorhexidine, and it is necessary a large sterile field so that there is no risk of contamination of any material: syringes, needles, catheter (Estrada-Orozco et al., 2020; Silva et al., 2020; García et al., 2015; Duwadi et al., 2018; Timsit et al., 2018; Bravo et al., 2016; Lacostena-Pérez et al., 2018). These results are in line with CDC recommendations (2017), Moureau (2019), and Krein et al. (2019). The PICC must be inserted using an ultrasound-guided technique, thus ensuring greater safety during the puncture, reducing the number of venipunctures and increasing patient comfort (Estrada-Orozco et al., 2020; Silva et al., 2020; Braga et al., 2019; Pan et al., 2018; To reduce the patient's pain associated with venipuncture, local anesthesia should be used (García et al., 2015; Duwadi et al., 2018; Lacostena-Pérez et al., 2018). According to Chopra et al. (2015), ultrasound-guided insertion in the upper limb increases the probability of successful insertion and patient satisfaction, reducing complications such as infection at the insertion site, thrombosis and catheter migration.

To confirm the correct positioning of the catheter tip, most studies advocate confirmation by x-ray (Estrada-Orozco et al., 2020; Pan et al., 2018; Duwadi et al., 2018; Bravo et al., 2016; Lacostena-Pérez et al., 2018), and its location should be located between the lower 1/3 of the superior vena cava and the upper 1/3 of the right atrium in order to avoid thrombosis (Estrada-Orozco et al., 2020), something corroborated by Moureau & Chopra (2016). The same authors identify two more means of confirmation: fluoroscopy and intracavitary ECG, something also identified in two studies (Silva et al., 2020; Braga et al., 2019). According to Chopra et al. (2015), if the PICC is inserted with the aid of intracavitary ECG, it is not necessary to confirm the location of the catheter tip through x-ray. Regarding the vein to be selected, most studies (Silva et al., 2020; Braga et al., 2019; García et al., 2015; Bravo et al., 2016; Wan et al., 2022) indicate that the PICC should be inserted into the basilic vein, due to its location and simplicity



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in isolating, followed by the brachial and radial veins, in order of preference. The veins of the upper limbs have a lower incidence of complications when compared to the femoral vein, namely a lower risk of CLABSI (Duwadi et al., 2018; Timsit et al., 2018; Lv et al., 2022). CDC recommendations (2017) point out that, whenever possible, PICC placement in the femoral vein should be avoided, as it poses a greater risk of infection.

Neutral pressure valves should be used to prevent occlusions (Estrada-Orozco et al., 2020; Pan et al., 2018). For PICC fixation, it is advisable to use a sutureless device and not a stitch, as it reduces the risk of infections, catheter displacement, and hematoma (Duwadi et al., 2018). These indications are in agreement with Rupp & Karnatak (2018). The access points of the systems and extenders must be disinfected by rubbing 2% chlorhexidine with alcohol for 15 seconds and allowing it to dry (Timsit et al., 2018). These data are corroborated by the DGS (2022), adding that connectors must be replaced every 72/72 hours, maximum up to 96 hours; serum systems, including stopcocks, connectors, and extenders every 72/72, systems used for the administration of blood and/or derivatives at the end of the infusion and albumin systems in periods of less than 24 hours.

As for the dressing to be applied, a dressing with gauze should be used for the first 24 hours (Duwadi et al., 2018; Timsit et al., 2018), which should then be replaced by a transparent semi-permeable membrane adhesive (Duwadi et al., 2018; Timsit et al., 2018; Lacostena-Pérez et al., 2018). This dressing should be replaced every 7 days (Duwadi et al., 2018; Lacostena-Pérez et al., 2018). Moureau (2019) and the CDC (2017) corroborate these indications, highlighting that the dressing should be replaced whenever it is visibly dirty, with blood, or detached. Systematic dressing changes and constant manipulation of the insertion site lead to an increased risk of infection. Thus, a transparent film allows you to observe the insertion site without requiring manipulation. Two studies (Duwadi et al., 2018; Timsit et al., 2018) advocate the use of a transparent dressing impregnated with chlorhexidine, going towards the CDC recommendations (2017) and Rupp & Karnatak (2018).

Regarding washing the catheter lumens, there are still some discrepancies in the choice of the solution to use: saline solution and/or heparin. One of the aspects in which the studies coincide is the use of the turbulent technique for washing the lumen (Pan et al., 2018; Duwadi et al., 2018; Wan et al., 2022; Lacostena-Pérez et al., 2018), with the administration of 10cc of saline in pulses (slowly) of around 2.5 ml. Moureau (2019) and Rupp & Karnatak (2018) also recommend this technique, indicating that all PICC lumens (clamped and in use) must be washed when replacing administration systems, using the turbulent technique combined with the positive pressure technique (clamping of the PICC route previously removing the syringe). Two studies recommend salinization (Duwadi et al., 2018; Bravo et al., 2016), and one of them (Duwadi et al., 2018) reinforces that there is no difference in terms of effectiveness in the use of saline solution or serum with heparin. It also indicates that if the catheter is not used for a week, it should be washed with 10cc of saline solution. Other studies (Pan et al., 2018; Wan et al., 2022; Lacostena-Pérez et al., 2018) argue that the use of heparin or serum with heparin can lead to a decrease in occlusion. According to Chopra et al. (2015) the use of serum is sufficient to prevent occlusions, and the use of serum with heparin is not necessary.

According to the study of Estrada-Orozco et al. (2020), to administer parenteral nutrition, a single-lumen PICC must be used, or there must be a single route for parenteral nutrition, something also mentioned by Moureau (2019).

The PICC should be removed when intravenous therapy is discontinued and/or when its use is no longer necessary (Duwadi et al., 2018). A study (Wan et al., 2022) reveals that most complications do not require immediate removal of the catheter, and the benefits and possible complications of maintaining it must be analyzed. Moureau & Chopra (2016) and the CDC (2017) emphasize the same idea, indicating that vascular accesses should not be routinely replaced as a way to prevent CLABSI and the necessity to carry out an ongoing assessment of the need to maintain access.

The PICC has numerous advantages over other vascular devices, both for the patient and the professional. Regarding the advantages for the patient, this device increases the patient's quality of life during hospitalization since it is possible to insert it under local anesthesia and in the patient's bed. It also reduces multiple puncture attempts since it has a longer maximum time of permanence. For the professional, the PICC is a safe access for the administration of antibiotic therapy, enteral nutrition, and chemotherapy, and blood collections can also be carried out through it (Silva et al., 2020; Braga et al., 2019; Oliveira et al., 2021; Zhu et al., 2021). Another factor that increases nurses' satisfaction is the reduction in the influence of the medical team with the insertion of the PICC (Braga et al., 2019; Timsit et al., 2018). These advantages are in line with those identified by Moureau & Chopra (2016) in their study, arguing the author that, when possible and indicated, this type of device should be used, as it increases not only the patient's quality of life but also the satisfaction of healthcare professionals. Another of the advantages identified by Moureau & Chopra (2016) is the fact that the PICC when inserted peripherally, avoids the risk of pneumonia and hemothorax that can occur in CVCs, something also highlighted in one of the studies (Timsit et al., 2018). The recommendations of the DGS (2022) and Moureau (2019) are to insert a PICC instead of a PVC if the expectation of treatment duration is more than 6 days, as indicated in one of the studies (Estrada-Orozco et al., 2020). In terms of parenteral nutrition administration, when it lasts less than 3 weeks, PICC may be used. However, if a treatment time of more than 3 months is anticipated, a tunneled or implanted catheter should be considered (Estrada-Orozco et al., 2020).

Like all devices, the PICC also has complications, the most frequent of which are deep vein thrombosis, thrombophlebitis, catheter occlusion and CLABSI (Silva et al., 2020; Braga et al., 2019; Zhu et al., 2021; García et al., 2015; Duwadi et al., 2018; Timsit et al., 2018; Bravo et al., 2016; Wan et al., 2022) and migration (Silva et al., 2020; Duwadi et al., 2018; Timsit et al., 2018; Bravo et al.,

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2016). Chopra et al. (2015) corroborate this evidence, highlighting that most of them can be avoided or reduced through correct nursing care. Comparatively, PICC has a lower risk of CLABSI than CVC (Estrada-Orozco et al., 2020; Silva et al., 2020; García et al., 2015; Timsit et al., 2018; Lv et al., 2022; Lacostena-Pérez et al., 2018). Given this fact, Moureau (2019) emphasize that when making the decision on which venous access to insert in the patient, this factor must be taken into account. This decreased risk of CLABSI can be explained by the PICC being shorter, less deep and having a smaller number of lumens (Lv et al., 2022). In one of the studies (Lv et al., 2022), the author identified that the risk of CLABSI increases up to the 4th day, decreases from the 5th to the 8th day and increases from the 8th day onwards, therefore care must be reinforced in these time periods. In terms of CLABSI, one of the studies (Duwadi et al., 2018) identifies 3 modifiable causes: lack of information, lack of asepsis and incorrect hand hygiene. Despite these complications, most complications are mild or moderate and do not require immediate removal of the catheter (Wan et al., 2022). According to guidelines from the CDC (2017), the PICC should not be removed based solely on suspicion of CLABSI. A detailed analysis must be carried out, identifying other potential sources of infection.

In one of the studies (Oliveira et al., 2021), the fact that most PICCs have a single lumen was also identified as a disadvantage, not being sufficient for the needs of some patients. Despite being seen as a disadvantage, some studies (Estrada-Orozco et al., 2020; Duwadi et al., 2018; Bravo et al., 2016) identified the use of a PICC with the lowest number of lumens possible as the norm to reduce the risk of infection and complications. In terms of material, polyurethane PICCs should be used preferentially (Estrada-Orozco et al., 2020; Duwadi et al., 2018; Bravo et al., 2016), since they have less risk of occlusion, are more flexible and the walls are stronger, with a lower risk of rupture (Duwadi et al., 2018). Also, CDC (2017) and Chopra et al. (2015) identified the single-lumen polyurethane catheter as the ideal catheter for reducing complications.

In Portugal, it is not yet a rule for nurses to place a PICC, which is only used in some specific cases (Oliveira et al., 2021). Despite being a central catheter, nurses are able to insert them and inherently carry out maintenance care since they have accredited training that allows them to carry out this procedure within a standardized process at the institutional level (OE, 2020).

Moureau & Chopra (2016) identified the difficulties inherent in the use of the PICC: the necessity if an intact vascular network with sufficient caliber for catheter implantation, the need for education and training of healthcare professionals for catheter insertion and maintenance, the need for close monitoring of the device and the need for radiography to locate the catheter tip.

## CONCLUSION

With this scoping review, it was possible to identify nursing interventions related to PICC insertion, maintenance, and removal. The advantages and complications were also identified, and how these complications can be avoided or minimized. The PICC is a safe vascular access, with less risk of infection than the CVC, and allows the administration of vesicant and irritant therapy. On the other hand, it reduces venipunctures, thus increasing the patient's quality of life.

In terms of implications for clinical practice, studies suggest the need to form multidisciplinary vascular access teams with sufficient knowledge and training so that the use of PICC can be a reality in hospital institutions in Portugal.

This review is not without limitations, and they are related to the scarcity of studies on the topic carried out in Portugal. Therefore, it would be important to implement improvement programs in institutions, using recommendations regarding the care to be taken when inserting, maintaining, and removing the PICC and analyzing their results.

## AUTHORS' CONTRIBUTION

Conceptualization, P.R. and S.B.; data curation, P.R. and S.B.; formal analysis, S.B. and A.M.D.; investigation, S.B. and A.M.D.; methodology, P.R. and S.B.; project administration, S.B.; supervision, S.B. and A.M.D.; validation, A.M.D. and S.B.; visualization, P.R. and S.B.; writing-original draft, P.R. and S.B.; writing-review and editing, P.R., S.B. and A.M.D.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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