



# Chapter 10

## Action of the intensivist nurse in the implantation of the peripheralinsertion catheter (PICC) in adult patients in an ICU environment

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### ABSTRACT

The peripheral inserted central catheters (PICC) are mechanisms used for the administration of intravenous therapy; they are inserted by qualified nurses for the procedure. The purpose of this project was to and emphasize the nurse's role in an intensive treatment environment relating the PICC, its insertion, manipulation, removal, and main recommendations for its use. Pointing the importance of theoretical and practical knowledge; the nurses must be trained to use the PICC, to guarantee constant improvement of quality of care for the patients in the intensive care unit. This is a review study of literature with samples of articles searched in database from 2005 to 2020. The descriptors used were nursing, central catheter, intensive care unit, and it's expected to promote propagation of this type of knowledge and development of this practice.

## 1 INTRODUCTION

The central venous catheter in the intensive care environment is extremely important. Being chosen depending on the treatment that the patient will perform. The central peripheral insertion catheter (PICC) is one of the options chosen, because its material is silicone, long, being usually inserted in the ante cubital area, which is located at the end of the middle third of the superior vena cava. (LAMBERT *et al* 2005).

PICC has a low incidence of complications, reducing the number of infection being safe and effective, especially in difficult cases. (DI SANTO *et al* 2017).

This procedure presents a low rate of infection and complications both at the time of insertion, during its maintenance and removal. This may be an effective option when contraindications arise in therapy in the use of central thoracic puncture catheters. (LAMBERT, *et al* 2005).

Prolonged antibiotic therapy (52.0%), NPT (19.3%), difficult access (16.0%), administration of vesiccan medications (8.0%) being with a lower scale, risk of bleeding (3.3%) and chemotherapy (1.4%) are the main indications for the installation of the PICC catheter. (DI SANTO, *et al*, p.106, 2017).

In the 1980s, with the advancement of a new generation of PICC catheter, it would provide greater safety, reduce trauma to the patient's venous network, and enabling prolonged use that being healthy can be continued for up to 180 days of use. (LAMBERT, *et al* 2005).

Some types of complications were observed in the use of the PICC catheter being local, systemic or circumstantial that may occur due to poor positioning (5 to 62%), occlusion (2 to 44%), thrombosis (4 to 38%), phlebitis (5 to 26%), sepsis (2 to 21%), difficulty of removal (1 to 12%), rupture (4 to 5%), local infection (2 to 3%), catheter embolism (0.6%). (JESUS *et al*, p. 253,254, 2007).

In the intensive care unit, it was evaluated that the use of the PICC catheter in high complexity patients showed low infection rates and a lower cost when we related its use compared to other types of central catheters that have short permanence being inserted by jugular or subclavian puncture. (LAMBERT *et al* 2005).

## 1.2 JUSTIFICATION

This study was necessary after considerable numbers of patients were affected by complications related to the use of PICC in hospital units. Many of these complications could be avoided by applying anti-septic methods, such as hand washing and others. Given this, an integrative literary review was conducted in a qualitative approach in order to exalt the benefits that picc brings to the client, such as reducing their hospitalization time thus generating less expenses, collecting data on the types of complications that are more frequent in relation to catheter use and what actions can be taken so that we can avoid future complications and maintain the patient's well-being.

## 1.3 METHODOLOGY

This study was an integrative literary review in a qualitative approach dealing with the understanding and explanation of describing the importance of nursing in the preventive factor in the care of patients using PICC avoiding and/or decreasing the risk of infections related to this procedure. Thus, for the construction of the same, we searched for literatures on the PubMed and Virtual Health Library (Bvs) platforms, we found the DeCS descriptors: peripherally inserted central catheters, central venous catheter, peripheral catheterization and complications resulting from PICC, and after we started the search for the literature published on the platforms, a study was selected, according to the title and abstract, the exclusion criteria were materials that were not within the proposed theme. Data collection after the selection of articles, where a search was conducted in the literature according to their concepts related to the theme of interest and that underpinned our theoretical approach.

Thirty-two articles were selected to be read in full and the analysis of the articles was elaborated, which includes data from title, authors, journal, research year and results. The critical reading of the articles in the integra, referred us to 15 articles selected for the data source of this research.

In view of the studies of the articles selected in this integrative review, information was obtained to develop the theme, where five categories were chosen, which are: Describe the history of picc; Define the Importance of using PICC in the treatment of clients; Report the picc insertion procedures by the nurse; List possible complications due to the use of the Peripherally Inserted Central Catheter (PICC); Elucidate the Importance of the Preventive Factor in the hospital environment by nurses for a client using PICC.

**DECs:** peripherally inserted central catheters; central venous catheter; peripheral catheterization and complications arising from PICC.

## 2 THEORETICAL REFERENCE

### 2.1 THE HISTORY OF PICC

In the fifteenth century was proven the first practice of intravenous therapy, when the equipment applied to this purpose gathered the bladders and feathers. With this, technology and research enabled the progress of specific products and equipment for the satisfaction of venopuncture, administration of solutions and drugs. (RODRIGUES, 2017).

The PICC Peripheral Insertion Central Venous Catheter was first described in 1929 in the literature by a German physician named Werner Theodor Otto Forsmann in which he introduced a cannula into his ante cubital vein, introducing a 65cm catheter to the right atrium, confirming its location by radiographic image. Due to this procedure in 1956 was awarded the Nobel Prize in Medicine, with the emergence of a new alternative of central venous access by peripheral route. (DI SANTO *et al* 2017).

The PICC peripherally inserted central venous catheter is a device made of biostable and biocompatible material that is a great facilitator because it presents low thrombogenicity, being inserted through a peripheral vein and positioned in the superior or inferior vena cava. Introduced in Brazil in the 1990s in the intensive care unit and has been used by nurses in patients who have venous difficulty in infusion of irritant substances into the blood vessel and with medium and long-term therapy (DE OLIVEIRA *et al* 2017).

The PICC catheter is a device that presents with one or two lumens being long that can vary (20 to 65 cm in length), has a caliber of 1 to 5 french, flexible, radiopaque with smooth and homogeneous walls. In 1929, when picc was described in the literature as a new option of peripheral access due to the materials used to present frailty, the procedure could not be performed at the time. With the development in 1970 the catheter gained silicone material began to have its use in the neonatal ICU; in 1980, an increase in the use was observed, due to the opportunity to be installed at the bedside by nursing professionals and the elaboration of the training program. In 1990, the PICC catheter was used in Brazil in neonatology, pediatrics, intensive care, oncology and home care. (JESUS, 2007).

The use of venous therapy was initiated at the time of rebirth with the discovery of blood course. Between 1941-1945 during the Second World War, with the respective reduction in the number of physicians, began the development of realization with complexities for nurses, with nurses IV emerging in the USA, a group of nurses who performed intravenous therapy administration. As the evolution progressed, other types of catheters were born: needle, needle, midline, percutaneous, tuneilized, implanted, PICC. (DE OLIVEIRA. *et al* 2017).

The PICC catheter has been used in the treatment of several patients for approximately three decades. In 1912 its use was carried out for the first time, but only in 1973 was its insertion technique described and with this it gained prominence in its use, especially for the administration of antineoplastic agents, parenteral nutrition, vesicant drugs and irritants. (RODRIGUES *et until*2017).

## 2.2 FLAG THE COMPLICATIONS RELATED TO FAILURE IN PICC MANAGEMENT

Obstruction, hyperemia and secretion and bacteremia may occur at the catheter insertion site. To ensure the success of treatment and promote the health of the patient in order to prevent complications, know the techniques and care with PICC. (DOS SANTOS *et al* 2017).

Very serious complications may occur, and they are bloodstream infection evidenced by fever and chills, symptoms that suggest infection. Where the PICC line was inserted, the patient may also present pain complaints, in addition to edema and epiremia in the arm. (KERIN *et al* 2017).

Limiting the number of lumens in thrombotic and infectious complications may be related to the insertion of PICC with multilumens, not being necessary in all patients. The number of infections may be reduced after adopting a lumenyl pattern. (RATEZ, *et al* 2017).

Poor catheter positioning when it cannot reach the correct site of the vena cava, where difficulty in catheter progression may occur. The most common complications are TUP tramboflebit infections. The rate of thrombosis and 0% for brachial vein. (DI SANTO *et al* 2017).

Taking into account the number of infections may be related to the time in which this patient is hospitalized and the amount of lumens, and may present positive blood culture, being more common agents staphylococussp and klebsiellapneumonial. Guidance in cases of fever after 48 hours is removed from the catheter in patients with positive culture. (DI SANTO *et al*2017).

## 2.3 CARE NECESSARY FOR THE INSERTION AND MAINTENANCE OF THE PICC CATHETER WITH THE ABILITY TO MINIMIZE THE RISKS OF INFECTION AND OTHER COMPLICATIONS

The PICC peripheral venous catheter has its usefulness for a longer period than other catheters that have a shorter permanence, thus bringing greater assurance and less discomfort to the patient when installed in the upper limbs. When it comes to a central catheter, they can all generate risks for adverse events, so there is a need to follow the protocols with strict standards of insertion and maintenance (MANUAL OF WORK PROCESSES AND TECHNICAL HOSPITAL OF CLINICS UNICAMP 2017).

In order to prevent infection, the use is made by means of an aseptic technique during the insertion and maintenance of the catheter by observing the established guidelines, in relation to the duration of the infusion and permanence of the catheter and evaluation of replacing the equipment. The way to acquire microorganisms at the tip of the catheter are associated with puncture, colonization of the skin through solutions that are contaminated, poor operation in the air inlet in the filter and microorganisms through the connections of the catheter or some accessory. (JESUS, SECOLLI, 2007).

Over time with the evolution of intravenous therapy, the PICC catheter has stood out for its qualities and advantages that it has been offering to the patient. Because the catheter has a biocompatible, less thrombogenic, and silicone material has greater advantages and benefits to patients, with a lower rate of risks due to complications. The indication is important care because it is evaluated before the venous network is impaired due to the various puncture attempts. (COSTA, BENETTI, 2017).

PICC has some related complications such as local, systemic or circumstantial. Local complications include phlebitis, local infection and thrombosis: phlebitis: inflammation of the venous wall by mechanical, chemical or infectious agents. Infection that extends hospitalization if you do not have early treatment, has an incidence of 5 to 26% in PICCs. Causes that claim the appearance of infectious phlebitis, are inappropriate aseptic techniques during the introduction or maintenance of the device, inadequate fixation and error in choosing the insertion site. To reduce this type of occurrence, a 3 Fr catheter should be used, movement should be minimized at the time of insertion of the device, timely fixation, and observe platelet levels. Infection and based between 2 and 3% microbial contamination that reached the catheter common source of local infections, with prevention by aseptic technique at the time of catheter introduction and maintenance. Thrombosis is the formation of platelets and fibrins that block the catheter and lumen of the vessel, so that this does not occur should be used a catheter of smaller diameter. In systemic complications: sepsis occurs in the bloodstream, which may affect the patient's life, with this it has to be used the aseptic technique and the training of professionals who are facing care. Embolism: displacement of part of the device that breaks and circulates in the systemic current, avoiding this type of occurrence catheter washing has to be delicate, and an adequate fixation. Circumstantial: occlusion, which is the total or partial blockage of the catheter, bringing catheter loss. It is important to check the correct positioning. (JESUS, SECOLLI, 2007).

One of the advantages of PICC and the reduction of the risks of cardiac arrhythmias, reducing pain and stress caused by multiple attempts of peripheral punctures without except. In relation to the literature, the contraindications are inferior to the indications, and anatomies present alterations that prevent the progression of the catheter, have some type of skin infection near the site chosen for insertion, have phlebitis, thrombosis or thrombi. (DE OLIVEIRA, E. L. *F. et al* 2017).

For the reduction of incidence, it is necessary to use strategies: to bring the nursing team closer to the continuing education sector so that the aseptic technique for performing peripheral venous puncture

according to the CCIH (hospital infection control commission) is effectively fulfilled. (RODRIGUES, 2017).

#### 2.4 DESCRIBE THE NURSE'S KNOWLEDGE ABOUT the PARTICULARITIES OF PICC

The Federal Nursing Council has already standardized through the resolution of Coren 258/2001 that it is the Insertion of Peripheral Catheter by nurses, clarifying in its Art. 1 law to the nurse the insertion of the central peripheral catheter and in Art. 2 that the nurse for the development of such activity should undergo professional qualification or qualification. (COFEN. 2015).

Being a procedure of high complexity requires specific technical knowledge and practices. In Brazil, this practice is directed to nurses and physicians for this procedure, professionals must have training offered in progress and training that provides the theoretical and practical contents for the insertion, maintenance and removal of the catheter, indications and contraindications of the use of the device and methods of verification of insertion, to ensure the quality of the procedure and the health of the patient. This attribution is of technical and legal competence for nurses to insert and manipulate the PICC is based on the COFEN Resolution. (JESUS, SECOLI, 2007).

Different institutions that offer the training course of the introduction of PICC to nurses were noted that for the duration of the course depends on the programmed content that does not necessarily need to comply with a standard. The concern of schools and the guarantee of a theoretical baggage with notions in anatomy, physiology, insertion techniques, maintenance and possible complications. The purpose of the content and give the professional in training the necessary experience to be acting safely. (COREN 2015)

Nurses started this activity more complex, due to the reduced number of physicians. In the emergence of PICC in the USA, nurses were already working directly in the administration of intravenous therapies. With the advancement of technology new types of catheters have emerged, picc is inserted by trained nurses, the preferable sites are the veins of the upper limbs (cephalic or median basilica) and its extremity should progress to the middle third of the superior vena cava. After placement, x-ray should be performed to confirm catheter positioning and start its use. (DI SANTO. *and al* 2017).

Nursing that promotes the care of the human being in all its phases of life. Nurses have technical and legal competence to insert and manipulate picc, based in Brazil by Resolution No. 258/2001 of the Federal Nursing Council (COFEN), qualified and/or professionally trained. Considering the importance of nurses as one of the main responsible for the indication, insertion, maintenance and removal of the central catheter of peripheral insertion, to disclose what has been published in the scientific literature of nursing on the insertion of PICC. (VERA. *et al* 2015).

CCPiarise stems from extension projects and professional experience, as a possibility to balance science and tradition. Extension projects are relevant, since they provide scientific grants from teaching and research for movements in the community, which are responsible for processes of social, environmental



and political change. Moreover, critical reflection on the practice and exchange of knowledge consolidates the realization of safe and culturally accepted practices. (AZEVEDO . *et al* 2019).

## 2.5 TO SHOW THE TECHNIQUE NECESSARY FOR THE USE OF PICC BY THE NURSING TEAM

Certified and specialized nurses can insert PICC catheters. The importance of their presence for catheter passage and care brings benefits such as success in the first puncture attempt, decreased rate of bloodstream infection and decreased rate of adverse events with the catheter. Nurses use the ultrasound associated with the modified Seldinger technique to perform catheter insertions, performing catheter fixation with a non-suture device, which considerably decreases bacterial colonization. Soon after the procedure, the PICC nurse according to the hospital protocol requests a chest X-ray to verify catheter positioning. (BARBOSA, J, A, S. *et al* 2020).

The PICC has established indications and contraindications in its use; for its greater safety during its positioning, the guided implant is established with the aid of an ultrasound, ensuring greater efficacy during puncture and catheter positioning during the procedure and offering comfort to the patient. (DI SANTO *et al* 2017).

Nurses should monitor catheter maintenance and evaluations when the nursing team of the unit in which the patient is located. It is part of the daily evaluation of the nurses of the units to verify the brachial circumference of the upper limb of the patient with PICC and to observe if there was any suggestive alteration to thrombosis evidencing edemas in the upper limb, change in skin color and algia reported by the patient. (BARBOSA. *et al* 2020).

The nursing team should be qualified to change the dressing, which is also one of the main complications of PICC. The exchange should be performed with an occlusive dressing, transparent film and gauze. According to the institution's protocol, or any sign of compromised coverage integrity this dressing should be changed. (PERES *et al* 2019).

It is necessary that the nursing team be trained to handle the PICC catheter in order to avoid its early removal. Team training is essential, because it is through it that the nursing team will be trained to promote adequate care. (PERES *et al* 2019).

The procedure to be performed to the patient hospitalized in the ICU or in the other sectors of the hospital should be performed by trained professionals who will have the ability to solve any complications related to insertion (see Annex I) and use of the catheter with a rigorous maintenance where there will be a need for training of the nursing team that will be responsible for caring for and preserving the catheter to minimize future complications. (DI SANTO *et al* 2017).

### 3 RESULTS

According to the research conducted we can define that PICC is a procedure that was first described in the year 1929, 92 years ago. Only in the 1980s we obtained an evolution regarding the modernization of PICC catheters that were used at that time.

Confirming the aforementioned text, LAMBERT, *et al* 2005 states that: "In the 1980s, with the advancement of a new generation of PICC catheter, it would provide greater safety, reduce trauma to the patient's venous network, and enabling prolonged use that being intact can be continued for up to 180 days of use."

With regard to the need for PICC, we saw that the importance of the procedure and everything that involves the process in the insertion of picc depend exclusively on the training of the nurse who will perform the procedure. Among the several articles researched, we observed the fundamental role of nurses in this procedure.

We know that any and all health care must be done consciously where there is the importance of knowledge to the intensivist nurse for the insertion of the catheter leading comfort and quality of care to the patient, but we also know that it is not everywhere that give the opportunity of the nurse to train. This fact goes against the evolution of PICC, since it is the responsibility of the nurse this procedure.

As mentioned in COFEN in 2015 through the resolution of COREN 258/2001, which was approved by the federal nursing council, which says that it is lawful for nurses to insert the central peripheral catheter and art. 2 that the nurse for the development of such activity must undergo professional qualification.

We can identify the importance of clear and objective communication on the part of the professional with the patient and/or his/her family members. This fact is important for all the insecurity and apprehension that the patient and his/her family members present when they are aware of the critical health status of the patient in question.

Thus, the entire procedure to be performed should be evaluated by the multidisciplinary team, where the best way to success of the treatment to be performed will be discussed. This procedure requires an adequate technique and consequently the nurse needs professional training to perform the procedure and to maintain the PICC properly. Scientific knowledge and qualified technique provide the professional with a critical look at the signs of infection, pointing out possible causes.

### 4 DISCUSSION

After analyzing the studies of the selected authors, we did this rereading and analyzed that the peripheral insertion catheter is the best option for therapeutic treatments and the high complexity patients who use this device according to research demonstrate low infection rate.

For JESUS, SECOLLI, 2007. This is a high complexity procedure requires technical knowledge and specific practice. However, some authors report that PICC would be the best choice for treatment, but it is not the reality. Some hospitals even offer free to train their nurse and in practice this option of puncture



is not given as the first choice for access. The course outside the institutions is not accessible, few places have and in the institutions there are priority queues for those who will take the course since it is not yet a course available to all professionals.

Over time with the evolution of intravenous therapy, the PICC catheter has stood out for its qualities and advantages that it has been offering to the patient. Because the catheter has a biocompatible, less thrombogenic, and silicone material has greater advantages and benefits to patients, with a lower rate of risks due to complications. The indication is important care because it is evaluated before the venous network is impaired due to the various puncture attempts. (COSTA, BENETTI, 2017).

Even so, it is common to observe in the work environment that the medical clinic is one of the hospital sectors that least chooses PICC, this being a place where some patients remain for a long time until they finish their treatment and the same is discharged to their home.

One question to be observed and researched more closely is why there was so much denial of hospital units with regard to the use of this procedure? Maybe for the delay and all the material that needs to be used? Perhaps the cost and delay of the procedure are some of the issues in which nurses feel unsafe for performing this procedure, since there is a great demand for care in this sector. Perhaps these are factors that make nurses not put this type of puncture as a first attempt.

In the ICU, on the other year, due to our professional experience, we can observe a significantly higher number of patients with PICC.

Another factor to be observed is what concerns the professional qualification of nurses to perform this procedure. Do nurses in sectors that do not work with high complexity patients receive the same stimulus for specific courses to perform PICC?

We agree on the risks of phlebitis, extravasation, among others. These complications can be caused by poor positioning or even lack of care and maintenance of this access, hence the strengthening of the importance of training to train nursing staff and nurses for the purpose of maintaining and integrity of access.

PICC promotes the patient a comfort and well-being much greater than a peripheral venous access, in addition this procedure in the medium and long term is made more economical to hospitals than various materials and time that are used in repeated peripheral venous punctures. However, still, many institutions standardize PICC as second-intention access, maintaining peripheral access as first intentions, even increasing the stress of patients on several occasions having to undergo procedures that can generate pain discomfort and many complications.

When commencing deep access with PICC, we can observe according to the literature that deep access has a high cost for insertion and the probability of this access causing an infection is much higher since it lasts an average of 15 to 30 days depending on the clinical picture as described below.

The PICC peripheral venous catheter has its usefulness for a longer period than other catheters that have a shorter permanence, thus bringing greater assurance and less discomfort to the patient when installed

in the upper limbs. When it comes to a central catheter, they can all generate risks for adverse events, so there is a need to follow the protocols with strict standards of insertion and maintenance (MANUAL DE PROCESSOS DE TRABALHOS E TECNICAS HOSPITAL DE CLINICAS UNICAMP 2017).

One negative point that we observed throughout the research is that some patients have the need to infusion several drugs simultaneously. With this deep venous access emerges the PICC, since deep venous access can offer up to 5 lumens for simultaneous infusions, while PICC offers a maximum of up to 3 lumens. And so, in these cases picc becomes less indicated.

However, with all the research and articles read we can realize that PICC offers much more benefits of contraindications and that this device is minimally used in view of the facilities, comfort and safety that it offers patients compared to other devices used in a hospital environment.

## **5 CONCLUSION**

We conclude that the use of PICC is of great importance for clients, bringing numerous benefits, which this procedure can provide mainly if talking about the reduction of peripheral punctures and, with consequences relieving pain and stress, besides promoting a safe venous access for the infusion of venous therapy according to the prescription and the proposed treatment.

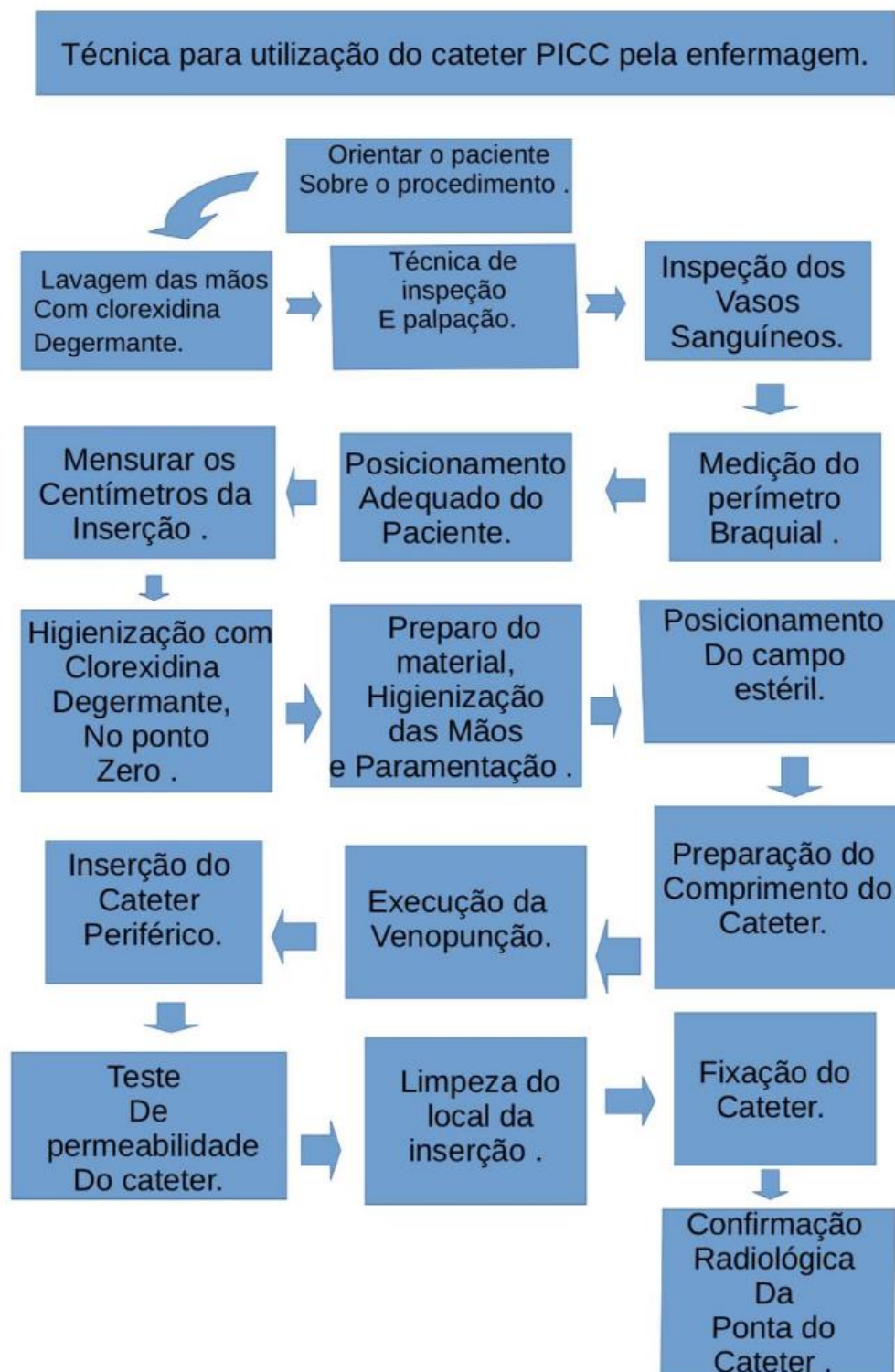
The performance of the qualified nurse for safe care and some nursing care in the maintenance of picc was present showing its efficacy and value.

An increase in the use of PICC requires keeping health professionals constantly updated, in order to keep the catheter as long as possible in pleasant conditions of use without resulting in complications. Through this positive knowledge we emphasize the need for continuing education in the demand for technical excellence and better nursing care.

## 6 ANNEX

### ANNEX I

#### FLOW CHART



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