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RESEARCH ARTICLE

DIFFERENCES BETWEEN THE USE OF A CENTRAL VENOUS CATHETER AND A CENTRAL VENOUS CATHETER PERIPHERAL INSERTION: ADVANTAGES, DISADVANTAGES AND RISK FACTORS ASSOCIATED WITH EACH PROCEDURE

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Abstract

Central venous access is a frequent procedure in intensive care units. The peripherally inserted central venous catheter (PICC) is an intravenous device, made of soft and flexible material (polyurethane or carbonane). its disadvantages, and the risks associated with each procedure.

Material and Methods: This article is a systematic review, based on the PRISMA methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). Central Venous Catheter: Some complications result from its use, such as infection, obstruction, infiltration or extravasation, among others. Some of these events can be handled, but device removal cannot always be avoided. The peripherally inserted central venous catheter (PICC) is an intravenous device, made of soft and flexible material (polyurethane or carbonane), introduced through a superficial or deep vein of the arm, which progresses to the superior vena cava located in the thorax. In this sense, the PICC is the first choice for central venous access after umbilical catheterization, standing out over the conventional central venous catheter.

Final Considerations: It is emphasized that serious complications are associated with the use of CVC and PICC, which may result in death. Therefore, correctly performing the technique of handling these devices, avoiding infections and obstructions, as well as knowing how to identify, prevent and treat possible complications, should be considered good clinical practices that contribute to a better useful life of the device and quality of life for its user.

Introduction:-

The fully implanted central venous catheter (CVC) has been used since 1983, becoming essential in the treatment of cancer patients. Allows the infusion of chemotherapy drugs, blood products and parenteral nutrition, in addition to blood collection for laboratory tests). This device consists of a catheter (made of silicone or polyurethane) and a port (titanium camera covered by a punctureable silicone septum), which is surgically implanted. Access to the device is

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done by puncturing the skin over the port with a non-cutting needle (Huber needle) and care includes washing with saline solution and heparinization, performed monthly (BÖLL et.al 2020).
Central venous catheterization is sometimes used to monitor central venous pressure (pressure in the superior vena cava, the large vein that returns blood to the heart from the upper part of the body). The central venous catheter (CVC), also called central venous access, is indispensable in the management of critically ill patients in emergency or intensive care units. Central venous pressure reflects the pressure in the right atrium when it is full of blood. Handling this type of catheter requires technical and scientific knowledge. Its handling is not characterized as an activity of greater technical complexity, which requires adequate scientific knowledge and the ability to make immediate decisions. Thus, it becomes possible to infer that the responsibility for handling the CVC-IT should be restricted to the nurse (SMITH, 2013).

The central venous catheter is a device that plays a very important role in health care, especially for patients who demand highly complex care, such as patients in intensive care units, patients on dialysis or onco-hematological patients, for example (BUETTI& TIMSIT 2019).

The Peripherally Inserted Central Venous Catheter (PICC) is among these expanding technological and therapeutic advances within intravenous therapy, through a safe and functional venous access. A PICC catheter is a catheter inserted into a vein on the inside of the upper arm and extending into a larger vein that leads to the heart. A PICC catheter allows medications, nutrients, blood products and fluids to be administered into a large vein. Blood samples may also be taken. This is inserted in this context as a primordial resource in the care for these newborns, who usually need medication for a long time. ICU (PITIRIGA et.al 2020).

The PICC has numerous benefits, including the possibility of establishing intravenous therapy of prolonged duration, with a reduction in the number of punctures and insertion at the bedside by qualified nurses through qualification and professional training, generating legitimized care and conferring professional autonomy (FRANCO-SADUD et.al, 2020).

Compared to a CVC line, a PICC line is inserted into a vein in the arm or hand. As with the CVC, the catheter is slid along larger veins until it reaches the superior vena cava. Both CVC and PICC lines allow long-term venous access without frequent needle sticks (LI et al, 2023).

Objectives:-

Carry out a study on the differences between the use of a central venous catheter and the use of peripherally inserted central venous catheters, their disadvantages, and the risks associated with each procedure.

Material And Méthods:-

This article is a systematic review, based on the PRISMA methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

A search strategy was developed based on the evaluation of an objective about the theme in question, which is configured as the basis of the study. It being: To identify the differences between the use of a central venous catheter and the peripheral insertion of a central venous catheter, their disadvantages, and the risks associated with each procedure.

The search descriptors were selected from the search on the Health Sciences Descriptors website (DeCS) and later combined with the Boolean operator "AND". The databases used for the research were: PubMed and the Virtual Health Library (BVS), where cross-sectional, cohort and case-control studies were evaluated from 2017 to 2022, covering Portuguese, English and Spanish.

Results And Discussion:-

Central Venous Catheter

Complications inherent to the use: prevention and treatment. In this category were considered: infection, obstruction, extravasation, exteriorization of the port, in addition to other complications cited in the seven studies analyzed.

Some complications result from its use, such as infection, obstruction, infiltration or extravasation, among others. Some of these events can be treated, but device removal cannot always be avoided (MCGEE & GOULD, 2023).

Infection

Infection is the most frequent complication related to the use of a catheter. It can occur either in the subcutaneous pocket, where the port is installed, or along the subcutaneous tunnel where the catheter is inserted, putting the patient at risk of sepsis due to the direct communication between the catheter and the central circulation.

The best way to prevent it is by using a sterile technique when handling the catheter (FIGURE 1); in addition to complying with the established deadline for changing the needle, equipment and connections (MCGEE & GOULD, 2023).

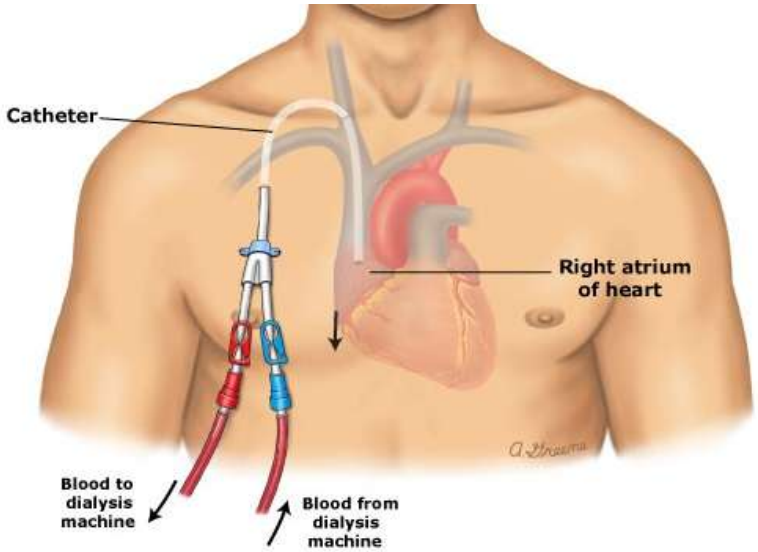

Figure 1:- Central venous access. **Source**: Azura Vascular, 2023.

The conduct for the treatment of infection in these devices provides for the confirmation of the infection using the comparison between the blood culture collected from the catheter and the blood culture collected through the peripheral route. Only after identifying the site of infection and the microorganism should appropriate antibiotic therapy be instituted by the physician in charge. In cases where the patient does not respond to therapy, removal of the catheter may be indicated (TAYLOR, 2007).

Obstruction

Obstruction of these devices results from thrombus formation, fibrin or drug precipitation. The main conduct to prevent reported cases of catheter obstruction was washing with 20 ml of saline solution, regularly, between the administration of two or more drugs and after using the device, followed by heparinization; whose solution must have a final concentration of 100UI/ml (EISEN et.al, 2006).

In cases where the obstruction is confirmed, fibrinolytic therapy stands out as the only possible treatment, and each institution is responsible for determining the most appropriate fibrinolytic, the therapeutic dose as well as the unobstructing technique (EISEN et.al, 2006).

Extravasation

The most frequent causes of extravasation were the formation of fibrin or thrombus at the tip of the catheter and fracture of the device, accounting for 1% to 2% and more than 2% of occurrences, respectively. Other possible causes were incomplete insertion of the needle into the port; needle displacement due to changes in positioning and frequent manipulations, as well as disconnection between catheter and reservoir (port). The author further alleges that the incidence rate of extravasation ranges from 0.3% to 4.7%, and may be higher due to underreporting. As the cause of extravasation is multifactorial, preventive measures are aimed at controlling these factors. The results of the study indicate that the complete insertion of the Huber-type needle at the time of puncture and the use of an

appropriately sized needle are ways of preventing extravasation caused by incomplete insertion of the needle into the port (TAYLOR, 2007).

Needle displacement, on the other hand, can be avoided with a dressing that is well attached to the skin and that fully protects the needle, preventing traction of the equipment connected to the catheter. Regarding extravasation caused by catheter fracture, only that resulting from the strong pressure exerted by small-caliber syringes (1ml and 3ml) can be prevented. Therefore, during the handling of CVC-TI, syringes with a caliber greater than 5ml are used. Other ways to prevent extravasation include frequently monitoring the puncture site, confirming venous return before starting drug infusion, in addition to advising the patient to avoid manipulation of the dressing and pulling equipment connected to the catheter (SRIDHAR, 2020).

Port exteriorization

Port exteriorization is not a frequently encountered complication, which suggests that its occurrence is rare, although unknown. The occurrence is due to injury to the skin over the port and surrounding structures to the device, mainly due to dehiscence of the surgical incision, repeated punctures in the same site or loss of viability of the tissue over the port that can occur due to severe weight loss (MCGEE & GOULD, 2023).

Other complications among the possible complications inherent to the use of the CVC-IT, there are reports of venous thrombosis, phlebitis, displacement of the catheter from the port and migration of the catheter. Despite the possible complications, the CVCTI is a safe and more comfortable vascular access for the patient, whether it is implanted in the thoracic region or in the forearm. In the post-implantation phase of the catheter, the nurse must pay attention to the observation of bleeding or secretion, hematoma or seroma at the insertion site. It is the nurse's job to identify any unusual signs while handling the device, in addition to recording the conditions of the skin at the site surrounding the insertion of the catheter, blood flow and reflux (SRIDHAR, 2020).

Device handling

The seven articles analyzed in this category describe skin antisepsis, port puncture and dressing, in addition to other nursing care. Skin antisepsis Skin preparation is essential to prevent infection. Three applications of alcoholic PVP-I are indicated in spiral movements on the skin over the port, followed by three applications of 70% alcohol also in spiral movements. There are authors who claim that skin preparation should be done with two applications of 70% alcohol in spiral movements, followed by alcoholic PVP-I. They also emphasize the need for the skin to be completely dry before it can be punctured. Some studies indicate the use of alcohol followed by PVP-I; the application being performed three times (SRIDHAR, 2020).

Port punch

The use of sterile material when handling the catheter is essential and was highlighted in all analyzed studies. Regarding the needle, the recommendation is to use only the non-cutting or Huber-type needle for puncture of the port, as the use of a hypodermic needle can crack the silicone septum. It should also be noted that the insertion of the needle must obey the angle of 90º and be introduced into the silicone septum until you feel that its tip has touched the bottom of the port (MCGEE & GOULD, 2023).

One aspect to be considered concerns the rotation of the needle insertion site, in order to avoid injuries to the skin over the reservoir. Needle change when in long infusions should be performed every two or three weeks (SEMERCI et.al, 2023).

It is also important to check the tip of the needle after removal, observing integrity, signs of occlusion or clots. Dressing Handling and applying the dressing are the nurse's responsibility. Right after the puncture, the insertion site, the needle and its entire extension must be covered with a transparent bandage so that the site can be monitored. In cases of prolonged infusion, the average dressing change varies from three to five days. Other nursing care. Nursing care includes pre- and postoperative care, dressings and device handling, medication administration and patency maintenance (MCGEE & GOULD, 2023).

Also noteworthy is the responsibility of both the professional and the patient in handling the catheter, for its permanence and achievement of therapeutic objectives. Perception of the patient in relation to the catheter. The main complaints of the patients are related to the discomfort during the insertion of the needle and the change in body image caused by the implantation of the device. Anxiety associated with puncture pain and the difference perceived

by them at the time of catheter puncture was also reported, showing that the painful sensation is less when punctured by oncology specialist nurses. According to these authors, anxiety can be reduced using a topical anesthetic consisting of 2.5% lidocaine associated with 2.5% prilocaine, which reduces pain during the catheter puncture procedure. Despite the discomfort described by previous studies, patients and family members have shown good acceptance of the use of the catheter (MCGEE & GOULD, 2023).

Peripherally Insertion Central Catheter (PICC)

The peripherally inserted central venous catheter (PICC) is an intravenous device, made of soft and flexible material (polyurethane or carbethane), introduced through a superficial or deep vein of the arm, which progresses to the superior vena cava located in the thorax. In this sense, the PICC is the first choice for central venous access after umbilical catheterization, standing out over the conventional central venous catheter (FIGURE 2) (MIELKE et.al, 2020).

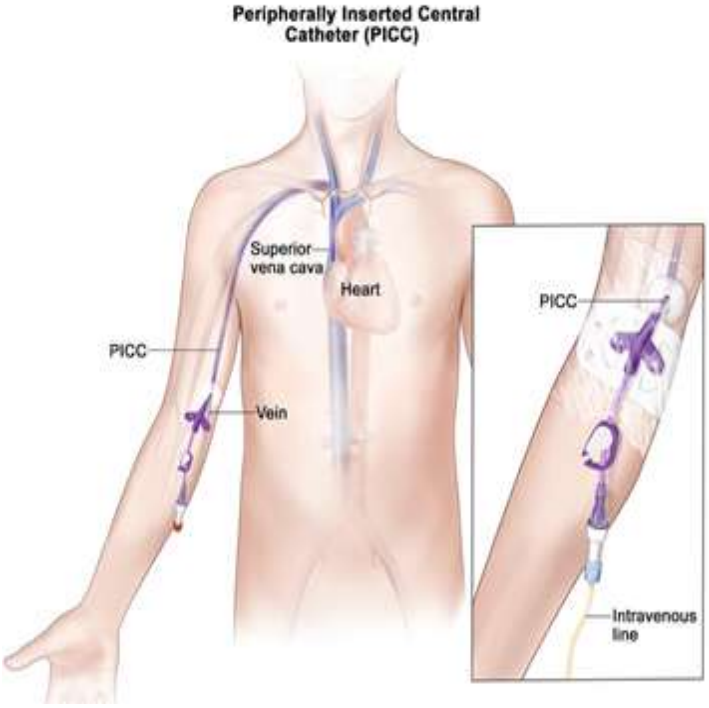

Figure 2:- Peripherally Inserted Central Catheter.**Source**: Terese Winslow LLC, Medical And Scientific Illustration, 2015.Site Copyright: © 2022 Terese Winslow LLC.

Complications

It is noteworthy that the percentage of complications associated with the use of the PICC is considerable, ranging from 15% to 48%, represented by events such as occlusion, extravasation, migration of the catheter tip and thrombosis, these intercurrences result in the reduction of the permanence time of the catheter and consequent failure in the implementation of drug therapy and survival of newborns (EISEN et.al, 2006).

Patients undergoing PICC are mostly premature and low-weight newborns, who need the catheter to ensure that drug therapy is implemented and, thus, have a greater chance of survival and better prognosis9, since they have an increased risk of mortality, being prematurity responsible for about a third of neonatal deaths. In Brazil, the mortality rate in this group ranges from 7.9 to 14.2% (TAYLOR, 2007).

Associated conducts, average length of stay and insertion sites The insertion of the catheter must be indicated early so that there is success in its use and in the NB as soon as he is able to undergo the procedure, because of repeated venipunctures, anatomical, surgical or traumatic distortions they generate very thin blood vessels, difficult to identify, compromised by pain, edema, erythema and bruising, which makes it difficult to insert and maintain the catheter. The procedure is elective and should not be performed in urgent and emergency cases, due to the risks it presents (WALSH, 2023).

The PICC can remain for an indefinite period as long as there are no complications and proper care is taken, but the CDC recommends its use for 8 weeks and there are studies that indicate its use for up to 6 months. The longer the length of stay, the greater the risk of infection, however, centrally positioned catheters are associated with lower complication rates (thrombophlebitis, phlebitis and occlusion) compared to non-central catheters. When choosing the vein for insertion of the PICC, it should be noted whether it is palpable, thick and with less curvature. The skin at the chosen site must be intact, without bruises, edema, signs of infection or anatomical changes (EISEN et.al, 2006).

The most indicated veins are the basilic and cephalic veins, as they have a smaller number of valves, larger caliber, have a favorable anatomy, facilitate the performance and change of dressings and have a shorter path to the superior vena cava, however the cephalic vein, because it is smaller than the basilica and having more valves, it poses a potential risk for phlebitis and poor positioning. (EISEN et.al, 2006).

The choice of the right upper limb offers easier progression and centralization of the catheter 24, in addition to being closer to the vena cava. Articulation areas should be avoided, prioritizing the more distal and superficial veins (LI et al, 2023).

Veins located in the head, such as the temporal, posterior auricular and external jugular veins present a greater risk of catheter migration, therefore they should be the last option, and the veins of the lower limbs such as the popliteal, saphenous and femoral veins have valves that can hinder the progression of the catheter (LI et al, 2023).

Although the external jugular vein is the most visible, it poses the greatest risk of infection from the site. In her puncture, it is recommended to choose the right one, as the left one can ascend to the internal jugular vein. The auricular vein is fragile and of variable size, and like the jugular vein, it is difficult to fix.

However, the axillary allows the use of a larger caliber catheter with a greater number of lumens, due to its larger diameter. In premature infants, the popliteal artery is more visible, but it should be punctured with caution. The saphenous vein, due to the excess of valves, is more technically difficult and may favor the development of lower limb edema. The femoral vein is difficult to puncture because it is located below the inguinal ligament and presents a higher risk of thrombus formation and a higher incidence of catheter-related infection (PATEL, 2019).

The caliber of the PICC must be defined by the professional, taking into account the adjustment of the lumen diameter for the patient's weight, age and vessel size. To measure the length of the catheter to be inserted, the NB is placed in dorsal decubitus, with the arm to be punctured at a 90 o angle in relation to the trunk and the head turned to the ipsilateral side of the limb that will be catheterized. For puncture in the UL, head and neck, the distance between the puncture site and the right clavicle and the third intercostal space is measured, and for the LL, the distance from the puncture to the inguinal region, passing through the umbilical region to the xiphoid process (RAY-BARRUEL et.al, 2023).

In the implementation of the PICC, the maximum barrier technique should be adopted and cardiorespiratory monitoring should be performed, in addition to sedation and analgesia to prevent pain, since exposure to multiple painful procedures and stress generate greater metabolic expenditure and depletion of energy reserves, disfavoring gain weight loss, delaying the recovery and/or aggravating the clinical conditions of the newborns. The following are analgesic measures: containment, non-nutritive sucking with sucrose or human milk, distraction with soft music, inclusion of parents in the procedure, application of a eutectic mixture of prilocaine and 5% lidocaine (EMLA) and drug analgesia with intravenous fentanyl (IV), IV or nasal midazolam, or oral chloral hydrate. In NB, guidewire is not used for insertion, especially in silicone catheters, due to the risk of device fracture (LI et al, 2023).

Insertion time is about 45 minutes to an hour. It should be performed slowly, from 0.5 to 0.5 cm, thus preventing mechanical phlebitis. On average, 10 to 15 cm are inserted from the catheter, depending on the vein and limb chosen. The 2002 CDC (category IA) recommends 2% aqueous chlorhexidine gluconate, 10% polyvinyl-pyrrolidoneodode, 70% alcohol, or 0.5% alcoholic chlorhexidine for skin antisepsis during catheter insertion. However, the use of antiseptic depends on the weight of the NB, due to the fragility of the skin. For NB weighing less than 1,500 g, degerming chlorhexidine and weighing 1,500 g or more, alcoholic chlorhexidine, and in both, 0.9% saline solution (SF) are recommended to remove the antiseptic (FENG et.al, 2023).

Difficulty in catheter insertion may occur due to excessive bleeding, obstruction by venous valves, and aberrant venous anatomy. The device may follow other venous branches and not be positioned centrally, requiring limb repositioning maneuvers, catheter traction and a new attempt at progression, in addition to instillation of SS to stimulate the opening of the venous valves and progression of the PICC. Other causes of difficulty in progression are: resistance in the path caused by venospasm, sclerosis, incorrect catheter or patient position, venous bifurcation and previous vein dissection (KEHAGIAS, 2023).

A poorly positioned catheter tip can cause complications such as cardiac arrhythmia, pleural and pericardial effusions, cardiac tamponade, myocardial perforation, vascular thrombosis, bacteremia, endocarditis, sepsis, pulmonary embolism afterfracture, catheter migration, hemorrhage, hematoma, arterial puncture, nerve damage and stimulation, arteriovenous fistula, catheter migration to the brain, pneumonitis, perforation and extravasation in the renal pelvis and even death (GRAHAM, 2007).

The dressing at the catheter insertion site is intended to cover, prevent local trauma and contamination, protect the catheter insertion and prevent its displacement is a sterile procedure and exclusive to qualified nurses. In the presence of drainage of liquids or blood at the insertion site, a dressing with gauze and adhesive tape is recommended, which must be changed between 48 and 72 hours, or sooner, if integrity is compromised, if the site is clean and dry. semipermeable polyurethane membrane, which allows better visualization and prolonged permanence, for up to 7 days (SHI et. Al, 2020).

There are studies that indicate the transparent dressing, which is impermeable and allows water evaporation, right after insertion, being changed after 24 hours and subsequent changes every 7 days (TIAN et.al, 2007).

PICC is a technology that is expanding within the hospital environment. It has advantages when compared to CVC and brings the possibility of outpatient follow-up, which is positive for the patient's quality of life and recovery. It still allows insertion by qualified nurses, however, the lack of technical-scientific knowledge and team preparation mean that complication rates are still relevant, the length of stay is much shorter than recommended, in addition to being a gap for the dissemination of practice in other medical specialties in addition to neonatology (RAY-BARRUEL et.al, 2023).

It is evident that the nurse is of great importance in this process, both as an agent for preventing complications and as a disseminator of the practice, but what is noted are few publications on the subject. The relevance of including the theme in academic training is noted, as well as the professional's investment in research in the most diverse areas, thus enabling increasingly positive results in the implementation of this technique (RAY-BARRUEL et.al, 2023).

Final Considerations

The findings presented by this study show the complexity involved in medical care related to the handling of CVC and PICC. The insertion of these devices has been an increasingly common practice in hospitals specialized in cancer treatment, where safe vascular access is an essential condition for the therapeutic success of these patients.

However, it should be noted that serious complications are associated with the use of CVC and PICC, which may result in death. Therefore, correctly performing the technique of handling these devices, avoiding infections and obstructions, as well as knowing how to identify, prevent and treat possible complications, should be considered good clinical practices that contribute to a better useful life of the device and quality of life for its user. Physicians are responsible for care related to these catheters, in order to prevent early withdrawal, delays in treatment and increased hospital costs.

Therefore, the results indicated by this study can help these professionals to identify the knowledge produced about the correct handling of the CVC and PICC, so that they can apply them in clinical practice.

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