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Nursing care for patients submitted to cine coronary angiography and the nurse's role in the vascular sheath removal

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ABSTRACT
Objective: This study aims at reviewing the nursing role based on recent literature regarding patients submitted to cine coronary angiography, emphasizing arterial sheath removal procedures. Methods: This is an intuitive and narrative literature review, with a qualitative approach, using scientific articles published preferably in the last 5 years, available in full in Portuguese or English, in Scientific Electronic Library (Scielo), PubMed, and Virtual Health Library (VHL) databases. Results: Nursing professionals provide complex and essential care for the maintenance of life in patients subjected to cine coronary angiography during every moment of their hospitalization. Brazilian nurses, when trained, have the autonomy and ability to proceed with arterial sheath removal after the percutaneous endovascular procedure in the catheterization laboratory. There are new vascular closure devices that can decrease hospitalization time in femoral punction cases. However, the radial function is still associated with a lesser adverse event rate. Evidence-based practices are key in preventing iatrogenic. Final considerations: There are several ways of removing the arterial sheath and reaching hemostasis. All of them require knowledge and experience in the best ways of providing nursing care and performing techniques, aiming for the patient to have the shortest possible recovery time, without increasing the risk to which he is subjected.

Keywords: Cardiovascular Nursing, Vascular Closure Devices, Endovascular Procedures, Nursing Care, Cardiac Catheterization.

1 INTRODUCTION

Diseases of the circulatory system are among the leading causes of mortality worldwide, accounting for about a third of overall mortality. Highlighted is ischemic heart disease, especially Coronary Artery Disease (CAD), which is the cause of 46% of cardiovascular deaths in males and 38% in females. Atherosclerosis, a progressive chronic vascular disease that is configured by the accumulation of atheroma in the arterial lumen, results in Coronary Artery Disease and often evolves with subtle clinical expression, and there is, therefore, a need for early diagnosis (Sartori, Gaedke, Moreira & Graeff, 2018).

According to statistical data published by the Ministry of Health (2021), Cardiac Ischemia is the first among the top 10 causes of death in Brazil until 2017, followed by Cerebrovascular Disease. Cardiac Ischemia is a significant disease in the incidence of cardiovascular mortality. This scenario corresponds to a serious Brazilian public health problem and, therefore, requires relevant financial investment to the public

coffers in the Unified Health System (SUS) and private hospital networks, since diseases of the circulatory system represent the second largest cause of hospital admissions in Brazil (Amoras, 2020; Birth, 2021).

A large portion of cases of ST-Segment Elevation Acute Myocardial Infarction (STEMI) is caused by occlusion of a coronary artery. When a plaque of atherosclerosis ruptures, the formation of obstructive thrombus, thromboembolism, and vasospasm occurs, which hinders myocardial perfusion and oxygenation (Amoras et al., 2020).

Currently, coronary angiography, coronary angiography, coronary angiography, or Cardiac Catheterization (CAT) is the most widely used intervention method in the definitive diagnosis of obstructive coronary lesions and evaluation of heart valves and myocardium. It consists of the introduction of an X-ray-guided catheter to the Aorta artery and Left Ventricle through a vascular introducer allocated in a puncture in a radial (transracial), femoral or brachial artery. The injection of contrast in this system allows the visualization of the coronary arteries. CAT is an invasive but effective procedure for identifying obstructive lesions, their extent, and the severity of myocardial involvement. It also evaluates the pressure values of the cardiac chambers and vessels. Consequently, it is decisive for the definition of an adequate therapeutic proposal (Parach, 2018; Moreira, 2017; Santos, 2020; Smith, 2016).

However, despite technological advances and the updating of cardiac catheterization techniques, complications due to thromboembolic events, allergic reactions, anxiety crises, transient intercurrences (neurological changes, arrhythmia, vasovagal reaction, ischemia, and problems with materials such as catheters) and severe complications (perforation of heart tissue, abrupt occlusion of a coronary artery) can configure in emerging situations that require the m immediate intervention, as well as can cause irreversible damage (renal failure, myocardial infarction, stroke, and death) (Santos, 2020; Smith, 2016).

The main treatment indicated in reperfusion therapy in infarction is Primary Percutaneous Coronary Intervention (PCI), considered the "Gold Standard" treatment in STEMI (Bianco et al., 2021). It consists of clearing the artery with the use of a balloon catheter aiming to reestablish adequate coronary perfusion (Lima et al., 2019).

Due to its caliber, the femoral artery enables a greater range of accessories and instruments used, which is fundamental in more complex interventions. However, currently, the radial pathway has been the most common choice. Femoral puncture, together with the combination of antiplatelet and antithrombotic pharmacological therapy, correlates with potential hemorrhagic and vascular complications, among which the following stand out: retroperitoneal hematoma, extensive hematomas, and hemorrhages, which can lead to hemodynamic instability, cardiac ischemia and the need for a reversal of antithrombotic and antiplatelet therapy. In comparison, the Radial pathway, which provides early ambulation, is associated with less occurrence of vascular and hemorrhagic complications of the puncture site and, consequently, lower occurrence of ischemic events. Thus, the radial pathway is associated with lower mortality rates (Feres et al., 2017).

Because of hemorrhagic complications associated with a femoral puncture, there may be a need for reversal or suspension of antithrombotics and antiplatelets. After the removal of the percutaneous vascular introducer, hemostasis is obtained using hemostatic vascular devices or manual compression (Feres et al., 2017).

That said, according to the Normative Opinion (PN) No. 001/2015 of the Federal Nursing Council (CoFEn), the nurse with the proper training has the legal competence to perform the removal of the vascular introducer after the percutaneous hemodynamic procedure (CoFEn, 2015).

In this context, nursing is the category that provides essential continuous care for the promotion and rehabilitation of the health of individuals with vascular diseases who undergo procedures in a hemodynamics laboratory (Sartori et al., 2018). The nursing team working in a hemodynamics unit is responsible for several activities related to the sector, among which are preoperative, perioperative, and postoperative care. It is up to the nurse to perform the pre-procedure nursing consultation, in which information will be observed that corroborates the health care for the patient. Nursing consultation is a tool for the identification of risks and potentialities. It should be guided by clinical reasoning and makes it possible to draw up a strategic plan of nursing diagnoses and interventions to achieve pre-established outcomes (Nascimento et al., 2021).

In this sense, the following question arises: what is the nursing care in the prophylaxis and management of complications in the removal of vascular introducer after coronary angiography? The objective of this study is to review, based on the recent literature, the performance of nursing concerning patients submitted to coronary angiography, emphasizing the procedure of removal of the vascular introducer.

2 METHODOLOGY

A narrative review of the literature was carried out with a qualitative and broad approach, respecting the following steps: selection of the theme; literature research; selection, exclusion, reading, and analysis of the material listed; redaction; and referencing. This method provides the development of subsequent studies through the evaluation and analysis of what is already described in the literature (Rother, 2007; Pereira, 2018).

The research was carried out by the Health Sciences Descriptors (DECS): "Cardiovascular Nursing", "Vascular Occlusion Devices", "Endovascular Procedures", "Nursing Care", "Cardiac Catheterization" and data from the Brazilian Society of Cardiology and the Brazilian Society of Hemodynamics in Interventional Cardiology.

Publications in Portuguese and English were selected, preferably from the last 5 years, available in full for consultation and visualization in the databases PubMED, and Scielo (Scientific Electronic Library Online), assisted by the VHL (Virtual Health Library), with a theme pertinent to the proposal of the review. The survey took place between June 2021 and May 2022. Through the descriptors used, several articles

were found in the databases cited, however, most of them were outside the scope of this study. Thus, the *Boolean* operator "AND" was used to restrict the research, being possible to select the articles relevant to the proposed theme, leaving 15 articles that were considered important to base the discussion, in addition to 2 guidelines and a normative opinion.

3 RESULTS

Chart 1 represents the articles that were used in the discussion process of this study. This instrument was developed to better represent the articles selected for analysis of the scientific panorama in question.

Table 1 – Distribution of articles according to title, authors, objectives, methods, conclusion, and year of publication (n=15). Brasilia, DF, 2022.

Article	Title	Author	Goals	Methods	Conclusion	Ano
Article 1	Comparison of MynxGrip vascular closure device and manual compression for closure after femoral access angiography: a randomized controlled trial: the closure devices used in everyday practice study, CLOSE-UP III trial.	Jakobsen, L., Holm, N. R., Maeng, M., Thim, T., Krinstensen, S. D., Mogensen, L. H., Christiansen, E. H.	To compare the use of the MynxGrip vascular occlusion device with manual compression for removal of femoral access after angiography.	A randomized, non-blind, two-armed, non-inferior clinical study.	Serious vascular adverse events were rare in both arms (manual compression and MynxGrip). Time to hemostasis was shorter in the MynxGrip arm.	2022
Article 2	Evaluation of door-to-balloon time as an indicator of care quality.	Blackberries, T. S. G., Rego, H. C., Menezes, C., Formigosa, J., Santos, E.	Evaluate the door-to-balloon time after the implementation of a care protocol at STEMI.	This is a quantitative, descriptive observational, retrospective study.	There was a decrease in door-to-balloon time in the short term, implying the possibility of better performance in the quality of care.	2020
Article 3	Differences in bleedings after percutaneous coronary intervention using femoral closure and radial compression devices.	Kim, S.-H., Behnes, M., Baron, S., Shchetynska-Marinova, T., Tekinsoy, M., et al.	To compare the use of a femoral vascular occlusion device with a radial compression device in patients undergoing percutaneous coronary interventions.	Observational study of a prospective analysis.	Despite the use of vascular occlusion devices, the femoral pathway is associated with a higher rate of post-procedure bleeding than the radial approach.	2019
Article 4	Nursing care to the client after coronary transluminal angioplasty.	Lima, V. C. G. S., Queluci, G. D. C., & Brandão, E. D. S.	To identify in the literature studies on basic care after the hemodynamic procedure.	This is a bibliographic, descriptive, integrative review study of publications between 2005 and 2017.	It is important to highlight the basic nursing care to the client given the complexity of the situational context experienced, to promote a better quality of care in the daily routine of professional practice.	2019

Article 5	A systematic review of vascular closure devices for femoral artery puncture sites.	Noori, V. J., & Eldrup-Jørgensen, J.	Provide an up-to-date summary of FDA-authorized vascular occlusion devices and analyze evidence comparing the devices with manual post-femoral puncture compression.	Literature review.	The use of vascular occlusion devices leads to greater patient satisfaction and comfort, and less time for hemostasis and ambulation. The comparison showed that the rates of post-procedure complications are similar when compared to the use of manual compression.	2018
Article 6	Clinical factors associated with physician choice of femoral versus radial access: A real-world experience from a single academic center.	Yee, J., Kumar, V., Li, S., Petraskova, T., Pham, A., Stys, J., Thompson, P. A., Petrasko, M., Stys, A., & Stys, T.	To evaluate the clinical factors influencing the decision of the use of femoral or radial arteries in the performance of percutaneous procedures and angiographies.	Retrospective data analysis.	Emergencies and advanced age favored the choice of the femoral approach primarily. Increased BMI and lower age favored the use of the radial approach.	2018
Article 7	Vascular complications in patients undergoing endovascular cardiac procedures: multicenter cohort.	Paganin, A. C., Beghetto, M. G., Feijó, M. K., Matte, R., Sauer, J. M., & Rabelo-Silva, E. R.	To evaluate the intercurrences in endovascular cardiological procedures in the hemodynamics sector in 3 reference centers.	Multicenter cohort study.	The incidence of complications is higher in the first 6 hours after the procedure. Immediate preventive measures should be taken.	2018
Article 8	Nursing diagnoses in the hemodynamics sector: an adaptive perspective.	Sartori, A. A., Gaedke, M. Â., Moreira, A. C., & Graeff, M. dos S.	To identify the nursing diagnoses of NANDA-I Taxonomy II in patients treated in the Hemodynamics Sector.	This is a descriptive, cross-sectional study with a quantitative approach.	The recognition of nursing diagnoses facilitates the link between the main adaptation problems and nursing interventions.	2018
Article 9	Incidence of hemorrhagic complications with the use of radial compression bracelets: a cohort study.	Córdova, E. S. M., Santos, L. R. dos, Toebe, D., Moraes, M. A. P. de, & Souza, E. N. de.	To analyze hemorrhagic complications in patients who used a radial compression bracelet after cardiac catheterization.	Prospective cohort study.	A radial compression bracelet is safe and reduces the incidence of bleeding.	2018
Article 10	The effect of evidence-based care guidelines on outcomes after removal of the arterial sheath in patients undergoing angioplasty.	Parach, A., Sadeghi-Ghahroudi, M., Saeid, Y., & Ebadi, A.	Develop and implement a *guideline* based on scientific evidence for the procedure of removal of the vascular introducer in patients undergoing angioplasty.	A randomized clinical trial with 200 patients in a hospital in Iran.	The use of *guidelines* is recommended in the procedure of removal of the vascular introducer in patients undergoing angioplasty.	2018
Article 11	Manual Versus Mechanical Compression of the Radial Artery After Transradial Coronary Angiography: The MEMORY Multicenter Randomized Trial.	Petroglou, D., Didagelos, M., Chalikias, G., Tziakas, D., Tsigkas, G., Hahalis, G., et al.	To compare manual compression versus the use of radial bracelets in patients undergoing coronary angiography.	Multicenter randomized clinical trial.	Hemostasis time was shorter with manual compression, but with equivalent rates of intercurrences	2018

Article 12	Two methods of hemostasis after trans-radial catheterization: THEMATIC - randomized clinical trial protocol.	Santos, S. M. dos, Rabelo-Silva, E. R., Aliti, G. B., Romero, P. S., Corrêa, C. L., Valle, F. H., et al.	Analyze radial artery occlusion with two different post-percutaneous procedure compression devices.	A randomized clinical trial using the Barbeau test in adults in the hemodynamics unit.	Study in progress.	2018
Article 13	Manual Compression versus Vascular Closing Device for Closing Access Puncture Site in Femoral Left-Heart Catheterization and Percutaneous Coronary Interventions: A Retrospective Cross-Sectional Comparison of Costs and Effects in Inpatient Care.	Walter, J., Vogl, M., Holderried, M., Becker, C., Brandes, A., Sinner, M. F., et al.	To compare complication rates, length of hospitalization, and costs between the use of vascular occlusion device and manual compression after catheterization.	Retrospective analysis stratified according to risk profiles.	The use of vascular occlusion devices reduced complication rates and costs in therapeutic catheterization procedures.	2017
Article 14	Nursing consultation pre-cardiac catheterization and percutaneous coronary interventions.	Moreira, M. L. A. P., Mizuno, E. W., & Meireles, G. C. X.	To analyze the pre-procedure nursing consultation aiming at improving peri- and post-procedure care.	This is a qualitative descriptive observational study with a sample of 200 patients.	The percutaneous pre-intervention nursing consultation is effective in increasing the quality of care.	2017
Article 15	Relationship between orientation, anxiety, and pain in patients undergoing cardiac catheterization.	Silva, M. A. dos S., Marques, P. T. V., Castro, D. F. A. de Padula, M. P. C., Yano, K. T., Coimbra, A. L. de L., et al.	To verify the occurrence of anxiety symptoms in the pre-interventional period of CAT and pain in the post-CAT period, to analyze the association between anxiety symptoms in the pre-interventional period of the CAT with satisfaction with the orientations received about the procedure, and to analyze the association between anxiety symptoms in the pre-interventional period and pain complaint after CAT.	Cross-sectional study that included 55 patients undergoing elective, therapeutic or diagnostic cardiac catheterization.	There was a low occurrence of previous anxiety and pain after cardiac catheterization. There was no association between anxiety and pain and anxiety and satisfaction with the orientations received. However, the study suggests that there is an association between previous anxiety and pain after the procedure.	2016

Source: LEÃO, et al., 2022.

In addition to these articles, three documents were also used that the authors considered useful in the evaluation of the subject, being them the guideline of the Brazilian Society of Cardiology in conjunction with the Brazilian Society of Hemodynamics in Interventional Cardiology, an international guideline of the *Society for Vascular Nursing* and the PN No. 01 of July 2015 of the CoFEn, which provides for the performance of nurses in the hemodynamics sector.

4 DISCUSSION

Through what was exposed, through the analysis of the articles presented, it was possible to group the results obtained in thematic categories about the points considered determinant for the quality of care

and nursing care to the focus patient of this study. Thus, the themes "Risk factors for complications after removal" and "Forms of hemostasis after removal of vascular introducer" resulted, in the present study, these subthemes guide the theoretical reasoning for "Nursing care" and the "Importance of training".

4.1 RISK FACTORS FOR POST-WITHDRAWAL COMPLICATIONS

There is a relationship between increased risk of complications and certain conditions and comorbidities, such as sex, age, obesity, Systemic Arterial Hypertension (SAH), CAD, renal dysfunction, history of cardiogenic shock and Cardiopulmonary Resuscitation (CPR), as well as the use of antiplatelet and anticoagulant drugs (Walter et al., 2017).

In particular, the female population tends to suffer more complications when compared to the male population and the risk increases with age. Obesity, in addition to favoring the involvement of coronary diseases, should be considered regarding the choice of access route that will be used to perform the procedure. In the obese population, femoral access presents a higher degree of difficulty in obtaining it and subsequent laborious containment of bleeding. In these cases, access via the radial artery becomes safer. The same occurs in the elderly population, which also tends to benefit more from radial access due to a lower incidence of bleeding (Yee, 2018; Walter, 2017).

The use of antiplatelet and anticoagulant drugs before the procedure increases the risk of excessive bleeding, so it should be strictly observed. Similarly, the combination of two antiplatelet drugs, known as antiplatelet therapy, promotes serious bleeding risk (Kohlman-Trigoboff, 2020; Walter, 2018). The use of larger introducers and the administration of glycoprotein IIb/IIIa inhibitors are prognostic factors of bleeding (Feres et al., 2017).

Typically, complications associated with hemostasis and vascular introducer removal methods include infection, hematoma, bleeding, arteriovenous fistula, pseudoaneurysm, retroperitoneal hemorrhage, and thrombosis. They are mainly motivated by non-modifiable factors (anatomical variation, age, and obesity) and by modifiable factors (puncture technique) (Feres, 2017; Walter, 2017).

When it comes to the choice of route, when performed the CAT transracially, Radial Artery Occlusion (OAR) is also a possibility and may result in ischemia of the extremity of the punctured limb, reduced function of the affected limb, and pain. This complication is associated with high anticoagulant dosage, use of larger caliber introducers, recurrent transradial "catheterizations" and prolonged arterial compression. Endothelial injury to the radial artery and reduced blood flow due to the passage of the introducer and catheters can lead to a favorable environment for the formation of local thrombus, increasing the risk of OAR. This condition may be evidenced by the absence of anterograde radial flow (Córdova, 2018; Petroglou, 2018).

However, a study conducted in 47 hospitals in Brazil found the occurrence of severe bleeding related to percutaneous access in 1.1% of patients undergoing angioplasty and, in this study, such an adverse event had no statistically significant relationship between the radial and femoral pathways (Sartori et al., 2018).

In addition, the patient's psychic condition in the post-procedure moment is a determining factor in how he will respond to the new moment of his journey. Anxiety may be related to the sensation of pain after the procedure, which can lead to physiological maladjustments such as hypertension, hyperventilation, and consequent impairment of homeostasis in the body (Silva et al., 2016).

Hemodynamic complications, such as hematoma formation and hemorrhages, occur predominantly in the first six hours after the procedure along with other important reactions, namely: vagal reaction, hypersensitivity, pyrogenia, arrhythmia, ischemia, and embolism (Paganin et al., 2018).

4.2 HEMOSTASIS TECHNIQUES AFTER REMOVAL OF THE VASCULAR INTRODUCER

The occlusion of the access after removal of the vascular introducer can be done through manual compression or with the use of vascular occlusion devices. When manual compression is used, the properly trained professional will take between 20 and 30 minutes to complete the procedure (Walter et al., 2017).

Transradial access has been widely used in percutaneous cardiovascular procedures because it favors hemostasis after artery compression. It is associated with reduced incidence of vascular complications and major bleeding and enables more patient comfort and early ambulation. The compression methods available for hemostasis commonly used are manual compression, occlusive dressing with an elastic bandage, and hemostatic bracelets. These hemostatic devices reduce the time to obtain hemostasis, the risks of bleeding, and the damage to arterial patency. Consequently, the length of hospital stay can be shortened by implementing the use of hemostatic bracelets (Córdova et al., 2018). The performance of the CAT by trans-radial route is also associated with lower hospital costs and reduced length of hospital stay, as it presents a lower probability of vascular adverse events (Feres et al., 2017).

After the femoral CAT route, two possibilities for achieving hemostasis are the use of vascular occlusion devices or manual compression (Walter et al., 2017). A large study showed that a certain device for vascular occlusion can be used and is as safe as manual compression of the femoral artery. However, with the device, the time to achieve hemostasis was shorter, including a shorter time for post-procedure ambulation (Jakobsen et al., 2022). A Belgian study concluded that the use of vascular occlusion devices promotes a significant reduction of vascular complications compared to manual compression of the femoral artery, thus being the safest option (Walter et al., 2017). In contrast, the Brazilian Society of Cardiology considers that the use of femoral vascular compression devices compared to the manual compression technique does not significantly reduce bleeding rates and hemorrhagic complications, despite allowing earlier removal of the introducer (Feres, et al. 2017).

It was found that the use of vascular occlusion devices brings greater comfort to the patient and increases their satisfaction. This is related to the shorter time between the procedure and the return to the baseline condition (movement and activities of daily living) (Noori & Eldrup-Jørgensen, 2018). There are several types of vascular occlusion devices, and the form of use varies according to the model and indication of the device. However, when comparing femoral vascular occlusion devices with radial compression

bracelets, bracelets remain a safer option because bleeding episodes are less frequent and have a significant reduction in recovery time (Kim et al., 2019). It is worth mentioning that, currently in Brazil, there is no clear legal basis for the application of femoral vascular occlusion devices by nurses.

Regarding mechanical compression after removal of the radial introducer, a study comparing manual compression versus the use of a hemostatic bracelet showed similar results regarding occurrences of bleeding and OAR, showing that both are safe procedures and with a low rate of adverse events (Petroglou et al., 2018).

The manual compression technique is performed similarly in both access routes, following the following steps: manual compression followed by incomplete removal between 4 to 5cm of the introducer, then manual compression at the puncture site is again applied. The introducer is completely removed until some blood is seen so that the patency of arterial flow can be confirmed by minimal bleeding in the puncture ostium and the possibility of the presence of thrombotic contents. Three-finger compression on the puncture site is reapplied to re-establish hemostasis. Compression should be maintained for 10 minutes or more if necessary to gain control of bleeding. When hemostasis is achieved, an occlusive dressing is made over the puncture site (Petroglou et al., 2018).

Mechanical compression of the radial artery is done with the use of an inflatable hemostatic bracelet. It is allocated to the puncture site and then inflated its cuff with air. The introducer is completely removed from under the inflated bracelet. At this time, the air pressure of the cuff should be slowly decompressed until some blood is seen so that the patency of the radial arterial flow can be confirmed by minimal bleeding in the puncture ostium and the possibility of the presence of thrombotic contents. The cuff is then reinflated with 1 to 2 ml of air to re-establish hemostasis. Transient compression of the ulnar artery is performed to evaluate radial arterial patency, and it is possible to define the presence of adequate blood flow through digital oximetry analysis, a technique known as the Reverse Barbeau Test (TBR). The loss of the signal in the oximeter represents the absence of anterograde flow from the radial artery. In this case, the compressive force exerted on the punctured artery should be reassessed, so that the anterograde flow of the artery can be reestablished without sacrificing hemostasis. Subsequently, the cuff should be deflated with the removal of 3 ml of air after 30 minutes and then with the removal of 3 ml of air every 15 minutes. If there is bleeding at the time of deflation, the cuff should be immediately filled with the volume of air removed. At the end of the process, when the cuff is empty, the bracelet is removed and an occlusive dressing is made over the puncture site (Petroglou et al., 2018).

In both forms of compression (mechanical and manual) of the radial artery, TBR is performed to evaluate the permeability of the radial artery and OAR. As described in the paragraph above, it consists of the evaluation of the permeability of the radial artery by digital oximetry analysis (Petroglou et al., 2018).

4.3 NURSING CARE

Nursing care is based on the following stages of the Systematization of Nursing Care (NCS): Nursing Consultation, in which the data obtained by physical examination and anamnesis will support the next steps; Nursing Diagnoses (NDs); Assistance Planning and establishment of expected results; Implementation of nursing care; and then, the Evaluation of care (Moreira, Mizuno, & Meireles, 2017).

Nursing Consultation is essential. During this, the nurse should guide the patient about the risks implied by the procedure, which uses ionizing radiation, and collect information, such as allergies to iodinated contrast medium, among others (Moreira et al., 2017).

For the prevention of various risks, as well as the prevention of risks of adverse events of vascular involvement, nursing care planning should be based on the prior evaluation of important patient information (Kohlman-Trigoboff et al., 2020). Therefore, nursing consultation is fundamental for the elaboration of clinical reasoning, identification and prevention of risks, and determining nursing care in the care of the target patient, pleading the implementation of NCS (Nascimento et al., 2021).

Data collection at the consultation should plead complaints related to dyspnea, angina, fatigue, chest discomfort, fainting, cyanosis, and palpitations. The approach allows us to clarify the onset, triggering factors and duration of angina and dyspnea. The tests performed are also part of the data relevant to patient care. Electrocardiogram (ECG), exercise testing, echocardiogram and laboratory tests are important (Moreira et al., 2017).

Faced with a STEMI, Percutaneous Coronary Intervention should be performed in an agile time to decrease the morbidity and mortality rate (Feres et al., 2017). The performance of the Electrocardiogram (ECG) is important to guide medical conduct. The "Porta-ECG" time should be less than or equal to 10 minutes, which comprises the time between medical care and ECG performance (Amoras et al., 2020). As recommended by the Brazilian Society of Cardiology, the approach of this patient in a hemodynamics unit for reperfusion of the obstructed vessel should be done in a time less than or equal to 90 minutes between the clinical presentation, or initial medical care. The counting of this time is known as "Balloon-Door" Time and must be rigorously observed (Feres et al., 2017).

The nurse plays a primary role for the stability of the patient's clinical status, since it is necessary to identify related adverse events in an agile time. In general, vascular complications occur in the first six hours after the procedure. It is necessary for the integral and individual care of the patient. Considering this, nurses should equip themselves with scientific technical preparation for the proper implementation of nursing care (Paganin et al., 2018).

A 2018 analysis conducted with 100 patients from a Hospital in Rio Grande do Sul showed that among the Nursing Diagnoses (NDs) identified in patients undergoing diagnostic or therapeutic procedures in a hemodynamics unit, the most frequent were, according to their recurrence, respectively: Risk of bleeding; Risk of impaired cardiovascular function; Risk of infection; Risk of adverse response to iodine contrast medium; Decreased risk of cardiac tissue infusion; Overweight; Decreased cardiac output;

Ineffective peripheral tissue perfusion; Activity intolerance; Impaired verbal communication; Acute pain; Impaired ambulation; and Impaired physical mobility. The first three NDs stand out because they are present in 100% of the patients in the study and the fourth, in 90% (Sartori et al., 2018). These data corroborate the fact that there are several situations in which the risk of adverse events increases in patients undergoing endovascular procedures in the hemodynamics sector.

The "Risk of bleeding" is highlighted, since the performance of the professional who will perform the removal of the vascular introducer is directly related to the mitigation of this risk and prophylaxis of other complications related to the procedure. Among the possible nursing interventions for this risk, the book Classification of Nursing Interventions (CIN) describes as possible actions the control of thrombolytic therapy, care of the incision site, shock prevention, among others (Butcher, Bulechek, & Dochterman, 2018).

Regarding the "Risk of impaired cardiovascular function", many actions were validated by the CIN: monitor electrocardiogram (ECG) to identify ST follow-up alterations; frequently monitor vital signs; monitor and document the presence of cardiac arrhythmias; observe signs and symptoms of reduced cardiac output; monitor for the presence of respiratory disorders (bradypnea, tachypnea, orthopnea); in addition to quickly assessing any sign of chest pain (Buthcer et al., 2018).

The "Risk of infection" requires attention, and actions that reduce its incidence and severity are recommended. These actions include: maintenance of the sterile technique during the percutaneous procedure; aseptic technique in the removal of the vascular introducer; and attention to phlogistic signs such as hyperemia, flushing, pain and edema at catheter insertion sites, whether peripheral, central or bladder (Buthcer et al., 2018).

Patients undergoing vascular procedures have as characteristic profile comorbidities that should be evaluated and considered in advance because this population commonly suffers from vascular diseases that affect several systems and increase the risk of morbidity and mortality (Kohlman-Trigoboff et al., 2020).

Thus, nurses should consider in their evaluation comorbidities and risk factors for atherosclerosis, such as kidney disease, hypertension, dyslipidemia, diabetes, obesity and drug abuse; list medications in use and known allergies; rigorous evaluation of vital signs; physical examination of the patient, paying attention to the general appearance, anthropometric data, skin integrity, presence of edemas or lesions, presence of jugular stasis, ascites, cardiac and pulmonary auscultation, capillary refill, pulse evaluation, and neurological evaluation (Kohlman-Trigoboff, 2020; Moreira, 2017).

Evaluation of palmar arch patency should be performed in advance to prevent vascular complications related to radial puncture. The Allen Test is a simple application technique that allows to verification of the double blood supply of the hand by evaluating the radial and ulnar arteries (Santos et al., 2018).

Before the patient enters the hemodynamics unit it is important to take some specific measures to promote patient safety, which is of paramount importance for everything to go well. Correct patient

identification is imperative and should consider at least two identifiers, such as the patient's name and date of birth, for example (Kohlman-Trigoboff et al., 2020).

At the intraoperative moment, the multidisciplinary team, especially nursing, and anesthesiology, should be attentive to the complete multiparametric monitoring of the patient, alerting any signs of changes or lowering of vital signs. In some cases, bladder probing may be necessary. Associated complications such as hemorrhage, hematoma and thromboembolism, respiratory depression, and signs of hemodynamic instability, among others should also be observed (Kohlman-Trigoboff et al., 2020).

After post-procedure recovery, the patient is transferred to another inpatient unit, depending on the institutional protocol. It is usually recommended that the patient be restricted to bed for a period of 1 to 4 hours after removal of the introducer with the use of an occlusion device, and 4 to 8 hours if manual compression is done (Kohlman-Trigoboff et al., 2020).

Another study demonstrated that the removal of the introducer 3 hours after the procedure obtained lower bleeding rates compared to another study with early removal of the introducer. It also concluded that following an evidence-based guide when removing an arterial introducer significantly decreases the number of post-procedure adverse events. It is noteworthy that in this study the removal of the introducer was made after the evaluation of the activated coagulation time (Parach et al., 2018).

The nurse essentially needs to evaluate the patient before and during the removal of the introducer and the performance of the compressive dressing. The removal of the femoral vascular introducer after a few hours of intervention is beneficial because it provides time for the reduction of the effects of antithrombotic drugs administered peri procedure (Feres et al., 2017).

After removal of the femoral introducer, it is recommended to keep the patient on bed rest with extended lower limbs for the duration of the antithrombotic or antiplatelet regimen with glycoprotein IIb/IIIa inhibitor (Feres et al., 2017). Continuously, complete multiparametric monitoring is essential for the prevention of cardiac or renal complications, as well as the assessment of the level of consciousness after anesthetic recovery and the level of pain. Evaluation of the puncture site allows the identification and prevention of vascular complications (Kohlman-Trigoboff et al., 2020).

Also, the nurse should pay attention to the patient's renal function to prevent the occurrence of Contrast-Induced Nephropathy (CIN). Some of the precautions include venous and oral hydration, observance of water restriction, and monitoring of serum urea and creatinine levels comparing them with values before the procedure (Lima et al., 2019).

4.4 IMPORTANCE OF TRAINING

As found in a previous study, the implementation of a *guideline* describing and guiding the procedure of removal of the vascular introducer in a hemodynamics unit obtained positive results, reducing the number of hemorrhage events and complications such as pain and urinary retention after the procedure (Parach et al., 2018).

Guidelines are scripts that guide clinical practice. They are based on the available scientific evidence and provide subsidies for iatrogenic-free care. In this context, SOPs (Standard Operating Procedures) emerge, which are standardized ways of performing a certain procedure within a health institution (Parach et al., 2018).

The implementation and use of standardization of care aim to reduce the number of adverse events, reduce costs and increase the efficiency of in-hospital care. This is only possible through the involvement and adherence of the team in the training processes, either in the POP of the institution or in self-training through *guidelines* and guidelines, based on scientific evidence (Feres, 2017; Parach, 2018).

Corroborating this fact, we highlight the PN No. 1 of July 2015 of the CoFEn, which, among other measures, mentions that the nurse professional has to have scientific and theoretical competence to perform the removal of the vascular introducer, and this item is acquired only through adequate training (CoFEn, 2015).

5 FINAL CONSIDERATIONS

Nursing plays a fundamental role in the care of patients undergoing endovascular procedures in the hemodynamics sector. Its role encompasses complex and essential care for the maintenance of life and progression of patient treatment. The patient submitted to the CAT has integral demands that require the attention of the nurse and begin in the moments preceding the procedure, and may extend for days after the percutaneous cardiovascular procedures.

Regarding the removal of the vascular introducer, the professional has legal support for the performance of the technique, observing the prerequisites of practical and theoretical knowledge.

New devices are constantly introduced to the market, which can improve the service provided. However, this requires continuous updating and study of the nurse to maintain the quality of the work. The use of national and international guidelines can provide valuable knowledge on how best to proceed, as well as improve clinical reasoning and decision-making skills.

Moreover, considering the low number of recent articles published in Brazil related to the role of nurses in the care of patients undergoing CAT, as well as in the removal of introducers, and considering the speed with which changes occur in clinical practice, it is perceived how important it is to carry out new studies that can deepen scientific knowledge about nursing care. Future research that brings new data on patient safety when submitted to the removal of the introducer by the nurse, or that discusses the different devices available in the market, would be useful for the health system as a whole, professionalizing the performance of the procedure and providing solid and updated bases for nursing care within the hemodynamics sector, in the removal of the vascular introducer and the performance of the occlusive dressing.

REFERENCES

Amoras, T. S. G., Rêgo, H. C., Menezes, C., Formigosa, J., & Santos, E. (2020). Avaliação do tempo porta-balão como um indicador da qualidade assistencial. *Revista de Enfermagem UFPE on line*, *14*(0), Article 0. https://doi.org/10.5205/1981-8963.2020.243995

Bianco, H. T., Povoa, R., Izar, M. C., Luna Filho, B., Moreira, F. T., Stefanini, E., Fonseca, H. A., Barbosa, A. H. P., Alves, C. M. R., Caixeta, A. M., Gonçalves Jr, I., Moraes, P. I. de M., Lopes, R. D., Paola, A. A. V. de, Almeida, D., Moises, V. A., Fonseca, F. A. H., Bianco, H. T., Povoa, R., … Fonseca, F. A. H. (2021). Acurácia da Redução do Segmento-ST Pós-Trombólise como Preditor de Reperfusão Adequada em Estratégia Fármaco-Invasiva. *Arquivos Brasileiros de Cardiologia*, *117*(1), 15–25. https://doi.org/10.36660/abc.20200241

Butcher, H.K., Bulechek, G.M., Dochterman, J.M., Wagner, C.M. (2018) *Nursing interventions classification (NIC)* (7th ed.). St. Louis: Elsevier.

Córdova, E. S. M., Santos, L. R. dos, Toebe, D., Moraes, M. A. P. de, & Souza, E. N. de. (2018). Incidência de complicações hemorrágicas com o uso de pulseira de compressão radial: Estudo de coorte. *Revista da Escola de Enfermagem da USP*, 52. https://doi.org/10.1590/S1980-220X2017041003410

Feres, F., Costa, R. A., Siqueira, D., Costa, J. R., Chamié, D., Staico, R., Chaves, Á. J., Abizaid, A., Marin-Neto, J. A., Rassi, A., Botelho, R., Alves, C. M. R., Saad, J. A., Mangione, J. A., Lemos, P. A., Quadros, A. S., Queiroga, M. A. C., Cantarelli, M. J. C., & Figueira, H. R. (2017). DIRETRIZ DA SOCIEDADE BRASILEIRA DE CARDIOLOGIA E DA SOCIEDADE BRASILEIRA DE HEMODINÂMICA E CARDIOLOGIA INTERVENCIONISTA SOBRE INTERVENÇÃO CORONÁRIA PERCUTÂNEA. *Arquivos Brasileiros de Cardiologia*, 109, 1–81. https://doi.org/10.5935/abc.20170111

Herdman, T.H. (2022) *Diagnósticos de Enfermagem da NANDA-I (2021-2023)* (12 ed). Porto Alegre: Artmed.

Jakobsen, L., Holm, N. R., Maeng, M., Thim, T., Kristensen, S. D., Mogensen, L. H., & Christiansen, E. H. (2022). Comparison of MynxGrip vascular closure device and manual compression for closure after femoral access angiography: A randomized controlled trial: the closure devices used in every day practice study, CLOSE-UP III trial. *BMC Cardiovascular Disorders*, 22(1), 68. https://doi.org/10.1186/s12872-022-02512-0

Kim, S.-H., Behnes, M., Baron, S., Shchetynska-Marinova, T., Tekinsoy, M., Mashayekhi, K., Hoffmann, U., Borggrefe, M., & Akin, I. (2019). Differences of bleedings after percutaneous coronary intervention using femoral closure and radial compression devices. *Medicine*, 98(20), e15501. https://doi.org/10.1097/MD.0000000000015501

Kohlman-Trigoboff, D., Rich, K., Foley, A., Fitzgerald, K., Arizmendi, D., Robinson, C., Brown, R., & Treat-Jacobson, D. (2020). Society for Vascular Nursing Endovascular Repair of Abdominal Aortic Aneurysm (AAA) Updated Nursing Clinical Practice Guideline. *Journal of vascular nursing: official publication of the Society for Peripheral Vascular Nursing*, 38(2), 36–65. https://doi.org/10.1016/j.jvn.2020.01.004

Lima, V. C. G. S., Queluci, G. D. C., & Brandão, E. D. S. (2019). Cuidados de enfermagem ao cliente pós-angioplastia transluminal coronariana. *Revista de Enfermagem UFPE on line*, 13(3), 732. https://periodicos.ufpe.br/revistas/revistaenfermagem/article/viewFile/236601/31570

Ministério da Saúde. (2021). Principais causas de morte. Recuperado em 29 de agosto, 2021 de http://svs.aids.gov.br/dantps/centrais-de-conteudos/paineis-de-monitoramento/mortalidade/gbd-brasil/principais-causas/

Moreira, M. L. A. P., Mizuno, E. W., & Meireles, G. C. X. (2017). Consulta de enfermagem pré-cateterismo cardíaco e intervenções coronárias percutâneas. *Revista de Enfermagem UFPE on line*, *11*(6), 2548–2556. https://doi.org/10.5205/1981-8963-v11i6a23423p2548-2556-2017

Nascimento, R. K. M., Andrade, K. B. S., Camerini, F. G., Franco, A. S., Marins, A. L. C., & Naves, C. B. de O. C. (2021). Consulta de enfermagem pré-procedimento de cateterismo cardíaco: Avaliação da satisfação do paciente. *Revista Enfermagem UERJ*, *29*(1), 49970. https://doi.org/10.12957/reuerj.2021.49970

Noori, V. J., & Eldrup-Jørgensen, J. (2018). A systematic review of vascular closure devices for femoral artery puncture sites. *Journal of Vascular Surgery*, *68*(3), 887–899. https://doi.org/10.1016/j.jvs.2018.05.019

Paganin, A. C., Beghetto, M. G., Feijó, M. K., Matte, R., Sauer, J. M., & Rabelo-Silva, E. R. (2018). Vascular complications in patients who underwent endovascular cardiac procedures: Multicenter cohort study. *Revista Latino-Americana de Enfermagem*, *26*. https://doi.org/10.1590/1518-8345.2672.3060

Parach, A., Sadeghi-Ghahroudi, M., Saeid, Y., & Ebadi, A. (2018). The effect of evidence-based care guidelines on outcomes after removal of arterial sheath in patients undergoing angioplasty. *ARYA Atherosclerosis*, *14*(6), 237–241. https://doi.org/10.22122/arya.v14i6.1380

Parecer normativo No 001/2015/COFEN (2015). Participação do enfermeiro nos procedimentos de hemodinâmica mais precisamente na retirada de introdutores vascular. Brasília, DF: CoFEn – Conselho Federal de Enfermagem.

Pereira, A.S., Shitsuka, D.M., Parreira, F.J., Shitsuka, R. (2018). *Metodologia da pesquisa científica*. (1 ed.) Santa Maria, RS: NTE/UFSM.

Petroglou, D., Didagelos, M., Chalikias, G., Tziakas, D., Tsigkas, G., Hahalis, G., Koutouzis, M., Ntatsios, A., Tsiafoutis, I., Hamilos, M., Kouparanis, A., Konstantinidis, N., Sofidis, G., Pancholy, S. B., Karvounis, H., Bertrand, O. F., & Ziakas, A. (2018). Manual Versus Mechanical Compression of the Radial Artery After Transradial Coronary Angiography: The MEMORY Multicenter Randomized Trial. *JACC. Cardiovascular Interventions*, *11*(11), 1050–1058. https://doi.org/10.1016/j.jcin.2018.03.042

Rother, E. T. (2007). Revisão sistemática X revisão narrativa. *Acta Paulista de Enfermagem*, *20*, v–vi. https://doi.org/10.1590/S0103-21002007000200001

Santos, A. N., Marins, A. L. C., Cardoso, R. B., & Camerini, F. G. (2020). Eventos adversos identificados em pacientes submetidos à coronariografia e angioplastia. *Rev. Pesqui. (Univ. Fed. Estado Rio J., Online)*, 977–983.

Santos, S. M. dos, Rabelo-Silva, E. R., Aliti, G. B., Romero, P. S., Corrêa, C. L., Valle, F. H., Gonçalves, S. C., Wainstein, M. V., & Wainstein, R. V. (2018). Dois métodos de hemostasia após cateterismo transradial: THEMATIC - protocolo de ensaio clínico randomizado. *Revista Gaúcha de Enfermagem*, *39*. https://doi.org/10.1590/1983-1447.2018.2017-0257

Sartori, A. A., Gaedke, M. Â., Moreira, A. C., & Graeff, M. dos S. (2018). Diagnósticos de enfermagem no setor de hemodinâmica: Uma perspectiva adaptativa. *Revista da Escola de Enfermagem da USP*, *52*. https://doi.org/10.1590/s1980-220x2017006703381

Silva, M. A. dos S., Marques, P. T. V., Castro, D. F. A. de, Padula, M. P. C., Yano, K. T., Coimbra, A. L. de L., & Carmo, V. L. do. (2016). Relação entre orientação, ansiedade e dor em pacientes submetidos ao cateterismo cardíaco / Relation between orientation, anxiety and pain in cardiac catheterization. *Arquivos Médicos dos Hospitais e da Faculdade de Ciências Médicas da Santa Casa de São Paulo*, 28–34.

Walter, J., Vogl, M., Holderried, M., Becker, C., Brandes, A., Sinner, M. F., Rogowski, W., & Maschmann, J. (2017). Manual Compression versus Vascular Closing Device for Closing Access Puncture Site in Femoral Left-Heart Catheterization and Percutaneous Coronary Interventions: A Retrospective Cross-Sectional Comparison of Costs and Effects in Inpatient Care. *Value in Health: The Journal of the International Society for Pharmacoeconomics and Outcomes Research*, *20*(6), 769–776. https://doi.org/10.1016/j.jval.2016.05.004

Yee, J., Kumar, V., Li, S., Petraskova, T., Pham, A., Stys, J., Thompson, P. A., Petrasko, M., Stys, A., & Stys, T. (2018). Clinical factors associated with physician choice of femoral versus radial access: A real-world experience from a single academic center. *J Interv Cardiol*, 236–243.