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COMPLICATIONS IN THE POSTOPERATIVE PERIOD OF CARDIAC SURGERY – A SCOPING REVIEW

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Abstract: Introduction: Cardiovascular diseases continue to be the main cause of death in Portugal. People undergoing heart surgery face a high risk of developing postoperative complications, with a significant impact on their quality of life. Nurses play a key role in this context, directly contributing to achieving health gains with interventions designed to control and prevent complications. **Objectives:** The objectives of this study were to identify complications associated with the postoperative period of cardiac surgery and map nursing interventions aimed at their prevention or control. **Methodology:** As a research question: "What are the complications associated with the postoperative period of cardiac surgery and the associated nursing interventions?" This was a review with a similar approach to the Scoping Review in which five scientific studies were analyzed using the acronym PCC. The studies were selected from the CINAHL Complete and MEDLINE Complete databases, among articles published between 2020 and 2023. **Results:** The selected articles identify complications and discuss interventions (autonomous and interdependent), promoting practices to be applied in clinical reality. The surgeries most referenced in the articles include myocardial revascularization, replacement of the mitral valve, aortic valve, and tricuspid valve, and correction of thoracic aortic aneurysm. We identified pain, ventilation, sleep, infection, and heart rate as focuses of nursing. Interventions such as the use of night eye masks, bupivacaine infiltration, and breathing exercises can have significant benefits for users. **Conclusion:** The studies highlight the importance of nursing practice. Considering the specific characteristics of users undergoing cardiac surgery, we understand that the nursing process and its interventions can improve quality of life, with individualized care aimed at the person as a whole.

INTRODUCTION

The Portuguese population, according to the Order of Nurses (OE) (2022), is aging, which implies a significant emphasis on cardiovascular diseases, influenced by contemporary lifestyles. Given this demographic reality and technological advances in cardiology, there is an urgent need to reorganize health services to meet the new demands of informed and demanding users. Furthermore, the OE (2022) highlights that cardiovascular diseases remain the main cause of death in Portugal, especially in people with multiple risk factors and frequent use of multiple medications. These people are also frequent users of health services, both in primary and hospital care. Therefore, considering the complexity of these diseases, it is crucial to adopt a multifactorial approach and integrate healthcare to adequately care for these people.

Intensive care, as described by OE (2018), is multidisciplinary and specialized, acting in the prevention, diagnosis, and treatment of potentially reversible acute conditions in people with imminent or established failure of one or more vital functions.

The World Health Organization (WHO) (2008, p.4) defines a quality health service as one that effectively organizes resources to meet the health requirements of those most in need of preventive and curative care, safely and without waste. Nurses, as established in the statutes of the OE (1998) (DL 104/98) and in the Professional Code of Ethics (DL 156/2015, article 97), have the responsibility to exercise the profession with appropriate scientific and technical knowledge, adopting measures to improve the quality of nursing care and services.

Aiming to identify the main complications and interventions in the postoperative period of cardiac surgery, we seek to apply the best care throughout the patient's journey, from hospitalization to return to daily life. It is essential to adopt a person-centered approach (PCA), demonstrating the importance of the relationship with the user, planning quality care, and identifying the characteristics and skills of the nurse. Nursing practice is guided by regulations and specific legislation, which guarantee the quality, effectiveness, and efficiency of the services provided, as described in the National Plan for Patient Safety 2021-2026 (DGS, 2023).

During the life cycle, human beings face challenges and changes that require adaptation and mobilization of resources to maintain health and well-being. In cases of transition to a critical condition that requires care in an intensive care unit (ICU), it is crucial to monitor and support the user's adaptation, as described by the theories of Callista Roy and Afaf Meleis. The nurse plays a vital role in this process, establishing a therapeutic relationship with the user and using clinical reasoning to identify and meet their needs (Osorio-Duran et al., 2019).

Nursing interventions are based on clinical reasoning that considers the needs and responses of the person in a critical condition. Caring for a person in a critical condition requires proficiency and autonomy from nurses, who must be able to anticipate adverse events and make decisions based on knowledge and experience. The theoretical framework of nursing metaparadigms by Fawcett identifies the essential elements that influence the experience of nursing care, guiding clinical practice and research (Ribeiro, 2018, p.3).

According to DGS (2023), the occurrence of safety incidents during the provision of healthcare is a reality in modern healthcare systems. Therefore, implementing policies and strategies to reduce these incidents is essential to promote health gains. In the immediate postoperative period of cardiac surgery, users may present hemodynamic instabilities and risks of surgical complications, requiring specific care and appropriate nursing interventions. The research question of this study consists of identifying the complications associated with the postoperative period of cardiac surgery and mapping nursing interventions aimed at their prevention or control, to improve the quality and safety of care provided to these users.

METHODOLOGY

The research question elaborated is presented, based on the PCC mnemonic, the objectives to be achieved, the inclusion and exclusion criteria, the databases used, and the article selection process. This work sought to follow the methodology proposed by the Joanna Briggs Institute (JBI) for a Scoping Review. According to Munn et al. (2022), a systematic review is a type of evidence synthesis that aims to systematically identify and map the breadth of available evidence on a given topic, field, concept, or problem, regardless of the source. A Scoping Review is a useful instrument to map the published literature, clarifying concepts and definitions as well as to gather conceptual maps of the topic, allowing the identification of the type of research and approaches used about the topic and the existing gaps (Peters et al., 2015).

The research question was elaborated using the acronym PCC, which facilitates the formulation of the research question, search, selection, and critical analysis of the identified scientific evidence. According to Munn et al. (2022), P (Population) refers to the set of characteristics of the participants under study, C (Concept) refers to the inclusion of interventions and phenomena of interest, and C (Context) to the clinical context. Therefore,

4

the following research question was developed: "What are the complications associated with the postoperative period of cardiac surgery and the associated nursing interventions? The objectives of the present study were to identify the main complications resulting from cardiac surgery and map nursing interventions based on the scientific evidence produced.

Therefore, Table 1 presents the development of the research question based on the acronym PCC.

P	Population	People undergoing heart surgery
C	Concept	Nursing intervention (control/ prevention) of complications
		Complications after heart surgery
C	Context	Postoperative

Table 1 - PCC mnemonic.

In this way, our population concerns every adult undergoing surgical treatment of diseases and deformities of the heart and vessels, namely the coronary arteries, heart valves, and aorta. Regarding our concept, we focused on the main complications that surgery causes for the person and the interventions to control them, as well as acting on their prevention.

After defining the PCC structure, it is essential to define inclusion and exclusion criteria. Thus, these criteria were drawn up according to participants, interventions, type of study, time limit, and languages, described in Tables 2 and 3.

Population	People undergoing heart surgery
Interventions	Studies that refer to nursing interventions in the management of complications after heart surgery
Time period	Published between 2020 and 2023
Language	Portuguese, Spanish, and English
Design	Primary, quantitative, and observational studies
Others	Studies available in full-text

Table 2 – Inclusion criteria

Population	Pediatric context
Concept	Studies that refer to interventions that are exclusively carried out by other health professionals
Context	Studies that present results exclusively in the preoperative context

Table 3 – Exclusion criteria

The Scoping review was carried out through bibliographic research from April 11 to May 25, 2023, on the EBSCOhost platform selecting the CINAHL Complete database and on Medline through the Pubmed platform. In this way, we operationalized the proposed methodology through the search for scientific descriptors in CINAHL and scientific descriptors in the Medical Subject Headings (MeSH) library in Pubmed, intending to identify the respective keywords and formulate a search strategy based on the PCC mnemonic, using the Boolean operators "AND" and "OR" and using the necessary truncations to obtain a comprehensive search, as specified in Tables 4 and 5. Taking into account the specificity of each database, the search expression is appropriate to the descriptors used in each of these.

The search was restricted to the title and abstract level ("Title/Abstract") to increase its specificity. After the search, 29 articles were found in CINAHL and 74 in Medline, via Pubmed. After applying the language and time restriction filters, from 2020 to 2023, as explained above, we obtained the final 8 articles. After the search, all identified references were inserted into reference management software (Mendeley® V1.19.8), with the respective removal of duplicates (n=0). Non-unanimous decisions were discussed among the authors, and doubtful cases were re-analyzed and decided by consensus regarding the inclusion of the articles. After completing this process, five articles were included in the Scoping Review.

Survey ID number	Search strategy	Results
S6	S1 AND S2 AND S3 AND S4 Limit to: - Publication date: 20200101- 20221231; - Language: English, Portuguese, and Spanish	4
S5	S1 AND S2 AND S3 AND S4	29
S4	MH Postoperative Complications OR TI complications OR AB complications	286,062
S3	MH Nursing Interventions OR TI (Nursing care OR nursing practice) OR AB (Nursing care OR nursing practice).	105,844
S2	MH Postoperative OR TI ("Postoperative" OR "Postoperative Period" OR "Postoperative Care") OR AB ("Postoperative" OR "Postoperative Period" OR "Postoperative Care")	115,763
S1	MH "heart surgery" OR TI ("Coronary Surg*" OR "Thoracic Surg*" OR "Cardiac Surg*" OR "Cardiovascular Surg*" OR "Heart Surg*") OR AB ("Coronary Surg*" OR "Thoracic Surg*" OR "Cardiac Surg*" OR "Cardiovascular Surg*" OR "Heart Surg*")	21,899

**Table 4** – Search strategy in the CINAHL Complete database via EBSCO.

Survey ID number	Search strategy	Results
S6	S1 AND S2 AND S3 AND S4 Limit to: - Publication date: 20200101- 20221231 - Language: English, Portuguese, and Spanish	4
S5	S1 AND S2 AND S3 AND S4	74
S4	(("Postoperative Period"[MeSH Terms]) OR ("Postoperative"[Title/Abstract]) OR "Postoperative Period"[Title/Abstract] OR ("Postoperative"[Title/Abstract]))	286,062
S3	(Postoperative Complications[MeSH Terms]) OR (Complications[Title/Abstract])	1.403,273
S2	(("Nursing care"[MeSH Terms]) OR ("Nursing Interventions"[Title/Abstract]))	637,605
S1	(("Thoracic Surgery"[MeSH Terms]) OR ("Coronary Surg*"[Title/Abstract] OR "Cardiac Surgical Procedures"[Title/Abstract] OR "Cardiac Surg*"[Title/Abstract] OR "Cardiovascular Surg*"[Title/Abstract] OR "Heart Surg*"[Title/Abstract]))	40,954

Table 5 – Search strategy in the Pubmed search engine.

Title	Author (s)	Country/Year	Type of Study
C1 – Risk factors for mediastinitis in the post-operative period of heart surgery.	Débora Ferreira da Cruz; Elbanir Rosangela F. da Sousa; Claudia Elizabeth de Almeida	Brazil / 2020	Descriptive quantitative study
P2 – Effect of eye mask on pain and sleep quality in patients undergoing cardiac surgery: A randomized controlled trial.	Ghada Shalaby Mahran; Matthew J. Leach; Mostafa Samy Abbas; Ahmed Mohamed Ghoneim	Egypt / 2020	Randomized controlled trial
P3 – Bupivacaine infiltration for acute post-operative pain management after cardiac surgery	Manuel Luque Oliveros; Rubén Morilla R. de la Olsa	Spain / 2021	Non-randomized experimental design
C4 – Perioperative risk factors for new-onset post-operative atrial fibrillation among patients after isolated coronary artery bypass grafting: A retrospective study	Hong Jae Choi; Eun Ji Seo; Jae-Sung Choi; Se Jin Oh.	Korea / 2021	Retrospective study
C5 – Application of breathing exercises using Ida Jean Orlando`s dynamic nurse-patient relationship model in overcoming post-operative hypoxia (POH) after coronary artery bypass grafting: A case-series	Ismai Fahmi; Elly Nurachmah; Hermin Esti Dianingtyas; Musaddad Kamal; Amelia Ganefianty	Indonesia / 2022	Observational study

Table 6 – Selected articles.

The article inclusion process is systematized in a PRISMA flowchart format:
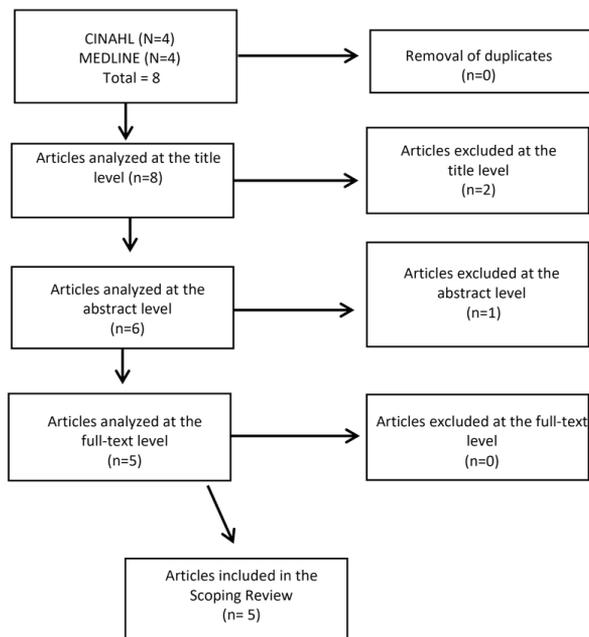
Figure 1 – PRISMA flowchart for article selection (prepared by the authors).

The selected articles were identified by the letters "C" or "P", according to the database that was selected, CINAHL Complete or MEDLINE-PUBMED, respectively. A brief presentation of the selected articles can be found in Table 6.

After selecting the studies, a rigorous analysis of their data was carried out, which is required in scoping reviews, to provide a logical and descriptive summary of the results that respond to the objectives and research question. In general, objective details and type of study, results and discussions, and conclusions were extracted from each study.

The extraction tool used, made available by JBI, is modified according to the needs encountered during the data extraction process of each study.

RESULTS

The results identified in the analysis of the articles are presented in order to group and characterize the evidence found, providing an initial basis for discussing the literature mapped in our research.

The selected articles answered our research question, identified complications, and approached nursing interventions, promoting them as practices to be used in clinical reality. The articles are distributed across four continents, which may be important for us to understand, at a cultural level, that the data, when transposed, to work carried out in Portugal, may carry bias at the level of clinical practice.

We have two articles from the Asian continent, one article from the African continent, another from the European continent, and another from South America.

The sample of article P1 consists of 192 patients and the sample of article P2 corresponds to 80 patients undergoing cardiac surgery. Article P3 is made up of 137 adult patients, a control group made up of 69 patients and an intervention group made up of 68. Article C4 has a larger sample, with 437 patients, while article C5 has only 3.

Regarding the construction of the sample, two characteristics must be present: they must be representative and random. Previously, we identified articles that sought to validate whether the sample size was sufficient to ensure the accuracy of research results: P2, P3, and C4. In article P3, the authors identify that, due to probable human error, they were unable to guarantee the randomization of the study and therefore it is a non-randomized controlled study.

Considering this, the authors report that they followed the methodological index for non-randomized studies and the Joanna Briggs Institute's critical assessment checklist for quasi-experimental studies.

The sample selection was carried out according to the characteristics of each study. Each article presents the inclusion and exclusion criteria; however, the articles that used records/documentary research (C1 and C4) faced some difficulties: the way the records were made, the quality of the information, and the lack of information.

In most studies, the people involved gave their informed consent with the exception of articles C1 and C4 because, due to the retrospective nature of the studies, the data were analyzed anonymously and confidentiality was maintained. Articles P2, P3, and C4 used the IBM SPSS (Statistical Package for the Social Sciences) software to organize and process the data. Article C1 organized and processed the data using EXCEL and Article C5 did not present this information.

Despite identifying different focuses of nursing, the sample of 5 articles mostly presents aspects in common, namely, male people, over 45 years old and with common pathologies: diabetes mellitus, hypertension, excess weight (BMI > 25kg/m^2), and smoking.

Regarding the representativeness of the sample, only one of the studies tested the suitability of the sample for the population under study. One of the articles presents only three patients for the study, calling into question the representativeness/adequacy of the results, Article C5.

Studies C1 and P2 were carried out with people undergoing cardiac surgery, respectively, in a Cardiology ICU of a hospital in Rio de Janeiro and an ICU of a hospital in Egypt. The P3 study was developed in a Spanish university hospital with patients undergoing scheduled or non-urgent surgery for valvulopathy or myocardial revascularization via median sternotomy with cardiopulmonary bypass. Studies C4 and C5 were conducted with patients undergoing 40 myocardial revascularization surgeries; C4 in a university hospital in South Korea, and C5 in an ICU of a hospital in Indonesia. The five selected studies were published between 2020 and 2022. The articles are descriptive observational studies - C5, analytical observational studies - C1, C4. Articles P2 and P3 are experimental studies.

As for the type of investigation, the studies follow a quantitative approach. The five articles present differences, both in terms of research and data processing. In the treatment and measurement of results, only articles P2, P3, and C4 presented statistical inference tests, for which they determined the statistical significance of a result - for the value of $p<0.05$.

Regarding data collection instruments, article P2, to assess pain, used the Visual Analogue Scale (VAS), and, sleep quality was assessed by Richards-Campbell Sleep Questionnaire (RCSQ). Article P3, which also assessed pain, used the numerical scale. Article C4 used the NYHA - New York Heart Association heart failure classification as a criterion and, to evaluate risk factors, it considered the Acute Physiology And Chronic Health Evaluation (APACHE II) index.

The focuses of nursing identified in the articles were pain, ventilation, sleep, infection, and heart rate. P2 and P3 addressed pain and one of them addressed pain with sleep deprivation and respective interventions following the context. Another article addressed breathing exercises and the effectiveness of the nurse-patient relationship on adherence, another article addressed the risk of infection and finally atrial fibrillation (AF) after myocardial revascularization.

In line with our objectives, the interventions identified are distributed between autonomous and interdependent ones. Texts C1 and C4 presented the interventions as a result of the risk factors that were identified. The authors indicate the ideal time for intervention and the role of nurses but do not describe

Study	Objectives	Population	Comorbidities
C1 – Cruz, Sousa & Almeida (2020)	Identify risk factors; Characterize population; Analyze the relationship between risk factors and the incidence of mediastinitis	Total: 192 Gender: male 69.80% Age: >50 years 80.25%	BMI > 25kg/m² – 55.73 %; Diabetes Mellitus; Smoking; COPD; Chronic kidney disease; Vascular disease.
P2 – Mahran et al. (2020)	Examine the effect of eye masks; Evaluation of the use of eye masks and the significant improvement in postoperative pain and sleep quality	Total: 70 Gender: male 51.55% Age: 45 to 49 years.	Diabetes mellitus
P3 – Oliveros, Luque & Romero (2021)	Evaluate the effectiveness of surgical wound infiltration with 0.5% bupivacaine	Total: 137 Gender: male 62.04% Age: no data	No data
C4 – Seo et al. (2021)	Investigate preoperative risk factors for the occurrence of AF after myocardial revascularization surgery	Total: 327 Gender: male 71.60% Age: >60 years 72.20%	Hypertension; Diabetes mellitus; Chronic kidney disease; COPD
C5 – Fahmi et al. (2022)	Describe the application of respiratory exercises in hypoxia (…) using the dynamic nurse-patient relationship model by Ida Jean Orlando	Total: 3 Gender: male 100% Age: 56 to 57 years	Obesity; Smoking

Table 7 – Population characterization.

the intervention. Article C1 states that the identification of factors can contribute to the development of mediastinitis prevention strategies, as well as to the implementation of nursing care both pre- and post-operatively of cardiac surgery. Article C4 highlights that the findings can help health professionals develop strategies to prevent postoperative AF during the perioperative period and improve the quality of care provided.

Articles P2, P3, and C5 applied interventions and the results that affected their reading and interpretation. Articles P2 and P3 divide the sample into two groups: a control group and an intervention group, and analyze the results following the interventions that were applied. Article C5 applies the interventions to a group of three patients. Article P2 applied the interventions over three nights. Patients were divided into the control group and intervention group using the closed envelope method. The control group received routine care during the night: reduction of light, noise, and awakenings to take medication. Patients from both groups had an indwelling urinary catheter in situ.

The intervention group received single-use eye masks during nighttime sleep on all three nights of the experimental period. Patients were instructed to use the mask correctly. During hospitalization in the ICU, nurses assisted patients with eye masks from 9:00 pm to 7:00 am the following morning. Regarding the pain, in article P2, the researchers used the same standardized anesthesia technique for all patients in the study. In article P3, patients were divided into two groups: an intervention group that received local subcutaneous infiltration of 0.5% bupivacaine (10mL) at the edges of the surgical wound. In the control group, infiltration was carried out, in the same location and with the same amount of saline solution. All patients received the same preoperative care and teaching to reduce anxiety levels.

Bupivacaine was infiltrated by the surgeon in the operating room after thoracic suturing. All surgical wounds were closed using the same techniques and materials. The standard postoperative analgesic protocol was one gram of intravenous paracetamol for all patients. All received the same anesthetic

protocol. The numerical pain assessment scale was applied 2 hours (h), 12h, 24h, and 48h after surgery. All patients were evaluated at rest and during exertion, such as walking, coughing, or bathing. Through analysis of the article, we were unable to identify whether pain assessment and other interventions were carried out by the nursing team. The authors of article C5 divided interventions into primary interventions; breathing monitoring; performing breathing exercises, and support interventions; monitoring acid-base balance.

The exercises were performed using incentive spirometry four times a day, 15-20 minutes per session during three days of intervention. Patients were placed in the semi-Fowler position, holding the respirometer in a vertical position. The researcher guided and taught the patient the correct way to use spirometry.

The communication process was divided into two categories: automatic action and deliberative action. When a deliberative action took place, the patient's immediate need was met after validation and discussion between the nurse and the patient. Meanwhile, when an automatic action occurred, the patient's need was met without any discussion or input from the patient.

The interventions were carried out by three nurses specializing in the cardiovascular field and a consultant doctor from the ICU. Table 7 provides a summary of the results in terms of characterizing the population that took part in the study of each article. The comorbidities identified are transversal to all articles, with only one of the articles that do not address this item.

Articles C1, P2, and C5 refer to health control and education by nurses within the scope of prevention and health education. The surgeries most referenced in the articles were Myocardial revascularization, replacement of the mitral valve, aortic valve, and tricuspid valve, and correction of thoracic aortic aneurysm. One of the studies does not differentiate the type of cardiac surgery, only referring to the sternotomy surgical approach.

According to the type of study, each article related the data collected with the context in which it took place, the period of analysis, namely, surgery time, hospitalization time, use of mechanical ventilation and the time the person was ventilated, participants and dropouts during data collection, medication, and analgesia. In the articles with an intervention group and a control group - P2 and P3 - the authors specified how the distribution between groups was made and described how the interventions were applied. As a whole, the articles addressed different complications and interventions, except for articles P2 and P3 which addressed the same nursing diagnosis, pain. In article P2, the intervention tested was an autonomous intervention, while in article P3, the interventions were interdependent.

The authors of article P3 assume that the intervention depends on the joint action of the medical team and nursing team, but leave to the consideration that the intervention may be promising if used in conjunction with other nursing interventions. Article P2, in addition to evaluating the effectiveness of a non-pharmacological intervention for pain, also sought to validate its effectiveness for the focus of nursing on sleep. It relates the two focuses, assuming, based on the results presented, that there is a significant negative correlation between pain assessment and sleep assessment, when the intensity of pain decreases, the quality of sleep improves. Regarding article P3, which focuses on pain, the results demonstrate that the infiltration of 0.5% bupivacaine into the surgical wound showed statistically significant pain relief compared to the control group, in addition to reducing SOS analgesia.

Considering article C4, the authors assume in the study objectives that the incidence of AF is high after myocardial revascularization surgery and, therefore, intend to know what the risk factors are pre-, intra-, and postoperatively. Based on the data collected, where they compare two groups of patients: a group that presented AF in the postoperative period and a second group that did not present AF, the authors identified the following risk factors in the preoperative period: history of stroke (26.9% versus 13.2% with a p= 0.003), history of depression (19.4% vs. 3.0% with a p=0.014), and comorbidities such as hypertension (82.8% vs. 67.9% with a p= 0.007), and COPD (18.2% vs. 3.8% with a p = 0.020). The intraoperative risk factor identified was the use of IABP (11.8% versus 3.8% with p= 0.007).

For the postoperative period, risk factors were evaluated according to the score obtained on the APACHE II scale. The authors concluded that patients who presented AF in the postoperative period had a higher score on the scale than the group that did not present AF (72.% versus 54.3% with a p= 0.003). Concluding the results of this article, the authors suggest that the occurrence of AF in the postoperative period was significantly associated with factors such as advanced age, history of stroke and depression, COPD, comorbidities, and use of IABP intraoperatively.

Along with article C4, which sought to identify the risk factors for AF, article C1 also sought to identify pre- and postoperative risk factors for infection at the site of the surgical wound, mediastinitis. Contrary to article C4, a control group was not used to check for relationships, the article analyzed patients who presented mediastinitis and identified the predictive factors. Therefore, for the authors of article C1, sex, age, obesity, diabetes mellitus, and smoking are factors, inherent to the patient, and predictors for developing mediastinitis after heart surgery.

At the same time, the article also pointed out other associated factors, such as the use of a mammary artery graft, the use of mechanical ventilation for more than three days, and surgical re-approach. Finally, article C5 describes breathing exercises as an effective intervention based on the nurse-patient relationship by Ida Jean Orlando. The authors of the article recognize that it is a small sample (three people), but they extrapolate the results into recommendations, indicating that breathing exercises can prevent pulmonary atelectasis and hypoxia, and that, when performing the exercises, the professional should make use of approach to the dynamic model of nurse-patient relationship, as this model presupposes psychological and physical changes in patients. Likewise, it also supports the importance of implementing the ERAS (Early Recovery After Surgery) protocol, developed to improve treatment results, based on perioperative care processes (Fahmi, 2022).

DISCUSSION

In article C1, the authors suggest that the identification of risk factors can contribute to the development of mediastinitis prevention strategies, as well as the implementation of nursing care both pre- and postoperatively to lower the incidence of this type of infection.

The authors of article P2 indicate that the use of nighttime eye masks can help improve sleep quality, as well as contribute to a reduction in reported pain and the need for analgesia. The intervention can be applied by nurses in a complementary way to other interventions that aim to optimize the patient's comfort and well-being.

Article P3 justifies the topic as a highly important area of nursing practice-pain management. Even though it is an

interdependent intervention, the results obtained demonstrate a statistically significant pain relief compared to the control group; thus, according to the authors, the results could constitute an important therapeutic tool in clinical nursing practice and can be applied alone or together with autonomous interventions.

Article C4 identifies the predictive factors for the occurrence of AF in the postoperative period, with statistical significance: advanced age and diseases related to aging, but adds, at the level of information, that stroke and COPD compete with the remaining factors for the risk of AF, results that corroborate previous studies. Therefore, this study also served to validate the research carried out previously. In addition to the identification of risk factors, the authors launch, for future studies, the validation of other results that emerged within the scope of this study: the history of depression before surgical intervention, factors such as unrefreshing sleep, and the use of IABP. For nursing, the authors point out that the possibility of using monitoring means that detect AF early and act beforehand, developing AF prevention strategies and improving the quality of care provided, is most valuable.

Finally, article C5, based on its objective- to describe the application of breathing exercises - recommends that intervention with the patient is based on the application of the nurse-patient relationship model, as it improves the quality of nursing care and promotes psychological and physical changes in patients.

We found a Scoping Review during our search, which identified the following as the main complications: infectious, neurological, cardiovascular, renal and urinary, respiratory, digestive, and hydroelectrolytic. Based on the articles analyzed, we have mediastinitis (infection), which represents 28.57% of total infectious complications, AF, which represents 23.81% of total cardiovascular complications, pain, and sleep, which represents 9.52% of total neurological complications and hypoxia, which represents 9.52% of respiratory complications (Neto, Melo, Dantas & Costa, 2021).

Pain is one of the main causes of human suffering and interferes with the physical and psychosocial well-being of those who experience it. The approach and management of pain were, for this reason, considered a priority in the provision of health care, being a decisive factor in the humanization of care (Sousa, 2015). As nurses, it is important to recognize that the sensation of pain has behavioral and emotional signs and responses. Bertolini (2021) also states that not managing pain has an impact on improving the patient's health status and disposition, since intense pain reduces the patient's satisfaction and availability, in turn delaying the beginning of walking, and may be associated with the development of chronic postoperative pain (Huang & Sakata, 2016).

Poorly controlled pain is associated with the activation of the sympathetic nervous system and consequently leads to an increased hormonal response to stress. This response may contribute to multiple postoperative adverse events, including myocardial ischemia, cardiac arrhythmias, hypercoagulability, pulmonary complications, and increased rates of delirium and surgical wound infection (Huang & Sakata, 2016). In the case of our object of study, cardiac surgeries are considered major surgeries that "generate an acute pain response due to incision and tissue dissection, use of drains and invasive devices and their management can lead to vascular, respiratory and even psychological complications, such as insomnia" (Bertolini, 2021, p.27). Article P2 makes this connection between pain and sleep quality. During the

postoperative period, patients report greater pain complaints when drains are present, initially, when they are removed, and at the incision site. This pain is closely associated with chest movement, such as: getting up and coughing. The use of chest drains after myocardial revascularization is essential to prevent pleural effusion, pneumothorax, and hemothorax and, therefore, is necessary to guarantee cardiac and pulmonary functioning (Bento & Cruz, 2019).

Article P3, within the scope of the discussion of the results, identified several studies that sought to highlight the effectiveness of the use of bupivacaine, namely an article from 2015, called "The analgesic efficacy of continuous presternal bupivacaine infusion through a single catheter after cardiac surgery", authored by Nasr (2015), cited by Oliveros (2021), which corroborates the results found. In our search, we found a text by Huang and Sakata (2016) - "Pain after sternotomy - review", with 36 patients undergoing cardiac surgery and who received treatment with 0.25% bupivacaine, and 0.5% bupivacaine for 48 hours after surgery, with improvements in pain control and less postoperative morphine consumption. The authors concluded that continuous infusion of 0.5% bupivacaine is effective in reducing the intensity of postoperative pain, as well as reducing the need for supplementation with opioids.

In addition, a review of the literature by Bertolini (2021) corroborates the results on the use of bupivacaine "Pharmacological and non-pharmacological interventions adopted for postoperative pain management in patients undergoing myocardium revascularization surgery: an integrative review", in which the author concluded, after analyzing several articles: "Anesthetic techniques (...) perioperative parasternal block with levobupivacaine proved to be effective and allowed a reduction in the use of opioid drugs,

but they require further studies to ensure the advantages of this type of analgesia" (Bertolini, 2021, p.70).

This conclusion is in line with the results obtained in article P3. In article P2, as we mentioned previously, in addition to demonstrating the importance of controlling pain, they establish a relationship with sleep quality. The authors indicated a negative relationship between the two variables; when pain decreases, sleep quality improves. Heart surgery and admission to an ICU are predictors of poor sleep quality. Several procedures, the number of professionals and equipment, end up altering the circadian cycle, generating an impact on the patient's health condition: increased blood pressure, emotional changes, and healing problems with the surgical wound (Brandão, 2021). Therefore, the importance of nursing care in managing the environment at night is extremely important to reduce interruptions during the sleep cycle.

Article P2 concludes that the use of nighttime eye masks can help improve sleep quality in postoperative cardiac patients. According to the authors, after using nighttime eye masks, a significant reduction in pain intensity was achieved and the result of the intervention suggests that the use of nighttime eye masks can be included as a safe and effective complement for postoperative pain control and optimize patient comfort (Mahran, 2020). The article by Trama, Esteves and Silva, (2022), "Nursing in humanized assistance in an adult intensive care unit", corroborates the results of article P2, as they also divided the sample into two groups: control and intervention; the intervention group received earplugs and eye masks, and presented results that showed better sleep quality.

The role of nursing involves not only interventions but also the assessment of the ICU environment, which is not ideal for

providing the rest and environment necessary for restful sleep. Therefore, and according to the results produced, nursing interventions involve the adoption of strategies to promote sleep, such as: promoting the circadian rhythm, in the absence of pain/promoting comfort, optimizing the care environment, ventilation optimization, care management, emotional support, and alternative and complementary therapies (Arantes, 2022, p. 58). About these results, the evaluation of effectiveness in practice, to improve the quantity and quality of sleep of patients, is not always consensual (Trama et al., 2022, p.8).

Another complication addressed in one of the articles was infection. Article C1 addressed the risk of infection at the surgical site - sternotomy. The article aimed to identify risk factors to prevent infection. The results proved useful for anticipating potential intra- and postoperative complications, for example, smoking habits - nicotine delays the healing of primary wounds and/or hyperglycemia that promotes the proliferation of pathogens, impairing the function of neutrophils. Concerning nursing care, the results of this article are important for interventions in terms of health education and for intra- and postoperative monitoring interventions, such as the control of blood glucose levels.

Recent studies reinforce the importance of identifying the profile of patients undergoing cardiac surgery, to anticipate potential complications, this is the case with this integrative review from 2022 when describing the profile of patients who developed surgical site infections after cardiac surgical treatment, Most conditions could be prevented through simple actions, including preoperative bathing, antibiotic prophylaxis, glycemic control, smoking management, reducing hospital stay, nasal decolonization and other safe surgery strategies (Fiorin et al., 2022, p.8).

Another study analyzed "Surgical Site Infection in Cardiac Surgery", authored by Zukowska and Zukowski (2022), and suggested that infection control must take into account the following factors before surgery: poor nutritional status, hypoalbuminemia, glycemic control, and obesity. It also proposes the resolution of all infections involving systems and organs outside the cardiovascular system, reduction or cessation of smoking habits at least thirty days before the procedure, and pulmonary physical therapy and respiratory etiquette. For the authors, these factors are potential risks of postoperative infection and sternal dehiscence. Besides the modifiable risk factors, article C1 also addressed other factors such as the use of the mammary artery in the bypass procedure, preoperative length of stay in the ICU, use of mechanical ventilation in the postoperative period lasting more than three days, and surgical re-approach.

Interventions are outlined from pre- to post-operative. And because it is a continuous process, it makes sense for us, in addition to identifying risk factors, to refer to interdependent and autonomous interventions that promote safe practices and reduce the risk of infection. Standard 020/2015 updated on 17/11/2022 called "Surgical Site Infection Prevention Bundle" presents a set of interventions that provide for controlling the risk of infection and that must be applied systematically and uniformly.

AF is presented in article C4 as a postoperative complication and the authors propose to investigate perioperative risk factors for the development of AF in the immediate postoperative period. As it is a frequent complication in the postoperative period of heart surgery, it is extremely important to know the predictors of the occurrence of AF, anticipate its occurrence, and minimize complications of morbidity, mortality, and difficulty in recovery (Santos

et al., 2022). In this way, Santos et al. (2022) also state that the performance of combined procedures, such as MRS and valve surgery, is associated with the development of AF, as well as other factors such as time of aortic clamping during bypass, use of cardioplegia, and use of IABP as mentioned in article C4.

No studies were addressing the correlation between AF and stroke; however, several articles refer to this association. Article C4 refers to stroke as a predictor factor in the preoperative period, as both share the same risk factors such as age and central pathophysiology, but also corroborates that further studies are needed to identify this correlation in post-cardiac surgery. Another risk factor identified by article C4 is a previous history of depression because symptoms of depression are strongly associated with heart disease; however, it should be noted that existing studies before this investigation do not identify an association.

In article C5, the authors suggest that pulmonary complications - hypoxia - after cardiac surgery have an incidence of 2-4%. According to Neto et al., (2021), the main complications were: pleural effusion and respiratory failure. Hypoxemia only accounts for 9.52% of the total 100% of pulmonary complications. It was very difficult to find articles that corroborated the results of article C5. In the articles we analyzed, for other complications, hypoxia appeared associated, for example, with COPD. The authors of this article wanted to validate the results of the added value of applying spirometry exercises, contradicting the results of other investigations that do not validate the application of these same exercises to improve hypoxia. Based on the findings of the articles analyzed in the context of hypoxia, breathing exercises, despite little evidence of their effectiveness, have benefits in involving the patient in their recovery, involving them

in the process through the adoption of habits that strengthen the respiratory muscles.

This work on the respiratory muscles is essential in the postoperative period because it trains and exposes the patient to exercises that will undo the posture of sternotomy pain protection and activate the muscles that were relaxed during the period of bed rest (Kotta & Ali, 2021).

When conducting this study, we identified some limitations that impacted the production of the content presented. Firstly, our search was restricted to two databases, which may limit the scope of the information obtained. Additionally, we imposed a time limit, including only articles published from 2020 onwards, which may have excluded relevant work prior to that date. Finally, there was a linguistic restriction, considering only articles in certain languages, which may have led to the exclusion of important studies published in other languages.

CONCLUSION

Taking into account what was exposed in this study to answer our research question, the main complications found were infectious (mediastinitis), neurological (pain and sleep), cardiovascular (atrial fibrillation), and respiratory (hypoxia) complications. In line with clinical practice, the complications identified are in line with the literature found, and there are specific protocols to prevent their emergence. Despite advances in cardiac surgery and perioperative and postoperative care, postoperative complications remain frequent, leading to a substantial increase in mortality among patients undergoing these surgical procedures.

In most of the articles analyzed, the patient improved with the proposed interventions, improving their recovery in the focuses of nursing: pain, sleep, and hypoxia. This avoids the increase in opioid analgesia and

the return to the operating room, with the inherent reduction in associated costs and comorbidities. Considering the specific characteristics of post-cardiac surgery patients, we can understand that the nursing process and its interventions allow for improving the patient's quality of life in the postoperative period, since the nurse, as a health professional, who has a close relationship with the patient receiving care, must provide individualized and planned nursing care.

In summary of the articles analyzed, the preliminary results are promising, since the identified nursing interventions, which can be applied, isolated, or together, could constitute an important tool for this area of clinical nursing practice. The findings can also help nurses develop risk factor prevention strategies in the perioperative period to improve the quality of postoperative care. In this way, there is an opportunity here to develop and implement Guidelines / Protocols in the ICU, and in the course of this work, the training of health professionals within the scope of these results. In conclusion, it is important to note that reflection on the adoption of evidence-based practices by nurses becomes essential for the provision of quality care, promoting user safety and health gains.

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