

Evaluating the Impact of Nursing Interventions in Postoperative Settings

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Abstract: Background: Postoperative critical care for cardiac surgical patients refers to the specialized care provided to patients in the intensive care unit (ICU) after they have undergone heart surgery. This care is designed for nurses to monitor and support the patient's recovery and may include a variety of interventions and treatments. **Objectives:** This systematic review aimed to identify the roles of nurses in postoperative critical care for cardiac surgical patients, considering factors that impact the length of stay in ICU, recovery time, the risks of cardiac surgery based on the types of heart surgery, and understanding the link between patients and the management of medical resources. **Methods:** To identify relevant studies, we utilized electronic databases such as PubMed, SCOPUS, Web of Science, and Springer. The search strategy involved using free-text terms related to the title and objectives of the study to retrieve articles from databases. We restricted our search to include only research published in journals subjected to peer review between June 2015 and December 2022. This time frame best reflects the evolution of treatment options, known risk factors, and technological advances in the medical field. Our initial search of four databases yielded 60,3080 papers. We then chose the most relevant papers by title and abstract. We accepted 20 papers, this collection includes case-control studies, randomized controlled trials studies, meta-analyses, and review studies. **Results and conclusion:** We observed that the postoperative roles of nurses in critical care for cardiac surgery patients contribute to minimizing the risk factors of cardiac surgery, mitigating the potential effects of cardiac surgery, adequate management of patients and resources in the hospital, and immensely contributing to the length of stay of patients in the ICU.

Keywords: cardiac surgery, postoperative critical care, length of stay, roles of nurses, intensive care unit

1. Introduction

What do we already know about this topic?

Post-heart surgery, patients receive specialized care in the ICU, managed by a team including nurses, doctors, and therapists for close recovery monitoring.

How does your research contribute to the field?

This systematic review identifies nurses' roles, postoperative activities, ICU stay factors, surgery types, and patient-resource links, contributing to a holistic understanding of postoperative care.

What are your research's implications towards theory, practice, or policy?

The study's insights highlight nurses' pivotal role in postoperative care, risk reduction, efficient resource management, and ICU stay.

2. Background

Critical care in cardiac surgery refers to the specialized care provided to patients who have undergone heart surgery and require close monitoring and support in the intensive care unit (ICU) [1]. These patients may have a variety of conditions that require close monitoring, such as heart attacks, heart failure, coronary artery disease, and other cardiac problems. In the ICU, patients will be monitored closely by nurses [2].

Postoperative nursing care for cardiac surgical patients typically involves close monitoring and management of the patient's vital signs, oxygenation, and fluid balance [3]. It may also involve managing pain, administering medications, and providing wound care. In the critical care setting, postoperative nursing care for cardiac surgical patients may involve providing mechanical ventilation, hemodynamic monitoring, and monitoring for complications such as infection or bleeding. The nursing care plan will be tailored to the individual patient's needs and may involve working closely with other healthcare professionals, such as physicians, respiratory therapists, and physical therapists [1], [2], [3].

Table 1: Some specific tasks that may be included in postoperative nursing care for cardiac surgical patients in the critical care setting include:

S/N	Specific Tasks	Definition
1.	Monitoring vital signs and oxygenation levels [4]	This may involve continuous monitoring of the patient's heart rate, blood pressure, respiratory rate, and oxygen saturation levels.
2.	Managing pain [5]	This may involve administering pain medication as prescribed and using non-pharmacological methods, such as positioning and relaxation techniques, to manage pain.
3.	Providing wound care [6]	This may involve cleaning and dressing the surgical wound and monitoring for signs of infection.
4.	Administering medications [7]	This may involve administering medications as prescribed, such as antibiotics to prevent infection or medications to manage heart rhythm.
5.	Providing mechanical ventilation [8]	This may involve using a ventilator to assist with breathing and monitoring the patient's response to ventilation.
6.	Hemodynamic monitoring [9]	This may involve using specialized equipment to monitor the patient's blood pressure, cardiac output, and other hemodynamic parameters.
7.	Monitoring for early identification and prevention of postoperative complications [9]	This may involve regularly checking for signs of infection, bleeding, or other complications and taking appropriate action if any are detected
8.	Nutrition [10]	Patients may receive nutrition through an IV or feeding tube to help support their recovery.
9.	Physical therapy [11]	Patients may receive physical therapy to help them regain strength and mobility after surgery.

The type of postoperative care a patient needs and the length of time a patient spends in the ICU after cardiac surgery can vary widely depending on the surgery type, the surgery's complexity,

and the patient's overall health condition [12]. In some cases, patients may only spend a few days in the ICU, while others may require a longer stay. The goal of postoperative nursing critical care is to provide the necessary support and monitoring to allow the patient to recover and eventually be transferred to a regular hospital room [3].

Despite the plethora of studies identifying the roles of nurses in postoperative critical care for cardiac surgery patients, there has been no review combining the conclusions reached with regard to the different types of cardiac surgery and factors that can impact the length of stay in ICU, the risks imposed on cardiac surgical patients, the length of time it takes for patients to recover from cardiac surgery, or how this information can be put to use in patient care or in the management of resources. This study aims to address this knowledge gap by reviewing the relevant literature and suggesting directions for future investigation.

3. Objectives

The goal of this review was to identify the roles of nurses in postoperative critical care for cardiac surgical patients, as well as to gain an understanding of the various postoperative activities with respect to factors that impact the length of stay in ICU, recovery time, risks factors of cardiac surgery based on the types of heart surgery and gaining an understanding of the link between patients and the management of medical resources.

Questions

Our rationale for conducting this systematic review was based on the following;

- 1) What are the roles of nurses in postoperative critical care for cardiac surgical patients?
- 2) What factors contribute to a patient's length of stay in the ICU?
- 3) Do any of the selected studies investigate whether or not there is an application that could help improve the understanding of the connection between patients and the administration of medical resources?

4. Methods

Search strategy

The search strategy involved the use of free-text terms related to the title of the study. We also utilized the snowballing search method which involved the use of references from identified studies to find additional relevant studies with the objective of identifying additional studies that may not be captured through traditional free-text search methods by following citation trails. To enhance transparency and completeness of reporting, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) was used to conduct the flow diagram of inclusion and exclusion criteria as seen in Figure 1.

The following free-text terms were used to conduct electronic searches of PubMed, Web of Science (WOS), SCOPUS, and Springer: Roles of nurses in postoperative critical care in cardiac surgery patients, Postoperative activities of cardiac surgery Factors impacting length of stay in ICU, Types of cardiac surgery, and Risk factors of cardiac surgery. The searched terms and results are summarized in Table 2. The bibliographies of the included studies were combed for additional articles not uncovered by the electronic search.

Table 2: Searched terms used in databases

S/N	Keywords	Searched terms	Databases	Searched results
1.			PUBMED	48

	Roles of nurses	Roles of nurses in postoperative critical care in cardiac surgery patients	SPRINGER	7693
			SCOPUS	24
			WOS	6
2.	Postoperative activities	Postoperative activities of cardiac surgery	PUBMED	8482
			SPRINGER	38852
			SCOPUS	2509
			WOS	1370
3.	Length of stay	Factors impacting length of stay in ICU	PUBMED	1621
			SPRINGER	19043
			SCOPUS	21
			WOS	1176
4.	Cardiac surgery	Types of Cardiac Surgery	PUBMED	12771
			SPRINGER	186619
			SCOPUS	15381
			WOS	22351
5.	Risks factors	Risk factors of cardiac surgery	PUBMED	72309
			SPRINGER	156348
			SCOPUS	30931
			WOS	28226

5. Study criteria

The following criteria were used by a panel of three reviewers who are nurses and one anesthesiologist (AA, BB, and ME) to determine which abstracts to include and which to exclude.

Selection criteria

The articles were screened based on duplication, title, abstract, and full text of the publications using the specified selection and exclusion criteria:

- 1) Reported reviews or meta-analyses that included the roles of nurses in postoperative critical care for patients of all age groups who underwent any of the 7 types of cardiac surgeries namely, coronary artery bypass surgery, heart valve surgery, heart transplant, cardiac catheterization, pacemaker or defibrillator implantation, cardiac ablation, heart surgery for congenital heart defects only.
- 2) Reported studies published between June 2015 to December 2022 in the English language
- 3) Reported studies published in peer-reviewed journals from June 2015 to December 2022. We limited our search to this time frame because it best reflects the evolution of treatment options, known risk factors, and technological advances in the medical field [13], [14], [15]. These elements have probably evolved over time. There is a possibility that the recent improvements in perioperative and postoperative care have also contributed to this shift [13], [14], [15]. For this reason, we selected a time frame of 7 years and
- 4) Included studies whose primary objective was to assess the factors that influence the length of time patients spend in the ICU after cardiac surgery.

Exclusion criteria

Studies were excluded if they;

1. Are not published in English language

2. Had no reference to the roles of nurses in postoperative critical care for patients who underwent any of the 7 types of cardiac surgeries namely, coronary artery bypass surgery, heart valve surgery, heart transplant, cardiac catheterization, pacemaker or defibrillator implantation, cardiac ablation, and heart surgery for congenital heart defects.
3. Studies that only look at preoperative or intraoperative variables without considering postoperative variables such as recovery time or ICU length of stay.
4. Duplicate publications or those previously listed in another search database, and publications without the full text

Following the meticulous application of the eligibility and exclusion criteria, the literature screening yielded a final count of 20 research papers

6. Data extraction and quality assessment

We utilized four electronic databases such as PubMed, SCOPUS, Web of Science, and Springer. The search strategy involved the use of free-text terms related to the title of the study. We used a standardized data collection form to gather information from case-control studies, randomized controlled trial studies, meta-analyses, and review studies. Information related to the studies' designs, postoperative nursing activities, patient samples, surgical procedures, ICU stays, recovery times, resource management, and major risk factors like bleeding, infections, anesthetic reactions, stroke, tissue injury, and mortality. 20 papers were eventually accepted after meeting our criteria as seen in Figure 1.

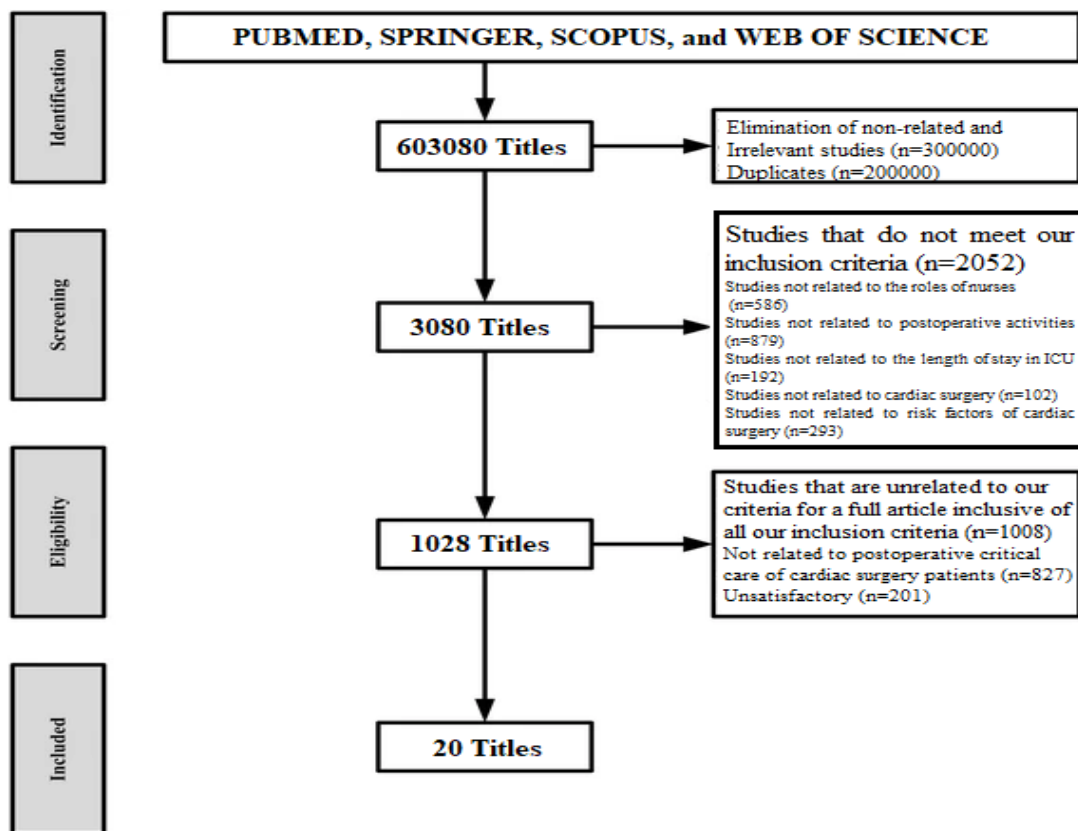


Fig. 1 Search process flow for articles included in the review

We looked for suggestions for managing resources, either individually or in conjunction with patients. In the context of this discussion, we refer to management intervention as any strategy with the goals of improving patient scheduling, reducing the length of time patients spend in the ICU, lowering patient risks, and improving patient flow or resource allocation.

Quality assessment

The paper quality was evaluated by checking that our researchers had accessed relevant material through the Near East University library's online catalog. We went through the articles on the library's website and made sure they met the following standards:

Selection

1. If the samples used in the studies are truly indicative of the population of patients who have undergone cardiac surgery
2. Justified by our inclusion criteria
3. Satisfactory information relating to our inclusion criteria
4. Case-by-case evaluation
5. Double-blind data recording and
6. Correlation self-report

The Near East University library is well-regarded for its extensive collection of scholarly resources, including prominent databases for research purposes. The decision to utilize the Near East University Library's online catalog for quality assessment was based on the rich array of academic materials accessible through this platform. To ensure the comprehensiveness and reliability of our quality assessment, we cross-referenced the resources available through the Near East University library with other reputable databases such as the Willey online library. This triangulation of sources aimed to enhance the robustness of our data collection and analysis.

7. Findings from reviewed studies

The initial search of the four databases we looked at yielded a total of 60,3080 papers. After that, we used the papers' titles and abstracts to determine which were most pertinent. 20 papers were eventually accepted after meeting our criteria. The papers included in this collection are case-control studies, randomized controlled trial studies, meta-analyses, and review studies. Some of the studies have specifically focused on the roles that nurses play in postoperative critical care for cardiac surgery patients, postoperative activities of cardiac surgery, factors that impact the length of stay in the intensive care unit, different types of cardiac surgery, risk factors for cardiac surgery, and studies that improve the understanding of the connection between patients and the administration of medical resources. Reviewed papers that met inclusion criteria have been summarized in Table 3.

Table 3: Studies Summary

S/ N	Refer ence	Ye ar	Num ber of patie nts inclu ded	Cardiac surgery type	Observe d postope rative risk factors of	Observed factors impactin g length of stay in ICU	Postope rative roles of nurses after cardiac surgery	The aver age stay in ICU	Findings
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					cardiac surgery				
1.	[16]	20 22	3476 26	Coronary artery bypass	age	NA	Monitoring of patients	NA	The result of the survey reported a decrease in the observed mortality rate for all procedures, a reduced workload, and adjusted lifestyles due to advanced postoperative activities
2.	[17]	20 22	250	Heart valve surgery	Acute kidney injury,	Acute kidney injury,	Monitoring of vital signs	5 days	Cardiac biomarkers predicted the outcome of cardiac surgery
3.	[18]	20 22	3611	Heart transplantation	hemodialysis,	Stroke, pacemaker insertion, hemodialysis,	Coordinating care with other healthcare professionals	NA	There will be an increase in adult heart transplantation in the United States
4.	[19]	20 21	3127 7	Surgical aortic valve replacement	Bleeding	Bleeding, stroke, cardiopulmonary bypass times	Coordinating care with other healthcare professionals	NA	Results from the survey showed that surgical aortic valve replacement has low levels of complication

									ns and low mortality risk considering both the preoperative and postoperative activities
5	[20]	20 22	NA	Valve surgery	sternal wound infection	Sternal wound infection	Assisting with mobility , monitoring vital signs, coordinating care with other healthcare professionals	NA	A clear difference between the preoperative and postoperative quality of life was reported in elderly people who underwent valve surgery
6.	[21]	20 22	NA	Coronary artery bypass graft surgery	sternal wound infection	sternal wound infection	Assisting with mobility , monitoring vital signs, coordinating care with other healthcare professionals	NA	The findings of this study reported an improvement in health-related quality of life after coronary artery bypass surgery.
7.	[22]	20 22	313	Cardiac surgery	delirium	delirium	Coordinating care with other healthcare		The results indicated that postoperative delirium is a major risk factor

							professionals		that can contribute to a decrease in the quality of life, and functional/cognitive abilities in patients after 3 years of cardiac surgery.
8.	[23]	2022	616	Heart valve surgery	Cardiac arrest	Cardiac arrest, pacemaker implantation	Monitoring of vital signs		Reported cardiac arrest as a risk factor for heart valve surgery
9.	[24]	2022	61	Cardiac surgery	VAP infections	VAP infections, acute kidney injury, nasal feeding	Coordinating care with other healthcare professionals	28	Ventilator-associated pneumonia (VAP) is a risk factor for cardiac surgery patients
10	[25]	2020	946	cardiac surgery	VAP infections, congested heart failure, preoperative glucose levels, blood transfusion, hypertension	VAP infections,	Coordinating care with other healthcare professionals	30	VAP is associated with cardiac surgery

1 1	[26]	20 19	2215	Coronary artery bypass	Increase d glucose	Increased glucose,	Monitoring of vital signs	NA	Increased glucose is associated with coronary artery bypass
1 2	[27]	20 22	564	Infra inguinal revascularization	Preoperative hemoglobin, Surgery stress, blood transfusion	blood transfusion, anemia, surgical stress	Coordinating care with other healthcare professionals	30	Blood transfusion, anemia, and other comorbidities and surgery stress as some of the complications resulting prolong stay in ICU after cardiac surgery.
1 3	[28]	20 18	NA	Cardiac surgery	Acute kidney injury	Acute kidney injury	Coordinating care with other healthcare professionals	NA	Acute kidney injury as a complication impacting the length of stay in the ICU after cardiac surgery
1 4	[29]	20 16	NA	Cardiac surgery	age, atrial fibrillation, cardiac arrhythmia, low ejection fraction	obstructive pulmonary disease, heart failure, renal dysfunction, severe pain	Monitoring of vital signs	NA	Advanced age, atrial fibrillation, cardiac arrhythmia, obstructive pulmonary disease, heart failure, low ejection fraction, renal dysfunction,

									non-elective surgery status, and severe pain are common factors that impact the length of stay in the ICU
15	[30]	2022	196	Cardiac surgery	venous catheters infection	venous catheters infection	Providing wound care, Educating the patient and their family	10	Early postoperative interventions of nurses in the ICU reduces complications and length of stay in the ICU
16	[31]	2022	NA	Invasive surgeries	anxiety, depression, sleep disturbance	Delirium, depression	Educating the patient and their family	NA	Psychological issues such as anxiety, depression, delirium, sleep disturbance, etc. can be alleviated by the postoperative roles of nurses.
17	[32]	2022	NA	Surgery	Reintervention	post-operative complications	Educating the patient and their family, Coordinating care with other	NA	Nurses' involvement and experience in AI-based medical technology is a method of delivering

							healthcare professionals		advanced care to patients
18	[33]	2022	356	Implantable cardioverter defibrillator	Inappropriate shocks, induced ventricular arrhythmias	NA	Monitoring of vital signs	NA	Safety in extravascular implantable cardioverter defibrillator
19	[34]	2020	149	Heart transplantation	bacterial infection	bacterial infection	Providing wound care, Coordinating care with other healthcare professionals	NA	Multidrug-resistant organisms is a burden to patients who underwent heart transplant.
20	[35]	2022	NA	Thoracic aortic surgery	Reoperation	post-operative complications	Close monitoring	NA	strategies for improving quality of life of patients who will undergo thoracic aortic surgery

We have classified the study into 4 categories in this present section. The categories encompass the way this review is sectioned to answer the questions, considering the types of cardiac surgery, the risk factors of cardiac surgery, the factors impacting length of stay in ICU, postoperative activities of cardiac surgery, and the role of nurses in postoperative critical care in cardiac surgery patients.

Nurses' approaches to cardiac surgery types

Cardiac surgery is a type of surgery that is performed on the heart or the blood vessels surrounding the heart. It is typically performed by a team of surgeons, cardiologists, and anesthesiologists [36]. There are several types of cardiac surgery, including:

1. Coronary artery bypass surgery: This surgery involves bypassing a blocked coronary artery using a blood vessel taken from another part of the body, such as the leg or chest. The blood vessel is used to create a new route for blood to flow to the heart [16].
2. Heart valve surgery: This surgery involves repairing or replacing a damaged heart valve. Heart valves can become damaged due to conditions such as heart disease, infection, or injury [17].
3. Heart transplant: This type of surgery involves replacing a damaged or diseased heart with a healthy heart from a donor [18].
4. Cardiac catheterization: This procedure involves inserting a thin tube (catheter) into a blood vessel and threading it through the body to the heart. It is used to diagnose and treat certain heart conditions [18].
5. Pacemaker or defibrillator implantation: This surgery involves implanting a device that helps regulate the heart's rhythm. A pacemaker is used to treat slow heart rhythms, while a defibrillator is used to treat fast, irregular rhythms [33].
6. Cardiac ablation: This procedure involves destroying or removing heart tissue causing abnormal electrical signals. It is used to treat certain types of arrhythmias (irregular heart rhythms) [37].
7. Heart surgery for congenital heart defects: This surgery is used to repair or correct heart defects that a person is born with. These defects can include heart structure or function problems [38].

The majority of the studies reported decreased risk factors following the roles of nurses in managing postoperative cardiac situations. A study by [16] targeted coronary artery bypass surgery. The outcomes of surgical operations after the postoperative activities of involved hospital management in the UK over the period of 15 years dating from 2002 to 2016 were reported in this study. The study used validated data acquired from the National Institute for Cardiovascular Outcomes Research. The data collected totaled 347626 coronary surgical procedures. The average age considered was 66 years. Their workload, risk factors, emergency health cases, other comorbidities, and mortality cases after the surgery within these 15 years were considered. The result of the survey reported a decrease in the observed mortality rate for all procedures, a reduced workload, and adjusted lifestyles. The study reported an improved quality of care over the 15 years and also a consistent decline in overall cases of related coronary artery bypass in the UK.

Similarly, [19] reported outcomes of people who underwent surgical aortic valve replacement between April 2013 and March 2018 in the UK, and compared with transcatheter aortic valve implantation. About 31277 patients were included in the study. Their demographics, preoperative and postoperative risk factors, mortality rate, and operative data were all included as criteria for the review. Results from the survey showed that surgical aortic valve replacement has low levels of complications and low mortality risk considering both the preoperative and postoperative activities, even though factors like poor functioning of ventricles, emergency operations, higher Euro SCORE, and cardiopulmonary bypass times affected the outcomes. We further observed similar reports from other reviewed studies, [20], [21], [35], [39], [40], [41] as a result of the advanced postoperative activities of nurses and other hospital managing departments.

Postoperative risk factors of cardiac surgery

We observed several potential risk factors that can affect the outcome of cardiac surgery in our systematic review. These include:

1. Age: Older patients may be more at risk for complications due to their age and potentially underlying health conditions.
2. Pre-existing medical conditions: Patients with certain medical conditions such as diabetes, kidney disease, or lung disease may be at higher risk for complications after surgery.
3. Procedure type: Some types of cardiac surgery, such as valve replacements or coronary artery bypass grafts, may be more complex and have a higher risk of complications.
4. Surgical technique: The skill and experience of the surgical team can also play a role in the risk of complications.
5. Blood loss and transfusion: Blood loss during surgery can increase the risk of complications, as can the need for a blood transfusion.
6. Infection: Infection is a common complication after any surgery, and it can be particularly dangerous in the case of cardiac surgery due to the risk of infection spreading to the heart or other vital organs.
7. Heart attack: There is a risk of a heart attack occurring during or after surgery, which can be life-threatening.
8. Stroke: Stroke is a rare but serious complication of cardiac surgery that can result in significant disability or death.

It's important to discuss these and any other potential risk factors with patients and/or patient relations before any surgery to understand the potential risks and benefits of the procedure.

An independent risk factor called delirium has been reported to contribute to poor quality of life after postoperative activities of cardiac surgery. The study [22] evaluated the influence delirium possesses on the functional and cognitive abilities of patients within 3 to 4 years who underwent cardiac surgery. About 313 patients were included in the study ages 18 years and above. The following factors were considered for their evaluation; (concentration, development of memory problems, confusion, sleep disorders, emotional disorders, nightmares, and mobility. The results indicated that postoperative delirium is a major risk factor that can contribute to a decrease in the quality of life, and functional/cognitive abilities in patients after 3 years of cardiac surgery.

Similarly, a study by [23], reported cardiac arrest as a risk factor for 14 patients amongst 616 patients that were included in the study. The study reported 4 death cases as the endpoint for some patients with such risk attacks, and 10 patients were given permanent pacemaker implantation. 5 out of the 10 patients were further reported dead due to prolonged MODs. Two other studies by [24], [25], reported ventilator-associated pneumonia (VAP) as a risk factor for cardiac surgery. For [24] 61 cases were included in the study of which 34 cases were VAP-infected. While for [25] 57 patients were identified to be VAP infected out of 946 patients. Similarly, [26], [34], [42] are studies reviewed and observed to be associated with postoperative risk factors after cardiac surgery.

Factors impacting length of stay in ICU after cardiac surgery

There are several factors that can impact the length of stay in the intensive care unit (ICU) after surgery or other medical procedures. These include:

1. Type of procedure: Some procedures, such as major surgery or organ transplantation, may require a longer stay in the ICU due to the complexity of the procedure and the need for close monitoring and support.
2. Patient's age and overall health: Older patients or those with underlying health conditions may require a longer stay in the ICU due to their increased risk of complications.

3. **Complications:** The presence of complications, such as infection or organ failure, can extend the length of stay in the ICU.
4. **Recovery progress:** The rate of recovery can also impact the length of stay in the ICU. Patients who are recovering quickly may be able to be transferred to a less intensive level of care more quickly, while those who are not recovering as quickly may need to remain in the ICU longer.
5. **Availability of a hospital bed:** In some cases, the length of stay in the ICU may be extended due to a lack of availability of a hospital bed in a less intensive care unit or on a regular hospital floor.
6. **Insurance coverage:** In some cases, the length of stay in the ICU may be limited by insurance coverage or other financial considerations.

It's important to discuss the expected length of stay in the ICU with your healthcare team to understand the factors that may impact it and to have a general idea of what to expect. Some of the factors impacting the length of stay in the ICU have been reported in a study by [27]. The study reported blood transfusion, anemia, and other comorbidities and surgery stress as some of the complications resulting prolong stay in ICU after cardiac surgeries specifically for infra inguinal revascularization. Similarly, a retrospective study by [28] and [43], reported acute kidney injury as a complication of postoperative risk factors impacting the length of stay in the ICU after cardiac surgery. In addition, a well-detailed systematic review reported other factors that may influence the length of stay in the ICU after cardiac surgery. The study [29] reported the following factors (advanced age, atrial fibrillation, cardiac arrhythmia, obstructive pulmonary disease, heart failure, low ejection fraction, renal dysfunction, non-elective surgery status, and even severe pain [44]) as some common factors that impact the length of stay in the ICU.

Postoperative roles of nurses after cardiac surgery

Performing cardiac surgery is not only difficult, but it also takes a significant amount of time and can be quite traumatic for the patient. The early intervention of nurses' postoperative activities is necessary to manage and mitigate the resulting risks of cardiac surgery. There are several key roles that nurses play in the postoperative care of patients who have undergone cardiac surgery. These roles include:

1. **Monitoring vital signs:** Nurses will closely monitor the patient's vital signs, including blood pressure, heart rate, and oxygen levels, to ensure that the patient is stable and recovering well.
2. **Providing pain management:** Nurses will administer pain medication as needed and help the patient manage any pain or discomfort they may be experiencing.
3. **Assisting with mobility:** Nurses will help the patient get out of bed and move around as soon as possible after surgery, as this can help prevent complications such as pneumonia or blood clots.
4. **Providing wound care:** Nurses will change dressings and monitor the patient's incision for any signs of infection or other complications.
5. **Educating the patient and their family:** Nurses will provide information and instruction to the patient and their family about what to expect during the recovery process and how to care for the patient at home.
6. **Coordinating care with other healthcare professionals:** Nurses will work closely with the patient's surgeon and other members of the healthcare team to ensure that the patient's care is coordinated and that all of their needs are being met.

A study by [30] reported that the early postoperative interventions of nurses in the ICU reduced the complications of cardiac surgery, especially infection-related risks and length of stay in the ICU. Another study by [31] focused on the psychological issues such as anxiety, depression, delirium, sleep disturbance, etc. that patients experience and how the roles of nurses help in alleviating its effects and reducing the length of stay in the ICU. Similarly, nurses' involvement and experience in AI-based medical technology as a method of delivering advanced care to patients were reported in a study by [32]. Another study by [45] reported the importance of nurses' educational needs in managing postoperative activities after cardiac surgery. Also [46] reported the involvement of nurses in monitoring ECG for the early detection of atrial fibrillation.

8. Discussion of findings

1. Cardiac Surgery and Types

Coronary Artery Bypass Surgery: The review highlighted a substantial decrease in observed mortality rates and improved quality of care over 15 years in the UK for patients undergoing coronary artery bypass surgery [6]. The study, encompassing 347,626 procedures, emphasized the positive impact of advanced postoperative activities and a consistent decline in overall cases.

Surgical Aortic Valve Replacement: A similar trend was observed in patients undergoing surgical aortic valve replacement, where outcomes indicated low complication levels and mortality risk [12]. Despite influencing factors like poor ventricular functioning and longer cardiopulmonary bypass times, these findings underscore the success of surgical interventions.

2. Postoperative Risk Factors of Cardiac Surgery

Delirium as a Risk Factor: Delirium emerged as a significant risk factor affecting the quality of life and functional/cognitive abilities of patients post-cardiac surgery [19]. The study emphasizes the importance of addressing postoperative delirium to enhance long-term patient outcomes.

Cardiac Arrest and Ventilator-Associated Pneumonia: Cardiac arrest and ventilator-associated pneumonia were identified as notable risk factors for heart valve surgery and cardiac surgery, respectively [20, 21, 22]. These findings stress the need for targeted interventions and preventive measures to mitigate these risks in postoperative cardiac care.

3. Factors Impacting Length of Stay in ICU After Cardiac Surgery

Complications Leading to Prolonged ICU Stay: Several factors were identified as contributors to prolonged ICU stays after cardiac surgery, including blood transfusion, anemia, comorbidities, and surgery-related stress [26, 27, 28]. Understanding and addressing these complications are crucial for optimizing postoperative care and resource management.

Multifactorial Influences: The comprehensive systematic review reported various factors influencing ICU length of stay, such as advanced age, atrial fibrillation, cardiac arrhythmia, and pain [29]. This multifaceted approach underscores the need for tailored strategies to address diverse patient needs.

4. Postoperative Roles of Nurses After Cardiac Surgery

Comprehensive Nursing Interventions: The review highlighted the pivotal role of nurses in postoperative cardiac care, encompassing monitoring vital signs, pain management, mobility assistance, wound care, patient and family education, and coordination with other healthcare professionals [31, 32, 33, 34, 35]. The collective impact of these interventions is crucial for minimizing complications and optimizing patient outcomes.

AI-Based Medical Technology: Nurses' involvement in AI-based medical technology emerged as a modern and effective approach to delivering advanced care, showcasing the integration of technological advancements in patient management [33].

Educational Needs of Nurses: Recognizing the importance of nurses' educational needs in managing postoperative activities after cardiac surgery, the review emphasizes the ongoing development of nursing skills and knowledge to meet evolving healthcare demands [34].

Early Detection through Monitoring: Nurses' involvement in monitoring electrocardiograms (ECGs) for the early detection of atrial fibrillation demonstrates the multifaceted role of nurses in not only postoperative care but also in the early identification of complications [35].

5. Implications for Theory-Policy and Practice

The findings from this systematic review have significant implications for theory, policy, and practice in cardiac surgery care [47]. The positive trends observed in mortality rates and complication levels suggest the efficacy of advanced postoperative activities, emphasizing the need for continued investment in healthcare resources and training.

Theory

These findings contribute to theoretical frameworks by highlighting the importance of tailoring interventions to specific cardiac surgery types and risk factors. The multifactorial nature of complications underscores the need for a comprehensive theoretical approach to postoperative care [47].

Policy

Policy implications include the need for standardized protocols addressing postoperative complications, as well as the integration of AI-based technologies in nursing practice. These policies should emphasize ongoing education for nurses to keep pace with evolving medical technologies.

Practice

In practice, healthcare professionals should prioritize early interventions, patient education, and collaborative care to minimize postoperative risks. The success observed in certain procedures emphasizes the importance of disseminating best practices across healthcare settings [48].

Limitations

Only studies originally published in English were considered for review. This means that potential studies that met the inclusion criteria but were written in a different language were not considered. Additionally, we did not explicitly include systematic reviews and meta-analysis studies published until the year 2015. Our focus was primarily on primary studies conducted between 2015 to 2022. Although we followed a methodological approach in selecting databases, data extraction, and quality assessment in the interest of transparency and completeness of reporting, expert opinion was not consulted in database development and data extraction. Furthermore, longitudinal follow-up studies were not included in this review. Longitudinal follow-up studies could provide valuable insights into the dynamics of postoperative care and recovery over time. Future reviews could explore the inclusion of such studies to enhance the understanding of long-term outcomes and variations in patient care practices [49][50].

9. Conclusion

Based on our systematic review, we can say that the postoperative roles of nurses in critical care for cardiac surgery patients help reduce surgical risks, lessen postoperative complications,

ensure efficient use of hospital resources, and significantly shorten patients' lengths of stay in the intensive care unit. The process of identifying the risk factors of cardiac surgery and the various risk factors for prolonged length of stay should not be treated in isolation from the intended use of the information gathered. That is to say, it is important to specify why identifying risk factors is useful. This will make it easier to incorporate influential factors into the decision-making process when allocating resources. More investigation is required to establish a causal relationship between variations in hospital resource utilization and management approaches that aim to maximize patient flow. The postoperative roles of nurses in the critical care of patients undergoing cardiac surgery also need further study. It is recommended that registered nurses take on postoperative responsibilities in critical care for cardiac surgery patients because nurses make a significant contribution to the overall health of patients who undergo cardiac surgery.

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