

Coronary Artery By-Pass Surgery -Nurses' Interventions in Post-operative Pain Management

A Scoping Review

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Abstract

Coronary artery by-pass graft (CABG) comes under the most common surgery done all over the world. This surgery includes incisions made by the surgeons, which causes tissue and nerves damage, causes inflammation and pain. Post-operative pain is an inevitable consequence of almost all surgeries. Effective pain management is necessary because it can influence vitals of the patients, can lead to complication, and delay recovery.

The aim of this study is to enhance the knowledge among nurses to effectively improve patient outcome about post-operative pain management after coronary artery by-pass surgery. The scoping review was used as the study methodology and Katherine Kolcabas' theory of comfort has been chosen as a theoretical framework. There were 12 articles in total, which were reviewed for the result. There were three categories made: pain assessment tools, pharmacological intervention and non-pharmacological intervention. The result includes pain assessment tools, nurses' role in pain assessment and administration of pain medicine, non-pharmacological interventions include use of eye mask, music, body positioning, rhythmic breathing and aloe vera gel. As a conclusion, all of these interventions were able to effectively lower post-operative pain and improved patient outcome in CABG patients. As there was lack of studies discovered related to this topic of CABG and nurses' intervention in post-operative pain management, more studies are suggested, especially nurses' role in post-operative pain management among CABG patients.

Language: English

Key Words: Post-operative, pain management, CABG, Nurses' Interventions

Abbreviations:

CABG - Coronary Artery By-pass Graft

VAS - Visual Analogue Scale

VDS - Verbal Descriptor Scale

NRS - Numeric Rating Scale

TPS - Thermometer Pain Scale

DEX - Dexmedetomidine

CPSP - Chronic Post-Surgical Pain

RB - Rhythmic breathing

RCSQ - Richards Campbell Sleep Questionnaire

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1 Introduction

According to International Association for the study of pain (1979) “ Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage ”. Pain can arise from different pathophysiology origins includes nociceptive, neuropathic and nociplastic pain. It can be acute, persistent or chronic pain and relates to the varied and individual experiences of pain while recognising its diversity and complexity with biological, psychological and social factors. (Raja SN, 2020)

Post-operative pain arises due to surgery done in certain part of the body due to cuts, incisions etc. During the surgery the patient is under certain types of analgesic which blocks the nerves which sends signal to brain due to which patient doesn't feels any pain or he/she is kept in deep sleep under observation, but after the surgery when the effect of analgesic starts to decrease patient starts feeling the pain, this this pain can be chronic, acute or persistent. (Gan T. J. 2017)

There are different types of surgery taking place worldwide and post operative pain is common and obvious but in most of the cases severe post operative pain leads to complication as it provokes hypertension, tachycardia which causes anxiety and bleeding on the surgery site and causes obstruction in wound healing process. (Gan T.J. 2017)

The nurse responsible for post-operative care have to assess the intensity and severity of pain by the assessment tools. The goal of the nurse is to lower the patient's pain of the patient and effectively improve patients outcome and in order to achieve this we need to improve and gain new insights in mechanism, techniques and analgesics used for pain relief. We also need to implement evidence based methods in our clinical practices to enhance our knowledge for better result. (Horn, R., Hendrix, JM & Kramer J., 2024)

The author was motivated to choose this topic as a research topic due to post-operative pain experienced by her family members who had cardiac surgery done, which increased her interest in finding out more methods and nursing interventions for post operative pain relief for cardiac bypass surgery patient.

2 Background

In this content author has described and discussed briefly about the bypass surgery, pain, its classification, myths, misconception and evidence of pain. Post operative pain, its assessment, management and interventions.

2.1 Coronary Artery Bypass Surgery

The birth of Coronary Artery Bypass Surgery was in 1960s by Robert Goetz at Albert Einstein College of Medicine in New York by using Rosenak (tantalum) rings. He did many successful surgery previously by his team on dogs but first time they performed in human in 1960s and was successful. (Melly, L., Torregrossa, G., Lee, T., Jansens & Puskas, 2018)

By-pass surgery is a major surgery in which surgeon takes artery from others parts of your body to replace blocked coronary artery in order to restore the blood flow through your heart muscles. Its the most common surgery done every year around the world but recently its occurrence is decreased because now they have more alternative these days or percutaneous coronary intervention (PCI) is preferred, but sometimes if PCI fails or if it cannot be done they prefer bypass graft. (Bachar, B. J., & Manna , B. 2023)

2.1.1 Types

There are two types of Coronary Artery Bypass Graft most commonly used nowadays, on pump and off pump CABG.

2.1.1.1 On Pump CABG

In this On pump CABG surgeon connects your heart and lungs to a machine while performing the procedure and machine does the function of the heart and lungs (Cardiopulmonary bypass). Surgeon joins one end of the grafted vessels to aorta through small incision in it and connects it to the other end to the blocked coronary vessel through a small opening in it. After then function of heart and lungs is restored. (Khan, M.S et al., 2014)

Benefits of on pump CABG is that it provides better and complete revascularisation than off pump CAB. (Khan, M.S et al., 2014)

There are also some disadvantages of this procedure like one can get renal dysfunction, gastrointestinal distress and cardiac abnormalities due to these surgeons look for other options. (Khan, M. Set al., 2014)

2.1.1.2 Off pump CABG

In an off pump CABG surgery is done without using machine to perform work of heart and lungs until surgery is done (Cardiopulmonary bypass) instead heart supplies blood to entire part of the body through out the surgery. Surgeon makes incision in between your sternum to perform the surgery. Suction device is needed to manipulate or control your heart and the bypass graft is joined or placed in the desired place. (Lawton J. S. 2012)

Benefits of off pump CABG is that it avoids complication, less invasive procedure is required, fewer blood transfusion and reduced manipulation of aorta, reduce post surgical cerebral microemboli, better option for atherosclerosis and older patients, decreased level of post surgery inflammatory cytokines and also reduces hospital stay and cost. (Khan, M.S. et al., 2014)

2.2 Pain

The most accepted definition of pain is that it is a sensory and emotional experience associated with potential or actual primary harm. The experience of pain at the individual level is unique; it can be influenced by biological factors, personal beliefs about pain, previous experiences with painful stimuli. (Raja SN et al., 2020)

Because of difference in neuro-endocrine mechanism women requires more analgesia than men. Smokers requires more analgesia compared to non smoker as they metabolise drugs faster than normal. Neurotic person suffers more postoperative pain than less neurotic person. (Gupta A et al., 2010)

2.2.1 Classification of pain

Pain can be classified in two ways nociceptive and neuropathic. According to Hader and Guy (2004) there are three main type of pain.

Nociceptive

There are two origins of this nociceptive pain somatic and visceral.

Somatic - Pain which originates from joint, muscles, bones, skin or connective tissues it is called somatic pain. These types of pain can be localized and characterized by aching or throbbing.

Visceral - When the pain originates from gastrointestinal tract or organs then its called visceral pain. These type of pain localized and characterized by cramping.

Neuropathic

In this types of pain, pain can occur due to injury caused to neuronal transmission or inadequate regulation. Pain can be characterized by the burning sensation or shooting pain, which usually travels down a nerve to the dermatome associated with that particular nerve.

Mixed category pain

These type of pain is when there's a complex mixture of both nociceptive and neuropathic factor. Like nervous system dysfunction can result in subsequent neurogenic inflammation for example migraine. (Gupta, A., Kaur, K. et al. 2010)

2.2.2 Myths, misconceptions and evidence of pain

In this sub chapter author has discussed myths about pain, like perception of an elderly about pain and myths about use of opioid or analgesic for pain management.

2.2.2.1 Pain is a natural part of getting older

Through in- depth interview it was reported that many older people belief that pain is a part of getting older. A patient said that "That's how you know you're alive...you ache". therefore there is misconception about pain but pain is not the part of ageing. Pain can get reduced or improved over time or it can be worsen it depends upon the pathophysiology of pain but not on ageing. (Thielke S, Sale J, et al. 2012)

2.2.2.2 *Prescription analgesics are highly addictive*

Patients usually think that analgesics used as a pain killer are addictive. (Conrardy, M., Lank, P. et al. 2016) The study was conducted to assess the knowledge and belief of patient's about addictive potential of opioid. The data collected from randomized trial investigation was analyzed in order to assess patient knowledge. Qualitative method was used and one hundred and seventy four discharged patient's who were prescribes hydrocodone - acetaminophen for acute pain in emergency ward were investigated through audio phone after 4-7 days of

discharged. Content analysis was done and responses were categorised according to the patients belief about opioid. Yes opioid are addictive (58.7%), no opioid are not addictive (19.5%), I don't know (17.2%) and it depends on condition(4.6%). According to whether or not patients own experience of medicine. Personalized (35.6%) and not personalized (64.4%). There was three themes analyzed: Patients expect to feel addicted when they are addicted, Patients fear of addiction and Side effects effected patients view about addiction. So it was concluded that there is misconception about opioid addiction among patient. Some didn't know and some feared about addiction due to which there is risk of pain management. (Conrardy, M., Lank, P. et al. 2016)

2.3 Post operative pain

Post operative pain are the result of surgical procedures cuts and incisions done to the tissues or organs which causes pain, but pathophysiology of pain is different for and it's consequences are specific. The intensity of pain is different for individual according to their pain tolerance but it can be categorized in two ways chronic and acute post operative pain. (Pogatzki-Zahn, E. M. & Segelcke, et al., 2017)

Postoperative pain should be controlled effectively and as soon as possible, delay or uncontrolled postoperative pain can raise heart rate to the point of tachycardia, reducing blood flow and can even cause cardiac ischemia. For some it can cause shallow breathing which can cause atelectasis, hypoxia, hypercarbia making suitable environment for pneumonia. After all it will cause obstruction in the recovery process. (Moyoral Rojals et al., 2022)

2.3.1 Pain assessment tools

Analgesia nociception index (ANI) is a pain assessment tool which can be used for both intra and post-operative pain assessment. It works by analysing patients heart rate variability. It ranges from 0 (maximum pain) to 100 (no pain). A systematic review and meta-analysis was designed to assess the effectiveness of ANI in measuring intra-operative and post-operative pain in patients undergoing general anaesthesia. They looked for all the studies done prior to May 2023 and they got 962 studies among which 30 were selected for systematic review and 17 for meta-analysis. As a result of this study the use of ANI is valuable for assessing

intra and post operative pain in patient under general anesthesia. (Kim, M. K., Choi, G. J. et al. 2023)

Patients under sedation and mechanically ventilated cannot communicate and cannot inform their nurses about pain they are going through. This post-operative pain if left untreated can result in complications. In order to manage pain, a nurse must know the patients' intensity of pain. A study was done to compare the efficacy of three pain scales Critical-care Pain Observational Tool (CPOT), Non-Verbal Pain Scale (NVPS), and Face, Leg, Activity, Cry, Consolability (FLACC). Pain was measured after suctioning and repositioning. As a result CPOT and NVPS were able to assess pain effectively. (Marmo, L., & Fowler, S. 2010)

2.3.2 Strategies of pain management

Some of the strategies that can be followed by nurses for pain management are exercise or physical activity. Physical activity and exercise can reduce the severity of pain and improve the body function, quality of life and mental health. (Dey & Vrooman, 2023)

2.3.3 Pharmacological intervention

Pharmacological intervention are first and effective method used by healthcare professionals for managing pain. There's no fixed medicine for pain, it's prepared according to the intensity of pain, potential drug interaction, side effects of drugs and according to patients preference, so the pain medicines are tailored according to the patients condition. (Ford, C. 2024)

Analgesics are divided into three parts Non-opioid/Non steroidal anti-inflammatory, opioids and Adjuvants/co-analgesics. Analgesic ladder must be followed for effective management of pain and to avoid overdosing of drugs. (Ford, C. 2024)

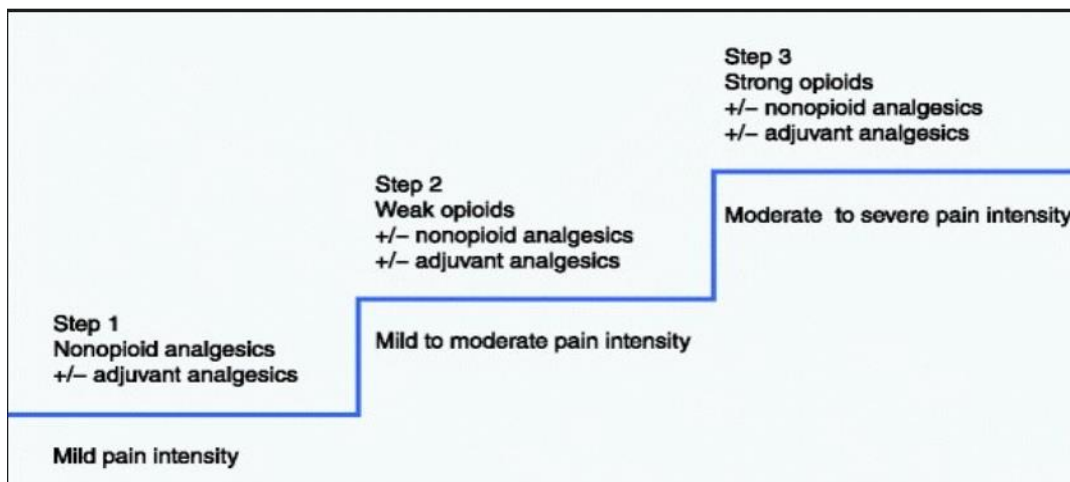


Figure 1. Analgesic ladder (Source: From World Health Organization 2024)

Analgesic ladder recommended by the world health organization explains that, in order to manage post-operative pain, healthcare professionals must follow analgesic ladder. Where the for the mild pain, non-opioid analgesics are started like paracetamol, but if the pain rises to moderate pain intensity then weak opioid are started like codeine in a combination of non-opioid depends on patients condition and types of pain, but if weak opioid fails to manage pain and the pain gets severe, then strong opioid should be started like morphine, which can be in combination of non-opioid. But if the patients pain is severe when first time assessed post-operatively, then it should be started with strong opioid and slowly go down the ladder to weak opioid and then non-opioid as the pain decreases. (Gupta & Bha, 2016)

Multi-modal analgesia is considered as a significant advancement in post-operative care, it aims to reduce pain and prevents chronic post-operative pain. Multi-modal analgesia is tailored individually, as there are factors such as patients age, gender, weight, substance used disorder can influence the effectiveness of multi-modal analgesia. While planning for multi-modal analgesia, types of surgery should be considered. One example of multi-modal analgesia is the combination of dexketoprofen and trometamol showed effective reduction of post-operative pain. Dexketoprofen trometamol is an anti inflammatory drug which has been proven to be safe and effective in reducing acute pain. Its dosage are adjusted according to the perception of pain. Its side effects are similar to NSAIDS. It is available in both oral formulation and parenteral form. (Moyoral Royals et al., 2022)

Gabapentin is primarily used as a medication for seizures but its effectiveness in treating different types of pain such as neuropathic and inflammatory pain. A systematic review was conducted to evaluate effectiveness of gabapentin in post-operative pain management and as a result it proved to be an effective medication for post-operative pain management. (Hurley, Cohen, Williams, Rowlingson & Wu, 2006) Pregabalin is another type of antiepileptic drugs used for treatment of seizure. But it also causes effect on neuropathic pain. A study found out that pregabalin can be used as an analgesics for pain management. (Moore, Straube, Wiffen, Derry & McQuay, 2009) Gabapentinoids is a combination of pregabalin and gabapentin are administered pre operatively which reduces post operative pain effectively. Gabapentinoids works by binding to α -2 subunit and reduces the release of glutamate which results in inhibition of transmission of pain signal, it also works by activating noradrenergic pathways which also inhibits transmission of pain signal to central nervous system which results in pain relief. Pregabalin has maximum effect in the first hour of post surgery in contrast to effectiveness of gabapentin, but after that their effects are same. (Moyoral Royals et al., 2022)

Tramadol is a pain medication which works by affecting central nervous system. It can work through opioid and also non-opioid mechanism. A research was done to assess the effectiveness of single dose of tramadol on pain reduction before extubation and to reduce morphine usage in CABG patients. Randomized controlled trial method was used and patients were divided into two groups having 30 patients in each groups. Group T patients' got intravenous tramadol in a dose of 1mg per Kg and Group P got just 2ml of saline (strength of 0.9%). As a result the patients who received a single dose of tramadol had a lower VAS score and had reduction in use of morphine. Hence, tramadol proved to be effective in post-operative pain reduction. (But et al, 2007)

2.3.4 Non - pharmacological intervention

Non - pharmacological intervention are methods or therapies which can be used simultaneously with drugs for pain reduction. A study was conducted in eastern turkey to examine non pharmacological methods used by post surgical patient and to find the relationship between gender and participants clinical characteristics. Cross - sectional and descriptive design method was used. There were 225 patient in public hospital who participated in this study. Data analysis was done and it concluded that majority of patients felt decreasing of pain after using non pharmacological methods like massage, music therapy, prayer, deep breathing etc. So this intervention is relevant. (Arli, S.K. (2023)

There was a literature review conducted in Turkey to identify non-pharmacological methods which can be used by nurses to reduce postoperative pain. The methods are Positioning, relaxations, imagination, hypnosis, exercise, prayer, music therapy and more. These all methods provides distraction from the sense pain to the patients and they feel relaxed, which overall helps stabilize the vital signs of the patient, but the study concluded that due to lack of nurses and their heavy workload they fail to implement these non-pharmacological interventions. But all these interventions can calm down the patient, causing reduction of pain and overall comfort to the patient. (Yaban, Z. S. 2019)

2.3.5 Integrative method intervention

Music and prayer are considered as method of relaxation, music can provide distraction and pain relief, and prayer effects a person psychologically resulting comfort and relief. A study was done to compare effect of listing to music and prayer recitation intra-operatively to reduce post-operative pain. Seventy two Muslim patients were recruited who were under general anesthesia for acute appendicitis requiring open, emergency appendicitises and were divided into three groups. G-A patients who listened to prayer recitation, G-B listened to music and G-C didn't listened to music or prayer. Result was that G-A patients had lower heart rates than G-B and G-C. significant pain reduction was seen G-A but there was no significant difference seen in pain score in G-B and G-C patients. As a conclusion the prayer recitation was able to significantly reduce heart rate and postoperative pain. (Rahman et al., 2018)

3 Aim and Research Question

The purpose of this study is to enhance the knowledge among nurses to effectively improve patient outcome about post operative pain management after coronary artery by-pass surgery.

Research question: What are the nursing interventions in post operative pain after coronary artery by-pass surgery to improve patient outcome and enhance well-being?

4 Theoretical framework

Author has choosen Kolcaba's Theory of Comfort for this study as a framework. This is a middle-range theory. Katherine Kolcaba first developed her theory of comfort in 1990s. The

first and the last thing to consider as a nurse for the patient is comfort of the patient in general. Comfort is an immediate and holistic experience of being strengthened when one's needs are been fulfilled. According to Kolcaba there are three types of comfort that are relief, ease and transcendence. Kolcaba got the idea of these three types of comfort from three early nursing theorist, relief from the theorist Orlando, ease from the work of Henderson and transcendence from Paterson and Zderad. Comfort occurs in four dimensions: physical, psycho-spiritual, environmental and social. Nurses can provide holistic care by assessing comfort needs across these four dimensions. This theory has been widely used among healthcare professionals and for nursing education. It is used by the nurses for patient assessment and for making care plan. (Alligood, 2017, p. 528)

The conceptual framework of Kolcaba's theory of comfort explains that the sum of healthcare needs, Nursing intervention and intervening variables together enhances comfort. Where healthcare need refers to the needs of the patient and family members. The needs can be either of them, combination of them or all of the four dimension of comfort that is physical, psycho-spiritual, environmental and social. As a nurse you must assess all the patient's needs of comfort and how can you address to that. The next is comfort or nursing intervention, which refers to all the tools or interventions which can be used by the nurse in order to meet patients needs. The interventions can be evidence based non-pharmacological interventions, psychological, social, cultural, financial etc. The next comes intervening variables refers to the factors that affects how patients perceive there overall comfort. The factors can be patients' age, gender, past experiences, attitudes, education, finance, their emotional condition and cultural background. These factors affects the patient care plan and its success. Then comes enhanced comfort, when the patients needs are met and they are fully satisfied with the care provided by the nurses or healthcare professionals. Then comes health seeking behaviour which can be categoried in three ways internal, external and peaceful death. Internal behaviour are the metabolism with are ongoing inside the body which cannot be seen such as wound healing. External behaviours are the those which can be felt, seen and measured such as blood pressure. Peaceful death refers to the end of life care where patient seek comfort, minimum suffering and peace during their dying phase. And at last institutional integrity, an institution or healthcare centre follows the ethical guidelines and protocols which aligns Kolcaba's comfort theory such as treating the patient with dignity and respect, encourages effective communication and collaboration among healthcare professionals and provides holistic approach to the patient's comfort. (Alligood, 2017)

5 Method

The author has chosen qualitative study method because it's a naturalistic approach gives broader understanding, explores to deeper knowledge, a flexible approach to data collection and analysis and its material are narrative and subjective.

The qualitative description is a type of qualitative research design which focuses on providing straight forward description, describes a phenomenon in detail, especially related to healthcare and nursing. It seeks to distill the core of people's viewpoints, experiences, or events without going into complex interpretation or analysis. It can be used when a researcher wants to develop and refine the interventions. It can be used in various ways, like an independent research design, a preliminary step before more in-depth qualitative research, or as a qualitative component within mixed-methods research. (Doyle, McCabe, Keogh, Brady & McCann, 2020)

The scoping review is relatively new method. It aims to map the existing literature in a field of interest in terms of volume, nature and characteristics of primary research and it helps to recognize the research gap in existing literature. It provides an overview of large and diverse body of literature pertaining to broad topic. It not only answers the research question but also the procedure of this study method are simpler and it makes it much easier for the reader to understand the research. There are six steps in this study method identifying the research question, study selection, charting the data, collecting, summarising and reporting the result, optimal consultation exercise. (Arksey and O'Malley 2005)

5.1 Identifying research question

This is the first and most important step, which helps the researcher to be on the track or to stay focused on his or her goal through out their research. While selecting the research question you must consider which aspects of your research question is important like prevention or management of pain. (Arksey & O'Malley 2005)

- What are the nursing interventions in postoperative pain after coronary artery bypass surgery to improve patient outcome and enhance well being?

Author mainly wanted to focus on the interventions or management of post operative pain among cardiac surgery patients and as a nurse how they can manage it.

5.2 Study selection

After selecting research question, now you have to find all the primary studies and reviews which will be suitable for answering your research question. Primary studies can be either published or unpublished. In order to get this we can use different sources like electronic database, reference list, relevant organizations and conferences, hand searching of key journal. (Arksey & O'Malley 2005)

In this study, author has used electronic database, websites, journal, the data base which were used are CINHALL, EBSCOhost, Academic search Elite, Pubmed and Medline. The key words which were used are Postoperative pain management and nursing intervention, Coronary artery bypass surgery and postoperative pain management, Pharmacological intervention for postoperative pain management, Non-pharmacological intervention for postoperative pain management, Pain assessment or pain scale and postoperative pain. Only AND was used as a boolean expression while searching for articles. The articles were selected between 2015 - 2024.

Author found in total about 171 articles but only 12 were selected for the review. The inclusion and exclusion criteria was that articles which were in full text only were included, articles which were not so relevant were excluded, articles which suggested further research or investigation at conclusion for more accuracy were excluded, articles with confident and clear result were included. The selection of articles were done by going through the abstract and conclusion of the article.

Author choose this method: (Munn, Z., Peters, M.D.J. et al. 2018)

- To identify types of evidence in a given field.
- To clarify concepts in the literature.
- To examine how research is conducted on certain topic.

5.3 Data collection

For the data collection for this study author used articles which were peer reviewed, scientific articles, English language, full-text articles and recent articles from 2015 -2024. The data based used to find the articles were CINHALL, EBSCO, Academic search Elite, Pubmed and

Medline. Total number of articles were 171 but only 12 articles were selected due to unreliability of the articles.

5.3.1 Prisma Flow Chart

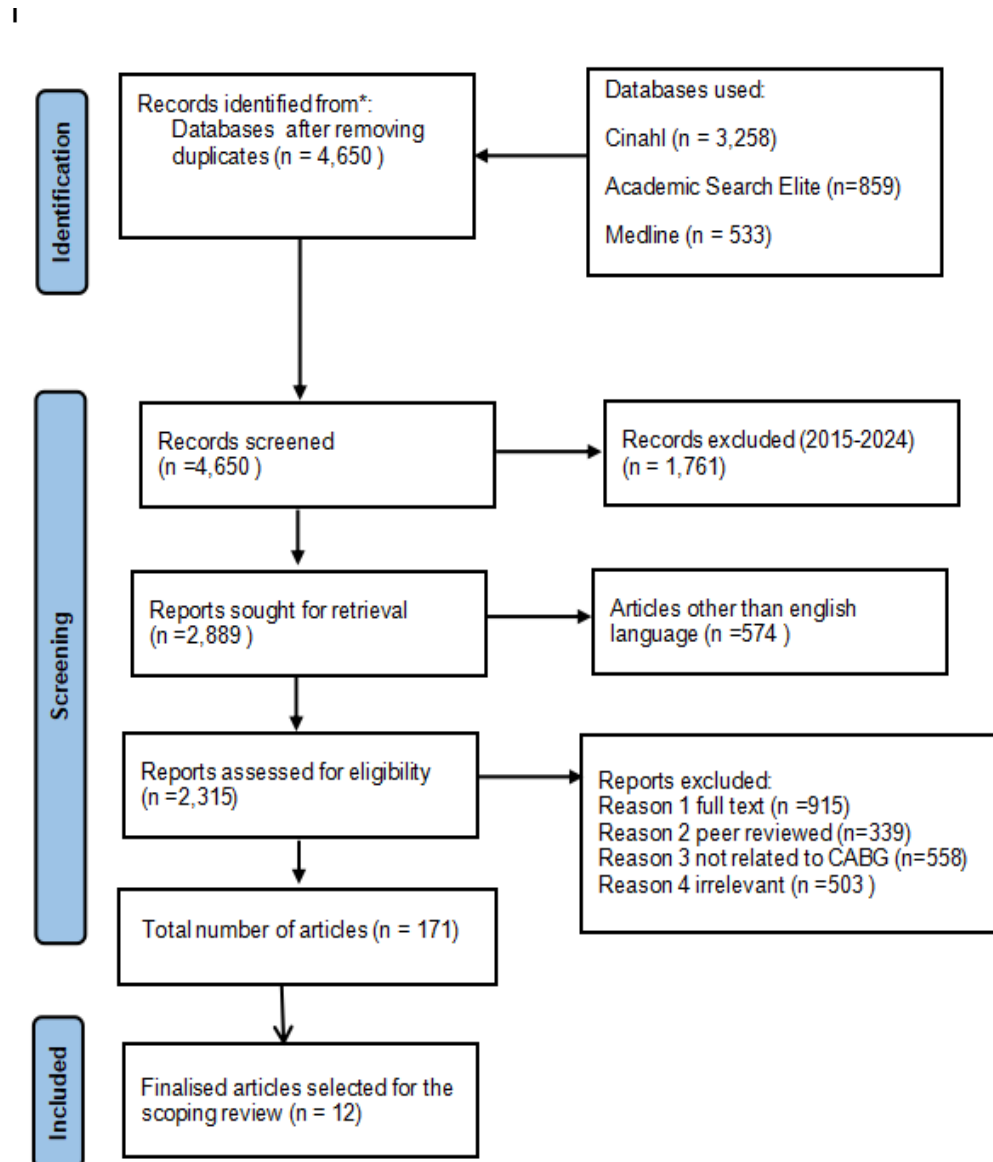


Figure 2. Prisma flow-chart

5.4 Charting the data

In this step all the important findings from primary research reports are mapped. Author will review all the articles and sort into simple categories so it facilitates in assembling the results. (Arkeys & O'Malley 2005)

After going through all 12 articles, the author charted the summary of the articles in appendix. Summary of the articles are reported as name of the author of the article, date of publication, aim of the study, topic of the articles, method, and its result.

5.5 Data Analysis/ content analysis

The purpose of data analysis is to organize, provide structure to and elicit meaning from the data. Researchers using qualitative analysis method typically scrutinize their data carefully by reading it again and again until they are familiarized with it. According to Polit, D. F., & Beck, C. (2010) developing a category scheme is a step where data must be converted into smaller and smaller units so that it can be reviewed and retrieved.

Scoping study method provides an overview of all the selected articles or materials. Since it doesn't try to evaluate the quality of the evidence, it cannot say whether a certain study produces reliable or broadly applicable result. (Arkeys & O'Malley 2005)

In this step all the selected materials or articles were analyzed and read several times and the summary of the outcome was categorized. It was also reviewed by the appointed supervisor. The summary of the result was categorized as pain assessment, pharmacological intervention and non-pharmacological intervention.

5.6 Ethical Consideration

Ethical consideration in research are the set of principles which are used by the researchers as a guide for conducting research. It enables ethical behaviour for carrying out research and implementing findings in practice. (Ingham Broomfield & Becky 2017)

The Finnish National Board has developed the ethical guidelines for studies involving human subject and board of ethics in human science uses them as a guide when conducting ethical reviews. Some general ethical principles which must be followed by the researchers while having human participants are to respect the dignity of the participants which includes right to privacy, right to personal liberty and integrity, freedom of expression, religion, conscience and movement. Researcher must follow the principle of non-maleficence and beneficence which means to cause no risk or harm to human participants, communities or to various other subjects. Instead your research must be beneficial to the community or provide good results. Researcher must be faithful and transparent to the participants, providing reasons and telling the truth behind their every action. Participants are allowed to discontinue

their participation in research if they no longer want to be the part of research at any time they want. All these principles enables fair method of research to be implemented. (TENK, 2019)

Author has tried to follow the guidelines according to the recent updated guidelines for research by board of advisory. As in this study, author chose scoping review method so there was no direct contact with the participants. Author has also followed Novia's instruction and the reference provided after the paragraph is as per Novia's method of writing references. Everything is written in own words, copying text from the articles is avoided to get rid of plagiarism.

6 Result

This chapter unveils the findings from all 12 articles which were selected for the review.

6.1 Pain assessment tools

Visual Analogue Scale is a tool used for pain assessment. VAS is a continuous line having numbers from 1 to 10, where 1 represents no pain and 10 represents maximum pain or most severe pain. Patients are asked to select a number from 1 to 10 according to intensity of pain they have. A cross-sectional study was designed to evaluate it's utility in monitoring and managing postoperative pain following thoracic surgery. In this study patients who underwent thoracic surgery were selected for the study. In total 240 patients participated who were able to communicate, didn't had cognitive impairment and didn't underwent emergency surgery this was the exclusion criteria. Patients were asked to select a number according to their intensity of pain from VAS. As a result their was a gradual decrease in VAS score indicating decrease in the intensity of pain. VAS was evaluated as effective tool for postoperative pain assessment. (Qu et al., 2024)

Analgesic Nociceptic Index (ANI) is a device which uses heart rate variability to find out parasympathetic tone. ANI has scale 0 to 100. When the range is equal to or greater than 50 then it indicates effective analgesia, when its in between 30 to 50 it indicates moderate pain and when its below 30 it indicates severe pain. A study was done to find out efficacy of ANI in pain assessment for conscious, sedated or mechanically ventilated patient who had undergone cardiac surgery. There were 135 patients who took part in this study, they were divided in three group, S0 group who didn't got any cardiac support, S1 group got inotropic

support through dopamine and S2 group got bot inotropic and vasopressor support. As a result of this study ANI was evaluated to be an effective tool for both intra and post operative pain assessment in cardiac surgery patients. (Watson et al., 2024)

The purpose of this descriptive research was to compare the consistency of the four scale in assessing pain level for the first three days after the surgery of the patients who had open-heart surgery. The comparison was done between verbal descriptor scale (VDS), numeric rating scale (NRS), visual analogue scale (VAS) and thermometer pain scale (TPS). (Bas & Ayhan, 2024)

Numeric Rating Scale is mostly used as one-dimensional pain scale. Which has numbers from 0 to 10. Range one to three indicates mild pain, range four to six indicates moderate pain and range seven to ten indicates severe pain. Patients are asked to select a number according to their pain intensity. Higher the number more intense and severe is the pain. (Yvonne D'Arcy, 2011, p. 57)

Verbal descriptor scale is a scale consists words instead of numbers of all stages of pain from no pain to worst pain. At one end of the scale its no pain than mild pain and it continues with moderate pain, severe pain, very severe pain and at the other end worst possible pain. Nurses needs to ask the patient to select one word from the scale which best describes their pain intensity. (Yvonne D'Arcy, 2011, p. 56)

Thermometer pain scale (TPS) is a vertical scale with combination of VDS and NRS. It consists of both numbers and words that describes the pain intensity. It has 0 at the bottom which is blue in colour indicating no pain and 10 on the top of the scale which is in red colour indicating worst possible pain. (Yvonne D'Arcy, 2011, p. 58)

There were 87 patients who participated in this study who had open-heart surgery. Pain assessment was done on the first second and third day after the surgery. As a result all four scales VDS, VAS, NRS and TPS showed similar efficacy and all four scales can be used for pain assessment among the cardiac surgery patients. (Bas & Ayhan, 2024)

6.2 Pharmacological interventions

Dexmedetomidine is a selective alpha agonist which is used for sedation and analgesic effect. A retrospective study was designed to evaluate the effect of dexmedetomidine (DEX) infusion in reduction of morphine consumption and pain reduction. There were 120 patients who had undergone CABG participated in this study. They were divided into two groups,

group 1 included 55 patients who were given DEX infusion (dose 0.2-0.4 mcg/kg/h) and group 2 included 65 patients did not received DEX infusion. The pain was measured immediately after extubation and post extubation for 12 hours. As a result DEX infusion was proved to safe and effective in sedation pain management and also reduced opioid usage. (Hamouda, Ismail, Ibrahim, Ewila & Elmahrouk, 2020)

A research was conducted to identify pharmacological and non-pharmacological interventions which can be used to manage postoperative pain among CABG patients. Pharmacological interventions included methadone, morphine, lidocaine gel, remifentanil, sufentanil and also nefopam were used to identify their efficacy and treatment of post-operative pain. The result was that medications which were used for reducing postoperative pain proved to be reliable and safe, only nefopam which didn't show much benefit in pain relief. (Bertolini et. al., 2024)

Nurses play a crucial role in managing postoperative pain experienced by the patients. They collaborate with other healthcare teams, physicians, pharmacists, surgeons and patients in making care plans. Nurses can effectively manage postoperative pain by administering pain medication at the right time and right dose, constantly monitoring the effect of analgesics on pain intensity and their side effects, taking immediate action on change in pain score according to the medicines prescribed by the physician. Delayed pain assessment or pain medication administration can deteriorate the patient's condition and complications. (Horn, Hendrix & Kramer, 2024)

Similar type of study was done to identify the variables that affect nurses' time to evaluate patients' pain before providing acute post-surgical pain relief. The most effective approach for nurses to manage postoperative pain is by administering analgesics on a planned, PRN basis, by assigning duties, simplifying procedures, keeping a check on activities in real-time, and including physicians, nurse leaders to enable quick responses on the pain experienced by the patients. (Manworren & Atabek, 2021)

A qualitative research was conducted with an open-ended reply to the questionnaire, the aim of the study was to find nursing intervention to avoid Chronic Post Surgical Pain (CPSP) by describing the obstacles and the opportunities that nurses see in present time. There were 10 nurses taken for the interview who were from different clinical setting. According to their point of view early intervention would be possible if primary care pain management nursing staff would had prominent role. (Martorella & McDougall, 2021)

6.3 Non-pharmacological Intervention

The aim of this study was to evaluate Rhythmic Breathing (RB) in controlling post operative CABG sternotomy pain. There were 60 patients selected for the study who were to undergo CABG. They were divided into two groups A and B. The group A (intervention group) patients were taught breathing techniques before operation. After CABG when they were back to conscious state and attained hemodynamic state, they were asked to perform RB while closing their eyes, inhaling through their nose, holding the breath for few seconds and then exhaling through their mouth, with full concentration on their breathing. They were to do this for 1 minute in every 5 minutes for 20 minutes (four times in 20 minutes) and this was done every 12 hours for 3 days. Group B received just opioid (morphine) routinely. Group A also received morphine together with intervention but in lower dose. As a result severity of pain was lowered significantly in over time in group A compared to Group B. RB intervention is evaluated as effective measure in controlling post-operative pain. (Babamohamadi, Karkeabadi, & Ebrahimian, 2021)

This study was conducted to assess the effectiveness of eye mask on postoperative pain following CABG and sleep quality of patients. There were 60 patients who participated in the study and were divided in two groups intervention and control group. Visual Analogue Scale (VAS) was used to assess pain intensity and Richards Campbell Sleep Questionnaire (RCSQ) was used to assess sleep quality. The controlled group received standard care throughout the night and interventions group received both standard care and eye mask intervention. As a result controlled group had higher pain scores compared to interventions group and higher RCSQ scores for interventions group compared to controlled group. So eye mask can be used as an effective nursing intervention for both post-operative pain relief following CABG and for quality sleep. (Daqcan Sahin et al., 2024)

Change of patient's body position when lying on the bed post-operatively can provide pain relief. Changes of body position gives positive response to hemodynamic and cardiopulmonary function by enhancing respiratory efficacy, improves ventilation and optimizes blood circulations. Due to these positive effect on hemodynamic and cardiopulmonary function, patient gets relief from pain. But while changing the position, patient's conditions must be considered and should be done accordingly. (Doering L. V., 1993) A study was done in which effect of body positioning on pain was been assessed. The patient's who had undergone cardiac surgery were selected for the study. Position was

changed multiple times according to the patient's condition. As a result there was significant decrease in VAS score. (Vilite, Strike, Rutka & Leibuss, 2019)

Another study was conducted to assess the effectiveness of music on relieving pain, anxiety and physiological parameters after cardio-thoracic and vascular surgery. Randomized controlled trial method was used for this study which included 70 postoperative sternotomy patients. Numeric pain rating scale and post-operative anxiety scale was used as a tool for assessment of pain, anxiety and cardiac monitors, non-invasive blood pressure machine, saturation meter was used to assess stability of physiological parameters. Assessment was done before and after seventh day of intervention. The patients were divided equally into two groups, study group and control group. Control group patients were given routine care without music but patients in study group were given routine care including music, which was played 15-20 minutes for 4 times per day with a difference of four hours in between each round. After the intervention pain and anxiety levels were assessed by using assessment tools. As a result there was significant difference between both groups was found. Study group had lower score levels for both pain and anxiety compared to control group and physiological parameters were improved. Music therapy can be used as a nursing intervention for effective pain management. (Ganesan, Manjini & Bathala Vedagiri, 2022)

Aloe Vera has several beneficial properties like moistening properties, antioxidant, antimicrobial and anti-inflammatory properties. A research has been done to assess the impact of aloe vera gel on pain intensity and saphenous vein harvest wound healing in non-diabetic patients who underwent open heart surgery. There were 35 patients who participated in this study and were divided in two groups intervention and control group. On the second day after the surgery when the wound was cleaned with normal saline and was dried with sterile gas, they applied 2mm of aloe vera gel, with a dry gauze on top of it and then bandaged it. This was done for the intervention group together with usual care. Control group had just usual care. Both pain and wound healing was assessed on the first, fourth, seventh and on fifteenth day after the surgery. As a result, for the intervention group there was significant reduction in the intensity of pain and ecchymosis at the surgical site from the seventh day after the intervention, so it was concluded that this intervention can be used from the seventh day after the surgery. (Mohamad-Abadi, Haghghat, Tajmir-Riahi, Asgari & Eghbali-Babadi, 2023)

7 Discussion

This chapter contains the explanation of the research findings and correlation between Kolcaba's comfort theory and this study. The aim of this study was to find nursing interventions to manage post-operative pain management after coronary artery by-pass surgery.

7.1 Discussion of the method

For this study author chose scoping review as a research method, because while searching for the articles for this study, author got articles which had used several types of research methods like qualitative, cross-sectional and many more. While looking for the articles for nurses interventions for postoperative pain management, author realized that there were more articles related to non-pharmacological intervention, only few were related to pharmacological intervention but in that also most of them were needed to be paid to get access into that article, so this can be one limitation of this study because they were excluded from the study. Due to lack of articles author also took few articles whose study was not specified to CABG but cardiac surgery. It would have been much better if the method for this study would have been done as conducting interviews with open-ended questionnaires of the nurses managing post-operative pain among patients undergoing CABG. As the open ended questionnaires provides deeper knowledge about the field selected for research, and could have got better and practical results.

7.2 Discussion of the result

In this sub topic of discussion chapter author has discussed about the results of this studies, that how they can be used by the nurses, implementation and effectiveness of interventions.

7.2.1 Pain assessment tools

Author found several tools for pain assessment post-operatively. After the surgery when the patient is still under sedation and cannot communicate or cannot inform the nurses about the actual intensity of pain he/she is going through, nurses can use ANI for the assessment of pain. ANI measures parasympathetic activity using a scale having numbers from 0 to 100, where 0 indicates no pain and 100 indicates maximum possible pain. (Watson et al., 2024)

For the patients who are awake and are able to communicate, then nurses have several tools which they can use to assess pain intensity. The tools are VDS, VAS, NRS and TPS. These all four scales differs slightly with each other but shows similar effect in assessing pain. They all contain numbers from 0 to 10 and patients and select one number which best indicates their pain intensity. Where 0 is no pain and 10 is maximum pain.(Bas & Ayhan, 2024)

7.2.2 Pharmacological intervention

Author has included two articles related to medicine in the pharmacological intervention in first two paragraph. The nurses off-course cannot select the medicines for pain management by their own but need to follow the prescription written by the surgeon or physicians. But after going through this study nurses can have the knowledge about medicines used post cardiac surgery for pain management. After medicine related intervention, the author has included articles which explained nurses role in pharmacological intervention.

DEX is an alpha 2 receptor agonist which has effects like sedation, analgesics and anxiolytic effect. A study concluded that the use of DEX infusion was safe, reduces length of intubation, vasopressors and effective sedation and pain reduction. (Hamouda, Ismail, Ibrahim, Ewila & Elmahrouk, 2020)

Another study was done to identify of the efficacy of medicines like methadone, morphine, lidocaine gel, remifentanil, sufentanil and nefopam in managing post-operative pain management after CABG. Out of these medicines only nefopam showed less effectiveness or less benefits on pain control, where as all of these medicines where able to manage pain effectively. (Bertolini et al., 2024)

When we talk about pharmacological nursing interventions, nurses are limited to the physician's prescription, but nurses have a crucial role in it too. From pain assessment, pain medication administration, symptoms management and at last overall evaluation. Nurses are the ones taking care for the patients 24/7. In order to manage post-operative pain experienced by the patient and overall patient's satisfaction, nurses can assess pain and provide medication according to the pain intensity and doctors prescription on time without delay. There should be a pro active care plan made for patient's post-operative pain, and for which nurses must include all the healthcare professionals including patient.(Horn, Hendrix & Kramer, 2021)

According to Manworren & Atabek, (2021) A nurse can better manage post-operative pain by administering pain medicines according to the planned basis or PRN basis. Whenever there is a change in the pain score, quick action should be taken immediately and care plan should be updated like if pain score is low then the dose of drugs should be reduced, if the pain is high then dose should be increased according to the prescription and when the pain is unmanageable then physician should be contacted for different intervention method. The head nurse of the department should simplify the procedures so one can do their work efficiently. Nurses should monitor the patients on real-time basis and follow the pain management protocols of the ward or unit. Team work is essential and clear instruction to the team members should be given, so one can focus on their work efficiently, which improves and reduces the workload of the nurses, resulting in better pain management and greater patients satisfaction.

A research was conducted to investigate barriers and facilitators in post-operative pain management. Nurses were interviewed about the barrier and facilitators they face in managing post-operative pain. According to the nurses lack of time, lack of staff and improper education about the post-operative pain management were the barriers they faced in real life while managing post-operative pain. But they concluded that effective communication among the team members and early intervention for post-operative pain in primary care that is immediately after surgery then it can prevent chronic post-operative pain and help them better manage post-operative pain experienced by the patients. (Martorella & McDougall, 2021)

7.2.3 Non-pharmacological intervention

Non-pharmacological interventions for pain management not only reduces pain but also provides holistic care to the patient. It reduces medicine requirements especially need for opioid.

Rhythmic breathing (RB) is a simple exercise which requires little efforts with no side effects. RB activates parasympathetic nervous, serves as distraction from pain and decreases anxiety. A study was done to assess the effectiveness of RB in pain reduction post CABG patients. Nurses can use this exercise for CABG patients when they are fully awake from sedation and can communicate. Nurses can teach their patient about breathing techniques and patients are asked to follow the instruction given by the nurse. The instructions includes closing your eyes, inhaling through your nose, exhaling it slowly through your mouth after

holding your breath for few seconds. This continues for 1 min in every 5 minutes in each 20 minutes. This seems simple but proved to be a powerful method of intervention for pain management and relaxation for CABG patients. (Babamohamadi, Karkeabadi & Ebrahimian, 2021)

Eye masks provides relaxation and comfort for better sleep quality. A study was to assess the effectiveness of this eye mask in post CABG pain reduction. As a result eye mask was proved to be effectively reduced pain and improved sleep quality. This eye mask does not have any side effects and can be used by anyone. It helps patients to be calm and relax. Though they alone cannot be used for pain management but can be used simultaneously with medicines to provide holistic comfort to the patients. (Daqcan Sahin et al., 2024)

Music is considered to be an effective tools used in different clinical setting for patient relaxation. Dunbar et al. (2012) explains that music also stimulates the release of endorphin which is a natural pain killer in our body. A study was conducted to assess the efficacy of music in reducing post-operative pain, anxiety and physiological effect following CABG. As a result music was able to reduce pain and anxiety effectively and physiological parameters such as blood pressure and saturation was stabilised. So music can be used by nurses provide holistic care to the patient. (Ganesan, Manjini & Bathala Vedagiri, 2022)

According to Doering L. V. (1993) staying in the same position for long time on the bed causes muscles tightness and causes constant pressure on the same area of the body, and this can accelerate the post-operative pain. Change of position causes redistribution of body's pressure on different tissues, expands lungs for better ventilation as patient's after surgery do not have strength to breath properly so change in position can help them breath easily, proper blood circulation which is necessary for fast recovery. Another study by Vilite et al. (2019) found that change of body position can reduce pain and improve overall well-being among cardiac surgery patients. Change of position includes raising or lowering the head side of the bed according to patients comfort, keeping pillows underneath their arms or shoulder while considering patient's conditions. Nurses can use this method of intervention in managing post-operative pain.

Aloe Vera is widely used for medicinal purposes and for therapeutic effect. It contains properties like antioxidant, it fastens tissue repairs and it's hydrating properties together accelerates wound healing, it has natural analgesic properties and cooling effects which provides pain relief and many more. A research was conducted to assess the effect of Aloe Vera on pain reduction on saphenous vein harvest site in non-diabetic patients who had open

heart. As a result it decreased the pain significantly and accelerated wound healing. but it's maximum effects are seen after seventh day of the surgery. But for this intervention a nurse must take permission from the surgeon who did the surgery. Nurses can apply this Aloe Vera gel on the vein harvest site, where there it become painful wound after vein harvest. Aloe Vera does not have any side effects so it can be used as a pain reduction nursing intervention method. (Mohammad-Abadi, Haghghat, Tajmir-Riahi, Asgari & Eghbali-Babadi, 2023)

7.2.4 Theoretical Framework

For this study author has chose Kolcabas' theory of comfort for the framework. As concept of this theory explains that health care needs of the patients, intervention taken by nurse and the evaluation of the nursing intervention, all together enhances patients comfort. This theory can help nurses to manage post-operative pain in healthcare setting. Nurses can first assess the overall needs of the patient. According to comfort theory, patients' comfort should be assessed in four terms of physical, psychological, social and environmental factors. However for post-surgical patient, physical and emotional needs should be prioritized. Nurses can use pain assessment tools according to the patients' condition, to assess post-operative pain. Then according to the patient needs nurses can tailor individual care plan and choose method of intervention which will be suitable for the patient according to their condition. The factors such as patients' age and gender can influence effectiveness of the interventions. Nurses can use evidence based non-pharmacological method of intervention together with pharmacological intervention to facilitate the healing process. After implementation of the intervention, nurses must evaluate if the intervention used was able to manage pain and also patients' comfort should be assessed. This theory promotes collaboration between healthcare professionals and effective communication between them. If the intervention used proved to be ineffective then physicians and other healthcare professionals should be consulted immediately and different method should be implemented. Thus, Kolcabas' theory of comfort can be used as a guide to assess pain, implement the nursing interventions used for managing pain, and evaluate the patients' comfort, resulting in facilitation of overall recovery of patient. (Alligood, 2017)

8 Conclusion

The purpose of this study was to assess different nursing intervention which can be used to manage post-operative pain in patients with CABG. The study found that nurses have an

important role in managing post-operative pain in CABG patients. This study found out five scales in which ANI is a scale can be used for the patient who is still in sedation and cannot inform about his/her pain, VDS, NRS, VAS and TPS can effectively assess pain intensity. After assessment, nurses can administer medicine as prescribed or PRN basis, monitor patients' overall condition in real-time and collaborate with other healthcare professionals for making care plans of the patients. The study identified few non-pharmacological interventions which can be used by the nurses for managing post-operative pain such as music and eye mask which provides distraction and relaxation to the patient, change of body's position improves circulation and ventilation, Rhythmic breathing and applying aloe vera gel on vein harvesting site reduces pain intensity. All of these interventions can be used by the nurses to manage post-operative pain in CABG patients. As mentioned before there are lack of studies regarding nurses role in managing post-operative pain in CABG patients so more research are recommended to fill the gaps.

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10 Appendix

No	Author	Year	Topic	Aim	Method	Result
1.	Hamoud a, T., Ismail, M.,	2020	Role of dexmedetomidine infusion after coronary artery	To examine the efficacy of post-coronary artery bypass grafting	Retrospective study method	DOX infusion proved to be safe and

	Ibrahim, T. H., Ewila, H., & Elmahrouk, A.		bypass grafting. (CABG) DEX infusion in reducing postoperative morphine consumption and in improving the quality of postoperative recovery.			effective in pain management and reduced use of morphine.
2.	Bertolini, B., Dos Santos Felix, M. M., de Andrade, E. V., Raponi, M. B. G., Calegari, I. B., Barichello, E., da Silva Pires, P., S Barbosa, M. H.	2024	Postoperative Pain Management in Coronary Artery Bypass Grafting. An Integrative Review.	To identify pharmacological and non pharmacological interventions adopted for pain relief in the postoperative period of coronary artery bypass graft surgery.	Integrative review was done. two hundred studies were identified but eleven were included. Methodological analysis was done using Medical Education Research Study Quality Instrument.	A greater tendency to use drug strategies for postoperative pain relief was identified.
3.	Manworrén, R. C.	2021	Time from pain assessment to	To describe factors that	Human factors	Nurses more

	B., & Atabek, A.		pain intervention.	influences nurses time from pain assessment to intervention for acute surgical pain.	engineering and ethnograph y were used to quantify factors influencing time from pain assessment to interventio n.	efficiently managed the post surgical pain by giving analgesics ordered by PRN on a scheduled basis.
4.	Martorell a, G., & McDoug all, G. J.	2021	Barriers and Facilitators to the Prevention of Chronic Pain in the substance Phase (CPSP) After Cardiac Surgery.	To explore the implementation of the nursing intervention to prevent CPSP	Qualitative data from individual interviews and open end surveys regarding the interventio n's acceptabilit y were used. Content analysis was done using a deductive approach.	Effective pain managemen t by nurses in primary care would allow early intervention preventing chronic post surgical pain.

5.	Babamohamadi, H., Karkeabadi, M., & Ebrahimiyan, A.	2021	The effect of Rhythmic Breathing on the Severity of Sternotomy Pain after Coronary Artery Bypass Graft Surgery.	To evaluate the impact of Rhythmic Breathing on the severity of sternotomy pain after Coronary Artery Bypass Graft (CABG).	Randomized control trial was done among sixty patients after CABG.	There was significant decrease in severity of pain after the intervention of Rhythmic Breathing.
6.	Dagcan Sahin, N., Nal, B., Gurol Arslan, G., Astarcioglu, M. A., & Parlar, A. I.	2024	Effect of Eye Mask on Pain and Sleep Quality in Patients undergoing Coronary Artery By-pass Graft Surgery.	To evaluate effect of nocturnal eye masks on postoperative pain and sleep quality in cardiac surgical patients.	There was a double-blind randomized controlled trial done among sixty adult patients who had undergone CABGs.	There was reduction in pain and better sleep quality for the patients who used the eye mask.
7.	Bas, N. S., & Ayhan, H.	2024	Comparison of four different pain scales and patient preferences in the evaluation of pain severity after open cardiac surgery.	To compare the pain levels of open-heart surgery patients in the first three days after surgery with four pain scales, to assess the efficacy between the	Descriptive study method	All four scales had similar outcomes and effectively assessed postoperative pain. Most preferred

				scales and determine patients preferences.		scale was NRS and VDS was preferred by elderly patients.
8.	Qu, M., Zhao, J., Zhang, Y., Xu, Z., Ma, C., & Cui, H.	2024	Utilizing the visual analogue scale (VAS) to monitor and manage pain in post-operative skin wounds after thoracic surgery.	To validate the visual analogue scale (VAS) as the valid method for measuring postoperative pain in thoracic surgery patients.	Cross-sectional study method.	Visual analogue scale was evaluated to be a reliable tool for assessment of post-operative pain.
9.	Mohamad-Abadi, N. M., Haghghat, S., tajmir-Riahi, M., Asgari, S., & Eghbali-Babadi, M.	2023	The effect of Aloe Vera Gel on Saphenous Vein Harvest Wound Healing and Local Pain in Non-diabetic Patients Undergoing CABG Surgery.	To determine the effect of aloe vera gel on pain intensity, and GSVs wound healing in non-diabetic patients.	A single-blinded randomized clinical trial method.	Aloe vera gel effectively decreased pain and speed up surgical wound healing.
10.	Ganesan, P., Manjini, K. J., &	2022	Effect of music on Pain, Anxiety and Physiological	The aim of the study was to assess the effect of music on pain,	A randomized controlled	Music had a significant effect on lowering

	Bathala Vedagiri, S. C.		parameters among Postoperative Sternotomy Patients.	anxiety and physiological parameters in postoperative sternotomy patient.	trial was used as a method.	pain, anxiety and helped stabilize physiologic al parameters.
11.	Tanrikul u, N., Polat, F., Haspolat, A., & Koprulu, A. S.	2024	Pain Evaluation Using Analgesia Nociception Index (ANI) in Postoperative Cardiovascular Intensive Care patients.	To evaluate the feasibility of implementing ANI in assessment of pain among conscious, sedated and mechanically ventilated patients in cardiovascular ICU.	Prospectiv e observatio nal study.	ANI proved to be an effective tool for pain assessment among patients with cardiac surgery.
12.	Vilite, B., Strike, E., Rutka, K., & Leibuss, R.	2019	Pain management in intensive care unit patients after cardiac surgery with sternotomy approach.	To describe knowledge and competence of intensive care nurses, to assess postoperative pain for intensive care patients after cardiac surgery with sternotomy approach, gather data about pharmacological	A prospective and cross- sectional research method.	The Patients experienced mild pain and were really satisfied with the pain managemen t intervention s which were used.

				treatment options and to assess patient satisfaction regarding pain management		
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