

Case Report

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Case Study: Pain Management in Postoperative CABG Patient in General Intensive Care Unit

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ABSTRACT

Acute pain is a significant manifestation in postoperative Coronary Artery Bypass Graft (CABG) patients. A sternotomy performed in open-heart surgery is a major cause of post-operative pain. Prolonged post-operative pain can lead to increased the use of analgesics, reduce infection resistance, delayed wound healing after surgery, and extended hospitalization. This study aims to evaluate pain management interventions in the form of deep breathing techniques and collaboration in administering morphine to acute pain in postoperative CABG patients. This research uses the case study method. A 69-year-old postoperative CABG patient experienced acute pain in the chest and incision wound on a scale of 7 (0-10) in General Intensive Care Unit (GICU). He described the pain as a stabbing in the chest and getting worse when coughing, eating, and talking. After three days of intervention, the patient experienced a decrease in pain levels. This condition is seen from the reduction in pain levels to a scale of 2 (0-10), the patient's face appears relaxed, the patient does not appear restless, vital signs are within the normal range, and the patient can perform deep breathing techniques by himself when the pain is felt. Pain management through deep breathing techniques and collaboration on morphine administration can reduce acute pain in postoperative CABG patients. Researchers recommend pain management through deep breathing techniques and collaboration on morphine administration to treat acute pain in postoperative CABG patients.

Introduction

Coronary artery disease (CAD) is a cardiovascular disease that is the leading cause of death in both developed and developing countries (Naghavi et al., 2015). CAD is characterized by the presence of atherosclerotic plaques within the walls of coronary vessels that cause blood vessels to stiffen (cause ischemia), or that can rupture, where thrombotic vessel occlusion is the primary mechanism for acute myocardial infarction (AMI) (Thygesen et al., 2012).

Globally, according to World Health Organization (2015) data, 70% of deaths in the world are caused by non-communicable diseases (NCDs) (39.5 million out of 56.4 million deaths). As many as 45% of all deaths due to NCDs are caused by heart and blood vessel diseases, which is as many as 17.7 million out of 39.5 million deaths. According to Kementerian Kesehatan RI (2018), the prevalence of heart disease in Indonesia reaches 1.5% of the total population of Indonesia at all ages. It means that out of 200 people in Indonesia, three suffer from heart disease.

Treating CAD can be done with medical therapy to control angina symptoms and prevent plaque development. In addition to medical therapy, approximately two invasive strategies aim to reshape adequate blood supply to the myocardial area, one of which is coronary artery bypass grafting (CABG) (Neumann et al., 2019). CABG is a surgical procedure in which autologous arterial channels or veins are harvested to bypass atherosclerotic coronary arteries (Gimpel, Fisher, Khan, & McCormack, 2019). This action aims to improve the quality of life and reduce the risk of death. Familiar channel sources for CABG include the internal thoracic artery or mammary artery, radial artery, and large saphenous vein.

Despite CABG, pain is still the primary manifestation reported by CAD patients. Sternotomy performed in open-heart surgery is a significant cause of postoperative pain. Surgical trauma, tissue damage, and release of inflammatory mediators cause pain in patients with open-heart surgery (Zubrzycki et al., 2018). Adelborg et al. (2017) found that 47 – 75% of

patients experience pain after heart surgery. As many as 50 – 60% of postoperative heart surgery patients report moderate to severe pain 24 to 72 hours after the surgical procedure (Pishkarmofrad et al., 2016). Adequate postoperative pain management is necessary to reduce the risk of complications from pain.

Assessing and reducing the intensity of post-CABG pain is one of the essential responsibilities of nurses. Pain management is necessary because pain and changes in vital signs can indirectly lead to increased use of analgesics, reduced resistance to infection, delayed wound healing after surgery, and prolonged hospital stays (Kalkman et al., 2003).

There are several interventions to reduce pain. Pharmacological therapy is the easiest and most convenient method to reduce postoperative pain, such as giving analgesics in the form of morphine to reduce pain with severe intensity. However, these interventions are not the only methods that can reduce pain. Researchers have explored the effect of different non-pharmacological interventions on pain control in postoperative CABG patients, including deep breathing techniques.

Deep breathing exercise techniques are non-pharmacological interventions that positively affect autonomic heart function, depression, anxiety, high blood pressure, and lung disease. Deep breathing exercises have been shown to balance bodily and brain functions and parasympathetic system functions, so it is considered an excellent therapeutic modality to facilitate relaxation (Ghorbani et al., 2019). Thus, this case study aims to evaluate pain management through morphine administration and non-pharmacological interventions using deep breathing exercise techniques for patients with acute pain after CABG surgery.

Method

Study Design

This research uses the case study method. Data was collected through an assessment of a nursing evaluation conducted in the GICU-B room in October 2022. Data collection techniques used are interviews, observation, and documentation.

The patient's pain level was observed for 5 hours daily for 3 days. The pain assessment used is the Numeric Pain Rating Scale (NPRS) because the patient is not intubated and fully conscious when assessed on postoperative day 2 (POD-2).

Research Subject

The subject in this study was a 69-year-old male who entered the GICU-B room on October 26th 2022, after undergoing a Coronary Artery Bypass Grafting (CABG) procedure with saphenous vein grafts. The patient complained of chest pain in the postoperative incision wound. The pain feels like being stabbed on a scale of 7 (0-10). Pain disappears. Pain increases when the patient tries to cough and after doing light activities such as eating and talking and decreases at rest. The patient has had a history of CAD since 2020 and had a heart attack. Patients feel quickly tired if they do strenuous activities such as walking >100 m. The patient had a history of controlled hypertension and kidney disease for 3 years before entering the hospital.

Intervention

Researchers focused the discussion of interventions on a nursing diagnosis of acute pain. The most commonly used analgesia postoperatively is intravenous opioids through the bolus. In this study, the type of opioid used in the patient was morphine at a dose of 20 mcg/kg/hour. In addition to pharmacological intervention, postoperative pain can be given non-pharmacological intervention that can be applied to the patient. These non-pharmacological interventions include aromatherapy, positioning, music therapy, imagination, massage, and distraction.

The primary interventions were pain management through deep breathing techniques and collaboration in giving morphine 20 mcg/kg/hour. Other supportive interventions include controlling environmental factors that may worsen pain levels, encouraging patients to improve rest and sleep, and also listening to the murmur. Morphine administration was stopped in POD-4, followed by paracetamol 1 gr IV every

6 hours because there was an improvement in the patient's condition.

With pain management, the patient's complaints and pain levels are expected to decrease, do not appear restless or grimaced, and his vital signs will be within normal ranges. Deep breathing techniques are performed to make the body relaxed and calm because it affects the parasympathetic nervous system, and reduces the buildup of toxins in the lungs by encouraging alveoli clearance, increasing lung volume, cleaning secretions, increasing gas exchange, controlling shortness of breath, lowering blood pressure, and relaxation responses to reduce stress and control pain.

The deep breathing technique is done using slow and deep inspiration from the mouth or nose to take in as much air as possible into the lungs. Then, hold the breath for 2-5 seconds and then expel the air out slowly through the mouth until the air comes out of the lungs repeatedly when pain is felt. When performing the deep breathing technique, support is carried out on the incision area with solid but gentle pressure without pressing directly on the incision wound. The technique of deep breathing is performed 3-4 times a day or whenever pain appears. Each session consists of 5-15 consecutive deep breaths repeated 1-3 times.

Results

Table 1. Patient Condition After Intervention

<i>Postoperative day 1</i>	<i>Postoperative day 2 (1st day of intervention)</i>	<i>Postoperative day 3 (2nd day of intervention)</i>	<i>Postoperative day 4 (3rd day of intervention)</i>
<ul style="list-style-type: none"> The patient is extubated 	<ul style="list-style-type: none"> Pain score 7 (0-10) HFNC attached patient (FiO₂/Flow 20/30) with a desaturation period of up to 	<ul style="list-style-type: none"> Pain score 5 (0-10) HFNC attached patient (FiO₂/Flow 20/30) The patient said that pain feels 	<ul style="list-style-type: none"> Pain score 2 (0-10) HFNC attached patient (FiO₂/Flow 20/30) The patient does not appear to grimace and fidget

80%	like	▪ BP
▪ The	elapsed	115/62
patient	▪ BP	mmHg,
appears	117/63	HR
grimacing and	mmHg,	85x/min,
restless	HR	RR
▪ BP	81x/min	19x/min
131/69	, RR	▪ Morphine
mmHg,	18x/min	administration is
HR		stopped,
106x/min,		followed
RR		by
24x/min		paracetamol 1 gr
		IV every
		6 hours

After nursing care and the provision of deep breathing technique exercises with morphine administration for three days, it was found that acute pain problems in patients were reduced. This can be seen from the patient's narrative, who said that pain had been reduced on a scale of 2 out of 10 and pain only appears occasionally when moving. Patients also seem to do deep breathing exercises when pain appears, patients can fall asleep soundly and do not appear restless, vital signs within normal ranges are BP 115/62 mmHg, MAP 74 mmHg, HR 85x/min, RR 19x/min, SpO₂ 98%.

Discussion

This study raised the nursing issue of acute pain with pain management in patients with acute pain after CABG surgery. After intervening for three days, the patient experienced a decrease in pain levels. This condition is evidenced by the patient's pain level decreasing from a scale of 7 (0-10) to 2 (0-10); the patient seems more relaxed, does not appear restless, can sleep soundly, and vital signs are within normal range.

Sternotomy performed in open-heart surgery is a significant cause of postoperative CABG pain. Surgical trauma, tissue damage, and release of inflammatory mediators cause pain in patients with open-heart surgery (Zubrzycki et al., 2018). The incidence of acute postoperative pain is associated with surgical trauma to tissues or organs, as well as the presence of surgical

wounds. Postoperative pain is described as chest discomfort in up to 65% of cases and can appear along with pain in the upper extremities, neck, head, and middle back (van Leersum et al., 2010).

Pain in postoperative cardiac patients occurs due to tissue damage due to sternotomy, which develops into neurogenic inflammation at the site of trauma. This causes changes in the nature and sensitivity of the primary afferent nerve terminal (peripheral sensitization), accompanied by changes in the central nervous system (central sensitization) (Zubrzycki et al., 2018). In connection with the pain mechanism, patients are given pharmacological intervention in the form of morphine 20 mcg/kg/hour. Morphine works by binding to mu-opioid receptors in the central nervous system (CNS) and peripheral nervous system (PNS) (Leite Junior et al., 2019) to reduce the intensity of pain in patients.

Postoperative pain of CABG is the most severe patient complaint. Although it can be managed with pharmacological or non-pharmacological therapy, as many as 50 – 60% of postoperative heart surgery patients report moderate to severe pain 24 to 72 hours after the surgical procedure (Pishkarmofrad et al., 2016). Buvanendran et al. (2015) found that as many as 66% of patients had moderate to extreme postoperative pain, while 59% had moderate to severe or extreme pain levels during the first two weeks postoperatively.

According to Choinière et al. (2014) study of 1,247 postoperative cardiac studies, it was found that more than 65% of patients experienced moderate to severe pain in the first week after surgery, while 10% of patients experienced pain during the first two years after surgery. In patients in this case study, the pain was severe during the first two days postoperatively, with an NPRS score of 7 (0-10). With severe pain, patients are given pharmacological therapy in the form of morphine 20 mcg/kg/hour. The therapy is following the analgesic ladder according to WHO, where severe pain is in step 3, which is given analgesics in the form of strong opioids, one of which is morphine (World Health Organization, 2018).

When the patient feels pain, breathing becomes shallow and irregular due to increased tension in the respiratory muscles. The increase in muscle tension can increase the pain felt by the patient (Phulli, Arora, & Neema, 2021). In addition, there is also an increase in blood pressure and pulse rate when the patient feels pain. This happens because pain activates the sympathetic nervous system, which significantly affects the cardiovascular system, so blood pressure and pulse rate increase (Zubrzycki et al., 2018).

Prasad et al. (2013) research mentioned that deep breathing techniques can lower blood pressure and pulse rate in the long run. This is related to the effect of deep breathing techniques on increasing baroreflex sensitivity and cardiac parasympathetic activity and decreasing sympathetic activity on patients' blood pressure and pulse rate. Baroreceptor stimulation and autonomic modulation have also been reported as possible mechanisms underlying the hypoalgesic effects of deep breathing techniques that have projections to brain areas involved in pain regulation suggested as major neural gateways (Gholamrezaei et al., 2021).

In this regard, the intervention of deep breathing techniques is carried out in conjunction with the administration of morphine in collaboration with doctors to reduce pain intensity. The intervention of deep breathing exercise techniques was performed on the second day postoperatively, and pain began to decrease on the third day postoperatively with an NPRS score of 5 (0-10). This aligns with the analysis of Zubrzycki et al. (2018). The maximum pain intensity did not change significantly during the first two days postoperatively but decreased from the third day. Decreasing the pain intensity at the incision site of chest surgery will improve the ability to breathe, effective breathing, cough, and the prevention of atelectasis and other complications (Shaybak et al., 2017).

Deep breathing exercise techniques aim to promote relaxation in patients because deep breathing affects the parasympathetic nervous system. In addition, deep breathing techniques also serve to reduce and prevent the buildup of

toxins in the lungs by encouraging the cleaning of tiny air sacs (alveoli), increasing lung volume, cleaning secretions, increasing gas exchange, controlling shortness of breath, increasing exercise capacity, to reduce blood pressure, reduce obesity and reduce stress levels (Solomen & Aaron, 2015).

Research conducted by Hany et al. (2019) also proved that there was a significant reduction in postoperative pain intensity of CABG after the first day (score 7.1 to 4.07) and before and after the second day (score 5 to 1.5) deep breathing exercises. This is in line with this case study, where after patients were subjected to deep breathing techniques, the pain decreased one day after the intervention (NPRS score 7 to 5) and two days after the intervention (NPRS score 5 to 2).

The deep breathing technique is a slow deep breathing technique through slow and deep inspiration from the mouth or nose to breathe as much air as possible into the lungs. Then hold the breath for 2-5 seconds and then expel the air out slowly through the mouth until the air comes out of the lungs. Researchers recommend that patients do deep breathing techniques 3-4 times a day or whenever pain appears. Each session consists of 5-15 consecutive deep breaths repeated 1-3 times (Westerdahl, 2015).

On the first day of the intervention, patients are still hesitant to do deep breathing techniques for fear of the pain that will be felt. Patients say the pain is increasingly felt when the patient talks, coughs, and moves. As explained by Zubrzycki et al. (2018) that the most severe pain felt in postoperative heart patients is when coughing, moving, turning around, getting out of bed, and taking deep breaths. Therefore, researchers recommend that patients increase rest and minimize movement so that the intensity of pain can be reduced.

Patients feel hesitant to take deep breaths for fear of chest pain and incision wounds, where the pain can increase when taking deep breaths. Therefore, the deep breathing technique is performed in conjunction with providing support to the incision area with solid but gentle pressure without pressing directly on the incision wound

to reduce chest wall expansion which can increase pain in incision wounds. This can reduce pain and allow the patient to breathe deeply or cough. Placing the hand in the incision area can also induce tactile stimulation that can facilitate lung expansion (Ahmad, 2018). In this case study, applying gentle pressure in the incision area is assisted using pillows so that patients feel more comfortable.

From the results of this case study, it is known that pain management in the form of intervention, deep breathing exercise techniques, and collaboration with doctors in giving morphine for three days can reduce pain intensity in patients after CABG surgery. Pain scores were evaluated every 5 hours every day for three days. The pain score on the first day of intervention was at 7 (0-10) and gradually decreased until the patient's pain score was at 2 (0-10) on the third day of intervention. The patient also said the pain only appeared occasionally when the patient moved, the patient's face seemed relaxed, and the patient's vital signs were within normal ranges. The patient can do deep breathing exercises independently when pain begins to be felt.

The decrease in pain levels decreases as the wound healing process increases. Wound healing can be achieved through four phases, namely hemostasis, inflammation, proliferation, and remodelling (Guo & Dipietro, 2010). The sternotomy wounds in the patients in this case study were in the inflammatory phase on the third day of the intervention (POD-4). In postoperative CABG wounds, classified as chronic wounds, it takes more than three months for the sternal wound to heal completely after the median sternotomy (Shin et al., 2015).

Restlessness in patients also gradually improved on the third day of the intervention. These results are consistent with research conducted by Zarneshan et al. (2021), which states that deep breathing techniques can also reduce anxiety levels in post-CABG patients. Pain in patients decreases with the healing process of sternotomy wounds. In addition, the pain response in patients is quite good, along with the general condition of patients who are getting better.

Conclusions

Patients with acute postoperative CABG pain in this case study were given pain management interventions through deep breathing techniques and collaboration of morphine administration of 20 mcg/kg/hour. Deep breathing exercise techniques are appropriate non-pharmacological interventions, easy to do, and do not require costs to reduce pain intensity. After three days of pain management, the pain level in postoperative CABG patients was reduced, as evidenced by a decrease in pain score from 7 (0-10) to 2 (0-10). These results prove that nurses can use morphine and deep breathing collaboration techniques as effective pain management interventions to reduce pain intensity in postoperative CABG patients.

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