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Nursing intervention using ice gel pack for pain reduction during femoral sheath removal after cardiac catheterization

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ABSTRACT

Cardiac catheterization is performed to reduce mortality risk from vascular stenosis. Following the procedure, femoral sheath removal often resulted in mild to severe pain. This study aimed to describe nursing care through the application of an ice gel pack as a nonpharmacological method to reduce pain during femoral sheath removal in post–cardiac catheterization patients at RSUP Dr. M. Djamil Padang. A case study design was applied, which included assessment, nursing diagnoses, intervention, implementation, and evaluation. The ice gel pack was applied over the sheath site for 20 minutes before sheath removal. Evaluation showed that pain intensity decreased from a scale of 5 to 3 after the intervention. The application of an ice gel pack effectively reduced pain and is recommended for inclusion in hospital standard procedures.

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INTRODUCTION

Cardiovascular disease has become the leading cause of death worldwide. The World Health Organization (WHO) (2021) reported that heart disease accounts for 17.9 million deaths annually, representing one in every three deaths globally. In Indonesia, cardiovascular diseases remain the highest cause of mortality and continue to increase each year (Kemenkes RI, 2021). According to data from the Basic Health Research (Riskesdas) 2018, the prevalence of cardiovascular diseases in Indonesia is 15 per 1,000 people, equivalent to approximately 4.2 million individuals affected (Kemenkes RI, 2018). West Sumatra Province is among the top five provinces with the highest prevalence of cardiovascular diseases, reaching 1.6 percent (Kemenkes RI, 2021). One of the most common and deadly cardiovascular diseases is coronary heart disease.

Coronary heart disease is caused by the buildup of plaque within the arterial walls that supply blood to the heart. This plaque, composed of cholesterol deposits, can cause narrowing or blockage of the arteries over time (CDC, 2021). Coronary heart disease can be detected using both noninvasive and invasive diagnostic procedures. One of the recommended invasive procedures is cardiac catheterization (Masriani, 2020). Cardiac catheterization is performed under the recommendation of a cardiologist to assess the condition of vital organs (Pramudita, 2022). This

procedure aims to reduce the risk of death caused by vascular stenosis. Cardiac catheterization is currently one of the most widely used diagnostic and hemodynamic interventional techniques worldwide (Sinaga et al., 2022).

Cardiac catheterization involves inserting a small catheter tube into an artery or vein to reach the coronary vessels or other organ systems under X-ray guidance. The procedure helps evaluate the coronary arteries, cardiac structure, and potential therapeutic interventions such as Diagnostic Coronary Angiography (DCA), Percutaneous Transluminal Coronary Angioplasty (PTCA), and Percutaneous Coronary Intervention (PCI) (CDC, 2021; PERKI, 2018). The femoral area is the most frequently used vascular access site for cardiac catheterization compared with the radial area (Katircibasi et al., 2018). The radial site is more susceptible to vasospasm, which can cause pain and increase the risk of procedural failure (Coghill et al., 2020). After the catheterization procedure, femoral sheath removal may induce mild to severe pain (National Heart, Lung, and Blood Institute, 2022). The pain level often increases significantly compared with before sheath removal. Bayındır et al. (2017) found that the mean pain score before femoral sheath removal was 0.1, rising to 5.6 during removal and 5.5 afterward.

Pain experienced during femoral sheath removal may trigger a vasovagal reaction, characterized by a sudden decrease in heart rate and blood pressure. Other symptoms may include dizziness, blurred vision, weakness, sweating, and sensations of warmth or cold. When this reaction leads to loss of consciousness, it is referred to as vasovagal syncope (Ghods et al., 2022; Malave & Vrooman, 2022). Over the past decades, pain management has included pharmacological and nonpharmacological approaches. One nonpharmacological technique used to relieve pain after cardiac catheterization is cryotherapy or cold therapy. A common form of cryotherapy is the use of an ice gel pack (Kristiyan et al., 2019). Kelechi et al. (2011) stated that cryotherapy in the form of an ice gel pack is safe and effective because it is non-toxic, noninvasive, dry, practical, reusable, flexible, and able to maintain a low temperature for an extended period at room temperature.

Bayındır et al. (2017) demonstrated that patients who received an ice gel pack prior to femoral sheath removal reported less pain compared with those who did not receive the intervention. The average pain scale in the intervention group was 0.1 before, 3.6 during, and 3.8 after sheath removal, which was two points lower than the control group. Similarly, Çürük et al. (2017) found that applying a cold compress with an ice bag for 20 minutes effectively reduced post-catheterization pain. Studies by Wicaksono et al. (2020) and Prasetya & Handian (2023); also reported that using an ice gel pack for 20 minutes before sheath removal, applied directly above the femoral sheath, significantly decreased pain levels in post-cardiac catheterization patients.

The use of an ice gel pack helps minimize tissue damage after cardiac catheterization and provides physiological benefits such as pain reduction, muscle relaxation, vascular constriction, and prevention of hematoma formation (Wicaksono et al., 2020). The cooling effect induces vasoconstriction in arteries and veins, stimulating smooth muscle in the vascular walls, which subsequently reduces bleeding and tissue swelling. Unlike distraction techniques or deep breathing exercises which primarily focus on relaxation and anxiety reduction (Perry & Potter, 2005), cryotherapy offers a dual advantage by physically addressing vascular integrity, thereby reducing the risk of local complications. Ice gel packs are also simple, inexpensive, comfortable, and suitable for noninvasive nursing management (Prasetya & Handian, 2023). This intervention aligns with national nursing standards to prioritize patient safety and comfort during invasive procedures, supporting the implementation of evidence-based practice in clinical settings (PPNI, 2018).

RSUP Dr. M. Djamil Padang serves as a regional cardiac referral center. In 2021, 410 patients underwent cardiac catheterization at the hospital. Based on these findings, this study applied nursing care through the use of an ice gel pack to reduce pain during femoral sheath removal among post-cardiac catheterization patients at RSUP Dr. M. Djamil Padang.

RESEARCH METHOD

This study used a case study design to explore the effectiveness of ice gel pack application in reducing pain during femoral sheath removal among post-cardiac catheterization patients at RSUP Dr. M. Djamil Padang. The case study approach was chosen to provide an in-depth understanding of the nursing care process and its outcomes in a real clinical context. The study followed the chronological sequence of the nursing process, including assessment, diagnosis, planning, implementation, and evaluation. Data were collected through direct patient observation and documentation from 20 November 2023 to 22 November 2023, covering all phases of nursing care.

The case involved a 60-year-old male patient diagnosed with ST-Elevation Myocardial Infarction (STEMI) who underwent Primary Percutaneous Coronary Intervention (PPCI) with femoral access. The assessment was carried out on 20 November 2023 at 04.15 pm, approximately six hours after the PPCI procedure. The patient reported pain at the femoral sheath insertion site with a pain intensity score of 5 on the Numerical Rating Scale (NRS). The sheath removal was scheduled for 20 November 2023 at 07.00 pm, and nursing interventions were planned to minimize procedural pain.

The intervention applied was cryotherapy using an ice gel pack, a non-pharmacological technique to reduce pain intensity. The ice gel pack was applied over the femoral sheath insertion site for 20 minutes before sheath removal (Figure 1). The pack was wrapped in a thin cloth to prevent direct contact with the skin and to maintain safety and comfort. Pain assessment was performed before, during, and after sheath removal. The initial NRS score was 4 before ice gel application, increased to 5 during sheath removal, and decreased to 3 immediately afterward. Further evaluations were conducted 8 hours after the intervention on 21 November 2023 and 32 hours after the intervention on 22 November 2023, showing a continued reduction in pain intensity to scores of 2 and 1, respectively. Throughout this period, hemodynamic parameters such as blood pressure and heart rate were continuously monitored and remained stable, confirming the patient's physiological tolerance to the intervention.

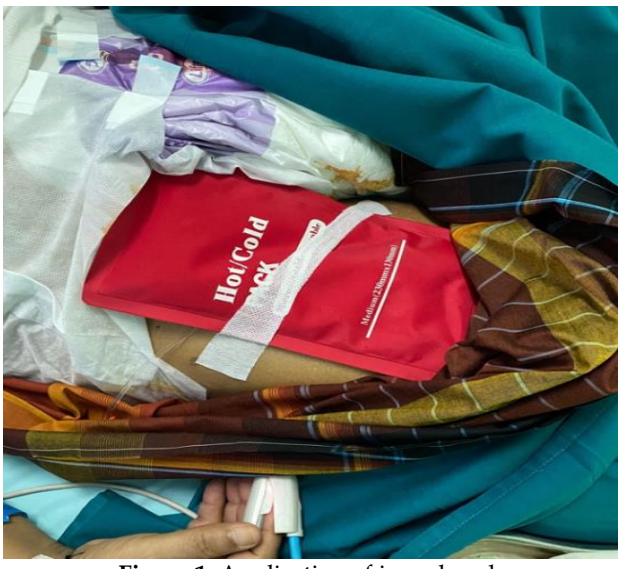

Figure 1. Application of ice gel pack

Data were collected through subjective and objective nursing assessments, including verbal pain reports, observation of nonverbal pain indicators, and measurement of vital signs. The analysis focused on comparing pain scores and hemodynamic stability before and after the intervention. The findings were supported by previous studies demonstrating that cryotherapy

induces vasoconstriction, reduces nerve conduction velocity, and decreases local tissue metabolism, leading to reduced pain perception (Bayındır et al., 2017; Kelechi et al., 2011; Wicaksono et al., 2020). The evaluation phase concluded on 22 November 2023, revealing a consistent decrease in pain and maintenance of stable hemodynamic parameters. These results indicate that the application of ice gel packs effectively reduced pain associated with femoral sheath removal and can be integrated as a safe, simple, and cost-effective nursing intervention in cardiovascular care settings. This study was conducted in strict adherence to the principles of nursing ethics and the standard operating procedures of RSUP Dr. M. Djamil Padang. Written informed consent was obtained from the patient prior to data collection and publication, ensuring confidentiality and voluntary participation.

RESULTS AND DISCUSSIONS

The study was conducted on a 60-year-old male patient who underwent Primary Percutaneous Coronary Intervention (PPCI) with femoral access due to ST-Elevation Myocardial Infarction (STEMI). The patient experienced moderate pain at the femoral sheath insertion site, with an initial pain score of 5 on the Numerical Rating Scale (NRS). Nursing care included the application of an ice gel pack as a non-pharmacological pain management intervention before sheath removal.

Pain intensity was assessed before, during, and after the intervention. Table 1 shows the patient's pain scores during the observation period. The pain level before the application of the ice gel pack was 4 (moderate), which increased to 5 (severe) during sheath removal. After the intervention, pain decreased to 3 (moderate), and further reductions were observed 8 and 32 hours post-application, with scores of 2 (mild) and 1 (mild), respectively. This progressive reduction in pain indicates that the application of an ice gel pack was effective in alleviating discomfort associated with femoral sheath removal.

Table 1. Observation of ice gel pack application

Date/Time	Measurment Description	NRS Pain Score
20 November 2023 / 7.00 pm – 7.20 pm	Before ice gel pack application (immediately before femoral sheath removal)	4 (Moderate)
	During femoral sheath removal	5 (Severe)
	After ice gel pack application and sheath removal	3 (Moderate)
21 November 2023 / 7.30 am – 7.50 am	8 hours after ice gel pack application	2 (Mild)
22 November 2023 / 8.00 am – 8.20 am	32 hours after ice gel pack application	1 (Mild)

Further monitoring of the patient's hemodynamic status and pain level during and after sheath removal was conducted to evaluate physiological stability. Table 2 presents blood pressure, heart rate, and pain score measurements taken at different time intervals following sheath removal. Hemodynamic parameters remained stable throughout the procedure, and the gradual reduction in pain scores confirmed the effectiveness of the ice gel intervention.

Table 2. Observation during femoral sheath removal

Time Interval	Hemodynamic	NRS Pain Score
0 minute (During sheath removal)	BP: 137/88 mmHg HR: 87 bpm	5 (Severe)
10 minutes	BP: 128/74 mmHg HR: 78 bpm	4 (Moderate)
20 minutes	BP: 125/78 mmHg HR: 79 bpm	3 (Moderate)
50 minutes	BP: 127/76 mmHg HR: 68 bpm	3 (Moderate)
80 minutes	BP: 118/73 mmHg	3 (Moderate)

Time Interval	Hemodynamic	NRS Pain Score
	HR: 54 bpm	
140 minutes	BP: 112/68 mmHg	3 (Moderate)
	HR: 54 bpm	

BP: Blood Pressure; HR: Heart Rate

The results demonstrated that after the application of the ice gel pack, the patient's pain intensity decreased progressively and hemodynamic stability was maintained. Blood pressure and heart rate remained within normal limits, and no complications such as bleeding or hematoma were observed. These findings support previous research showing that cold therapy induces vasoconstriction, reduces nerve conduction, and decreases pain perception, thereby providing a safe and effective nursing intervention for post-catheterization care (Bayındır et al., 2017; Kelechi et al., 2011; Wicaksono et al., 2020).

Discussions

The findings of this study demonstrate that the application of an ice gel pack before femoral sheath removal effectively reduces pain intensity among post-cardiac catheterization patients. The patient's pain score decreased from 5 during sheath removal to 3 immediately after the intervention, and continued to decline to 2 and 1 at 8 and 32 hours after application. These results support the use of cryotherapy as a non-pharmacological nursing intervention for managing procedural pain, aligning with previous research that confirmed the analgesic benefits of cold application in vascular and post-cardiac procedures (Bayındır et al. 2017; Çürük et al., 2017; Prasetya & Handian, 2023).

The physiological mechanism of cryotherapy explains this reduction in pain intensity. Cold application induces vasoconstriction, leading to decreased local blood flow, reduced nerve conduction velocity, and lowered metabolic activity in the tissues, which collectively diminish pain perception (Kelechi et al., 2011; Wicaksono et al., 2020). The decrease in temperature also helps reduce muscle spasm and tissue edema, providing both analgesic and anti-inflammatory effects. Kristiyan et al. (2019) further noted that ice gel packs are safe, flexible, non-toxic, and reusable, making them efficient tools for nursing interventions in clinical environments.

The results of this case study are consistent with findings from multiple studies that support the effectiveness of cryotherapy in managing post-procedural pain. Bayındır et al. (2017) found that pain levels during sheath removal in patients receiving cold application were significantly lower than those who did not receive the intervention. Similarly, Çürük et al. (2017) reported that applying a cold compress to the femoral region for 20 minutes effectively reduced both pain and local vascular complications after percutaneous coronary intervention (PCI). These findings are reinforced by Prasetya & Handian (2023), who observed that ice gel pack application before sheath removal led to a greater reduction in pain compared to patients in the control group. This cumulative evidence highlights cryotherapy as a practical, evidence-based method to reduce pain and improve patient comfort during femoral sheath removal.

The stability of hemodynamic parameters observed throughout the procedure in this study confirms that the intervention was safe and well-tolerated. Blood pressure and heart rate remained within normal ranges, and no complications such as bleeding or hematoma were observed. This finding aligns with the mechanism described by Wicaksono et al. (2020), who explained that cold application induces vasoconstriction of arteries and veins, stimulating smooth muscle contraction in the vessel wall, preventing bleeding, and maintaining vascular integrity. Similar findings were reported by Bayındır et al. (2017) and Çürük et al. (2017), who found that cold therapy reduced local vascular complications and discomfort without adverse effects.

From a nursing perspective, the ice gel pack represents an independent, non-pharmacological intervention supported by the Standar Intervensi Keperawatan Indonesia (SIKI), which encourages nurses to implement evidence-based care strategies to improve patient outcomes

(PPNI, 2018). Perry and Potter (2005) also emphasized the importance of non-pharmacological interventions as part of comprehensive pain management, allowing nurses to actively control pain while minimizing medication use and side effects. In this study, the use of cryotherapy demonstrated that nursing interventions based on scientific evidence can enhance patient safety and comfort during invasive cardiovascular procedures (Sindberg et al., 2014).

The psychological impact of pain and anxiety also deserves consideration (Zheng et al., 2023). The patient in this study initially expressed worry and hesitancy to move due to anticipated pain. This is consistent with findings by Kuusniemi & Pöyhiä (2016), who stated that postoperative pain can lead to emotional distress, including anxiety, which may interfere with recovery. Haryanto (2018) similarly explained that postoperative pain can provoke negative emotions that hinder mobility and healing. Therefore, nurses play a key role not only in providing physical interventions such as cryotherapy but also in offering emotional support, reassurance, and education before procedures. Clear communication about the process and benefits of cold therapy can enhance patient cooperation and reduce anxiety (Sinaga et al., 2022).

Furthermore, cryotherapy aligns with the principle of evidence-based nursing by integrating scientific findings into clinical decision-making to improve care quality. Its non-invasive nature, simplicity, and cost-effectiveness make it suitable for implementation in diverse healthcare settings, particularly where resource constraints exist (Prasetya & Handian, 2023; Wicaksono et al., 2020). The intervention not only addresses physiological aspects of pain but also supports patient-centered care, which focuses on holistic well-being. According to the Standar Diagnosis Keperawatan Indonesia (PPNI, 2017), patient comfort and safety are essential outcomes in nursing care, and interventions such as cold therapy directly contribute to achieving these standards.

The present findings reinforce the importance of incorporating non-pharmacological interventions as complementary strategies in nursing practice. While pharmacological treatments remain essential, combining them with methods like cryotherapy can minimize drug dependency and potential side effects, while also improving the patient's subjective experience of care (Kelechi et al., 2011; Kristiyan et al., 2019). The integration of this intervention into clinical protocols reflects a holistic approach that values both physiological and psychological aspects of patient care.

Given the simplicity, safety, and effectiveness of the ice gel pack intervention, it is recommended that hospitals consider adopting cryotherapy as part of their standard operating procedures for femoral sheath removal. This practice aligns with the national nursing standards (PPNI, 2018) and supports the continuous improvement of patient outcomes through evidence-based, independent nursing actions. Future research should include larger sample sizes, experimental designs, and multi-site studies to further validate these findings and explore additional benefits such as reduced anxiety, shorter recovery times, and higher patient satisfaction levels.

CONCLUSION

This study concludes that applying an ice gel pack before femoral sheath removal effectively reduces pain intensity in post-cardiac catheterization patients. The patient's pain score decreased from 5 to 3 immediately after the intervention and continued to decline to 2 and 1 in subsequent evaluations, while hemodynamic parameters remained stable. These results confirm that cryotherapy using an ice gel pack is a safe, simple, and effective non-pharmacological nursing intervention. Practically, these findings support the formal adoption of ice gel pack therapy into the hospital's Standard Operating Procedures (SOP) for femoral sheath removal as a safe non-pharmacological protocol. To further validate these preliminary findings, future research should utilize Randomized Controlled Trial (RCT) designs with control groups, providing stronger evidence than observational case studies for broader clinical application.

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