



Coldpack Intervention to Alleviate Hematoma in Post-Percutaneous Coronary Intervention Patient: A Case Study

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ABSTRACT

Introduction: Interventions necessary for patients experiencing Coronary Artery Disease (CAD) include revascularization through Coronary Artery Bypass or Percutaneous Coronary Intervention (PCI). Vascular complications resulting from PCI procedures include hematoma, microvascular aneurysm, bleeding, edema, incision site pain, ecchymosis, embolism, arterial occlusion, arterial spasm, arteriovenous fistula, and retroperitoneal hematoma.

Objective: To describe the nursing intervention outcomes using cold packs to address hematoma in post-PCI patients with femoral sheath access.

Method: A qualitative study employing a case study approach conducted from March 23-25, 2023, at the Heart and Vascular Hospital Tasikmalaya. Inclusion criteria for participants include a diagnosis of Coronary Artery Disease (CAD), prior PCI intervention, PCI access via femoral sheath, and willingness to provide informed consent. The intervention involves the application of a cold pack. Research instruments utilized in this study include semi-structured interviews (in-depth interviews) and observations using The Femoral Scale.

Result: The use of cold packs to address hematoma in post-PCI patients with femoral sheath access is effective. This is evidenced by the absence of hematoma in post-PCI patients with femoral access after applying mechanical pressure with a cold pack. During the observation, patients did not express significant complaints; they reported greater comfort using a cold pack compared to the conventional sandbag approach.

Conclusion: The utilization of cold packs in this case can be considered an alternative to sandbags to enhance patient comfort. However, it is imperative to conduct additional monitoring when removing the cold pack, especially during the 6-hour immobilization period, to ensure patient awareness and compliance with immobilization protocols.

Keywords: coldpack, coronary artery disease, hematoma, percutaneous

Introduction

Coronary Artery Disease (CAD) is a term for a condition that arises when the walls of the coronary arteries gradually narrow due to the formation of fatty materials. This disease often lacks symptoms in its early stages and silently develops as a chronic disorder throughout life. Moreover, CAD is accountable for a significant number of premature deaths, reduced quality of life, and imposes a substantial burden on healthcare systems (Setyaji et al., 2018).

The World Health Organization (WHO) estimates that CAD is a leading cause of death worldwide, causing 17 million deaths annually in 2008, projected to rise to 23.4 million deaths by 2030, with over 80.0% occurring in developing countries (WHO, 2020). According to the Global Burden of Disease and the Institute for Health Metrics and Evaluation (IHME) 2014-2019, heart disease ranks as the top cause of death in Indonesia (Public Communication and Service Bureau, 2022). Data from the Basic Health Research (Riskesdas) for 2013 and 2018 show an increasing trend in heart disease from 0.5% in 2013 to 1.5% in 2018 (Research and Development Agency, 2018).

Interventions for CAD patients often involve revascularization, such as Coronary Artery Bypass or Percutaneous Coronary Intervention (PCI) (Itier and Roncalli, as cited in Shofyan et al., 2021). Coronary angiography is considered the "gold standard" for detecting atherosclerotic plaque, with cardiac catheterization having the highest accuracy rate (96.0%-99.0%) in identifying cardiac abnormalities, particularly CAD (Osborn, as cited in Sari et al., 2017).

PCI, a primary intervention for CAD, is known to have post-procedural side effects, including cardiac tamponade, arrhythmia, pneumothorax, hypovolemia, cardiac arrest, and arterial embolism (Shofyan et al., 2021). Vascular complications resulting from PCI procedures include hematoma, microvascular aneurysm, bleeding, edema, incision site pain, ecchymosis, embolism, arterial occlusion, arterial spasm, arteriovenous fistula, and retroperitoneal hematoma. These complications elevate the risks of mortality, morbidity, treatment costs, and patient length of stay (LOS) (Kurt, as cited in Shofyan et al., 2021).

At the conclusion of a catheterization procedure with femoral access, the femoral sheath is removed, and pressure (either manual or mechanical) is applied to the femoral artery to control bleeding until hemostasis is achieved (Sari et al., 2017). The technique employed to achieve hemostasis impacts the occurrence of vascular complications (Jones, as cited in Sari et al., 2017). Common post-PCI patient complaints include pain and hematoma (Shofyan et al., 2021).

Bleeding or hematoma is a major vascular complication often reported post-PCI, potentially leading to serious complications. Hematoma occurs due to inadequate closure of the puncture site, resulting in the accumulation of blood around the tissue. A large hematoma can cause discomfort and has the potential to develop into false aneurysms. Some hematomas in post-cardiac catheterization patients emerge some time after the completion of mechanical compression, with some even appearing the next day (Sari et al., 2017). To reduce the risk of complications such as hematoma, management is undertaken post-cardiac catheterization, aiming to achieve vascular hemostasis at the catheterization access site through manual and/or mechanical compression.

Mechanical compression commonly performed in hospitals involves using a sandbag weighing 2.0-2.5 kg for 6-7 hours. The origin of using sandbags as a mechanical compression tool is uncertain. However, the 6-7 hour use of sandbags often results in patient discomfort

and has prompted numerous studies to explore alternatives to sandbags for managing hematoma. Research by Syahri et al. (2021) compared the use of sandbags and cold packs to address hematoma in post-PCI patients with femoral access. The results indicated that the use of cold packs not only shortened the compression duration and prevented hematoma but was also perceived as more comfortable by patients in preventing post-PCI hematoma complications.

The use of cold packs for managing hematoma in post-PCI patients with femoral access is not widely adopted in hospitals. Most hospitals providing cardiac catheterization services employ sandbags as a mechanical compression tool. In Tasikmalaya, the hospitals offering cardiac catheterization services, namely the Heart Hospital Tasikmalaya and TMC Hospital, still utilize sandbags for mechanical compression.

Objective

To describe the nursing intervention outcomes using cold packs to address hematoma in post-PCI patients with femoral sheath access.

Method

Design and setting

This research, designed as a qualitative study with a case study approach, was conducted at the Tasikmalaya Heart and Blood Vessel Hospital. The researcher carried out data collection and research document completion from March 23 to 25, 2023.

Participant

The study involved one participant meeting inclusion criteria. Inclusion criteria encompassed a diagnosis of Coronary Artery Disease (CAD), prior PCI intervention, PCI through femoral sheath access, and willingness to provide informed consent. Exclusion criteria included concurrent disorders such as thrombocytopenia, renal disorders, neurophatic issues, etc., mental disorders, and ongoing psychosis therapy.



Figure 1. Coldpack

Intervention

The researcher administered the coldpack intervention, involving placing a coldpack pre-frozen for one hour and wrapped in a soft cloth on the femoral puncture site of the patient. The coldpack was applied for 15 minutes, and the patient was positioned in a supine state for 6-7 hours. Hematoma observation, distal blood circulation, and arterial pulsation observation were conducted hourly for 24 hours post-coldpack intervention.

Instrument and measurement

The primary instrument utilized in this research was a semi-structured interview, employing a tailored questionnaire aligned with the nursing care process. Interview responses were recorded via voice recording and transcribed onto informant response sheets. Additionally, observational methods were employed. The Femoral Scale was utilized during observations to assess the scale of hematoma occurring in patients. Observations to measure hematoma were conducted using an alcohol-cleaned ruler, with the researcher wearing gloves. Measurement results were documented in an observation table, and photographs were taken using a mobile phone camera as research evidence.

Tabel 1. The Femoral Scale

Scale	Interpretation
I	Superficial local hematoma with a diameter below 5 cm.
II	Hematoma infiltrating muscle tissue with a diameter of 5-10 cm.
III	Infiltration of muscle tissue by hematoma with a diameter >10 cm but not extending below the knee or above the hip, false aneurysm, retroperitoneal space hematoma.
IV	Hematoma infiltrating muscle tissue with a diameter >10 cm, extending below the knee or above the hip, false aneurysm, intraperitoneal space hematoma.
V	Hematoma with threatened ischemia, hypovolemic shock, persistent false aneurysm, retroperitoneal space hematoma.

(Koltowski dkk. 2014)

Data collection

Data collection techniques in this study involved semi-structured interviews, where the researcher prepared a list of questions related to the research process. Specific observations focused on femoral hematoma using The Femoral Scale, and the researcher documented each activity performed on the patient.

Data analyses

Data processing was conducted after observing the patient for 24 hours. The interview and observation results obtained by the researcher were used as information about the intervention and the outcomes of coldpack intervention in managing hematoma in patients.

Once the data were collected, the researcher verified their accuracy, organized, and classified the data into categories relevant to the research. The next step involved data analysis. The data obtained from interviews and observations had a complex form. All data were then categorized as highly important, less important, or unimportant. Data classified as unimportant or less important were deemed safe to be discarded or not used. This simplified the data to be more straightforward, meeting the research needs and considered representative of all the acquired data.

The presentation of data could take various forms such as graphs, charts, pictograms, and others. This made it easier to convey the data to others, providing clear information that readers could easily understand. Drawing new conclusions could only occur when the diverse data were simplified, organized, or displayed using specific media. Only then could they be easily comprehended, allowing for the process of reaching new conclusions.

Result

Documentation review

The findings of this research are derived from respondent data, with the research subject being a patient with the initials Mr. DH, diagnosed with Coronary Artery Disease (CAD) on October 20, 2020, at 10:00 AM local time. The initial symptom experienced by the patient was chest pain radiating to the back, followed by loss of consciousness for approximately 4 hours. The family brought him to SMC Hospital, where he was observed and treated until he regained consciousness and improved. Due to suspected coronary artery blockage, he was referred from SMC Hospital on October 21, 2021, to RSUD Banjar for coronary stent placement or Percutaneous Coronary Intervention (PCI).

The first PCI procedure was performed at RSUD Banjar, revealing CAD 2VD with a fistula in the LAD and a patent stent in the LCx. This indicates two blockages in the patient's coronary arteries, specifically in the LAD (Left Anterior Descendent) or the right front lower coronary artery and LCx (Left Circumflex) or the left side rear lower coronary artery. The initial stent placement was performed in the LCx coronary artery. After the first procedure, the patient received double antiplatelet therapy for 12 months.

On March 11, 2022, the patient underwent a health checkup at RS Hasan Sadikin, where a coronary angiography procedure was performed to assess the blockages. The results were consistent with the previous examination at RSUD Banjar, but more severe stenosis was found in the LAD. Following this procedure, the patient attended regular checkups and adhered to medication prescribed by the attending physician (DPJP). In the latest checkup at RSUD Garut, the patient was instructed to undergo a second PCI, referred to RS Jantung Tasikmalaya, and underwent a CAG standby PCI procedure. The results revealed 80-90% stenosis in the mild Left Anterior Descendent (LAD) and a patent stent in the proximal Left Circumflex (LCx), along with 20-30% stenosis in the proximal Right Coronary Artery (RCA). Finally, a stent or PCI was placed in the mid LAD.

In interviews with the patient, it was revealed that during the two catheterization procedures, the access route was consistently through the femoral artery. When asked about the reason, the patient mentioned not knowing why femoral access was chosen. Further investigation uncovered that the patient had a tortuous aorta, a condition where the aorta is twisted, causing narrowing of blood vessels. Therefore, femoral access was feasible for the patient. The patient also mentioned that after sheath removal, he had to lie down for 5-6

hours and was pressed with a pillow weighing approximately 1 kg, which made the patient uncomfortable.

Interview and observation

Disease information

In the interview conducted with Mr. DH, the first heart attack that occurred on October 20, 2020, initially went unnoticed. A few minutes after sitting in front of his house, he experienced something abnormal, as revealed in the interview transcript:

"... I first felt it on Tuesday, October 20, 2020. Initially, I didn't feel anything; I was sitting in front of the house... suddenly, I felt something strange in my chest. Within a few minutes, I felt the pain in my chest increasing. From there, I don't remember what happened; I realized I was in SMC hospital ..."

Treatment

When the family realized that Mr. DH suddenly lost consciousness, they immediately took him to RS Singaparna Medika Citrautama (SMC). The family's statement is conveyed in the interview transcript as follows:

"I was cooking in the kitchen, suddenly heard someone fall in front of the house... when I looked, it turned out Dad had already passed out. I tried to wake him up, but he didn't wake up. I immediately called my child, and we quickly went to SMC Hospital... in the SMC ER, I was told to wait outside, and after 4 hours, Dad woke up again, and I accompanied him. After that, Dad was transferred to inpatient care; he stayed at SMC Hospital for one night. The doctor who handled Dad said he had heart disease, and there was suspicion of a blockage in the heart, so Dad had to have a heart stent. There, my children and I were very shocked and sad, especially seeing Dad shocked and sad. I handed over everything to the best doctor for Dad. Finally, the next day, on the 21st, Dad was referred to RSUD Banjar for heart stent placement. Dad was said to have one stent installed..."

After the first stent placement, Mr. DH received double antiplatelet therapy for 12 months. He explained in the interview transcript:

"After the stent was installed, it was better, no more chest pain. There are two main medications..."

The family added:

"When the procedure was finished, the nurse who cared for Dad said that the stent was placed through the leg because it couldn't be done through the hand, so the leg shouldn't be moved for 6 hours. Then a pillow was

placed under his right leg; after 6 hours, Dad could move his leg lightly but couldn't go up and down stairs. When he went home, he was given two types of blood thinners, prescribed for one month, and he had to have regular check-ups every month for a year..."

After the first stent placement, Mr. DH regularly attended health check-ups, and in March 2021, a coronary angiography was performed to assess blockages in coronary arteries using a contrast agent. The results were consistent with the examination at RSUD Banjar, but more severe stenosis was found in the LAD. In the last check-up at RSUD Garut, Mr. DH was instructed to undergo a second PCI, referred to RS Jantung Tasikmalaya, and underwent a CAG standby PCI procedure, finally having a stent or PCI placed in the mid LAD.

"When Dad had a check-up at RSUD Ciamis, they said the second stent had to be installed immediately, so he was referred here..."

Coldpack intervention





After the PCI procedure at 12:00 PM and sheath removal at 4:40 PM, mechanical compression using a coldpack was applied to Mr. DH. Mr. DH's response to mechanical compression using a coldpack is explained in the interview transcript below:







"Usually, after the stent is placed in the leg, a pillow weighing 1 kg is placed for 6 hours to prevent swelling. It's quite stiff, but here, they give something cold, so it's not too stiff because it's only kept for a short time. When it was placed at RSUD Banjar, my leg also felt painful when moved. But now, thank God, not here..."

Mr. DH admitted that the use of a coldpack is more comfortable than using sandbags as before. He also mentioned that the coldpack is faster than sandbags. Pain in the femoral access area is also felt to decrease more quickly, and there is no swelling or hematoma in that area.

The researcher also conducted observations during mechanical compression using a coldpack. Observations were made for 6 hours, with the first hour every 15 minutes, the second hour every 30 minutes, and the third hour every hour, with a total of 6 hours. Below are the results of the researcher's observations presented in the observation table using The Femoral Scale.

Table 2. Observation of Outcome

Time	<i>The Femoral Scale</i>	Pulsation	Response
1 st Hour 15 minutes 1 st	17.00 17.15 : Scale 0 	Strong palpable Strong palpable	Back pain
15 minutes 2 nd	17.30 : Scale 0 	Strong palpable	Back pain
15 minutes 3 rd	17.14 : Scale 0 	Strong palpable	Back pain
15 minutes 4 th	18.00 : Scale 0 	Strong palpable	Back pain

2 nd Hours 30 minutes 1 st	18.00 18.30 : Scale 0	Strong palpable Strong palpable	Stiff legs
			
30 minutes 2 st	19.00 : Scale 0	Strong palpable	Stiff legs
			
3 rd Hour	20.00 : Scale 0	Strong palpable	Stiff legs
			
4 th Hour	21.00 : Scale 0	Strong palpable	Stiff legs
			
5 th Hour	22.00 : Scale 0	Strong palpable	Stiff legs
			
6 th Hour	23.00 : Scale 0	Strong palpable	No
			

Discussion

Patient response

During the research to observe patient responses, a question and answer interview session was conducted with the patient and the patient's family. The interview results were obtained from both the patient and the family. Throughout the interview session, the patient and the family appeared cooperative in answering the given questions. However, in some instances, the patient's family could not provide answers regarding the date and time of the incident, as well as the reasons for certain actions or inactions due to limitations in understanding and forgetfulness.

Questions aimed at assessing the knowledge and actions taken with the patient when the disease occurred revealed that the family responded quickly and appropriately to the actions that should be taken. The family promptly brought the unconscious patient to the nearest hospital. The family also appeared consciously to entrust the medical staff with full authority over the actions to be taken for the patient's well-being. When the medical staff stated that the patient needed to undergo heart ring placement or PCI, after being educated, the family agreed and fully entrusted the decision to the medical staff. Post-treatment medication was also consumed regularly and systematically by the patient, and regular check-up schedules were diligently followed. The patient also began adopting a healthy lifestyle by quitting smoking, consuming nutritious food, and engaging in regular exercise.

During the sheath removal, the patient appeared calmer, unlike other patients who seemed tense, considering this was the patient's third procedure. Similarly, when mechanical compression was applied using a cold pack, the patient mentioned that it was more comfortable than the sandbag usually used. The patient also stated that the use of a cold pack did not cause prolonged stiffness. The research results align with the references taken from previous theories. A cold pack utilizes a cold temperature to handle injuries. The cold temperature causes vasoconstriction of arterial and venous blood vessels by stimulating the smooth muscles in the vessel walls. This vasoconstriction reduces bleeding and swelling in the injured tissues. Patient assessment results showed that the femoral area subjected to compression with a cold pack did not experience hematoma and reduced pain sensation in the patient. The use of cold packs also provided a different experience for the patient, usually resulting in stiffness and heaviness when using a sandbag, while the cold pack offered a more comfortable sensation.

Observation

The researcher conducted observations on the patient after PCI, sheath removal, and application of the cold pack. The observation period lasted for 6 hours, starting with the initial 20-minute application of the cold pack to the PCI access site, followed by observations every 15 minutes for the first hour, every 30 minutes for the second hour, and hourly for the remaining 4 hours.

Results of the observation using The Femoral Scale:

- 0 Hematoma was observed during the 6-hour period.
- The patient reported reduced back pain.
- The patient had no complaints of chest pain.
- The patient did not exhibit signs of hematoma in the femoral area.

- The patient remained comfortable during the application of the cold pack.
- The patient did not experience prolonged stiffness.
- The patient's back pain diminished with the application of warm oil.
- The patient's compliance with immobilization was noted.
- No hematoma was found in the femoral area.

In conclusion, the 6-hour observation aligned with the theoretical expectations derived from previous references, indicating that the use of a cold pack can effectively address hematoma in patients. However, challenges were identified in the patient's ability to control immobilization, as opposed to using a sandbag, which serves as a continuous reminder for the required 6-hour immobilization period. Despite this, the use of a cold pack successfully achieved its intended purpose of addressing hematoma in this case and can be considered as a comfortable alternative to sandbags for patients.

Coldpack is one of the nursing interventions widely used to reduce hematoma. The perceived cool sensation provides physiological effects that can reduce inflammatory responses, decrease blood flow, effectively lower edema, and alleviate local pain. In addition to serving as a substitute for cold compresses, coldpack is also utilized as an alternative to hot packs (Mosad et al., 2020). It serves various purposes, such as managing fever, headaches, muscle cramps, stiffness, and more. The usage involves boiling the hot pack for 10-20 minutes, after which it can be applied.

Coldpack is wrapped in a wet towel and directly placed on the area requiring treatment. Physiologically, 10-15 minutes after applying a cold compress, vasoconstriction occurs due to the smooth muscle relaxation effect resulting from the stimulation of the autonomic nervous system. It can also stimulate the release of endorphins, reducing pain and discomfort (Novita in Ulfah et al., 2019).

Price and Wilson propose that coldpack comes in the form of a double-layered plastic bag. The inner part of the bag contains ammonium nitrate powder, and the easily breakable outer part contains water. When the package is massaged, the water-filled plastic bag will break, and with a little shaking, ammonium sulfate will dissolve in water. The dissolution of ammonium sulfate is an endothermic reaction marked by a decrease in temperature. Coldpacks can be reused by simply cooling them back in the refrigerator. In terms of thermochemistry, the temperature decrease in a coldpack containing 120 grams of ammonium nitrate crystals ($M_r = 80$) and 500 mL of water is calculated. Therefore, the solution's temperature will drop by 18.6°C . The freezing resistance can last for 8-12 hours, depending on the pack used, and it can be reused as long as the packaging is not damaged (Mosad et al., 2020).

Nortech Lab, (2021), the discoverer and pioneer of the coldpack, states the advantages of using Coldpack: it can be reused, economical and effective, highly flexible, available in the form of plastic plates or bags to suit various needs. All packaged securely to prevent leakage or breakage, containing antimicrobial properties that prevent the growth of fungi, moss, odors, and bacteria, providing longer-lasting and colder temperatures than regular ice, and ensuring stability, safety, environmental friendliness, and non-toxicity, with cooling endurance of up to 12 hours.

Conclusion

Based on the research findings, it can be concluded that the nursing intervention using a coldpack to address hematoma in post-PCI patients with femoral sheath access is effective. This is evidenced by the absence of hematoma in post-PCI patients with femoral access after applying mechanical pressure with a coldpack. During the observation, the patient's responses did not indicate significant complaints; the patient expressed greater comfort using a coldpack compared to the conventional sandbag method. Therefore, the use of a coldpack to address hematoma in this case has proven successful and can be considered as an alternative to sandbags, providing enhanced comfort for the patient.

The use of a coldpack in this case can be considered as an alternative to sandbags to offer greater comfort to the patient. However, during implementation, additional monitoring is necessary when the coldpack is removed, particularly during the 6-hour immobilization period, to ensure that the patient remains conscious and compliant with immobilization. Collaboration with the patient's family is also essential for monitoring and reminding the patient by their close ones. The results of this study can serve as a guide on how to address hematoma in post-PCI patients with femoral sheath access, offering an alternative to sandbags. However, proper monitoring and collaboration with the patient's family are crucial during implementation to avoid new issues or prolong the patient's care period.

Conflict of interest

There is no conflict of interest.

Ethical approval

This research has received ethical approval from the Health Research Ethic Commission of the STIKes Muhammadiyah Ciamis number 021/KEPK-STIKESMUCIS/XII/2022.

Authors' contribution

Each author contributed equally in all the parts of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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