

## Comparison of Sand Pillows and Cold Compresses in Reducing The Incidence of Hematoma in Post Percutaneous Coronary Intervention (PCI) Patients: A Scoping Review

Qomaruddin Asy'ary<sup>1</sup>, Titin Andri Wihastuti<sup>2</sup>, Dina Dewi Sartika Lestari Ismail<sup>3</sup>

<sup>1,2,3</sup> Brawijaya University, Central Java, Indonesia

Email: qomaruddinasyary@gmail.com<sup>1</sup>, [wihastuti.fk@ub.ac.id](mailto:wihastuti.fk@ub.ac.id)<sup>2</sup>, [dinasli@ub.ac.id](mailto:dinasli@ub.ac.id)<sup>3</sup>

### ABSTRACT

Coronary heart disease is the most common cause of morbidity and death in the world. Cardiac catheterization is applied to diagnose and treat coronary heart disease. Non-invasive Percutaneous Coronary Intervention (PCI) aims to open narrowed coronary blood vessels. The most frequently used vascular installation site is the femoral artery. The PCI procedure has several vascular complications, such as hematoma, which often occur in post-PCI patients. Using sand pillows and cold compresses is one measure to reduce the incidence of hematomas. This study aims to compare the effectiveness of sand pillows and cold compresses in reducing hematomas in post-PCI patients. This study was designed as a scoping review. Article searches were limited to 2019-2024. Search using the Google Scholar, ScienceDirect, and Proquest databases and using advanced search with the keywords "sandbag," "cold pack," "hematoma," and "percutaneous coronary intervention." A total of 45 articles were found, and then by applying the specified inclusion criteria, we found 6 articles. The 6 articles obtained show that using a sand pillow can reduce the duration of compression and speed up the achievement of hemostasis by pressing on the arteries. Meanwhile, using cold compresses and cold packs can cause vasoconstriction of blood vessels, speed up blood clotting time, and form blood clots. It can be concluded that cold compresses are more effective in reducing the incidence of hematomas in post-PCI patients compared to using sand pillows.

**Keywords:** cold pack, hematoma, percutaneous coronary intervention, sandbag

### INTRODUCTION

Acute coronary syndrome (ACS) is a cardiac emergency that causes high mortality rates in hospitals. Compared to other causes, acute coronary syndrome is the cause of most cardiac arrest events, with a survival rate of < 10% (Wihastuti et al., 2020). According to WHO, in 2015, there were 17.5 million deaths out of all global deaths caused by cardiovascular disease and 7.4 million deaths caused by acute coronary syndrome (Goodwill *et al.*, 2019). Cardiac catheterization is used to perform early detection and establish the presence of coronary heart disease (Syahri & Andriani, 2021). Cardiac catheterization is also defined as an action or procedure using a catheter tube to evaluate the narrowing of the coronary blood vessels of the heart (Cauley et al., 2019).

## Comparison Of Sand Pillows And Cold Compresses In Reducing The Incidence Of Hematoma In Post Percutaneous Coronary Intervention (PCI) Patients: A Scoping Review

Cardiac catheterization is divided into two groups: coronary angiography and Percutaneous Coronary Intervention (PCI). PCI aims to open the narrowing of the coronary blood vessels so that the blood supply to the ischemic tissue increases (Cheema et al., 2020). However, as with other interventional procedures, cardiac catheterization causes major and minor complications. Major complications include myocardial infarction, stroke, and death. Minor complications include transient ischemic attacks, arrhythmias, vascular complications, allergic reactions related to contrast agents, and renal failure. Among minor complications, vascular complications are more common than others (Korkmaz1a & Karagözoğlu, 2022). Artery Femoral is a frequently used access to PCI measures. However, there are some complications of femoral access, such as infection (0-1%), pseudoaneurysms and arteriovenous fistulas (0.1-0.6%), and hematomas (0.5-1.7%) (Sari et al., 2017).

Hematoma events are vascular complications that are frequent to PCI measures, potentially leading to serious complications (Baidhowy et al., R, & Listiani, 2021). Hematomas can cause increased morbidity, where hematomas will prolong the patient's bed rest period, and in general, patients will complain of leg aches and cramps, pain in the thigh folds, and pain in the back of the waist (Manik, 2015). Hematoma occurs due to tearing after sheath removal and in the former puncture area that is not completely closed (Abdelaal et al., 2015). Research conducted by (Cauley et al., 2019) states that hematomas have signs such as swelling, pain, or neurovascular symptoms. This is because there is an accumulation of blood outside the intravascular. This condition can occur if the walls of arteries, veins, or capillaries are damaged so that blood exits into the tissue.

One of the nursing interventions used to reduce the incidence of hematomas is the use of sand pillows and cold compresses (Kurt & Kaşıkçı, 2019; Syahri & Andriani, 2021). Sand pillows can shorten the duration of compression and help achieve hemostasis by applying pressure to the arteries to prevent hematomas (Manik, 2015). While cold compresses are applied using cold packtaste, pain is inhibited at cold temperatures by decreasing the speed of impulses transmitted by nerve fibers. Vasoconstriction in arteries and veins is caused by the influence of temperature that stimulates smooth muscles in the lining of blood vessels. In addition, vasoconstriction also lowers bleeding and swelling in injured tissue (Sari et al., 2017).

Considering the importance of reducing the incidence of hematomas in post-PCI patients by intervention using sand pillows and cold compresses, researchers are therefore interested in conducting a literature review related to the comparison of the application of sand pillows and cold compresses in reducing the incidence of hematomas in post-PCI patients.

### RESEARCH METHODS

The research method used in this scoping review is a scoping review approach regarding the Arskey and O'Malley framework. The stages in the preparation of the scoping review include identifying research questions, identifying relevant literature sources, selecting literature, mapping and collecting literature, compiling, summarizing, and reporting the results of literature analysis, as well as consultation with competent parties. Literature searches are conducted through Google Scholar, ScienceDirect, and

Proquest databases using advanced search and certain keywords such as "sandbag," "cold pack," "hematoma," and "percutaneous coronary intervention," with restrictions in 2019-2024.

Inclusion criteria in this review include articles in Indonesian and English, original papers or review literature, and full text. In contrast, exclusion criteria include books or modules, theses, dissertations, scientific papers, articles that are issues for debate, letter editors, protocols, prereviews, and paid/inaccessible/non-full text articles. Articles that meet the inclusion criteria are then identified, filtered, extracted, and displayed in a table containing information about the title, author, year of publication, country of research location, research objectives, research design, and research conclusions. The data extraction results are then analyzed and elaborated in more detail in the discussion.

The research process involves screening articles based on title, abstract, year of publication, and age after removing duplicates, as well as assessing the eligibility of articles based on inclusion and exclusion criteria. The entire study was consulted with other authors for validation. The data were then mapped into tables to summarize the narrative findings of the results of this exploratory review, including study characteristics, hematoma incidence, hematoma risk factors, and the application of cold compresses to reduce hematomas. Information on the effect of the successful application of cold compresses is taken from the discussion and presented in table format in Microsoft Word 2016.

## **RESULTS AND DISCUSSIONS**

### **Characteristics of the selected studies**

After a literature search according to the inclusion and exclusion criteria, One article with experimental research design methods, a randomized posttest-only Control Groupon article with Design Experiment Methods control group, and four articles with methods Randomized Control (RCT). Based on the 6 articles found, *Scoping Review* This indicates that the application of a cold compress or *cold pack* in post-PCI patients is more effective in reducing the incidence of hematomas compared to the use of sand pillows ((Ebrahimi-Shalmani et al., 2020);(Kareem & Al-Kassar, 2023);(Korkmaz1a & Karagözoğlu, 2022);(Korkmaz1a & Karagözoğlu, 2022);(Valikhani et al., 2020);(Syahri & Andriani, 2021)).

### **Percutaneous Coronary Intervention (PCI)**

Percutaneous Coronary Intervention (PCI) is a non-surgical invasive procedure or procedure performed on patients with coronary heart disease to open occlusion or narrow the coronary arteries and increase blood supply to the systemic (Ahmad et al., 2020). PCI is done by dilating narrowed arteries and patenting them by installing stents to keep them open (Nuraeni et al., 2023). PCI is the primary treatment in patients with ST-elevation myocardial infarction (STEMI) (Mole et al., 2016). PCI procedure has several vascular complications that can occur, such as infection, arterial fistula, retroperitoneal hemorrhage, pseudoaneurysm, and hematoma (Khoiriyati et al., 2013).

### **Hematoma**

Hematoma is a vascular complication often occurring after PCI (Abdelaal et al., 2015). Research conducted by (Cauley et al., 2019) states that the hematoma has signs

such as swelling, pain, or neurovascular symptoms. This is due to the accumulation of blood outside the intravascular. This condition can occur when the walls of arteries, veins, or capillaries are damaged so that blood exits into the tissues. Some studies reported minor bleeding due to catheter removal in the femoral artery area (Kurt & Kaşıkçı, 2019). Previous studies have also suggested that post-PCI bleeding and hematoma complications can increase the length of stay and increase the cost of hospitalization (Numasawa et al., 2017). Decreased capillary permeability and increased blood clotting and metabolic needs cause bleeding to be controlled and prevent hematomas (Kurt & Kaşıkçı, 2019).

## Discussion

### Application of sand pillows and cold compresses

Effective non-pharmacological interventions in post-PCI patients To reduce the occurrence of hematomas, cold compresses are applied. The intervention aims to make the patient feel comfortable, and pain can be minimized (Baidhowy et al., 2021). In addition, using sand pillows is also an intervention that can reduce the occurrence of hematomas (Syahri & Andriani, 2021). (Swami et al., 2024) conducted a randomized controlled trial on 50 patients to identify the optimal method of lowering hematomas. One group was treated with a sand pillow weighing 2 kg, while the other group used a cold compress with an Ice pack weighing 365 grams to achieve hemostasis in the femoral area after removing the sheath. The sand pillow group was the control while the ice pack group was the intervention group. Hematomas occurred in both groups at 30-minute intervals over 3-hour intervals. The results stated a significant difference in the rate of hematoma reduction between the two groups. Namely, hematoma decreased significantly in the intervention group with cold compresses using ice packs compared to the sand pillows group (Valikhani et al., 2020).

Several other studies have also compared the use of sand pillows with the use of cold packs (Kurt & Kaşıkçı, 2019; Pamuk & Özkaraman, 2024; Syahri & Andriani, 2021). Literature studies conducted by Baidhowy *et al.* (2021) explained that using sand pillows is a less effective intervention. Sand pillows are placed on the patient's upper femoral area in bed for long periods, causing the patient to be disturbed and in pain (Korkmaz1a & Karagözoğlu, 2022). Another study also found that the group using sand pillows had hematomas by 18% and bleeding by 8% (Çürük, 2017). However, research (Sari et al., 2017) stated no significant difference in hematoma development within 24 hours in post-PCI patients who used sand pillows or cold compresses. However, using sand pillows causes tingling, pain, and difficulty moving in the access area after sheath removal.

Although statistically not statistically significantly associated with hematomas, the application of cold compresses found lower hematomas than other groups (Korkmaz1a & Karagözoğlu, 2022). This happens because the application of cold compresses a decrease in blood flow, increased coagulation, increased viscosity, and decreased metabolic density so that bleeding can be controlled in accordance with the research (Ginanjari et al., 2018), where experiments with the application of cold compresses and early ambulation with a control group using sand pillows and the results showed that the application of cold compresses with early ambulation was more effective than sand pillows in reducing the incidence of hematomas.

Several studies have shown that the application of cold compresses is effective in reducing hematomas in post-PCI patients ((Ebrahimi-Shalmani et al., 2020);(Kareem & Al-Kassar, 2023);(Valikhani et al., 2020);(Syahri & Andriani, 2021)). In addition, cold compresses also have the effect of vasoconstricting blood vessels, accelerating blood clotting time, and blood clot formation (Senan et al., 2020). Cold compresses are a nonpharmacological method that enhances the coagulation process by causing vasoconstriction, which leads to decreased blood flow and increased blood viscosity. Thus, increased coagulation and decreased capillary permeability, as well as metabolic needs, facilitate the control of bleeding at the site of trauma. Therefore, the application of cold compresses for femoral sheath removal in post-PCI patients can reduce the occurrence of hematomas, hemorrhages, and ecchymoses (Baidhowy et al., 2021; Kareem & Al-Kassar, 2023). In addition, cold compresses also have an effect on the nerves, which decreases the release of local pain mediators and slows peripheral nerve conduction (Ginanjar et al., 2018).

According to (Kurt & Kaşıkçı, 2019), the application of cold compresses reduces the formation of hematomas in the femoral artery area after catheter withdrawal, and the size of the growing hematoma is small. The low grade and small size of hematomas in the experimental group are considered to be the result of the application of cold compresses. One of the physiological effects is to reduce the speed of blood flow and increase its viscosity. In line with (Kareem & Al-Kassar, 2023), Yang explains that cold compress therapy has long been used as a noninvasive method to control bleeding. The physiological effects of cold compress therapy include arterial contractions, which ultimately result in decreased peripheral blood circulation, histamine release, inflammation, muscle spasms, and successive nerve conduction speeds. Slows blood flow by increasing the viscosity of blood flow to an invasively administered bleeding site; ice packs (cold packs) can also facilitate better achievement of hemostasis and fewer vascular complications such as hematomas.

Research conducted (Pamuk & Özkaraman, 2024) It is also stated that the use of cold compresses, along with sand pillows, is also effective in preventing perivascular complications. Cold compresses control bleeding by reducing capillary blood flow and capillary permeability through arteriole vasoconstriction. In addition, it reduces the blood flow rate and increases viscosity, thereby providing coagulation. Cold compresses reduce the development of ecchymosis and hematomas. In addition, cold compresses are preferred to prevent and treat vascular complications because they are more practical and inexpensive, can increase patient comfort, reduce pain, and significantly reduce hematomas in the intervention area.

### **The Role of Nurses in Hematoma Management**

Seeing a positive impact on the use of cold compresses in post-PCI patients compared to the use of sand pillows that can cause pain in patients. Where pain can negatively affect the healing process by causing anxiety and fatigue in patients, so the use of cold compresses becomes a more effective method in reducing the occurrence of hematomas. Therefore, nurses have an important role in preventing hematomas, and the key is early recognition and prevention of complications (Kurt & Kaşıkçı, 2019; Nuraeni et al., 2023). Controlling vascular complications such as hematomas can reduce the length of hospitalization and medical costs of patients. Prevention of complications

is also important to provide collaboration and adherence to the process, thus speeding up the recovery process. This can increase the level of patient satisfaction and the quality of nursing services better (Çürük, 2017).

## CONCLUSION

Based on the results of the scoping review, it can be recommended that the application of cold compresses is more effective in reducing the incidence of hematomas, so it can be an option for performing mechanical suppression to prevent bleeding in post-PCI patients. While the scoping review suggests the superiority of cold compresses in reducing hematoma incidence post-PCI, certain confounding factors warrant further investigation. The recommendation lacks granularity concerning these confounders, emphasizing the necessity for more comprehensive research. Additionally, a more exhaustive summary of the evidence supporting the recommendation is required to bolster its validity. Nonetheless, nurses play a pivotal role in preventing vascular complications post-cardiac catheterization, facilitating patient collaboration and adherence to recovery processes, and ultimately enhancing patient satisfaction with nursing services. Future research endeavors should meticulously address these confounders to provide new insights and optimize the quality of nursing care in post-PCI patients.

## REFERENCES

- Abdelaal, E., Rimac, G., Plourde, G., Machaalany, J., Roy, L., Tardif, M. A., ... Bertrand, O. F. (2015). 4Fr in 5Fr sheathless technique with standard catheters for transradial coronary interventions: Technical challenges and persisting issues. *Catheterization and Cardiovascular Interventions*, 85(5), 809–815. <https://doi.org/10.1002/ccd.25709>
- Ahmad, M., Mehta, P., & Akr, R. (2020). Percutaneous Coronary Intervention. In *StatPearls Publishing, Treasure Island (FL)*.
- Baidhowy, A. S., Antartika, G. Y., Sungkono, R, A. B., & Listiani. (2021). Tinjauan Literatur: Penerapan Kompres Dingin Untuk Mengurangi Nyeri dan Hematoma Pada Pasien Post Percutaneous Coronary Intervention (PCI). *Jurnal Perawat Indonesia*, 5(3), 784–793.
- Cauley, R., Wu, W. W., Doval, A., Chaikof, E., Ho, K. K. L., & Iorio, M. L. (2019). Identifying Complications and Optimizing Consultations following Transradial Arterial Access for Cardiac Procedures. *Annals of Vascular Surgery*, 56, 87–96. <https://doi.org/10.1016/j.avsg.2018.07.064>
- Cheema, F. M., Cheema, H. M., & Akram, Z. (2020). Identification of risk factors of acute coronary syndrome in young patients between 18-40 years of age at a teaching hospital. *Pakistan Journal of Medical Sciences*, 36(4), 821–824. <https://doi.org/10.12669/pjms.36.4.2302>
- Çürük, G. N. (2017). The Effect of Ice-Bag Applied to Femoral Region of Individuals with Percutaneous Coronary Intervention on Local Vascular Complications and Low Back-Pain. *IOSR Journal of Nursing and Health Science*, 06(01), 136–144. <https://doi.org/10.9790/1959-060105136144>
- Ebrahimi-Shalmani, F., Hasavari, F., Nikfarjam, S., Leili, E. K., & Javadi-Pashaki, N. (2020).

- The effect of the local cold application on low back pain and vascular complications of patients undergoing coronary angiography. *International Journal of Research in Pharmaceutical Sciences*, 11(4), 7754–7762. <https://doi.org/10.26452/ijrps.v11i4.4220>
- Ginanjar, R., Hadisaputro, S., Mardiyono, M., & Sudirman, S. (2018). Effectiveness of Cold Pack With Early Ambulation in Preventing Complications of Haemorrhage and Haematoma in Patients Post Cardiac Catheterization. *Belitung Nursing Journal*, 4(1), 83–88. <https://doi.org/10.33546/bnj.352>
- Kareem, H. M., & Al-Kassar, R. A. H. (2023). Effect of Direct Cold Compress for Femoral Arterial Sheath Removal on Reduction of Local Vascular Complications in Patients after Percutaneous Coronary Intervention: A Randomized Controlled Trial. *Kufa Journal for Nursing Sciences*, 13(2), 99–110. <https://doi.org/10.36321/kjns.vi20232.12477>
- Khoiriyati, A., Ropi, H., & Kosasih, C. E. (2013). Kejadian Komplikasi Vaskuler Pasien Pasca Intervensi Koroner Perkutan di RSUP Dr . Hasan Sadikin Bandung. *Jurnal Kesehatan*, 196–203.
- Korkmaz1a, E., & Karagözoğlu, Ş. (2022). Comparison of Sandbag, Close Pad, and Cold Application Combined with Sandbag in Preventing Peripheral Vascular Complications After Cardiac Catheterisation. 44(March), 1–8.
- Kurt, Y., & Kaşıkçı, M. (2019). The effect of the application of cold on hematoma, ecchymosis, and pain at the catheter site in patients undergoing percutaneous coronary intervention. *International Journal of Nursing Sciences*, 6(4), 378–384. <https://doi.org/10.1016/j.ijnss.2019.09.005>
- Manik, J. M. (2015). Perbedaan Bantal Pasir dan Cold Pack Gel dalam Mencegah Komplikasi Paska Kateterisasi Jantung. *The Soedirman Journal of Nursing*, 10(2), 105–113.
- Mol, K. A., Rahel, B. M., Meeder, J. G., van Casteren, B. C. A. M., Doevendans, P. A., & Cramer, M. J. M. (2016). Delays in the treatment of patients with acute coronary syndrome: Focus on pre-hospital delays and non-ST-elevated myocardial infarction. *International Journal of Cardiology*, 221, 1061–1066. <https://doi.org/10.1016/j.ijcard.2016.07.082>
- Muhibbah, M., Wahid, A., Agustina, R., & Iliandri, O. (2019). Karakteristik Pasien Sindrom Koroner Akut Pada Pasien Rawat Inap Ruang Tulip Di Rsud Ulin Banjarmasin. *Indonesian Journal for Health Sciences*, 3(1), 6. <https://doi.org/10.24269/ijhs.v3i1.1567>
- Numasawa, Y., Kohsaka, S., Ueda, I., & Miyata, H. (2017). Incidence and predictors of bleeding complications after percutaneous coronary intervention. *Journal of Cardiology*, 69(1), 272–279. <https://doi.org/10.1016/j.jjcc.2016.05.003>
- Nuraeni, A., Arrafi, A. R., & Rahmah, A. (2023). Potensi Kompres Dingin Terhadap Pencegahan Hematoma Pada Pasien Pasca Percutaneous Coronary Intervention (Pci): Scoping Review. *MALAHAYATI NURSING JOURNAL*, 5(7), 2185–2200.
- Pamuk, G. D., & Özkaraman, A. (2024). The Effect of Cold Sand Pack on Percutaneous Coronary Intervention-Induced Vascular Complications and Pain: A Randomized Controlled Trial. *Florence Nightingale Journal of Nursing*, 32(1), 58–67. <https://doi.org/10.5152/fnjn.2024.23074>

Comparison Of Sand Pillows And Cold Compresses In Reducing The Incidence Of Hematoma In Post Percutaneous Coronary Intervention (PCI) Patients: A Scoping Review

- Sari, E. A., Arifin, M. Z., & Fatimah, S. (2017). Perbandingan Hematoma Pasca Kateterisasi Jantung Berdasarkan Penekanan Bantal Pasir dan Cold Pack. *Jurnal Pendidikan Keperawatan Indonesia*, 3(2), 100. <https://doi.org/10.17509/jpki.v3i2.9414>
- Senan Mutlu, Ms., & Emel Yilmaz, P. (2020). The Effect Of Soft Tissue Injury Cold Application Duration On Symptoms, Edema, Joint Mobility, And Patient Satisfaction: A Randomized Controlled Trial. *Journal of Emergency Nursing*, 46(4), 449–459. <https://doi.org/10.1016/j.jen.2020.02.017>
- Swami, V., Voracek, M., Todd, J., Furnham, A., Horne, G., & Tran, U. S. (2024). Positive self-beliefs mediate the association between body appreciation and positive mental health. *Body Image*, 48, 101685. <https://doi.org/https://doi.org/10.1016/j.bodyim.2024.101685>
- Syahri, A., & Andriani, R. (2021). Perbandingan Penggunaan Bantal Pasir dan Cold Pack Dalam Mencegah Komplikasi Hematoma Pada Pasien Pasca Cardiac Catheterization di Cath Lab Program Studi Sarjana , STIKes Medika Seramoe Barat Komplikasi Hematoma Pada Pasien Pasca Cardiac Catheterization d. *Best Journal*, 4(2), 195–202.
- Valikhani, M., Mahdizadeh, S. M., Eshraghi, A., Mazlum, S. R., & Dehghani, J. (2020). The Effect of Simultaneous Sand-Ice Bag Application on Hemorrhage and Hematoma after Percutaneous Coronary Intervention: A Randomized Clinical Trial. *Journal of Caring Sciences*, 9(4), 188–194. <https://doi.org/10.15171/jcvtr.2015.24>
- Wihastuti, T. A., Widasmar, D., Program, N. M., & Program, M. (2020). Family Income and Health Insurance as Factors Related to Family Response to Acute Coronary Syndrome Attack. *International Journal of Science and Society*, 2(4), 639–648.

---

**Copyright Holder:**

Qomaruddin Asy'ary<sup>1</sup>, Titin Andri Wihastuti<sup>2</sup>, Dina Dewi Sartika Lestari Ismail<sup>3</sup> (2024)

**First Publication Right:**

Journal of Health Science

This article is licensed under:

