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Analysis of Patient Characteristics Associated with Hematoma and Pain Post-Percutaneous Coronary Intervention: A Cross-Sectional Study

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Abstract

Background: Percutaneous coronary intervention (PCI) is a standard treatment for coronary artery disease, yet post procedural complications such as hematoma and pain remain prevalent. Previous studies have reported inconsistent findings regarding the role of demographic factors in these outcomes. This study aimed to analyze the correlation between age, body mass index (BMI), gender, and PCI experience with hematoma and pain in post PCI patients while femoral sheath removal.

Methods: A cross-sectional correlational study was conducted involving 60 post PCI patients who reported hematoma and pain during femoral sheath removal. Data were collected from August to December 2025 in one referral hospital in Aceh Province. Hematoma and pain were assessed during femoral sheath removal using a measuring tape and the Numeric Rating Scale (NRS). Data were analyzed using Spearman's test.

Results: No significant correlations were found between patient characteristic variables and hematoma (age, p value 0.871; BMI, p value 0.788; gender, p value 0.160, and PCI experience, p value 0.891) or pain (age, p value 0.241; BMI, p value 0.343; gender, p value 0.256, and PCI experience 0.276).

Conclusion: Demographic factors were not associated with hematoma and pain outcomes. Health care providers focus should shift toward procedural and intervention-based.

Keywords: PCI, Hematoma, Pain, Demographic Factors

Introduction

Cardiovascular disease remains the leading global cause of death, accounting for approximately 17.9 million deaths annually. The leading cause of death from heart disease is Acute Coronary Syndrome (ACS), accounting for 85% of cases, or 15.2 million people [1]. In 2025 in the United States, one person died from heart disease every 34 seconds [2]. The average prevalence of heart disease in Indonesia in 2023 reached 0.85% and remains a concern for the government among noncommunicable diseases [3]. The Social Security Administration Agency or Badan Penyelenggara Jaminan Sosial (BPJS) in Indonesia spent approximately 11 trillion Rupiah on healthcare services for heart disease accounting for nearly half of BPJS's total expenditures in 2022 [4]. The prevalence of heart disease in Aceh reached 0.77%, ranking 14th out of 38 provinces in Indonesia [3].

Percutaneous coronary intervention (PCI) has become a primary revascularization technique for coronary artery disease due to its effectiveness in restoring myocardial perfusion [5]. Currently, PCI is the most widely used procedure for treating coronary heart disease worldwide [6-11]. This is because PCI is considered the primary effective treatment for heart attack patients due to its lower invasiveness, shorter treatment duration, and better curative outcomes [7]. Rapid improvement in PCI technology and techniques have improved safety and long-term clinical outcomes, thereby reinforcing the central role of PCI in the contemporary management of coronary artery disease [11] In Indonesia, the increased availability of PCI services at several hospitals, including in the Aceh province, has facilitated faster access to this interventional procedure, particularly in the treatment of ST-elevation myocardial infarction [9].

Despite its benefits, PCI is associated with complications such as vascular injury, hematoma, and pain following femoral sheath removal [12]. Hematoma and pain were of the most common complications, occurring due to tearing after sheath removal

and incomplete closure of the puncture area, which may lead to prolonged hospitalization, increased morbidity, and patient discomfort [13-16]. In post-PCI patients, hematoma manifests as swelling accompanied by discomfort [17, 18]. Several studies report varying incidence rates. A study in the United States found that more than 3 million PCI procedures (12.1%) resulted in hematoma complications [17]. At one of the hospitals in Iraq during six months, incidence of femoral hematoma in studied patients was 9.5% [19].

Pain is another frequent outcome influenced by tissue trauma, compression techniques, and patient-specific factors [20]. Several studies suggest that demographic factors such as age, gender, and BMI may influence complication risk, such as hematoma and pain. However, previous findings remain inconsistent [21]. For example, older age has been associated with vascular fragility and potentially increasing hematoma risk [22]. Conversely, other studies report no significant association between demographic characteristics and post-PCI complications [23]. Non pharmacological interventions such as cold compresses and mechanical compression have shown stronger associations with reduced hematoma and pain outcomes [24, 25].

Despite extensive research on PCI complications, there are several critical gaps, including inconsistent findings regarding the role of demographic factors in hematoma and pain on post PCI patients, limited studies analyzing multiple variables simultaneously using correlation analysis, lack of evidence from developing country clinical settings, and also minimal focus on PCI experience as a variable.

The objective of this study was to analyze patient characteristics and their association with hematoma and pain on post PCI patients immediately after femoral sheath removal in referral hospital in Aceh Province.

Materials and Methods

Study Design

A cross-sectional correlational design was used.

Population and Sample

The study population consisted of post-PCI patients with a femoral sheath puncture. Of the total 127 patients with a femoral sheath, 60 post-PCI patients were included in this study because they reported hematoma and pain.

The inclusion criteria for respondents are: (a) Patients aged 17 to 70 years, (b) Post PCI patients with a femoral sheath, (c) Patients experiencing a hematoma after femoral sheath removal, (d). Patients with complaints of pain following femoral sheath removal, (d). No blood coagulation abnormalities based on laboratory test results, (e) Use of heparin ≤10,000 IU during the PCI procedure, and (f) Patients in a calm state according to psychological status assessment. Exclusion criteria were patients receiving analgesic therapy such as paracetamol and ibuprofen.

Time and Location of Study

This study was conducted from August to December 2025 at a referral hospital in Aceh Province, Indonesia.

Collection Data Method

Data collection was conducted by enumerators. Enumerators underwent training beforehand to ensure they were capable of measuring hematoma and pain, as well as minimizing bias. Enumerators then introduced themselves to respondents, explained the study's objectives, and obtained informed consent from them. After providing an explanation, the enumerator asked the respondent to read the consent form. If the respondent agreed to participate, they were asked to sign the consent form. After the respondent signs the consent form, the enumerator begins collecting demographic data regarding age, gender, education, occupation, marital status, PCI history, body mass index (weight and height), and hemodynamic measurements. Following this, the enumerator reviews medical records regarding sheath size and anticoagulant therapy during the PCI procedure. Next, the enumerator measured the hematoma using a measuring tape and assessed pain using the NRS. Measurements were taken 0 minutes after removal of the femoral sheath or before the puncture site was covered with gauze.

Tools of Data Collection

This study used a questionnaire as a data collection tool. The questionnaire consisted of three sections: A, B, and C. The questionnaire with code A contains questions regarding sociodemographic data, specifically age, gender, education, occupation, marital status, previous PCI experience, body mass index (BMI), sheath size, anticoagulant therapy, and patient hemodynamic (blood pressure, pulse rate, respiratory rate, temperature, and oxygen saturation).

Meanwhile, Questionnaire B contains the results of observations and measurements of hematomas using a measuring tape in millimetres (mm) for greater detail [13, 18, 23].

Furthermore, Questionnaire C contains the Numeric Rating Scale (NRS). The NRS is considered a valid and relevant tool for measuring pain in patients [26]. The NRS helps patients rate their pain on an 11-point scale along a line, ranging from 0 to 10. A score of 0 indicates no pain, and 10 indicates the most severe pain. This scale is highly effective across various populations and can be used both before and after an intervention [27, 28].

Ethical Consideration

All research procedures were conducted after obtaining approval from the research site's ethics committee, under number 238/ETIK-RSUDZA/2025.

Data Analysis

Spearman's correlation was used to identify the relationship between age, gender, BMI, and prior PCI experience. Spearman's was applied due to non-normal data distribution.

Results and Discussion

Data about respondent characteristic show in the table 1.

Table 1: Respondent characteristic (n=60)

Characteristics Respondents	n(%)
Age, years	
Mean (SD)	56.17 ± 7.04
Min-Max	40-69
Body Mass Index, kg/m^2	
Mean (SD)	25.91 ± 4.23
Min-Max	18.0-44.9
Sheath Size	
Mean (SD)	6,00 ± 0
Anti-coagulant therapy	
Mean (SD)	6708.33 ± 1735.20

Min-Max	3000-10000
Gender	
Female	25 (41.7%)
Male	35 (58.3%)
Education level	
Basic school	4 (6.7)
Junior high school	13 (21.7)
Senior high school	36 (60.0)
College	7 (11.6)
Occupation	
Farmer	15 (25.0)
Civil servant	8 (13.3)
Entrepreneur	15 (25.0)
Housewives	22 (36.7)
Marital status	
Marriage	55 (91.7)
Widow/ widower	5 (8.3)
PCI experience	
Yes	23 (38.3)
No	37 (61.7)
Hematoma (mm)	
Mean (SD)	27.65 ± 18.2
Min-Max	10-80
Pain level	
Mean (SD)	3.52 ± 1.3
Min-Max	1-6

Table 1 shows that the mean age was 56.17 ± 7.04 years, the mean BMI was 25.91 ± 4.23 kg/m^2, the mean duration of anticoagulant therapy was 6,708.33 ± 1,735.20, the mean hematoma size was 27.65 ± 18.2 mm, and the mean pain score was 3.52 ± 1.3. Most respondents (58.3%) were male, 60% had graduated from high school, 91.7% were married, and 61.7% had never undergone PCI before. Correlation between age, BMI, Gender, and PCI experience with hematoma and pain immediately after femoral sheath removal show in table 2.

Table 2: Correlation between age, BMI, Gender, and PCI experience with hematoma and pain (n=60)

Variable	Hematoma		Pain	
	r	p-value	r	p-value
Age	0.021	0.871	0.154	0.241
BMI	0.036	0.788	0.125	0.343
Gender	-0.184	0.160	-0.149	0.256
PCI Experience	-0.018	0.891	0.143	0.276

Table 2 shown that there were no significant correlations were found between patient characteristic variables and hematoma (age, p value 0.871; BMI, p value 0.788; gender, p value 0.160, and PCI experience, p value 0.891) or pain (age, p value 0.241; BMI, p value 0.343; gender, p value 0.256, and PCI experience 0.276).

Effect size interpretation based on Spearman's indicated that all correlations between demographic variables and hematoma or pain were negligible ($r < 0.20$), suggesting weak or no practical significance. Specifically, correlations such as age with hematoma ($r = 0.021$) and BMI with pain ($r = 0.125$) fall within the 'very weak' category. According to Cohen's criteria, correlations below 0.30 indicate small effect sizes, meaning that demographic variables contributed minimally to hematoma and pain variability during femoral sheath removal.

In this study, more male participants than female participants experienced hematoma following PCI procedure. Upon further analysis, gender was not significantly associated with hematoma and pain. A previous study of patients who experienced hematoma after PCI procedure also reported male participants more than female participants, 40 male and 31 female. However, gender was not significantly associated with the occurrence of hematoma as measured immediately after femoral sheath removal [29]. In other side, there are other studies that indicate that women undergoing percutaneous coronary intervention are at higher risk for bleeding and vascular complications than [30]. These findings need to be explored from various clinical and procedural perspectives. Although other studies often report that women have a higher overall risk of vascular bleeding, the specific findings in this case suggest that subject characteristics or different procedural approaches may influence the outcomes. Although women are often older and have more severe comorbidities, men are more likely to be smokers and have a history of myocardial infarction (MI) or prior PCI, which can affect the fragility of blood vessels at the puncture site.

The average age of the respondents in this study is 56.17 ± 7.04 years. Similar with other studies of patients undergoing PCI procedures, the mean age was 58.3 ± 10 years [19]. This is consistent with the finding that advancing age is associated with an increased risk of cardiovascular disease. This study found no significant relationship between age factor and hematoma or pain. Similar findings have also been reported in previous studies, indicating that age was not significantly associated with hematoma (p-value 0.102), as measured immediately after removal of the femoral sheath [29]. There are differing research findings indicating that the incidence of femoral hematoma was significantly higher in older patients (Khidher & Al-Aqeedy, 2026). This discrepancy is due to the fact that the study assessed hematoma 24 hours after the PCI procedure was performed.

The mean BMI in this study was 25.91 ± 4.23 kg/m². Another study of patients undergoing PCI also found that the mean BMI was 29.9 ± 5.1 kg/m² [19]. Both studies showed a mean BMI above the normal range of 18.5–24.9. This information reinforces the finding that a BMI above average is a risk factor for cardiovascular disease. This study found no significant relationship between BMI factor and hematoma or pain. Similar findings have also been reported in previous studies, indicating that BMI (p-value 0.322) was not significantly associated with hematoma as measured immediately after removal of the femoral sheath [29]. This differs from the findings of previous studies, which indicated that body mass index was identified as a risk factor for vascular access complications in patients undergoing an early invasive strategy [31].

Conclusion

There is no significant relationship between demographic factors (age, gender, BMI, and PCI experience) with hematoma or pain on post PCI patients immediately after femoral sheath removal.

Recommendations

Healthcare providers performing PCI procedures are expected to optimize the implementation of standard operating procedures to minimize the incidence of hematomas and pain.

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