Original Article

PACNJ

The Correlation Between Post-Procedural Complications and Length of Stay Among Post Primary PCI Patients: A Retrospective Study

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ARTICLE INFO

Article history:
Received 30-06-2025
Revised 07-07-2025
Accepted 12-08-2025

Keyword:
Complication, Length of Stay, Primary PCI

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https://jurnal.unpad.ac.id/ pacnj/

E-ISSN: 2715-6060

ABSTRACT

Background: Coronary heart disease is a leading cause of morbidity and mortality globally. Primary PCI is an effective intervention, it is still carries risks, and complications arising post-procedure can significantly affect both patient outcomes and the length of hospital stay.
Aim: To describe the types and frequency of complications that occur among patients after Primary PCI and to analyze their correlation with the length of stay in the hospital.
Design: This study employed a retrospective design, using patients medical records who underwent a Primary PCI at a referral hospital in West Java, Indonesia, from December 2019 to April 2024. The authors recruited patients who had complete medical records using a convenience sampling. Data was analyzed using Fisher's exact test to assess the correlation between complications and length of stay. Length of stay data was categorized into three groups: ≤ 3 days, 4-5 days, and ≥ 6 days.
Results: The findings showed that 81.8% of patients did not experience any complications post-procedure, while 14.5% experienced hematomas and 3.6% experienced bleeding. The median LOS was 4.00 ± 2.28 days, with 60.9% of patients having LOS of more than 3 days. Patients who experienced complications, especially hematomas or bleeding, were more likely to have prolonged hospital stays, with 11.8% of them staying for ≥ 6 days.
Conclusion: Complications following Primary PCI significantly affect the length of stay in the hospital. The study highlights that patients who experience complications such as hematomas or bleeding tend to have longer hospitalizations. These findings underscore the importance of early detection and timely management of post-procedural complications to reduce LOS and enhance patient outcomes.

Introduction

Coronary heart disease (CHD) is a major cause of morbidity and mortality worldwide, including in Indonesia (World Health Organization [WHO], 2021). SKA is a cardiac emergency with manifestations of persistent chest pain or other symptoms as a result of myocardial ischemia (Singh et al., 2022). ACS refers to a group of conditions that includes ST-elevation myocardial infarction (STEMI), Non-ST-elevation myocardial infarction (NSTEMI), and unstable angina (Singh et al., 2022). SKA is caused by decreased or stopped blood flow to part of the heart which results in necrosis of the heart muscle (Saleh & Ambrose, 2018). This condition causes the heart muscle to weaken and the heart to stop functioning and can occur suddenly (Satoto, 2014).

Percutaneous Coronary Intervention (PCI) has become a standard procedure in the treatment of patients with coronary artery stenosis, especially in cases of ST-elevation acute myocardial infarction (STEMI) that require Primary PCI as the main reperfusion therapy (Toutouzas et al., 2017). Currently, primary PCI is the most effective acute management strategy for STEMI patients (Lawton et al., 2022). The primary goal of PCI is to restore normal blood flow to the patient's heart by opening blocked coronary arteries (Lawton et al., 2022). The PCI procedure requires arterial access to reach the coronary arteries and heart chambers, which is done by installing a ring/stent which functions to prevent restenosis (narrowing again) (Ojha & Dhamoon, 2022). This procedure has been used in 60% to 80% of patients undergoing PCI worldwide (Levine et al., 2016). Research has shown that the restenosis rate after simple coronary angioplasty without a stent is 30% to 40%, but the restenosis rate is reduced to 20% when a stent is used. This finding, PCI becomes safer and complications occur less (Harselia, 2018).

The process of caring for post-primary PCI patients in the intensive care unit is an important thing that nurses must pay attention to (Zhang & Qi, 2021). Apart from the post-primary PCI complications that must be controlled, previous studies reported that most patients undergoing PCI experienced increased psychological burden (Sa'aleek et al., 2016; Sharma et al., 2018). This condition is one of the factors that causes post-primary PCI patients to have a poor prognosis during treatment, which will affect LOS (Groves & Vidovich, 2019).

Differences in LOS duration in post-primary PCI patients can be influenced by various factors (Sugiharto et al., 2023). Although Primary PCI provides significant clinical benefits, this invasive procedure is not free from the risk of complications that can occur during or after the procedure (Sugiharto et al., 2023; Swaminathan et al., 2015a; Velagapudi et al., 2018). These complications include vascular complications such as hematoma, retroperitoneal bleeding, pseudoaneurysm, and coronary complications such as blood vessel dissection, stent thrombosis, arterial perforation, and recurrent myocardial infarction (Sugiharto et al., 2023).

However, data related to the complete describes of post-Primary PCI complications and their impact on LOS in hospitals in Indonesia are still limited. Retrospective studies examining the relationship between complications and length of stay are needed to provide a picture of local epidemiology and as a basis for developing more effective and efficient care protocols. Therefore, this study aims to describe the types and frequency of complications that occur in post-Primary PCI patients and analyze their correlation with LOS in the hospital. The results of the study are expected to provide an important contribution to improving the quality of

cardiovascular services and management of post-PCI patients in Indonesia.

Methods

This study used a retrospective design. The research was conducted by analyzing the medical records of patients treated at a referral hospital in West Java, Indonesia, from December 2019 to April 2024. The retrospective approach allowed the researchers to use existing data, making it more efficient in terms of time and cost compared to prospective studies.

The study population consisted of the medical records of patients who underwent primary PCI during the specified period. A convenience sampling technique was used, which involved selecting medical records from patients who met the inclusion criteria. Inclusion criteria included patients who underwent primary PCI and had complete medical record data, including both independent and dependent variables. Patients who underwent elective PCI or who died or left the hospital against medical advice after undergoing primary PCI were excluded from the study.

Data collection took place between May and June 2024, after receiving ethical approval and research permits from the hospital. Data were gathered using a checklist developed by the researchers, based on previous reviews (Sugiharto et al., 2023). This checklist included demographic data such as age, gender, post-procedure complications. The dependent variable, LOS, was categorized into three groups: ≤ 3 days, 4-5 days, and ≥ 6 days. These categories were based on the clinical condition of the patient, which was related to the severity and post-treatment complications, as also used in similar studies.

Data analysis was conducted in univariate and bivariate analysis. Univariate was performed to examine the frequency distribution of the data. Next, bivariate analysis using Fisher's exact tests was used to identify significant differences between independent variables and LOS. To measure the strength of the relationships or differences, Cramer's V was used.

The entire research process received ethical approval in accordance with the guidelines of the Declaration of Helsinki. Although secondary data were used, ethical principles were adhered to by ensuring that the data had been obtained with permission from the hospital and by maintaining the confidentiality of patient information. All collected medical records were treated anonymously and only relevant data were used for research purposes. This research has obtained ethical clearance from Dr. Hasan Sadikin General Hospital Bandung with number DP.04.03/D/XIV.6.5/62/2024 and research permit with number DP.04.03/D/XIV.4.4/458/2024.

Results

Characteristics of Respondents

Based on Table 1, it shows that most (79.1%) respondents were male with a median age of 52±8.53. The most common type of comorbidity was hypertension (25.5%) with most having a history of smoking (68.2%).

Table 1. Demographic Characteristics of Post Primary PCI Patients (n=110)

Variable	Frequency (*f*)	Percentage (%)
Gender		
Male	87	79,1
Female	23	20,9
Age (Median 52±8,53)		
26 - 45 years old	44	40
46 - 55 years old	26	23,6
56 - 65 years old	40	36,4
Types of Comorbid Diseases		

Variable	Frequency (*f*)	Percentage (%)
No	34	30,9
Hypertension	28	25,5
Hypertension with other chronic illness	20	19
DM	14	12,7
Cholesterol	5	4,5
Dyslipidemia	3	2,7
COPD	2	1,8
DM + CKD	1	0,9
CKD	1	0,9
Heart disease	1	0,9
Smoking History		
Yes	75	68,2
No	35	31,8

Types of Complication among Patient Post Primary PCI

Based on the research results, it was found that most patients in this study did not experience complications (81.8%). However, 14.5% experienced hematoma and 3.6% experienced bleeding (see Figure 1).

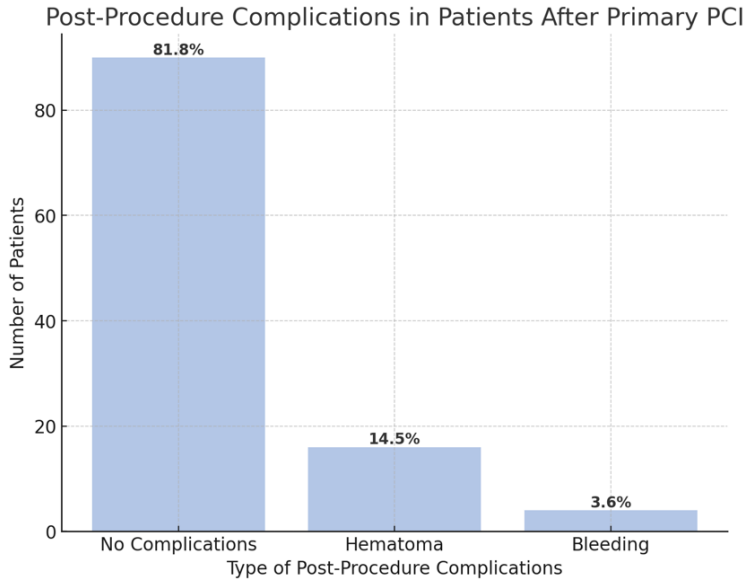

Figure 1. Types of Post-Procedural Complication (n=110)

LOS among Patient Post Primary PCI

Table 2 shows that the median LOS was 4.00 ± 2.28 days (>3 days). As many as 60.9% of respondents in this study had LOS > 3 days, and 21.8% still had a long LOS (≥ 6 days).

Table 2. Frequency Distribution of LOS (n=110)

LOS	Frequency (*f*)	Percentage (%)	Median ± SD
≤ 3 Days	43	39,1	4,00 ± 2,28
4 - 5 Days	43	39,1	

LOS	Frequency (*f*)	Percentage (%)	Median ± SD
≥ 6 Days	24	21,8	

Abbreviation: LOS, Length of Stay.

Differences in LOS Based on Post-Procedure Complication

Based on the crosstabulation results, 11.8% of respondents who experienced complications had a long LOS of ≥ 6 days compared to respondents who did not experience complications. This shows that post-procedure complications extend the duration of LOS (p<.001; V = 0.499) (See Table 3).

Table 3. Differences in LOS Based on Post Procedural Complication (n=110)

Independent Variable	LOS						n (%)	*p-value*	*Cramer's V*
	≤ 3 Days		4 - 5 Days		≥ 6 Days				
	f	%	*f*	%	*f*	%			
Post Procedure Complications									
None	41	37,3	38	34,5	11	10	90 (81,8)	<0,001	0,499
One Complication	2	1,8	5	4,5	13	11,8	20 (18,2)		

Discussion

In this study, there was a very strong difference in LOS in post-primary PCI patients when viewed based on post-procedure complications (p<,001; V=0,499). Complications that arise after primary PCI procedures can significantly affect patients' LOS in the hospital. Data show that patients who do not experience complications mostly have shorter LOS, with 41 patients (37.3%) discharged within ≤ 3 days and 38 patients (34.5%) discharged within 4-5 days. In contrast, patients who experience one or more complications tend to have longer LOS, with 13 patients (11.8%) with one complication having LOS ≥ 6 days. The types of post-procedure complications experienced by respondents in this study were hematoma (14.5%) and bleeding (3.6%).

Clinically, these findings highlight the importance of early detection and management of post-PCI complications. Complications, such as hematoma, bleeding, infection, or cardiac events, can prolong a patient's LOS because they require specialized care and longer recovery time. This explains why patients with one or more complications have a longer LOS compared to patients without complications. Effective management of these complications has the potential to not only reduce LOS but also improve overall patient outcomes (Rolley et al., 2011).

Hematoma is a collection of blood outside the blood vessels that occurs due to damage to the blood vessel walls (Andersen et al., 2005). In post-primary PCI patients, hematoma usually forms at the catheter insertion site, either radial or femoral (Manda & Baradh, 2024). Hematoma usually forms after poorly controlled hemostasis before or after sheath removal (Manda & Baradh, 2024). Most hematomas are self-limiting and benign, but large, rapidly expanding hematomas can cause hemodynamic instability requiring resuscitation with fluids and blood (Manda & Baradh, 2024).

Hematoma and bleeding are among the most frequently reported vascular complications and have the potential to cause serious complications after PCI (Merriweather & Sulzbach-Hoke, 2012). Kurt dan Kaşıkçı (2019) reported that the incidence of post-PCI hematoma was (15.5%) and bleeding was 1.5%. This is supported by previous studies that concluded that hematoma, ecchymosis, and pain are common complications at the catheter insertion site after PCI (Andersen et al., 2005; Kurt & Kaşıkçı, 2019).

There are several previous studies that support the results of this study. Vascular complications after primary PCI procedures are

considered to occur most frequently (Isik et al., 2016; Swaminathan et al., 2015; Velagapudi et al., 2018). Chin et al. (2011) and Mirbolouk et al. (2020) reported that post-procedure complications had a strong significance on LOS in post-primary PCI patients. Regarding the incidence of complications, pulmonary edema was the most common complication while cardiogenic shock was the least common complication (Mirbolouk et al., 2020). In addition, post-primary PCI patients have a high risk of experiencing acute renal failure and delirium (Li et al., 2019; Velagapudi et al., 2018).

Although rare, the occurrence of cardiogenic shock causes patients to experience a decrease in the Left Ventricular Ejection Fraction (LVEF) and has an impact on poor prognosis and high risk of death (Karamasis et al., 2018; Lv et al., 2021; Schellings et al., 2011). In this study, the incidence of cardiogenic shock can be seen based on the Killip class classification of respondents, where 8 (7.3%) respondents experienced cardiogenic shock. This complication causes patients to undergo additional diagnostic and treatment procedures, increasing LOS and even risking death (Sugiharto et al., 2023). Therefore, managing most post-PCI complications is one of the primary responsibilities of nurses in critical care settings (Nuraeni et al., 2023; Sugiharto et al., 2024, 2025).

Conclusion

Complications occurring after primary PCI procedures have a significant impact on the length of hospital stay. Patients who experience complications tend to have a longer LOS compared to patients who do not experience complications. Therefore, effective management of complications, such as hematoma and bleeding, is essential to accelerate patient recovery and reduce hospital stay. These findings provide important insights into designing more efficient and effective care protocols for post-PCI patients.

Acknowledgments

All authors would like to thank the Faculty of Nursing, Padjadjaran University, Bandung, Indonesia for helping us in facilitating the database for us to review this research.

Conflicts of Interest

The authors declare no conflict of interest.

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