



Primary Percutaneous Coronary Intervention in a 24-hour PCI Capable Hospital in Indonesia

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ARTICLE INFO	ABSTRACT
Keywords: Acute Coronary Syndrome Door-to-Balloon Percutaneous Coronary Intervention STEM Submitted: Oct 12th 2024 Reviewed: Nov 14th 2024 Accepted: April 27th 2025	Introduction: Chest pain may be a symptom of a life-threatening disease such as S ST-Elevation Myocardial Infarction (STEMI). Immediate primary percutaneous coronary intervention (PPCI) is recommended for virtually all STEMI patients who present in a PCI-capable hospital. Objective: We would like to present data on Door-to-Balloon (DTB) times and the factors affecting it. Methods: This is a single-center retrospective study. Patients are STEMI patients, undergoing primary PCI from 1st January 2024 to 30th April 2024. Secondary data are obtained from the medical records and analyzed. Results: A total of 60 patients undergo PPCI during the study period. Patients are generally male patients, aged 53.67 years old, with 2 traditional cardiovascular risk factors, presenting to the emergency department (ED) with an average of 5.88 hours of chest pain. DTB time was 86.25 minutes during the study period. We identified the onset of chest pain and referred patients to be associated with DTB time. Referred patients had longer onset since chest pain but faster DTB time. We found no association between age, gender, presenting time, diagnosis, Killip class, and physician factor to significantly affect DTB time. Conclusions: We have identified factors that may help us improve our DTB time. Patient knowledge should also be improved to increase awareness of symptoms of chest pain, minimizing patient delay and improving total ischemic time.

Introduction

Chest pain is one of the most frequent complaints encountered in emergency departments and can signal a potentially life-threatening condition, such as acute coronary syndrome (ACS). Prompt

identification and management are crucial, especially in ST-Elevation Myocardial Infarction (STEMI) cases, where timely reperfusion can significantly improve outcomes. For patients with STEMI, the recommended treatment includes either

fibrinolytic therapy or invasive interventions such as primary percutaneous coronary intervention (PCI) (Byrne et al., 2023).

To assist clinicians in delivering optimal care, current clinical guidelines recommend primary PCI as the preferred method of reperfusion for nearly all STEMI patients presenting to PCI-capable facilities (Byrne et al., 2023; Neumann et al., 2019). Delays in initiating reperfusion therapy are strongly linked to increased mortality, underscoring the need for swift action (Alrawashdeh et al., 2021). This study was conducted to evaluate the door-to-balloon (DTB) times in a PCI-capable hospital and to identify clinical and system-related factors that may influence these timings. By assessing local performance and associated factors, we aim to explore potential areas for improvement in STEMI care within our center.

Methods

This is a single-center retrospective cohort study. We analyzed the cath lab report of patients undergoing immediate Primary PCI from 1st January 2024 to 30th April 2024. The data was obtained from the electronic medical record system of a single PCI-capable hospital in West Java, Indonesia. The data obtained are secondary, consisting of patient characteristics, emergency department (ED) diagnosis,

onset of chest pain in our emergency department, and cardiovascular risk factors.

We also extracted the cath report for these patients and calculated their door-to-balloon (DTB) time, culprit vessel, and documented the reason for prolonged DTB time. We analyzed the data using the SPSS application. Inclusion criteria were adult patients (aged ≥ 18 years) diagnosed with ST-elevation myocardial infarction (STEMI) who received primary PCI during the study period. Patients were excluded if they had incomplete data, were diagnosed with non-STEMI, or underwent PCI more than 24 hours after symptom onset.

Data were analyzed using the SPSS application. Descriptive statistics were used to summarize patient characteristics. Univariate analysis (Chi-square and ANOVA tests) was performed to identify factors affecting DTB. Variables with $p < 0.1$ were considered for multivariate analysis to control for confounders. This study is under the Declaration of Helsinki and is approved by the local ethical review board.

Results and Discussion

During the study period, a total of 60 patients underwent immediate primary PCI. All patients presented with STEMI. Patient characteristics are summarized in Table 1. The mean age was 53.67 years, with a predominantly male population. Most

patients had at least two traditional cardiovascular risk factors and presented to the emergency department (ED) an average of 5.88 hours after symptom onset. Data on standard deviation were not available due to limitations in the secondary data set.

Table 2 presents detailed findings from the coronary angiography reports, including door-to-balloon (DTB) times and procedural details. In this study, the emergency physician (referred to as “physician”) was responsible for initial stabilization, while the “operator” was the interventional cardiologist performing the PCI. Notably, 75% of patients had significant coronary stenoses beyond the culprit lesion. Reasons for DTB delays exceeding 120 minutes were also documented (see Table 2).

Patients were divided based on time of presentation: 20 patients (33.3%) arrived during office hours (07:00–16:00), and 40 patients (66.7%) during off-hours (16:00–07:00). STEMI patients require immediate revascularization, and minimizing delays is critical to reducing morbidity and mortality (Alrawashdeh et al., 2021).

Table 1. Characteristics of patient presenting to the emergency department with STEMI

Patient Characteristics (n = 60)	n	(%)
Age (mean = 53.67)		
<40	5	8.3

40-49	19	31.7
50-59	17	28.3
60-69	13	21.7
>70	6	10
Gender		
Male	56	93.3
Female	4	6.7
Diagnosis		
Anterior	16	26.7
Anteroextensive	19	31.7
Inferior	15	25
Inferior + Right	2	3.3
Inferolateral	1	1.7
Inferoposterior	5	8.3
Inferoposterior + Right	2	3.3
Onset of Chest Pain		
<3h	16	26.7
3-6h	21	35
>6h	23	38.3
Killip Class		
1	35	58.3
2	21	35
3	0	0
4	4	6.7
Referred?		
Yes	29	48.3
No (walk-in)	31	51.7
Risk Factors		
Hypertension	28	46.7
Diabetes	13	21.7
Dyslipidaemia	18	30
Smoking History	40	66.7
Active Smoker	35	58.3
Ex-Smoker	5	8.3
Family History of CAD	12	20
Menopause	2	3.3

Table 2. Cath report details and findings

Physician (General Practitioner)	n	%
A	6	10
B	3	5
C	6	10
D	6	10
E	7	11.7
F	3	5
G	6	10
H	3	5
I	20	33.3
Operator (Interventional Cardiologist)		
1	26	43.3
2	23	38.3
3	10	16.7
4	1	1.7
Door-to-Balloon Time	(mean = 86.25 mins)	
≤60 mins	12	20
61 - 90 mins	29	48.3
91 - 120 mins	11	18.3
>120 mins	8	13.3
Stents Used		
POBA only	3	5
DEB only	1	1.7
DES only	48	80
DES + POBA	1	1.7
DES + DEB	1	1.7
DESx2	6	10
Culprit Vessel		
LAD	35	58.3
LCx	1	1.7
RCA	24	40
Vessel Disease		
1	15	25
1 + LM	2	3.3
2	13	21.7

2 + INT	1	1.7
2 + LM	3	5
3	22	36.7
3 + INT	1	1.7
3 + LM	2	3.3
3 + INT + LM	1	1.7
Delayed Reasons	16	16.7
Cardiac Arrest	2	3.3
Patient Consent	7	11.7
Puncture	2	3.3
Queueing	5	8.3
Intra-PCI Complications	4	6.7
Arrest in cathlab	1	1.7
Dissection	2	3.3
Stent Dislodgement	1	1.7

Recent recommendations from the European Society of Cardiology (ESC) suggest aiming for a reperfusion time (wire-crossing) of less than 60 minutes in PCI-capable centers and a target PCI time of under 120 minutes for patients referred from non-PCI centers (Byrne et al., 2023; Neumann et al., 2019). Traditionally, a "Door-to-Balloon" (DTB) time of 90 minutes was the standard, but this was revised in the 2017 ESC Guidelines, with the term DTB being replaced by wire-crossing time (WCT) and the target time shortened to less than 60 minutes. (Ibanez et al., 2018) Although recent guidelines use wire-crossing time (WCT), in our center the term 'door-to-balloon time' (DTB) is still used as the practical marker of reperfusion timing.

Globally, PCI centers have made significant improvements in reducing door-to-balloon (DTB) times. Minimizing delays in reperfusion is crucial for managing STEMI patients (Fabris et al., 2020). The implementation of STEMI networks in Europe and the United States has greatly enhanced reperfusion times and serves as a model for other nations, particularly in developing countries where DTB times are often suboptimal (Dharma, 2020; Krumholz et al., 2011). In Brazil, a median DTB time of 104 minutes has been reported (Amoras et al., 2020). In an Indian tertiary care center, the original DTB time of 121 minutes was reduced to 101 minutes after addressing system delays (Prakash et al., 2022). In a local hospital in the Philippines, the average DTB time was found to be 126 minutes (Toledano et al., 2023).

In our current study, we found that the majority of STEMI patients presenting to our emergency department are males in their 4th to 5th decade of life, with an average chest pain onset of 5.88 hours, however, standard deviation was not available due to the nature of secondary aggregated data. Furthermore, all but one patient ($n = 59$, 98.3%) had identifiable risk factors for coronary artery disease (CAD), with smoking history being the most common, followed by hypertension. Our mean door-to-balloon (DTB) time was calculated to be 86.25 minutes (data on variability not

available), as shown in Table 2, which meets the target DTB time of 90 minutes.

We conducted a univariate analysis to identify factors that influence door-to-balloon (DTB) times (Table 3). Our analysis revealed that Killip Class, the emergency physician, and the attending interventional cardiologist did not significantly affect DTB times (Figure 1). It is noteworthy that Physician I managed a higher number of STEMI patients ($n = 20$), which is attributable to Physician I's longer work hours in the emergency department compared to other physicians. In the emergency department, late or misdiagnosis is a known cause of delayed DTB, making the emergency physician a crucial factor, as delayed STEMI diagnosis can lead to system delays, ultimately impacting DTB times (Emami et al., 2023; Li et al., 2018; Martí et al., 2014). Additionally, our findings suggest that patients presenting during office hours had longer DTB times compared to those presenting during off-duty hours, although the difference was not statistically significant (Office Hours: 94 min, Off Duty Hours: 82.38 min, $p = 0.086$). Based on this data, we observed a longer DTB during office hours, which contrasts with findings from other studies (Hsiao et al., 2023).

Table 3. Univariate analysis of variance on factors affecting door-to-balloon time

Univariate Analysis	p-value
Gender	0.836
Age	0.916
Diagnosis	0.53
Onset	0.003*
Killip Class	0.074
Referral	0.004*
Presenting Time	0.086
Physician	0.593
Operator	0.94
Culprit Vessel	0.593
PCI Complication	0.298
*Significant value ($p < 0.05$)	

Our findings also indicate that patients referred to our center had significantly shorter DTB times compared to those who presented directly to the emergency department (Referred: 77.03 minutes, ED: 94.87 minutes, $p = 0.002$). This suggests that streamlining referral systems, including early activation of cath lab and pre-hospital consent, may help reduce system delay in direct arrivals as well. Additionally, referred patients tended to have later onset of symptoms than those who were not referred (Referred: 7.36 hours, ED: 4.5 hours, $p < 0.001$) (Figure 2). Similarly, a study by Liu et al. found that patients arriving by ambulance had shorter DTB times (Liu et al., 2021; Y. H. Park et al., 2012). A possible explanation for this finding is that informed consent is often

obtained at the referring hospital, so referred patients are already aware of their condition and future treatment plans, which may reduce delays in the emergency department and shorten the time needed for patient consent.

As half of our patients ($n = 29$, 48.3%) were referred from another hospital, and since our study does not account for hospital transfer times, this may influence the results. The time spent at the originating hospital (door-in, door-out time) is not included in our analysis, and based on our experience, this process can take a considerable amount of time, making it a potential confounding factor. Similarly, hospital transfer times, such as the duration spent in the ambulance, were not recorded or analyzed, though they are often identified as a cause of delayed DTB (Amoras et al., 2020; J. H. Park et al., 2016). This pre-admission delay likely contributes to the difference in chest pain onset between referred patients and those arriving independently at our ED, potentially affecting the total ischemic time. The significantly shorter DTB time in referred patients highlights a key opportunity by adopting pre-hospital processes such as pre-consent, ambulance triage protocols, or direct cath lab activation, even non-referred patients might benefit from reduced reperfusion times.

Improving system delays and establishing a STEMI network in our region could help reduce patients' total ischemic times and decrease morbidity. In 2010, the United States successfully implemented a STEMI network, which resulted in a reduction of STEMI DTB times from 94 minutes to 64 minutes (Krumholz et al.,

2011). This approach was previously demonstrated on a smaller scale in Indonesia by Fadlan et al., who found that implementing a STEMI network in their tertiary care center helped reduce ischemic time, DTB times, and in-hospital mortality (Rizki Fadlan et al., 2022).

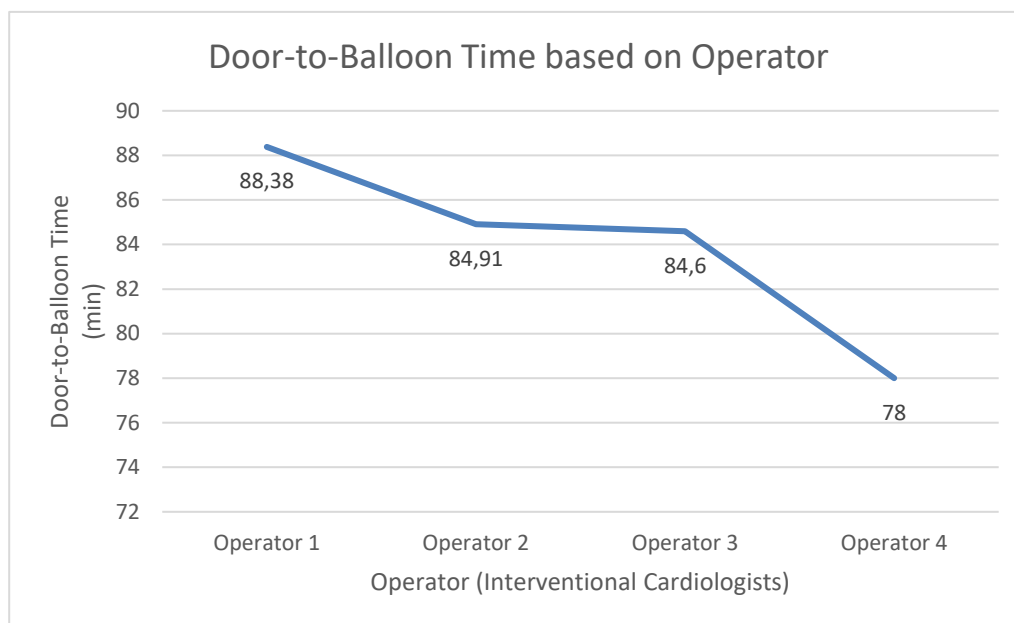


Figure 1. Door-to-balloon time based on operator

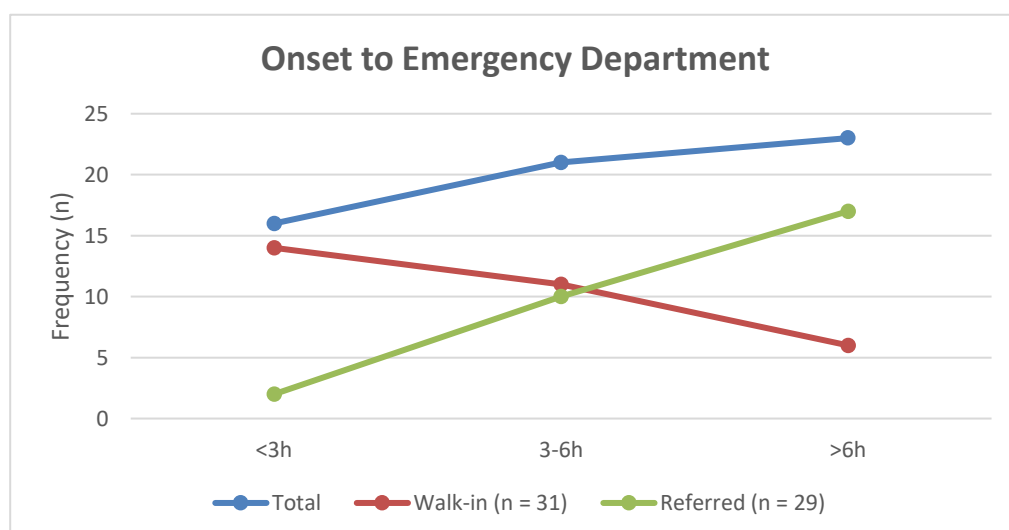


Figure 2. Time from symptom onset to our emergency department

Lastly, when excluding patients with delayed DTB times due to delays in obtaining consent, we observed an improved DTB time of 82.6 minutes. Our average onset of chest pain is also notably longer compared to that in other countries (Martí et al., 2014; Y. H. Park et al., 2012). This patient delay is included in the total ischemic time and may impact patient prognosis, as most life-threatening arrhythmias occur during the first few hours of a myocardial infarction (Karam et al., 2019; Shah et al., 2021). Therefore, increasing patient awareness of the signs and symptoms of a heart attack, as well as the potential adverse outcomes of not seeking medical treatment, is crucial for improving patient outcomes (Y. H. Park et al., 2012).

Conclusion

Although we are able to achieve DTB times of < 90 minutes, improvements in DTB time are always a target to strive for. Through this study, we have identified possible options and methods to further improve our DTB time in our hospital. We would also like to see improvements in the referral systems and possibly a STEMI network in our region. Another thing to note is the importance of increasing patient awareness of signs and symptoms of heart attack to improve total ischemic time and

aim to decrease morbidity and mortality in relation to heart diseases.

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