

# Evaluation the Door-to-Balloon Time in Patient with ST-Elevation Myocardial Infraction (STEMI) in King Abdullah Medical City (KAMC) in Makkah Almukarramah: A Retrospective Single Center Study

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## Abstract

**Background:** ST-Elevation Myocardial Infarction is a time-sensitive emergency condition. Thus, guidelines recommended 90 minutes or less for door-to-balloon time at a percutaneous coronary intervention-capable hospital and within 120 minutes or less if transferred from percutaneous coronary intervention-uncapable hospital. The main objective was to evaluate the recommended time needed for reperfusion therapy particularly percutaneous coronary intervention in patients with ST-Elevation Myocardial Infarction at King Abdullah Medical City.

**Method and Results:** A retrospective single center study. Data were obtained from 47 patients records diagnosed with ST-Elevation Myocardial Infarction and treated with percutaneous coronary intervention at King Abdullah Medical City from Jan 2018 through March 2019. About 36.4% of patients received percutaneous coronary intervention in more than 90 minutes even though they arrived directly at King Abdullah Medical City. For patients who were transferred to King Abdullah Medical City, 63.9% of those patients did not achieve the recommended door-to-balloon time.

**Conclusion:** High percentage of patients with ST-Elevation Myocardial Infarction at King Abdullah Medical City did not receive percutaneous coronary intervention within the recommended timeline.

**Keywords:** Ischemic heart disease, ST-Elevation Myocardial Infarction, percutaneous coronary intervention, Door-to balloon time, door-to-needle time.

## Introduction

Ischemic heart disease (IHD) is the number one cause of death worldwide.<sup>(1)</sup> During the last 15 years, IHD remained one of the leading causes of death. Myocardial

Infarction is a type of IHD, and ST-Elevation Myocardial Infarction (STEMI) incorporate about 25% to 40% of Myocardial Infarction cases, leading to approximately 5% to 6% in hospital mortality.<sup>(2-6)</sup> STEMI is a life threatening condition that must be diagnosed and treated immediately via coronary reperfusion.<sup>(7)</sup> Recent guidelines recommend urgent reperfusion with primary percutaneous coronary intervention (PCI) or full-dose fibrinolytic therapy for patients with acute STEMI.<sup>(8)</sup> Among these patients, a significant improvement in the short-term and long-term cardiovascular outcomes such as the mortality and morbidity have been marked due to the quality care guidelines with the emphasis on the time to reperfusion that initiatives by the American

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Heart Association and other organizations.<sup>(9)</sup> The early reperfusion can reduce mortality and morbidity inpatient with STEMI.<sup>(7)</sup> Particularly every 10-min delay in STEMI treatment cause additional 3.3% deaths in PCI patients.<sup>(10)</sup> Furthermore, primary PCI improve the outcomes and lowering the recurrent of myocardial infarction and stroke compared with fibrinolytic therapy.<sup>(11)</sup> Two definitions have been used to measure the time to reperfusion; Door-to-balloon time which describes the time from hospital arrival to the time of balloon intervention or using a stent. Likewise, door-to-needle time measures the time from hospital arrival to reperfusion with fibrinolytic administration.<sup>(12)</sup> The American Heart Association/American College of Cardiology (AHA/ACC) 2013 guidelines recommended 90 minutes or less for door-to-balloon time at a PCI-capable hospital for patients with STEMI and within 120 minutes or less if the first arrival was to non-PCI-capable hospital. On the other hand, if fibrinolytic therapy is chosen, the recommended door-to-needle time should be within 30 minutes from hospital arrival.<sup>(8)</sup>

Previously, some studies investigated the possible reasons of delaying in reperfusion times. Focusing on the arrival time, it has been reported that patients arrived during off-hour e.g. weekend, night and holidays had longer door-to-balloon time compared to patients arrived on regular working hours with an increase in mortality.<sup>(13,14)</sup> Another factor that could delay reperfusion times is gender. Women with STEMI had longer time to receive reperfusion therapy and higher mortality rates than men.<sup>(15)</sup> It has been reported that cultural factors can affect the delay in reperfusion therapy in women such as an ability of some women to travel to hospital without male relative.<sup>(16,17)</sup> Comorbidities factors such as diabetic or hypertension can be associated with delay in door-to-needle time.<sup>(18)</sup>

In Saudi Arabia, limited studies have been conducted to investigate time to reperfusion in STEMI. Most patients with STEMI had reported to have a delay in fibrinolytic therapy.<sup>(18,19)</sup> A single center study at King Faisal Cardiac Center (KFCC) reported door-to-balloon time of < 90 minutes in 62% only. So, door-to-balloon time still behind the recommended time.<sup>(20)</sup> In addition, a standardized Code-STEMI program in King Khalid University Hospital's (KKUH) have been established and code-STEMI implementation significantly improved door-to-balloon time.<sup>(21)</sup>

To the best of our knowledge, no data available on

the assessment of reperfusion time in the emergency centers in Makkah. Early reperfusion in STEMI cases is critical. Therefore, we aimed in this study to evaluate time needed for reperfusion therapy particularly percutaneous coronary intervention (PCI) in patients with STEMI and assess different factors that may delay reperfusion at King Abdullah Medical City (KAMC).

## Methodology

**Study design and setting:** We conducted a retrospective study. Data for 47 patients were obtained from Jan 2018 through March 2019 based on patient medication records obtained from an electronic medical record (EMRs) from KAMC in Makkah, Saudi Arabia.

**Data collection and assessment:** Data were collected from the electronic medical records in KAMC in Makkah. A data collection form was filled with patient demographics (patient name, age, diagnosis and drug therapy for the respective diagnosis), Arrival time (off hours versus regular hours. Regular hours is defined as 08 am to 17 pm during the weekdays, and off hours is defined as weekends, holidays or time between 17 pm and 08 am during the weekdays) and reperfusion time. Then time from arrival until reperfusion was calculated and patient demographics and reasons for delays in reperfusion therapy were analyzed.

**Inclusion and exclusion criteria:** Patients who were above 18 years old and presented to KAMC and diagnosed with ST-segment elevation myocardial infarction (STEMI) and had PIC between Jan 2018 and March 2019 were enrolled. While exclusion criteria included: receiving thrombolytic therapy before arrival or thrombolytic therapy for conditions other than myocardial infarction, starting myocardial infarction attacks at hospital, unknown arrival time or unknown reperfusion time.

**Outcomes and measurement:** Our primary outcome was to evaluate the door-to-balloon time for patients with ST-segment elevation myocardial infarction (STEMI) undergoing primary percutaneous coronary intervention (PCI) in King Abdullah Medical Center (KAMC) under different circumstances such as arrival time, ECG receiving time and direct/indirect presentation.

**Statistical analysis:** All the variables were analyzed using SPSS Var 23.0 software 2015. Descriptive statistics were calculated and presented as means and standard deviations. For continuous variables such as door to

balloon time in minutes, median was calculated. While other variables reported in percentages such as gender, hypertension, diabetes mellitus, dyslipidemia, previous myocardial infarction, renal failure and smoking.

### Results

**Demographic Characteristic:** Patients included in this study were predominantly male (87.2%, no=41). The mean age was 57 (SD ± 14.2). Majority live in Makkah (87.2%, no=41). History of hypertension and diabetes was present in 42.6% (no=20). Demographic characteristic of patients who were involved in this study are summarized in table 1.

**Assessment of Door-to-balloon time:** After reviewing patients’ profiles, data represent around 63.6% of patients (n=7) who were arrived directly at KAMC received PCI within 90 minutes(Door-to-balloon time). The median door to balloon time was 42 minutes (IQR: 29– 67 minutes) for those patients. However, 36.4% of patients (n=4) received PCI in more than 90 Minutes (Figure. 1).

For patients transfer to KAMC from another hospital, data report 63.9% (n=23) of patients received PCI (door-to-balloon therapy) within more than 120 minutes and only 36.1% (n=13)met the guidelines recommended time for the PCI; within 120 Minutes (Figure. 1)with median door to balloon time of 61 minutes (IQR: 27 – 74 minutes).

**Assessment of Door-to-balloon time according to arrival time:** All patients included in this study who arrived directly to KAMC arrived on regular hours. Around 64% of those patients received PCI within 90 minutes while 36% of these patients received PCI in more than 90 Minutes(Figure. 2).

For patients who were transferred from non-PCI-capable hospital about 60% of patients received PCI in more than 120 minutes even though they arrived within regular hours compared to 40% received PCI within 120 minutes. While around 80% of patients who were transferred from non-PCI-capable hospital and arrived during off hours time, had delayed inreceiving PCI in more than 120 minutes (Figure. 3).

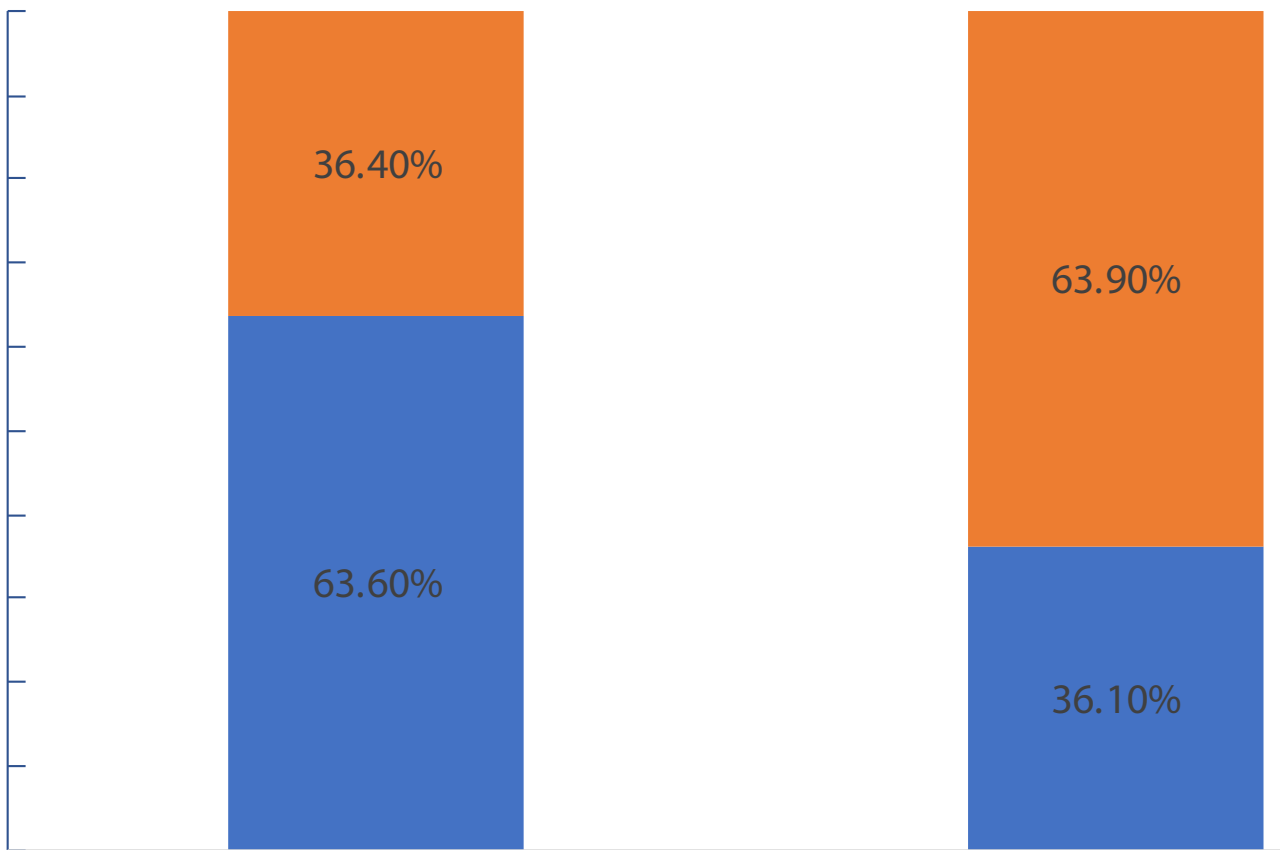
**Assessment of door-to-balloon time according to ECG:** Majority of patients(83%) who received ECG within 10 minutes received PCI within 90 minutes. However, from patients who received ECG after 10 minutes, 60% had a delay in receiving PCI in more than 90 minutes (Figure. 4).

For patients who were transferred from non-PCI-capable hospital, 43% received PCI in more than 120 minutes even though they received ECG within10 Minutes. Importantly, 77% of patients who were transferred from non-PCI-capable hospital received ECG after 10 minutes with a delay in receiving PCI in more 120 minutes (Figure. 5).

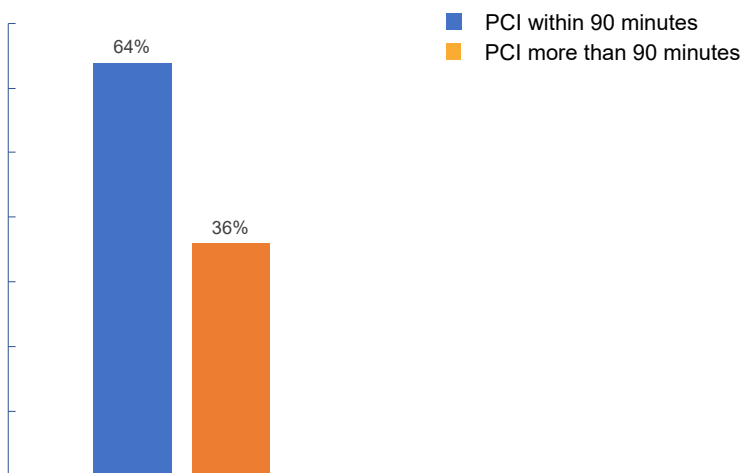
**Table 1: Demographic characteristic. Table represents demographic characteristics of the study population; data presented in actual patient’s numbers and percentage (%).**

Demographic characteristic		Actual patients’ numbers (Percentage %)
Age (Years)	30-49	15(32.9%)
	50-69	23(48.9%)
	70-89	8(17.0%)
	>90	1(2.1%)
Gender	Male	41(87.2%)
	Female	6(12.8%)
Area of residence	Makkah	41(87.2%)
	Outside Makkah	6(12.8%)
Nationality	Saudi	21(44.7%)
	Others	26(55.3%)

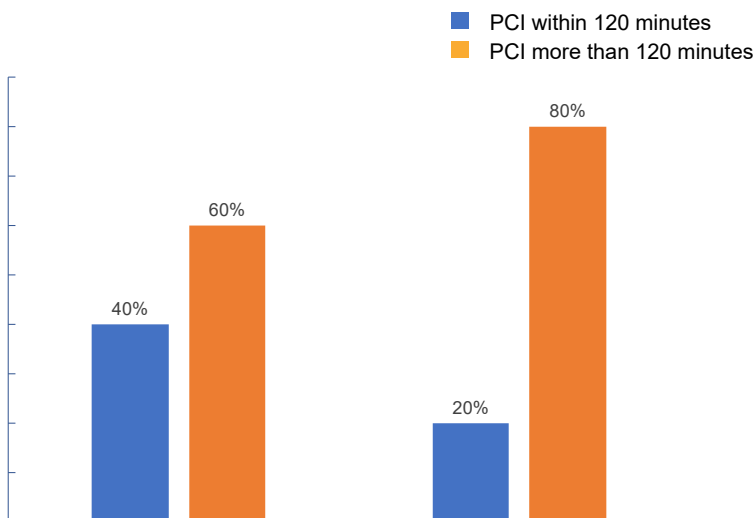
Demographic characteristic	Actual patients' numbers (Percentage %)	
Medical history	Hypertension	4 (8.5%)
	Diabetes	4 (8.5%)
	Dyslipidemia and smoking	2 (4.3%)
	Diabetes and smoking	2 (4.3%)
	Hypertension and diabetes	20 (42.6%)
	Previous myocardial infarction	2 (4.3%)
	Hypertension and previous myocardial infarction	2 (4.3%)
	Renal failure	1 (2.1%)
	Smoking and hypertension	2 (4.3%)
	Smoking	2 (4.3%)
	NON	6 (12.8)



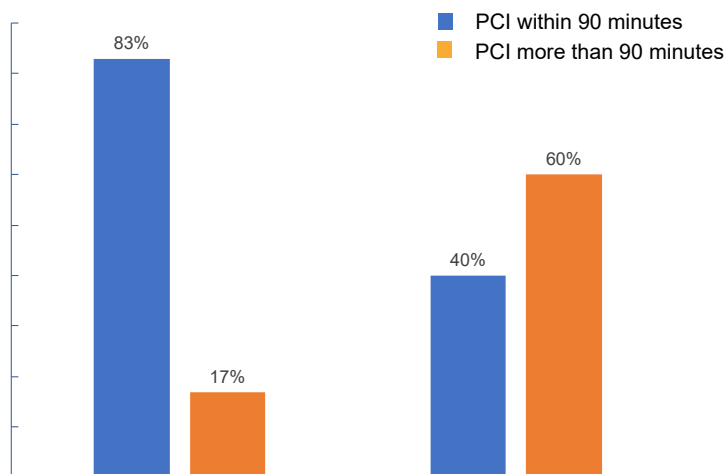
**Figure 1. Door-to-balloon time for patients directly arrived or transferred to KAMC. based on direct/ transferred arrival (x-axis across the page) and patient percentage % (y-axis going into the page).**



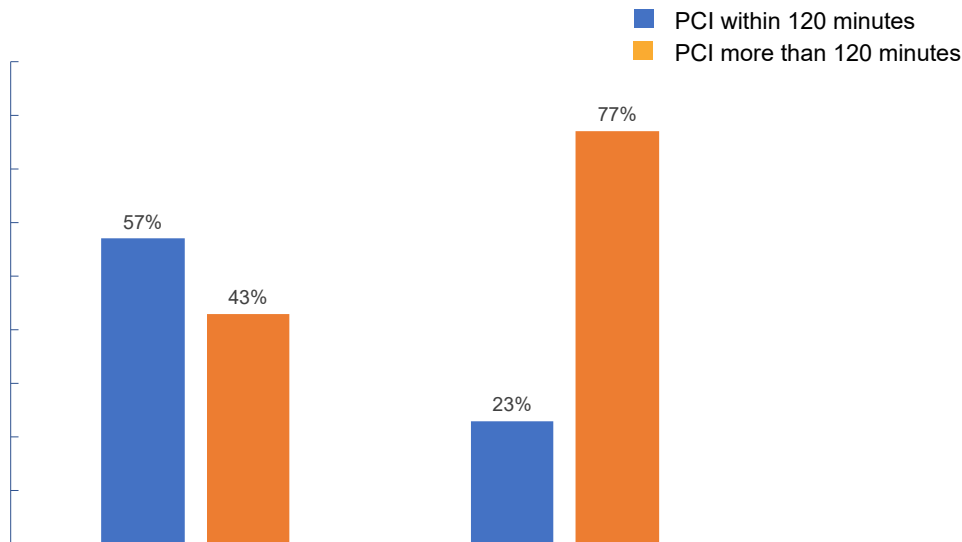
**Figure 2. Door-to-balloon time for patients directly arrived at KAMC based on arrival time (x-axis across the page) and patient percentage % (y-axis going into the page).**



**Figure 3. Door-to-balloon time for patients transferred from non-PCI capable hospital based on arrival time either regular hours or off hours (x-axis across the page) and patient percentage % (y-axis going into the page).**



**Figure 4. Door-to-balloon time for patients directly arrived at KAMC according to time needed to have ECG either within 10 minutes of arrival or more than 10 minutes of arrival (x-axis across the page) and patient percentage % (y-axis going into the page).**



**Figure 5. Door-to-balloon time for patients transferred from non-PCI capable hospital according to time needed to have ECG either within 10 minutes of arrival or more than 10 minutes of arrival (x-axis across the page) and patient percentage % (y-axis going into the page).**

## Discussion

According to recent guidelines, patients with STEMI should have time-to-needle within 90 minutes if arrived directly to PCI capable hospital or within 120 minutes if transferred from non-PCI capable hospital.<sup>(8)</sup> However, our study shows high percentage of patients with STEMI had a delay in receiving PCI. Unfortunately, 36.3% of patients with STEMI received PCI in more than 90 Minutes even though they arrived directly to KAMC. Receiving. For patients transferred from non-PCI capable Hospital such as: Al-Noor Specialist Hospital, Heraa General Hospital, East Jeddah General Hospital, King Faisal Hospital in Makkah or King Faisal Hospital in Taif, higher percentage around 63.8% of patients did not meet the guidelines recommended time for the PCI which is within 120 Minutes.

The delay in the PCI may be due to arriving at off working hours such as weekends, holidays or after 5:00 pm. Our data shows around 20% increase in patients percentage who have a delay in PCI when they arrived off hours. Another factor that may affect the delay in PCI, the delay in the ECG performing as the recommended time for having ECG is within 10 minutes of hospital arrival.<sup>(8)</sup>

Small Number of patients is the main limitation of this study. In addition, the effect of delaying time-to-needle in patients with STEMI patients on mortality remains unclear.

At last, hospitals should consider better strategies to ensure that patients with STEMI able to have reperfusion therapy within the recommended timeline. Easier system that accelerate patients access and simplify procedures for their entry as well as transferring between hospitals and universal healthcare system are needed to be implemented in Saudi Arabia in order to meet the international standards and guidelines.

## Conclusion

High percentage of patients with STEMI at KAMC did not receive PCI within the guidelines recommended time-line. More strategies have to be applied to ensure recommended door-to balloon time achievement.

**Conflict of Interest:** The authors have not declared any conflict of interests.

**Ethical Clearance:** Ethical approval was obtained from King Abdullah Medical City IRB committee, IRB #18-487.

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