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Original Article

The Role of STEMI Communication Network with Major Adverse Cardiac Event Incidence in STEMI Patients Hospitalized in Saiful Anwar General Hospital Malang

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ABSTRACT

Background : Patient with ST-Elevation Myocardial Infarction (STEMI) requires urgent reperfusion either with fibrinolytic or primary Percutaneous Coronary Intervention (PCI). In Malang, a communication network of STEMI has been developed. It connects Saiful Anwar General Hospital with all of the Public Health Centers (PHC) in Malang Raya to shorten system delay since 2015.

Objective : To elucidate Malang's communication network's role in decreasing Major Adverse Cardiac Event (MACE) in STEMI patients.

Methods : This is a retrospective cohort study. Study sample was taken from medical record. Non-network: 96 patients and 88 network patients. Statistical tests using SPSS version 20.0 software.

Results : Bivariate analysis showed network-group has a significantly lower MACE (p=0.001). Door-to-balloon time was also lower in network-group (p=0.026). Multivariate analysis without confounder showed that network-group had significantly shorter door-to-reperfusion time (p=0.032) and lower MACE (p=0.035) compared to non-network group. But multivariate analysis with confounder door-to-balloon and door-to-needle failed to explain lower MACE incidence. Network-group (p=0.005) and reperfusion with primary PCI (p=0.05) significantly decreased MACE incidence.

Conclusion : Malang's STEMI communication network and reperfusion with primary PCI reduced MACE in STEMI patients in Saiful Anwar General Hospital Malang.

1. Introduction

The World Health Organization (WHO) estimates that 17.5 million people worldwide died of heart disease in 2012, which is 31% of the total number of deaths and is the leading cause of death.[1] In 2011, around 478,000 patients in Indonesia were diagnosed with coronary heart disease. 2013 RISKESDAS data, the prevalence of coronary heart disease in Indonesia that was diagnosed in 2013 was 0.5% or estimated to be around 883,447 people, while based on symptoms and diagnosis of 1.5% or estimated to be around 2,650,340 people.[2]

In myocardial infarction, there is irreversible necrosis of the heart muscle that can occur while delayed revascularization. Furthermore, there was an imbalance of oxygen supply with tissue requirements, this condition was caused by plaque rupture and thrombus formation which caused a reduction in blood supply to the heart muscle Reducing the total ischemic time is very important not only for thrombolytic action but also for primary PCI action. Reducing the time from starting the first attack of chest pain and immediately starting treatment measures will significantly improve clinical outcome.

Efforts made to achieve these goals include patient education and establishing a referral system, as well as optimizing intra-hospital and prehospital response times so that patients can receive reperfusion therapy immediately. All measures are aimed at shortening the time between First Medical Contact (FMC) medical and primary PCI measures which should be under 90 minutes or fibrinolytic which should be done within 30 minutes.

ST-Elevation Myocardial Infarction (STEMI) communication network has been formed since 2015 in Malang Raya area. The network connects Saiful Anwar Malang Hospital with public health center (PHC) throughout Malang Raya. ECG was performed at the PHC and sent to Saiful Anwar General Hospital for confirmation of reading and diagnosis with the Whatsapp-based application. It is hoped that a faster ECG reading confirmation it will speed up staff at PHC to begin direct referrals to PCI-capable hospitals such as Saiful Anwar General Hospital. Unfortunately, there are no data that illustrates the extent of

the role of this communication network inreducing total ischemic time and improved major cardiac event.

2. Methods

The study design was a retrospective study. This study is aimed to determine whether the STEMI communication network can reduce the incidence of MACE in STEMI patients who are treated at Saiful Anwar General Hospital. The sample population was patients who came to the emergency room at Saiful Anwar Hospital Malang with a STEMI diagnosis between April 2015 and August 2017.

The sampling technique used was purposive sampling where all subjects were sequentially and medical record data could be found, as well as meeting the selection criteria included in the study until the required number of subjects were met. Inclusion criteria in this study patient with age more than 18 years old and diagnosed with STEMI who came to emergency room Saiful Anwar General Hospital either referred by the Public Health Center (PHC) through the STEMI Communication Network system or self admission. The exclusion criteria Patients referred to Saiful Anwar General Hospital through the STEMI Communication Network and subsequently it was proven that it was not STEMI.

Data Processing and Analysis were conducted using IBM SPSS software version 20.0. Data normality test used the Kolmogorov-Smirnov test. Categorical variable different tests were performed using the Chi-square test. Whereas the continuous variable difference test was performed by t-test or Mann-Whitney test using $\alpha = 0.05$ and considered significant if the p-value <0.05. The relationship between STEMI communication network patient group and Major Adverse Cardiac Event events was analyzed using bivariate and multivariate tests.

3. Results

Based on the recapitulation results of the data it was 196 medical records were obtained. Among them, there were 12 patients in the network group who were proven not to be STEMI. The remaining 184 patients were divided into 96 patients which were non-networking groups and 88 patients. Based on data analysis the results of the study can be explained as follows. The networking group an average age of 56.97 years was obtained while in the control group 58.06 (p = 0.512). Gender data showed that 79.17 percent of patients were men in the networking group, whereas in the non-network group, male sex was in 80.68% of patients (p = 0.789). As many as 73.98% of patients from the network group had health insurance when they arrived, and in the non-network group, the number of patients who did not have health insurance was 23.86% (p = 0.988).

In Non-Networking group, there are 95 patients which 63 patients underwent reperfusion therapy both with fibrinolytic and with Primary PCI. Whereas in the networking group, there were 76 patients out of a total of 88 patients who underwent reperfusion therapy (p = 0.001). A total of 42 of the 63 non-networked patients underwent fibrinolytic reperfusion therapy. Meanwhile, of the 76 patients in the networking group receiving reperfusion therapy, 52 of them were receiving fibrinolytic (p = 0.828). 18 patients from the networking group underwent PPCI therapy, while from the non-network group there were 23 patients underwent PPCI (p = 0.826).

To identify which variable partially influences the MACE

Table 1. Baseline Characteristics of Study Population

	All Patient (n = 184)	Networking Group (n = 88)	Non-Networking Group (n = 96)	P value
Men (n)	147	71	76	0.512
Mean Age (years)	57.53	56.97	58.06	0.789
Health Insurance (n)	138	67	71	0.989
Anterior STEMI (n)	91	41	50	0.457
RV Infarct (n)	28	17	11	0.245
Risk Factor:				
Diabetes Mellitus (n)	79	31	48	0.085
Smoker (n)	124	63	61	0.207
Hypertension (n)	124	64	60	0.139
STEMI Management:				
Revascularization (n)	139	75	64	0.001
Fibrinolytic (n)	94	52	42	0.828
Primary PCI (n)	41	18	23	0.826

STEMI = ST-Elevation Myocardial Infarction; RV = right ventricular; PCI = percutaneous coronary intervention;

event, the Wald test is used. The group variable obtained sig value <0.05 so it was concluded that the Networking group underwent PPCI therapy had an effect on predicting the risk of MACE events. The magnitude of the OR group variable was 0.305 because the OR value <1 could be interpreted that groups belonging to the STEMI network would inhibit MACE events of 0.305 times compared to non-networked ones. Patients treated with primary PCI will inhibit the incidence of MACE by 0.436 times compared to patients treated with fibrinolytic were 23 patients who underwent PPCI (p = 0.828).

Table 2. Primary and Secondary Outcomes`

	Networking Group (n = 88)	Non-Networking Group (n = 96)	Sig.
MACE:			0.01
Yes (n)	12	23	
No (n)	64	40	
Door to Balloon (min)	193 ± 85	270,50 ± 128	0.026
Door to Needle (min)	167,96 ± 78	204,33 ± 102	0.053

MACE = major adverse cardiovascular event

4. Discussion

The findings from our study showed data sociodemographically obtained normal age distribution of patients in the two groups and found no significant differences in both. However, in contrast to the results of studies in the United States, where the incidence of STEMI is higher in the age group above 65 years to 94 years, the recapitulation of age data in this study shows that the majority of patients experiencing STEMI are in the age group 51-70 year. The age data in this study is close to the results shown by a study conducted in Iran which states that in men, the most STEMI occurrences are in the age range of 35-64 years, whereas in the range of 65-85 years, the number drops to half, and after the age of 85 years, the incidence of STEMI is very low.[3]

In the non-network group, the most STEMI type was anterior which was 52%. Whereas in the networking group, anterior STEMI was found in 47% of patients. ARIC Study (Atherosclerotic Risk in Community) conducted from 1007 to 2008 in the United States revealed that the percentage of anterior STEMI events in all STEMI cases ranged from 43%, while inferior and lateral STEMI ranged from 17.5-24% and 16, 3-21.8%.[4] Similar to the study, our study subjects also largely indicated the location of the anterior STEMI. It was known that the clinical outcomes of patients suffering from anterior STEMI have in-hospital mortality, total mortality, heart failure, and a higher incidence of ventricular extra systole (VES) compared with inferior STEMI.[5]

Diabetes mellitus comorbidities were found in 49.5% of patients in the non-tissue group, and 36% in patients in the tissue group. According to MONICA (The World Health Organization Multinational Monitoring of Trends and Determinants of Cardiovascular Disease) registries, diabetes mellitus has been shown to increase mortality in patients with myocardial infarction. This is because patients with diabetes mellitus tend to have multicellular coronary lesions, diffuse lesions, smaller coronary artery sizes, collaterals are not formed, and often found on the Left Main lesion.[6]

First medical contact (FMC) also found in the network group was significantly shorter. This may be due to the network group, medical personnel are well aware that patients with typical symptoms of acute coronary syndromes should immediately record ECGs and follow up with consultation through Whatsapp networks for diagnosis. Whereas in non-networked patients, FMC is calculated from chest pain until the patient is disposed to the cardiology department. There are several factors apart from the patient delay factor that affects the FMC of this patient group. It could be that the patient may have been previously treated at another hospital which varies greatly how the health care worker at the hospital explores complaints felt by the patient.

In our study, patients who came through the network had a significantly lower incidence of MACE. This study related in the United Kingdom in 2010 stated that after the era of reperfusion networks, STEMI patients who came to the prehospital significantly received earlier diagnosis and therapy.[7] Nallamothu et al in 2013 conducted a retrospective study evaluating the relationship between door-to-balloon time and mortality in STEMI patients undergoing primary PCI. The results of the study showed that in patients with door-to-balloon significantly lower the 1-year mortality rate was also lower.[8]

Patients undergoing reperfusion with fibrinolytic differed in the incidence of MACE from those treated with primary PCI in this study. These results are contradictory to both the CAPTIM study and the WEST study which states that the 30-day outcome of STEMI patients given fibrinolytic therapy is no worse than that of patients undergoing primary PCI.[9] This is because in this study, the average door-to-needle time for patients coming through the network and especially non-networks has not yet reached the door-to-neddle time that is targeted by the guideline which is under 10 minutes, or at least equivalent to the door-to-needle as a reference the two studies were 2 hours.

There are some weaknesses of this study. There are no evaluation of coronary patency was performed. For example, whether patients given thrombolytic therapy succeed or fail, and in patients who performed primary PCI, TIMI Flow was not evaluated post-procedure. If the reperfusion procedure is carried out but good TIMI Flow is not achieved, then the ischemic process continues which leaves the patient at risk of developing MACE.

Although taking into account the variables of diabetes mellitus, this study did not look at the value of patients' blood sugar at admission. Some studies agree that blood sugar at admission, rather than HbA1C values, has a more significant effect on MACE. Patient's weight was also not considered in this study. This study uses secondary data, with a small sample, some confounding factors are not obtained data, such as body weight, post-procedure TIMI flow, eGFR value, coronary anatomy, and are retrospective studies.

5. Conclusion

The Malang STEMI communication network and reperfusion using primary PCI reduced the incidence of MACE such as acute lung edema, cardiogenic shock, and in-hospital mortality in STEMI patients treated at Saiful Anwar General Hospital. STEMI patients who come through the communication network receive reperfusion more often than patients who arrive without going through the network and patients who come through the network are significantly shorter in terms of door to balloon and door to needle time.

4. Declarations