Implementation of STEMI Communication Network System in Malang to Accelerate Door-to-Balloon Times

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ABSTRAK

Patient delay is a worldwide unsolved problem in ST-segment elevated myocardial infarction (STEMI). An accurate networking system will provide delightful reperfusion management and better outcomes. To implement STEMI communication network system among Saiful Anwar General Hospital with all of the Public Health Centers (PHC) around Malang region to shorten the door to balloon times and reduce MACE. A retrospective cohort study enrolled 184 consecutive patients with STEMI. 96 were non network and 88 network patients. Statistical tests using SPSS version 20.0 software. The mean ± SD door-to-balloon (D2B) time was significantly shortened from 270,5±128 minutes to 193±85 minutes (P=0.026). Multivariate analysis without confounder showed that the network-group had significantly shorter door-to-reperfusion time (p=0.032) and lower MACE (p=0.01) compared to the 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. Although the percentage is less than 50%, a significant increase in the percentage of D2B times less than 90 minutes in the network group vs the non network group with 18.5% vs 5.2% (*P*=.097). Implementation of the STEMI communication network system in Malang significantly reduced the D2B time, although the corresponding increase in the percentage of D2B times less than 90 minutes is not yet achieved. It also reduced MACE in STEMI patients undergoing primary PCI

Keywords: STEMI, networking system, door to balloon, MACE

1. INTRODUCTION

Coronary heart disease accounted for approximately 12.6% of deaths in the United States in 2018, causing 360,900 deaths overall. According to data from 2005 to 2014, the estimated annual incidence of heart attacks in the United States is 605,000 new attacks and 200,000 recurrent attacks ST-elevation myocardial infarctions (STEMIs) are caused by the acute occlusion of one or more coronary arteries, leading to myocardial ischemia, and if it not timely managed, myocardial infarction and myocardial death. Primary percutaneous coronary intervention (PCI) is the treatment of choice for patients with STEMI when performed by experienced operators in a timely fashion, as demonstrated in randomized trials and recommended by international guidelines.

Various countries have developed STEMI programs to facilitate early detection, appropriate transportation, and management of patients with STEMI. Some countries adopted a chest pain hotline activated by patients, while other countries organized STEMI networks with a primary PCI center receiving referrals from surrounding hospitals defined by specified catchment areas, supported by Rogers et al [1].

Y. A. Yusran et al. (eds.), *Proceedings of the 2023 Brawijaya International Conference (BIC 2023)*, Advances in Economics, Business and Management Research 294,
https://doi.org/10.2991/978-94-6463-525-6_7

The STEMI communication network was initiated in Malang in 2015. The goal behind this program is to provide timely coronary angiogram and angioplasty or fibrinolytics by facilitating early transfer of STEMI patients to RSUD dr Saiful Anwar Malang; the only tertiary cardiac center with PCI capabilities in Malang. All STEMI patients in Malang are eligible for referral and reperfusion whether it was primary PCI or fibrinolytic if clinically indicated, regardless of entitlement, insurance, or nationality.

Procedures related to the new STEMI hotline were as follows The new STEMI hotline was based at the cardiac transfer clinic in the cardiac center at RSSA by using whatsapp application. The STEMI hotline was covered by an in-house cardiology resident and senior cardiologist 24/7 and the GPs around Malang, in public health centers or in the clinic. Patient identification, data, clinical history along with the ecg is referred over the group by the referring physician or paramedic.

We retrospectively collected data from August 2021 to mid-January 2022 for patients in the traditional pathway. Since the start of the STEMI hotline in the mid of January, cases were collected prospectively, as the STEMI hotline only receives STEMI transfers for primary PCI or rescue PCI if applicable.

All patients came by activation of the STEMI hotline represented from April 2015 to 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 were patients with age more than 18 years old and diagnosed with STEMI who came to the 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 Kolmogoov-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

2. METHODS

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 none-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 the Non-Networking group, there are 95 patients in 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 who underwent PPCI ($p = 0.826$).

Table 1. baseline characteristic

	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

To identify which variable partially influences the MACE 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: Yes (n)	12	23	0.01
No (n)	64	40	
Door to Balloon (min)	193 ± 85	270,50 ± 128	0.02 6
Door to Needle (min)	167,96 ± 78	204,33 ± 102	0.05 3
MACE = major adverse cardiovascular event			

3. DISCUSSION

The findings from our study showed data sociodemographic ally 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 years. 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, supported by Riskesdas [2].

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% , supported by Deopujari et al [3]. 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 extrasystole (VES) compared with inferior STEMI, supported by Soliman et al [4].

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, supported by Topol et al [5].

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 of 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. significantly lower incidence of MACE. This study 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, supported by WHO Monica Project [6]. 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, supported by Alexander et al [7].

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, supported by Bonnefoy et al [8]. 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-needle 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. 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.

4. 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.

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