The role of STEMI Integrated Networking System based on tele-cardiology For Reducing delayed during COVID 19 pandemic : Insights from the Single Tertiary Healthcare Center in Malang East Java Indonesia

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ABSTRAK
In the event of a public health emergency like the COVID-19 epidemic, when time is of the essence, it is much more difficult to forecast how long it will take for patients to recover enough to undergo reperfusion. One of the benefits of telecardiology is that it shortens the time it takes for patients with ST-elevation myocardial infarction (STEMI) to reach the emergency room and begin receiving reperfusion therapy.
Purpose:
Evaluate the effect of this program on pre-hospital and in-hospital (door-to-balloon) delays in STEMI patients admitted to Saiful Anwar Hospital (Tertiary Healthcare Center in Malang East Java Indonesia) during Pre Covid-19 and Covid-19 Era.

Keywords : STEMI delayed, COVID-19, Telecardiology

1. INTRODUCTION

These delays are harder to forecast during a public health emergency, such as an infectious disease epidemic. The WHO designated COVID-19, a new coronavirus illness, a worldwide pandemic on January 30, 2020. According to Mutjaba SF et al [1] Prehospital and in-hospital delays have been cut as much as possible in an attempt to speed up reperfusion after the start of symptoms. To better serve STEMI patients in Jakarta and cut down on prehospital delays, the iSTEMI network was launched as a government initiative in 2014. Dharma et al. conducted a tele-cardiology study using data from the Jakarta Cardiovascular Care Unit Network System, and they found that after its implementation, the number of patients referred for primary PCI procedures at the Harapan Kita National Cardiovascular Center in Jakarta increased, and the number of patients waiting before they were taken to the hospital decreased. In various parts of Indonesia, including Malang, East Java, the ISTEMI network was implemented using the telemedicine-based Saiful Anwar Hospital Integrated ACS Networking System (SAHIANS), supported by Dharma et al [2] & Sunjaya et al [3].

This study analyzes the results of a Smartphone-based cardiac teleconsultation networking (SAHIANS) for patients at the Saiful Anwar General Hospital in Malang, East Java, Indonesia, during the Covid-19 period. The main goal of this study was to compare the pre-Covid-19 and post-Covid-19 periods in terms of the number of minutes it took to perform Primary PCI in patients with STEMI who were admitted to Saiful Anwar Hospital. Patients who were treated by the SAHIANS pre-hospital network and those who were admitted via the traditional ED were compared for in-hospital mortality and complications over the study period.

2. METHODS

2.1. Description of Saiful Anwar Hospital Integrated ACS Networking System

Saiful Anwar Hospital's Integrated Regional STEMI Network (Single Tertiary Cardiac Hospital Center, Malang, East Java, Indonesia) is a smartphone- and web-based system with the following primary components:

EMS: We created a smartphone app to identify acute coronary syndrome in the general population at an early stage (DETAK). This organization must take the lead in coordinating the various parts of the

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network and integrating them at the federal/state and local levels. Money for it comes from Universitas Brawijaya.

Health units - These include Malang's public health system's emergency rooms, general hospitals with ERs, and pre-hospital ambulance services. These clinics act as the front door, welcoming unscheduled patients who will be treated throughout the system. The network deployment did not noticeably disrupt the regular operations of these parts.

The ECG tracings are collected from the health units and the related reports are sent back to the health units of origin using our designed smartphone application at the telemedicine center, which has a cardiologist on call 24 hours a day, 7 days a week. These resources may be found on the World Wide Web. The nurse in charge of an ECG unit is a member of that unit's staff. In addition, the Regional STEMI Alert Team is notified of any suspicious ECGs by email and SMS. The state government has been working with this private company for over a decade.

The Regional STEMI Alert Team consists of cardiology and vascular medicine residents from Universitas Brawijaya who are constantly monitored by a cardiologist assigned to this role. Every resident is accountable for one day a week, in the event that anything happens, they will contact the patient's health unit and act as a liaison with the EMS control center. Due to differences in training and experience amongst ER medical teams, this group and the active search were integrated into the STEMI network.

2.2. Collecting Data

All patients aged 18 and older who presented with ST-elevation myocardial infarction (STEMI) to the SAHIANS prehospital network or the Accident and Emergency department at Saiful Anwar General Hospital were included in this retrospective observational analysis. According to the fourth universal definition of myocardial infarction, ST-elevation myocardial infarction is defined, supported by Thygesen et al [4] The indications for primary PCI were consistent with current practice recommendations, supported by Ibanez et al [5] They were separated into four groups based on where they were admitted: Group A, conventional emergency department prior to the COVID-19 period; Group B, SAHIANS; Group C, conventional emergency department during the COVID-19 period; and Group D, SAHIANS during the COVID-19 period (Group D). Our research period starts one month after the onset of the COVID-19 "Pandemic" (ie, March 1- 31, 2020; COVID-19 era group). A control group of patients who had STEMI at the same time last year was used (i.e., March 1–31, 2019; pre–COVID-19 era group). Patients with probable STEMI who were already hospitalized or whose symptom onset was delayed were not included.

The number of patients referred for reperfusion, the distribution of total ischemic time of patients referred in the network, and the duration from opening the door to crossing the wire were the outcomes of interest. Complications and deaths that occurred while patients were hospitalized were also evaluated. The four groups were compared throughout the following time scales:

Ischemic time is the elapsed time from the beginning of ischemia till the patient crosses the threshold. Time from admittance to the first Crossing wire after leaving Saiful Anwar Hospital is referred to as "Door-to-Crossing wire time" (DCT), supported by Ibanez et al. [5].

2.3. Statistics

If a continuous variable has a test of normality, the average (standard error) has been used; otherwise, the median is used. The chi-square test and, where appropriate, Fisher's exact test were used to compare categorical variables. The Student t test was used to compare variables that were constantly distributed. In the absence of a normal distribution, the Wilcoxon test was employed to compare the means of two groups. Univariate analysis took into account admission group, age, gender, BMI, smoking history, diabetes, hypertension, dyslipidemia, stroke, angina history, prior myocardial infarction or revascularization, reperfusion therapy, in-hospital drug treatment, blood pressure at admission, and maximum Killip class while hospitalized. Using a multivariate logistic regression model, we looked for additional risk factors for both 30-day and in-hospital mortality by including variables that were shown to be significant in the univariate analysis. The Kaplan-Meier method was also used to create a survival curve from the collected data over the course of three months. SPSS version 21 was used for the statistical analysis. (SPSS Institute, Inc.; Cary, NC)

3. RESULT

In this investigation, 184 patients in total—123 before and 61 during the COVID-19 Pandemic—were included. According to how they were admitted, the patients were split into four groups: the conventional emergency department group before COVID-19 (Group A, 27 patients), the SAHIANS-group before COVID-19 (Group B, 96 patients), the conventional emergency department group during COVID-19 (Group C, 25 patients), and the SAHIANS-group during COVID-19 (Group D, 27 patients) (Group D, 36 patients). Here is a summary of the traits that each category has. The four patient groups were quite comparable in terms of their state of health. Table 1 displays the demographic and clinical characteristics of the whole research.

Table 1. Baseline characteristics of patients of the overall study populations

	Group A N=27 (14.7%)			Group B N=96 (55.2%)			Group C N=25 (13.6%)			Group D N=36 (19.6%)			P
	n	%	Mean± SD	n	%	Mean±SD	n	%	Mean± SD	n	%	Mean±SD	
AGE			56.2±10.6			60.21±10.26			56.5±9.53			60.5±10.75	0.18
Male	20	74.1		82	85.4		22	88		27	75		0.29
Past Medical History													
Diabetes Mellitus	9	33.3		18	18.8		7	28		24	66.6		0.39
Hypertension	18	66.6		60	62.5		16	64		161	51.3		0.68
Smoker	15	55.6		68	70.8		19	76		23	63.9		0.34
Family History	3	11.1		10	10.4		3	12		4	11.1		0.64
Hyperlipidemia	2	7.4		11	11.4		4	16		54	8.3		0.36
Prior PCI	3	11.1		11	11.4		3	12		4	11.1		0.68
Prior CABG	0	0		1	1.04		0	0		0	0		0.96
Prior MI	6	4.6		5	4.4		10	14.08		21	8.9		
Prior CVA	7	5.4		1	0.9		3	4.2		11	3.5		
Killip Class													0.31
Killip I	18	66.7		75	66.3		12	48		22	61.1		
Killip II	3	11.1		7	7.3		4	16		6	16.7		
Killip III	1	3.7		2	2.1		1	4		1	2.8		
Killip IV	5	18.5		12	12.5		7	32		7	19.4		
Cardiac arrest befor admission	2	7.4		4	4.16		1	4		1	2.7		0.82
Medication													
ASA	27	100		96	100		25	100		36	100		1
CPG	20	74		80	83.3		20	80		28	77		0.78
Ticagrelor	7	26		16	26.7		5	20		8	33		0.78
Enoxaparin	18	66.6		62	64.5		14	56		21	58.3		
Heparin	5	18.5		21	21.8		8	32		10	27		0.32

Abbreviations: PCI = Percutaneous Coronary Intervention; CABG = Coronary Artery Bypass Grafting; MI = Myocardial Infarction; CVA = Cerebrovascular Accidents, ASA = acetylsalicylic acid; CPG = Clopidogrel

Patients with STEMI who went to an emergency room on their own or through the SAHIANS prehospital network were given the same reperfusion treatment. As the final treatment for STEMI, Primary PCI was done on patients. Patients were looked at in terms of the Primary PCI procedure and the patients' outcomes, which

included in-hospital death, reinfarction, stroke, VT/VF, High Degree AV Block, and the start of atrial fibrillation for the first time. Table 2 had more information about these facts.

Table 2. Characteristics of the Primary PCI procedure and the patient's outcomes

PPCI Procedure	Group A		Group B		Group C		Group D		P
	n	%	n	%	n	%	n	%	
Single Vessel	9	33.3	32	33.3	7	28	10	27.7	0.82
Multi Vessel	18	66.6	64	66.6	18	72	26	72.2	0.72
Thrombo suction	4	14.8	12	12.5	5	20	6	16.6	0.54
No Reflow after PCI	3	11.1	8	8.3	2	8	4	11.11	0.52
Stenting with predilatation	20	74.0	78	81.25	20	80	28	77.77	0.84
Direct stenting	7	25.9	18	18.75	5	20	8	22.2	0.66
Temporary pacing implant	4	14.8	9	9.37	1	4	2	5.5	0.44
Intra aortic Ballon Pump Implantation	2	7.4	3	3.12	1	4	0	0	0.32
Endotracheal intubation with Ventilatory support	3	11.1	4	4.166	1	4	1	2.7	0.42
Infarct Related artery									0.96
LAD	13	48.1	49	51	13	52	15	41.7	
LCx	1	3.7	7	7.3	1	4	3	8.3	
RCA	13	48.1	39	40.6	11	44	18	50	
LM	0	0	1	1	0	0	0	0	
Outcome									
Inhospital mortality	4	14.8	7	7.3	6	24	4	11.1	0.12
Reinfarction	3	11.1	6	6.25	3	5.6	3	13.8	
Stroke	2	7.4	1	1.04	1	4	1	8.3	
VT/VF	5	18.5	11	11.4	6	16.9	6	2.7	
High degree AV Block	2	7.4	8	8.3	2	14.08	2	8.3	
New onset AF	5	18.5	14	14.5	5	15.4	5	22.2	

Group B had the lowest mean of total ischemic time compare than group A, D, and C (217.34±116 minute, 285±165 minute, 432±204 minute, 609±246 minute, Respectively, P=0.000. The comparison of ischemic time between groups were shown in picture 1.

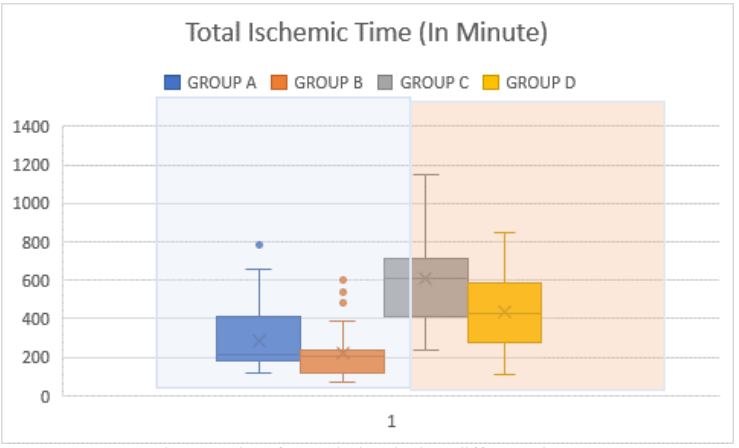

Figure 1 The Box Plot of mean ischemic time difference between group

When comparing group A, group D, and group C, group B had the shortest average crossing-wire time (8210.9 minutes, 96.448 minutes, 17541 minutes, and 13238 minutes, respectively, P=0.000). Picture 2 shows how the different groups' crossing wire times compare.

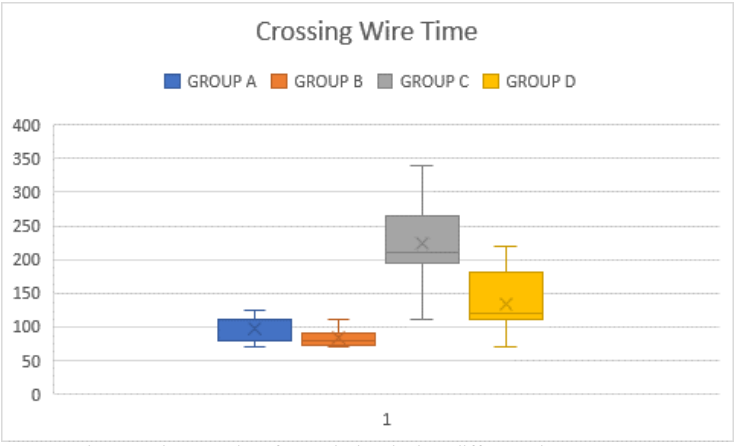

Figure 2 The Box Plot of mean ischemic time difference between group

Subgroup studies compare group C and group D based on their overall ischemia time delay, crossing wire time delay, and in-hospital death rates. Group C had a significantly greater incidence of ischemia time delay > 720 minutes compared to Group D (36% vs. 13.9%, P = 0.045). Group C had a much greater rate (76%) of crossing wire times > 140 minutes than Group D (27.8%; P=0.000). In group C, the rate of in-hospital deaths was significantly greater than in group D (32% vs. 11.1%, respectively; P=0.045). Table 4 displays a comparison of the ischemia and crossing wire time delays in groups C and D.

Table 4. comparison of ischemic and crossing wire time delayed between group C and Group D

Variable	HR	95% CI	P
Total ischemic time > 720 minutes	1.88	1.08-3.29	0.043

Crossing wire time > 140 minutes	3.49	1.62	7.53
Inhospital mortality	1.92	1.10-3.34	0.045

4. DISCUSION

We discovered that the number of STEMI patients treated with PPCI at Saiful anwar General Hospital dropped by 42% during the epidemic. Steady-State Myocardial Infarction (STEMI) admissions have decreased by between 25.5% and 40% in Austria, 26.5% to 40% in Italy, 40% in Spain, and 48.0% in the United States as a consequence of the COVID19 pandemic, supported by Park DW et al [6] & Range et al [7]. Under-detection of STEMIs in the community during lockdown may account for our findings. Patients may have delayed STEMI hospital admissions due to concerns about contracting an infection. In our research, we found that there was a general upward tendency in the duration between symptom start and first medical contact, which is consistent with a shift in patient behavior during the lockdown. Patients have been reported to be reluctant to go to the hospital, even in the face of a stroke or a transient ischemic attack.

Higher death rates were seen in individuals with STEMI who did not appear for treatment for a longer period of time. Patients presenting with STEMI have a 7.5% higher chance of dying within a year for every 30 minutes they wait to get treatment. Studies in animals have shown that the length of time that a coronary artery is blocked off correlates strongly with the size of the resulting infarct. For patients with STEMI, we found that ischemia periods were considerably longer during the pandemic, and this was associated with increased in-hospital mortality and complications, supported by Choudhary et al [8] & Patel et al [9].

Strategies are required to allow early detection of patients with STEMI and prompt transfer to such facilities to decrease treatment delays. Acute myocardial infarction patients may be safely transported to tertiary hospitals for primary coronary angioplasty, according to a number of observational papers and randomized trials, supported by Range et al [7].

Strategies are required to allow early detection of patients with STEMI and prompt transfer to such facilities to decrease treatment delays. Acute myocardial infarction patients may be safely transported to tertiary hospitals for primary coronary angioplasty, according to a number of observational papers and randomized trials, supported by Gomes et al. [10].

The results of this investigation showed and validated an increase in delayed ischemia time and crossing wire time, especially in Group D, during the pandemic period of COVID-19. These results raise critical questions, since pandemics present formidable obstacles to medical therapy. To be sure, telehealth isn't a silver bullet for every problem, but institutions like ours who have already made the investment in telemedicine will be in a good position to guarantee improved care of patients with STEMI even during the COVID epidemic. Ischemic delay, door-to-crossing-wire delay, and in-hospital mortality were all reduced to a lesser extent in group D compared to group C. These findings were linked to a higher rate of hospital-acquired complications.

It's also important to note that the low rate of pandemic transmission in our areas was likely a factor that prevented the frequency of STEMI diagnosis from falling. What's more, those that have already committed resources to telemedicine are in a prime position to guarantee patients rapid access to the treatment they need. Our telecardiology technology may be useful beyond the COVID-19 era as well. It is possible that a streamlined and ubiquitous telecardiology system may encourage individuals to seek medical care. The last potential advantage of this infrastructure is that it might help reduce the number of times people need to go to the emergency room, saving money for both the public and medical facilities, supported by Beig JR et al. [11] In fact, telecardiology might be expanded to include televisits, which could be helpful for bedridden patients with heart failure who are unable to travel with family members to the hospital. Hospitals may also have a beneficial effect on the economy. In fact, early departure from the hospital may result in cost savings thanks to the transfer of medical data and the speed with which a diagnosis can be made. During epidemics and beyond, telecardiology helps hospitals within a territory stay connected quickly and safely, improving resource management and better matching patient behavior and health-care requirements, supported by Solla et al [12].

Limitations: There are several clear caveats to this research. Patients were recruited at Saiful anwar Hospital, however they do not represent the general community since they were sent there by individual cardiologists or other nearby hospitals after being diagnosed with STEMI. Because of the specifics of the study's design, the length of the follow-up was limited to the duration of the in-hospital treatment. Patients were referred from various locations, but they were all treated at the same facility, which is where the data was collected.

5. CONCLUSIONS

According to our findings, the number of patients undergoing PPCI for a STEMI at Saiful Anwar hospital in Malang, Indonesia decreased significantly after COVID-19 was introduced. In the midst of the pandemic COVID-19 period, our STEMI networking based on tele-cardiology system decreased ischemia time delayed, crossing wire time delayed, and in-hospital mortality.

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