ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 13, Issue 11, 2020

Online - 2455-3891
Print - 0974-2441

Research Article

THE CORRELATION BETWEEN TROPONIN I LEVEL WITH CORRECTED THROMBOLYSIS IN MYOCARDIAL INFARCTION FRAME COUNT IN PATIENTS WHOSE UNDERWENT PRIMARY PERCUTANEOUS CORONARY INTERVENTION: A SINGLE CENTER STUDY

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Received: 17 June 2020, Revised and Accepted: 24 August 2020

ABSTRACT

Objective: There were studies reported about the correlation between troponin I with scale of myocardial infarction (MI) area. However, the effect of revascularization into the coronary flow has not been reported. We aim to determine the correlation between high sensitivity troponin I and the successfulness of revascularization primary percutaneous coronary intervention (PPCI) in ST-elevation MI (STEMI) patients. The successfulness of revascularization was assessed by calculating Corrected thrombolysis in MI frame count (CTFC).

Methods: This is a retrospective analysis including all consecutive patients undergoing PPCI over 1-year period from December 2018 to 2019 at the Integrated Heart Service Installation Dr. M. Djamil Padang Hospital, West Sumatra. Exclusion criteria included patients with incomplete medical record data, incomplete coronary angiography data, prior MI, and prior PCI and coronary artery bypass graft. Patients were put into two groups with normal (CTFC <30) and high (CTFC ≥30) to define the baseline characteristics.

Results: A retrospective analysis was performed of patients undergoing primary PCI. Ninety-six patients underwent PPCI between December 2018 and 2019 were enrolled. For the baseline characteristic, patient was divided into two groups with normal CTFC (<30) and high (CTFC ≥30). There was negative weak correlation between troponin I level and CTFC with Spearman's correlation value was 0.371 and correlation coefficient −0.092.

Conclusion: Troponin I level at first presentation before revascularization did not have a significant correlation with coronary flow result after revascularization in STEMI patients.

Keywords: Corrected thrombolysis in myocardial infarction frame count, Troponin I, ST-elevation myocardial infarction, Primary percutaneous coronary intervention.

 DOI: http://dx.doi.org/10.22159/ajpcr.2020.v13i11.38775

INTRODUCTION

Acute coronary syndrome can be divided as unstable angina pectoris, non-ST-elevation myocardial infarction (NSTEMI), and ST-elevation myocardial infarction (STEMI). The prevalence of STEMI was ranged between 29 and 47% from all of American Cancer Society (ACS) cases. This data were based from medical record of 2433 patients STEMI patients who were underwent reperfusion therapy from June 2014 to June 2017 [1,2].

The incidence of STEMI around 58 out of 100,000 people/year based from European STEMI registry in Sweden on 2015 [3]. The prevalence of STEMI in Indonesia had increased from 25% to 40% [4]. The majority of STEMI patients (59%) did not receive acute reperfusion therapy and 52% of patients were inter-hospital referrals based on Jakarta Acute Coronary Syndrome registry between 2008 and 2009 [5].

Immediate myocardial revascularization with primary percutaneous coronary intervention (PPCI) is the most suggested treatment for STEMI patients. PPCI was known could limit the scale of myocardial infarction (MI) and improving a clinical outcome [6-8]. The successfulness of PPCI can be considered based on electrocardiogram (ECG) by measuring resolution of ST-segment (STR) after procedure and evaluating thrombolysis in MI (TIMI) flow, or corrected TIMI frame count (CTFC) from the angiography findings [9,10].

The level of cardiac troponin is routinely measured in emergency room to confirmed MI. Troponin also could help the clinician to estimate the extent of myocardial necrosis and suggests if the patients should undergo early invasive management in NSTE-ACS cases [11]. The high level of troponin levels during admission is associated with mortality, regardless of patient's clinical risk [12]. Therefore, this study aims to determine the correlation between high sensitivity troponin I level and the successfulness of revascularization in STEMI patients. In this study, the successfulness of revascularization was assessed by calculating ctfc.

METHODS

This is a retrospective analysis including all consecutive patients undergoing PPCI over 1-year period from December 2018 to 2019 at the Integrated Heart Service Installation RSUP Dr. M. Djamil Padang, West Sumatera. Exclusion criteria included patients with incomplete medical record data, incomplete coronary angiography (CAG) data, prior MI, and prior PCI and coronary artery bypass graft. Patients were divided into two groups with normal (<30) and high (CTFC ≥30) to define the baseline characteristic. All patients have provided a signed informed consent. This research has received an ethical approval from the Ethics Committee of Medical Faculty of Andalas University.

Clinical data

STEMI was defined by ST elevation ≥2.5 mm in <40 years old male ≥2 mm in ≥40 years old male or ≥1.5 mm in woman at the two concomitants ECG lead with proof of sudden occlusion of coronary artery during angiography. Diabetes was defined by patient whose under treatment with anti-hyperglycemic medications. Hypertension was defined by blood pressure >140/90 mmHg or patient whose

under treatment with antihypertensive medications. Laboratory tests, including troponin I (high sensitivity) level, were obtained on the day of patient admitted at the ER.

Cardiac catheterization

After diagnosis of STEMI was made, all patients were given aspirin (160 mg) and ticagrelor (180 mg). Primary PCI was performed by femoral approach (conventional technique). After cannulation of coronary artery, all patients were administrated with heparin (100 U/kgBW). CAG was performed after a guiding catheter was in a correct position. Grading of coronary flow on the infarct-related artery (IRA) before and after PCI was measured visually based on to the TIMI Study group flow classification [13]. Subsequently, primary PCI was performed using standard balloon dilation catheters, which was chosen, based to the size of vascular areas to the stenosis. The successfulness of angioplasty was defined as reduced of 50% diameter stenosis with TIMI three flow (CTFC <40) of the culprit vessel after primary PCI. We only performed PCI on the culprit vessel during PPCI. CAG was performed to calculate the CTFC after administration of nitroglycerin after we achieved of TIMI three flow of culprit vessel.

TIMI frame count

The TIMI frame count is the number of frames which contrast need to filled a distal vessel. The technique to acquired TIMI frame of the coronary artery was described by Gibson *et al.* [14]. The TIMI frame count was calculated by digital cardiac image software on the recorded standard cine films. The frame rate was calculated as 15 frames/s. The LAD's TIMI frame count has to be divided by unadjusted normal LAD's TIMI frame count if LAD vessel was longer than right coronary artery or left circumflex coronary artery. CTFC was measured by dividing the LAD's TIMI frame counts by 1.7 (11). All the patients, in this study, had restored to TIMI three flow of the culprit vessel after intervention same with CTFC <30. Two experienced observers assessed CTFC and TIMI flow grade which were blind into other clinical data.

Statistical analysis

Data are reported as mean and SD or median (25–75th interquartile range). Student t-test or Mann–Whitney U-test was used to compare continuous variables. Categorical variables were compared using Chi-square test. $p<0.05$ was considered significant for all analysis.

RESULTS

Of 238 available patient data, 96 were enrolled to analyze the effect of troponin I level to coronary blood flow based on CTFC. There were 73 patients had ctfc <30. Demographic, clinical, and hemodynamic characteristics were quite similar between the groups (Table 1). The mean age was 56 years in the low CTFC and 60 years old in high cTFC groups with male gender was more frequent than female. Smoker was the most common risk factor that could be found and followed by hypertension which was similar in the both of group ($p>0.05$).

Baseline of laboratories findings and hemodynamic parameters were similar between groups. The mean random blood glucose was 161 mg/dL and 210 mg/dL with low-density lipoprotein level was 117 mg/dL and 111 mg/dL in the both of group. The mean arterial pressure was 94 mmHg with heart rate 82 bpm in low CTFC group. Anterior MI was more common in the both of group (65.8% and 52.2%) with killip Class I which was similar in the both of group ($p>0.05$).

Table 2 showed that there was negative and weak correlation between troponin I level and CTFC with $p>0.05$.

Table 1: Baseline characteristics

Variable	Result		p value
	cTFC <30 (n=73)	cTFC ≥30 (n=23)	
Age (years), mean±SD	56.66±11.29	60.65±10.10	0,216[a]
Gender, f(%)			
Males	64 (87.7)	18 (78.3)	0.438[c]
Females	9 (12.3)	5 (21.7)	
Height (cm)	162.95±8.16	160.48±4.62	0.057[a]
Body weight (Kg)	62.53±5.88	61.74±5.14	0.857[a]
Risk factors, f(%)			
Familial history	1 (1.4)	0 (0)	1.000[c]
Smoker	52 (71.2)	18 (78.3)	0.695[c]
Dyslipidemia	29 (39.7)	9 (39.1)	1.000[c]
Hypertension	31 (42.5)	8 (34.8)	0.681[c]
Diabetes mellitus	15 (20.5)	6 (26.1)	0.786[c]
Pre PPCI indicators			
MAP (mmHg)	94.33±16.06	93.91±23.24	0.686[a]
Heart Rate (x/min)	82.05±18.4	77.13±20.02	0.259[a]
Laboratorium			
RBG (mg/dL)	161.27±75.14	210.96±121.9	0.086[b]
Total cholesterol (mg/dL)	190.19±39.25	182.48±51.56	0.514[b]
HDL cholesterol (mg/dL)	42.52±15.07	44.48±16.05	0.884[a]
LDL cholesterol (mg/dL)	117.86±26.32	111.22±36.37	0.812[b]
Triglyceride (mg/dL)	154.37±79.19	150.09±105.526	0.379[a]
Onset (min)	597±726	358±347	0.171[a]
cTFC	19.19±5.66	40.30±13.75	0.000[a]
Infarct location			
Anterior	48 (65.8)	12 (52.2)	0.354[c]
Non-anterior	25 (34.2)	11 (47.8)	
Killip Class, f(%)			
Killip I	62 (84.9)	21 (91.3)	0.668[c]
Killip II-III	11 (15.1)	2 (8.7)	
Thrombus burden			
Grade I-III	25 (34.2)	6 (26.1)	0.635
Grade IV-V	48 (65.8)	17 (73.9)	

*significant $p<0.05$, [a]Mann–Whitney test, [b]paired t-test, [c]Chi-square test. PPCI: Primary percutaneous coronary intervention, HDL: High-density lipoprotein, LDL: Low-density lipoprotein

Table 2: The result of Spearman's analysis

Variable	Corrected TIMI frame count
Troponin I (mcg/mL)	r=−0.092[a] p=0.371 n=96

[a]Spearman's correlation test

DISCUSSION

The primary findings of this study (Table 2) were no correlation between high sensitivity troponin I level with CTFC with p>0.05. Wanamaker *et al*. found that the degree of troponin elevation during admission is a strong and independent predictor of in-hospital mortality for patients underwent PPCI. Markedly elevated of troponin levels during admission had higher mortality rates by the clinical risk model. If using non high-sensitivity troponin assay, the elevation of troponin could be detected by 3–4 hours from the onset of myocardial infarction with a peak level were between 12 and 24 hours depends on the successfulness of reperfusion [15].

Gibson *et al*. found that lower CTFC of the IRA immediately after PCI had a correlation with better improvement in function of left ventricle [16,17]. The other study also found a positive relationship between CTFC and wall motion score index [18]. Wanamaker *et al*. suggested higher CTFC with 90 min after fibrinolytic had a correlation with higher cardiac adverse event [15]. Gibson *et al*. in 1998 reported a higher CTFC in ACS patients who died after underwent PCI procedure compared survived group [18]. From the SPEED (GUSTO-4 Pilot) trial, the cut off CTFC analysis confirmed that the TIMI flow-grade data were normal if below 30 frames [19].

From Chinese acute myocardial infarction (CAMI) register, its found patients who had primary percutaneous coronary intervention (PCI) were relatively younger patients [20]. In this study was found the older patients group had higher cTFC compare with younger patients. The Western Denmark registry reported that TIMI III flow was achieved in 86.3% older patients and 83.3% in younger patients. However, the older patients had a higher 30-day and 1-year mortality rates in after STEMI. It could be associated with several comorbidities and history of previous cardiac ischemic event which affected left ventricular function which may responsible to worse prognosis [21].

This study also found that the prevalence of STEMI was higher in male than female patients. Lu *et al*. reported that 75.8% were men and 24.2% were women with a men-to-women ratio of 3:1 from all of 13,591 STEMI patients. Without seen of presenting diagnoses, male gender had a higher incidence in all ACS groups if being compared to female. However, in STEMI male gender men were outnumbered by female, if we compare with the NSTE-ACS groups [22].

Limitation

This study could not address causality, and the results should be counted as hypothesis-generating because of the retrospective nature of the study. Fewer samples are collected because not every data were available for every patient. Patient samples are only taken in a short duration of time, which is 1 year.

CONCLUSION

Troponin I level at first presentation before revascularization did not show a significant correlation with coronary flow result after revascularization by PPCI in STEMI patients.

ACKNOWLEDGMENT

The authors would like to thank Andalas University and Integrated Heart Service Installation RSUP Dr. M. Djamil Padang, West Sumatera for providing the facilities to conduct the research.

AUTHORS' CONTRIBUTION

Masrul Syafri concepted the research, provided the methods, collected the data, and authored the manuscript. Eryati Darwin and Eti Yerizel managed the literature searches and interpreted the data. Hardisman designed the study and performed the statistical analysis.

CONFLICTS OF INTEREST

The authors have declared that they have no conflicts of interest with respect to current research.

AUTHORS' FUNDING

No any source of support for the authors to disclose and all the works are supported by the authors

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