INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

COMPARISON OF MYOCARDIAL BLUSH GRADE IN STEMI PATIENTS WITH AND WITHOUT RESOLUTION ON RECIPROCAL ST SEGMENT DEPRESSION UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION

M. Fahrial Siregar[*1], Nizam Z. Akbar[2], Ali Nafiah Nasution[2], Harris Hasan[2], Zulfikri Mukhtar[2] & Hilfan A.P. Lubis[2]
[1]Resident of Department of Cardiology, Faculty of Medicine, Sumatera Utara University
[2]Department of Cardiology, Faculty of Medicine, Sumatera Utara University

Abstract

Background: Acute coronay syndrome is one of the problems in cardiovascular system. The revascularization recommended according to the ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation (STEMI) (2017) are Primary Percutaneous Coronary Intervention (Primary PCI). ST Segment Depression (STSD) in the tapping area in the opposite direction from the infacrtion area (non infarction area) of STEMI. Myocardial Blush Grade (MBG) to assess the effectiveness of myocardial reperfusion. This study aim to assess the differences of MBG with or without reciprocal STSD resolution in STEMI patients with <12 hour onset undergoing primary PCI strategy.

Methods: This study is a cross sectional study, in which 67 STEMI patients with onset <12 hours who underwent primary PCI therapy strategies at H. Adam Malik General Hospital, Murni Teguh Memorial Hospital, and Grandmed Hospital starting October 2018. Results of Myocardial Blush Grade (MBG) after primary PCI and electrocardiography evaluation of STSD changes in reciprocal leads at the start from emergency department (before primary PCI) and 90 minutes after Primary PCI. Statistical analysis was perfomed to assess the difference between MBG with or without reciprocal STSD resolution in STEMI patients undergoing primary PCI.

Results: From 67 patients, 35 patients had reciprocal STSD resolution with MBG 3, and 32 patients without reciprocal STSD resolution with MBG ≤2. From the basic criteria of this research subjects to MBG, there are significant difference in infarct location (p 0.001) and KILLIP classification (p<0.005). This study found significant difference between MBG and reciprocal STSD resolution (p<0.001).

Conclusion: There is a significant difference between MBG with reciprocal STSD resolution compared without reciprocal STSD resolution after primary PCI.

Introduction

Acute myocardial infarction ST segment elevation (STEMI) is a part of acute coronary syndrome that occurs due to a total blockage of coronary arteries by thrombus formed or released as the body's response to arteroschelotic plaque rupture. STEMI can result in sudden death even before being taken to hospital, after and during treatment. Even though the mortality rate has declined in the past two decades, about one in 25 patients who survive during the initial treatment period will die within the first year after STEMI.[1]

STEMI features a typical picture of ST segment elevation in the infarct area and accompanied by ST segment depression (STSD) on reciprocal or noninfarct area with a prevalence of 54% to 82%.[2] Initially STSD in the reciprocal lead was considered a benign electrical phenomenon.[3,4] Subsequent studies provide an alternative opinion that STSD in reciprocal leads shows extensive infarction by culprit lesions, as evidenced by higher cardiac enzyme levels, larger left ventricular regional wall abnormalities and lower ejection fractions (EF) compared to patients without STSD. Patients with STSD tend to experience short-term (in hospital) and long-term complications and higher mortality compared to patients without STSD.[3,5,6,7,8,9,10]

Management of STEMI start from the first medical contact, both in diagnosis or providing therapeutic treatment. If the onset of STEMI is found < 12 hours and in patients with STEMI onset > 12 hours there are ongoing ischemic symptoms, heart failure, unstable haemodynamic status, and arrhythmias revascularization is required to restore blood flow and myocardial reperfussion, and preventing infarct expansion to decrease mortality rate. The revascularization that recommended by ESC Guidelines for the management of acute myocardial infarction

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

in patient presenting with ST-segmen elevation (2017) is primary PCI. Many studies show the advantages of primary PCI compared to fibrinolytic therapy, so that primary PCI is still the first choice for early reperfusion.[11]

In 1998 Van't Hof et al. introduced the concept of Myocardial Blush Grade (MBG) to directly assess myocardial reperfusion in patients with patent recovery from arterial related infarction. MBG is the level of contrast density of myocardial tissue by arterial associated with infarction, and correlates with survival after PCI. Several studies shown that inconsistency and simultaneity between ST resolution and the degree of tissue reperfusion angiography occur in 40% of patients.[12]

This study aims to assess the differences between MBG with and without reciprocal STSD resolution in STEMI patients with an onset <12 hours undergoing primary PCI therapy strategy.

Methods

This study is a cross sectional study, in which 67 STEMI patients with onset <12 hours who underwent primary PCI therapy strategies at H. Adam Malik General Hospital, Murni Teguh Memorial Hospital, and Grandmed Hospital starting October 2018. Assess the difference between MBG with and without reciprocal STSD resolution in STEMI patients with onset <12 hours undergoing a primary PCI. STSD was assessed at the beginning of the patient's arrival and then undergoing primary PCI that before revascularization was given the same dual antiplatelet (aspilet 160 mg and clopidogrel 300 mg).

MBG is assessed after primary PCI procedure was performed. The MBG assessment was carried out by interventional cardiologists through the recording of primary PCI (table 1). The sample collection uses the quota (consecutive) method where each subject that meets the inclusion criteria is used as a sample of the study with a minimum number of samples based on the sample calculation formula as many as 32 people for each group. Baseline data, subject identity, history, physical examination, ECG (pre primary PCI and 90 minutes after primary PCI), chest radiograph, cardiac enzyme examination (CKMB and troponin I), coronary angiography and drug use were recorded complete. All of this data will be recorded carefully. From all the data possessed by the subjects, the initial important data evaluated were 12 lead ECG at the time of entry into emergency unit (before primary PCI) and 90 minutes after primary PCI with a recording speed of 25 mm/s and a scale of 10 mm/mv. Pre primary PCI STSD was assessed by calculating the number of deep ST segment depression in the reciprocal leads measured at 80 ms after the j point against the isoelectric line. STSD measurements on the ECG will be done manually using a 150 mm Krisbow dial caliper (KW06-351) and a magnifying glass. The measurement results are reported in units of mm. Reciprocal STSD resolution is done using the formula:
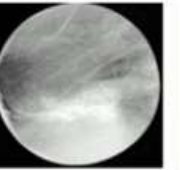
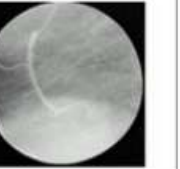After that, subjects who had undergone primary PCI performed were assessed as MBG. The MBG assessment was carried out by interventional cardiologist through the recording of primay PCI (MBG ≤2 and MBG 3), then the results were analyzed statistically.

$$\text{Resolution } \Sigma \text{ DSST (\%)} = \frac{\Sigma \text{ DSST pre Primary PCI} - \Sigma \text{ DSST post Primary PCI}}{\Sigma \text{ DSST pre Primary PCI}} \times 100$$

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Table 1. Distribution of TIMI myocardial perfusion grade (Gibson CM et al,2004)

TMP Grade	3	2	1	0
Description	Normal entry and exit of dye	Delayed entry and exit of dye	Dye enters slowly but does not exit	Dye does not enter the micro-vasculature
Image				

Categorical variables are presented by number or frequency (n) and percentage (%). Numerical variables are presented with mean (average) and standard deviations for data that are normally distributed, while numerical data that are not normally distributed use the median (middle value), which is then compared with Student's t-test or Mann Whitney U. Normality test on numerical variables on all study subjects using one sample Kolmogorov Smirnov (n> 50) or Shapiro Wilk (n <50). For samples that were found to be significant in the bivariate analysis test, they were included in the multivariate test. Analysis of statistical data using computer statistical devices, the value of $p < 0.05$ was said to be statistically significant.

Results

From all research subjects included in t*he* data collection, a number of basic research characteristics are shown in table 2. Infarction sites were found most frequently in the anterior location of around 36 people (54%) and the inferior locations of about 31 people (46%). Where can be seen the location of infarction in this study sample of MBG found in the anterior infarction location in MBG ≤2 and MBG 3 as much as 67% and 33%, in the inferior infarction location in MBG ≤2 and MBG 3 as much as 26% and 74%. There was a significant difference in the location of infarction at MBG (p 0.001).

KILLIP classification to assess the severity of heart failure and mortality in the next 30 days in acute coronary syndrome patients in the most research subjects, KILLIP I of 37 people (56%), followed by KILLIP II of 14 people (21%), KILLIP III of 9 people (13%) and KILLIP IV of 7 people (10%). KILLIP classification for MBG, in MBG ≤2 found KILLIP I,II,III and IV that is 24%, 65%, 77% and 100% then in MBG 3 found KILLIP I, II, III, IV that is 76%, 35%, 23% and 0%. In the KILLIP classification in this study sample there were significant differences between the two MBGs (p <0.005).

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Table 2. Basic Characterististics of Research Subjects Based on Myocardial Blush Grade

[a]T-test, [b]Chi-Square, [c]Mann-Whitney
[a]T-test, [b]Chi-Square, [c]Mann-Whitney

Variabel	MBG		P Value
	≤2 N=32(47%)	3 N=35(52%)	
Age	57.2 ± 97	56.7 ± 9.2	0.838[a]
Gender			
Male	29 (49%)	30 (51%)	0.536[b]
Female	3 (38%)	5 (62%)	
Diabetes Melitus	8 (44%)	10 (56%)	0.742[b]
Hypertension	13 (44%)	16 (56%)	0.675[b]
Smoking	27 (51%)	26 (49%)	0.352[b]
Dyslipidemia	3 (34%)	6 (64%)	0.310[b]
Systolic Blood Pressure (mmHg)	111 ± 24	126 ± 31	0.148[a]
Onset (hour)	7 (1-11)	5 (1.5-11)	0.105[c]
Door to wire			
< 90 min	9 (36%)	16 (64%)	0.768[b]
> 90 min	23 (54%)	19 (46%)	
Infarct Location			
Anterior	24 (67%)	12 (33%)	0.001[b]
Inferior	8 (26%)	23 (74%)	
Killip Classification			
I	9 (24%)	28 (76%)	
II	9 (65%)	5 (35%)	<0.005[c]
III	7 (77%)	2 (23%)	
IV	7 (100%)	0 (0%)	
CK-MB (U/L)	135 (14-650)	82 (21-874)	

In optimal subjects myocardial reperfusion (MBG 3) found more reciprocal STSD resolution than suboptimal myocardial reperfusion (MBG ≤2) in which 25 people compared to 10 people and this was statistically significant with p <0.001.

Table 3 MBG Comparison Test With and Without Reciprocal STSD Resolution

	Resiprocal STSD Resolution		
	Yes	No	P value
MBG 3	25	10	<0,001
MBG ≤2	10	22	
Total	35	32	

Discussion

This study found that presentation of research subjects obtained with the location of anterior infarction to MBG ≤2 and MBG 3 found 67% and 33%, where there were significant differences between the location of infarction and MBG (p 0.001). the results of this study are in accordance with Kandzari et al, who showed a significant difference in the location of infarction to MBG where MBG 3 was found to be 4 foldlowerat the location of anterior infarction compared with locations of infarction other then anterior.[13]

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

The KILLIP classification in this study sample showed a significant difference to the MBG (p<0.005), where in the MBG ≤2 there were many KILLIP II and IV and then MBG 3 there were many KILLIP I. this was also consistent with previous studies by De Luca et al showed that a significant association between low KILLIP and low myocardial perfusion.[14]

In this study assessing the difference between MBG and reciprocal STSD resolution, a significant difference was found between MBG and reciprocal STSD resolution with p value <0.001. In another study conducted by Sorajja et al in STEMI patients who performed primary PCI but in assessing the relationship between ST resolution and MBG found to be statistically significant.[12]

Conclusion
Based on the results of data analysis obtained from this study it was concluded that there was a significant difference between MBG with reciprocal STSD resolution compared without reciprocal STSD resolution after primary PCI.

References
[1] Alwi I. 2009. Infark miokard akut dengan elevasi ST, in Sudoyo, A.W, Setyohadi, B, Alwi, I, Simadibratra, M. and Setiati, S. (editors). Buku Ajar Ilmu Penyakit Dalam Jilid II, Edisi 5, Jakarta: Interna Publishing.

[2] Noriega F.J, Jorge E, Arzamendi D, Cinca J. 2013. Mechanism and diagnostic potential of reciprocal ECG changes induced by acute coronary occlusion in pigs. *Heart Rhythm*., 10:883-890.

[3] Berger P.B and Ryan T.J. 1990. Inferior myocardial infraction: high-risk subgroups. *Circulation*, 81:401-411.

[4] Rude R.E, Croft C.H, Willerson J.T. 1983. Reciprocal anterior ST depression early in the course of transmural inferior myocardial infarction: an ECG finding of uncertain clinical significance. *Int J Cardiol,* 4:80-85.

[5] Birnbaum Y., Herz I. 1996. Prognostic significance of pericordial ST Segment depression on admission ECG in patients with inferior wall myocardial infarction. *J Am Coll Cardiol,* 28:313-318.

[6] Jennings K, Reid DS, Julian DG. 1983. Reciprocal depresision of ST segment in acute myocardial infarction. *Br Med J* 287:634-637.

[7] Gelman JS and Saltrup A. 1982. Pericordial ST depression in pateients with inferior infarction: clinical implications. *Br Heart J* 7:133-139.

[8] Herlitz J, Hjalmarson H. 1987. Occurence of Anterior ST depression in Inferior Myocardial Infarction and relation to clinical outcome. *Clin Cardiol* 10:529-534.

[9] Hasdai D, Sclarovsky S, Solodky A, Sulkes J, Strasberg B, Birnbaum Y. 1994. Prognostic significance of maximal pericordial ST segment depression in right (V1-V3) versus left (V4-V6) leads in patients with inferior wall acute myocardial infarction. *The AmericanJournal Cardiology* 74(11):1081-1084.

[10] Forfar JC. 1989. Reciprocal ST segment changes in acute myocardial infarction: informative or incidental?. *Quarterly Journal of Medicine* 72:763-765.

[11] Ibanez, B., James, S., Agewall, S., Antunes, M.J., Bucciarelli-Ducci, C., Bueno, H. and et al. 2017. '2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation', *European Heart Journal*, vol. 00, pp. 1-66.

[12] Sorajja P and Gersh BJ. 2005. Combined prognostic utility of ST-segment recovery and myocardial blush after primary percutaneous coronary intervention in acute myocardial infarction. Eur Heart J 26: 667-674.

[13] Kandzari ED, Tcheng EJ, Gersh JB, Cox AD, Stucky T, Turco M, et al. 2006. Relationship between infarct artery location, epicardial flow, and myocardial perfusion after primary percutaneous revascularization in acute myocardial infarction. *American Heart Journal.* Vol. 151, 1288-1295.

[14] De Luca G, Gibson MC, Huber K, Zeymer U, Dudek D, Cutlip D, et al. 2009. Association between advanced Killip class at presentation and impaired myocardial perfusion among patients with ST-segment elevation myocardial linfarction treated with primary angioplasty and adjunctive glycoprotein IIb-IIIa inhibitors. *American Heart Journal.* Vol. 158, 416-421.