**Correlation between Right Ventricular Function with Revascularization Time and Thirty Days Mortality in ST-Elevation Myocardial Infarction Patients Underwent Right Coronary Artery Intervention**

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**Abstracts**

Background and Objective: Right ventricular (RV) function provides strong prognostic information in patients treated with primary percutaneous coronary intervention (PCI) for myocardial infarction. Longitudinal RV systolic function can be assessed by the measurement of the tricuspid annular plane systolic excursion (TAPSE). This study aims to evaluate the correlation between TAPSE and revascularization time and 30-day mortality using TIMI risk score in patients presenting STEMI who underwent revascularization of right coronary artery (RCA).

Methods:Data was collected from iSTEMI Registry database which consists of 49 STEMI patients undergoing PCI in RCA and TAPSE measurement in Prof. Dr. R. D. Kandou General Hospital from October 3rd, 2018 to July 28th, 2019. Echocardiographic examination was done within 48 hours of hospitalization. A descriptive analysis and bivariate correlation with Spearman’s rho were applied between given variables. P-value of <0.05 was considered to be statistically significant.

Results:The mean age of the patients was 57.92 ± 10.345 years old and 79.2% were male. The mean TAPSE measurement was 18.51 mm +/- 3.63 mm. The median revascularization time was 357.5 minutes while median TIMI score was 4. Shorter treatment time (p = 0.708) and lower TIMI score (p = 0.923) was not associated with better right ventricular function measured with TAPSE in patients undergoing RCA intervention.

Conclusion:Tricuspid Annular Plane Systolic Excursion is not associated with revascularization time and thirty days mortality in patients presenting with ST-elevation Acute Myocardial Infarction involving right coronary artery

**Keywords:** TAPSE, TIMI, Revascularization Time, RCA, STEMI

**INTRODUCTION**

Right ventricular (RV) function provides strong prognostic information in patients treated with primary percutaneous coronary intervention (PCI) for myocardial infarction. In post-AMI patients, the relevance of right ventricular (RV) function is poorly defined. Major complications and in hospital mortality are well correlated with involvement of the RV during inferior AMI.1

RV systolic function can be assessed by the measurement of the tricuspid annular plane systolic excursion (TAPSE). As a surrogate marker for RV systolic function, TAPSE reflects the longitudinal shortening of the right ventricle.2

Mortality has been associated with increased door-to-treatment time in acute coronary syndrome.3-5 Longer reperfusion time is associated with increased area of infarction and also myocardial function. In st elevation myocardial infarction patient, TIMI risk score can predicted risk for 30 days of mortality. The multivariable model used variables that captured the majority prognostic information in TIMI risk score for STEMI. In men and women, smoker and nonsmokers, this risk score was stable over multiple points. Furthermore, a large external data in STEMI patients has been performed well with the TIMI risk score.6

In patients who undergo primary percutaneous coronary intervention (PCI), however the clinical relevance of RV dysfunction in that currently growing population of post-AMI patients is unknown. Therefore, the aim of the current study was to investigate the relation between RV function measured by TAPSE with time to revascularization and 30 days of mortality in patients treated with primary PCI. In addition to traditional measurements that are recommended to quantify RV function with 2D-echocardiography.

**OBJECTIVE**

This study aims to evaluate the correlation between TAPSE with revascularization time and 30-day mortality using TIMI risk score in patients presenting STEMI who underwent revascularization of right coronary artery (RCA).

**METHODS**

**Study Design**

This is a single-centre cross sectional study in Department of Cardiology and Vascular Medicine, RSUP Dr. R. D. Kandou Hospital, Manado, Indonesia. Data was collected from iSTEMI Registry database which consists of 49 STEMI patients undergoing PCI in RCA and TAPSE measurement in Prof. Dr. R. D. Kandou General Hospital from October 3rd, 2018 to July 28th, 2019. Revascularization was refers to percutaneous coronary intervention (PCI).

**Inclusion and Exclusion Criteria**

Inclusion Criteria is as follows:

1. Patients with st-elevation myocardial infarction.
2. Patients undergo percutaneous coronary intervention (PCI) with right coronary artery (RCA) as culprit vessel.

Exclusion Criteria is as follows:

1. Failed to revascularization.
2. Patients with history of right ventricular (RV) dysfunction.
3. Patients with poor echo window whom TAPSE measurement is under optimal.
4. TIMI risk score cannot be obtained.

**Echocardiography**

Images were obtained with patients in the left lateral decubitus position using a commercially available system. Data acquisition was performed at a depth of 16 cm in the parasternal and apical views using a 3.5-MHz transducer. During breath-hold, M-mode and 2D images were obtained and 3 consecutive beats were saved in cineloop format. Tricuspid annular plane systolic excursion (TAPSE) was measured in the RV free wall. In the 4-chamber view, the M-mode cursor was placed through the tricuspid annulus in such a way that the annulus moved along the M-mode cursor and the total displacement of the RV base from end-diastole to end-systole was measured.

**TIMI Risk Score for STEMI**

Tabel 1. TIMI Risk Score for STEMI

|  |
| --- |
| TIMI Risk Score for STEMI |
| Age 65-74/>75 | 2/3 points |
| Systolic Blood Pressure < 100 | 3 points |
| Heart Rate > 100 | 2 points |
| Killip class II-IV | 2 points |
| Anterior STE or LBBB | 1 point |
| Diabetes, h/o hypertension or h/o angina | 1 point |
| Weight < 67 kg | 1 point |
| Time to treatment > 4 hours | 1 point |

We used validated TIMI score for stemi in this study, data collected with anamnesis, physical examination and other supporting examination.

**Statistical Analysis**

Statistical analysis was conducted using the Statistical Product and Service Solutions (SPSS) version 23. The target for sample size was derived from the formula for spearman test. The tricuspid annular plane systolic excursion and time to reperfusion were numerical data that was tested using spearman test. P-values < 0.05 were considered as statistically significant. The tricuspid annular plane systolic excursion and 30 days mortality TIMI risk score were numerical data that was tested using spearman test. P-values < 0.05 were considered as statistically significant.

**RESULTS**

The mean age of the patients was 57.92 ± 10.345 years old and 79.2% were male. The median TAPSE measurement was 18.51 mm +/- 3.63 mm. The median revascularization time was 357.5 minutes while median TIMI score was 4. Shorter treatment time (p = 0.708) and lower TIMI score (p = 0.923) was not associated with better right ventricular function measured with TAPSE in patients undergoing RCA intervention.

**DISCUSSION**

Despite evaluation of left chamber functional parameters, assessment of right chamber function has become increasingly popular and important in recent decades. The problem of visualization of the whole right ventricle, inconsistency in the analysis of RV parameters, and poor understanding of the impact of RV function on prognosis make the late adoption and integration of right ventricular (RV) function into a complete evaluation of cardiac function are difficult.7

Echocardiography has a high threshold for detecting right-sided myocardial dysfunction, and its increasing availability and fidelity has made it a rising diagnostic modality in a variety of settings such as the emergency department and the operating room. For detection of right ventricular infarction echocardiography have the sensitivity and specificity as high as 82% and 93%, respectively, Signs include right ventricular wall dyskinesia/hypokinesia, paradoxical septal motion, tricuspid regurgitation, and pulmonary regurgitation. Other measurements such as tricuspid annular plane excursion (TAPSI) are currently being evaluated and may indicate a poor prognosis.8

RV systolic functions can be assessed with parameters such as RIMP, TAPSE, 2D RV FAC, 2D RV ejection fraction (EF), three-dimensional (3D) RV EF, tissue Doppler-derived tricuspid lateral annular systolic velocity, and longitudinal strain and strain rate. TAPSE is known to be well correlated with parameters of RV global systolic function, such as radionuclide-derived RV EF, 2D RV FAC, and 2D RV EF.9

With the introduction of reperfusion therapy and with aggressive efforts to modify risk factors, the prognosis of patients with ischemic heart disease has improved markedly. The rate of cardiovascular events after myocardial infarction has decreased to approximately 5% over a period of 2 years as compared with the 20% to 30% reported in the prethrombolytic era. New risk markers can significantly improve survival of patients who are at high risk despite reperfusion therapy that others have demonstrated for the identification of subgroups of patients at greater risk.10

Right ventricular (RV) dysfunction is a powerful risk marker after acute myocardial infarction (MI). Reliable data on RV damage using cardiac magnetic resonance imaging (MRI) are scarce.11 The association between right ventricular functional parameters and STEMI12-16 was previously examined. Morbidity and mortality are well known to be associated with right ventricular (RV) involvement after an acute myocardial infarction (MI).17 In 50% to 80% postmortem and animal studies, RV involvement in acute MI has been reported but is frequently underestimated in the clinical setting owing to the diagnostic limitations of the electrocardiogram (ECG) and echocardiography. However in this study, we found that right ventricular function measured by TAPSE was not associated with TIMI score as predicted score for 30 days mortality of st-elevation myocardial infarction patients.

Current guidelines recommend rapid reperfusion in patients with acute ST segment elevation myocardial infarction (STEMI) to reduce infarct size. Mortality and improved myocardial recovery demonstrated in experimental dan clinical data in patient with shorter reperfusion times. Primary percutaneous coronary intervention (PPCI) has been the preferred treatment of choice for STEMI for two decades. The original concept of “Door-to-Balloon” (DTB) time has evolved over time, first to “Door-to-Reperfusion” (DTR) time, and most recently to “First Medical Contact to Device” (FMC-device) time Unfortunately, logistics can prevent some patients from receiving this treatment.18,19

In STEMI patient, many studies showed that reperfusion therapy especially primary PCI restores the right ventricular systolic function.20 However in this study, we found that right ventricular function not associated with time to reperfusion. In one study of right ventricular dysfunction after NSTEMI found that was not significantly different TAPSE and RIMP value of these patients recovered after 24 hours of successful PCI.21 This maybe associated with myocardial stunning after an acute myocardial infarction. RV dysfunction is reversible in most patients and permanent RV ischemic injury is very uncommon 4 months after acute MI treated with primary PCI.11 Serial echocardiography may needed to measure the recovery of myocardial infarction during a success revascularization.

**CONCLUSIONS**

Tricuspid Annular Plane Systolic Excursion is not associated with revascularization time and thirty days mortality in patients presenting with ST-elevation Acute Myocardial Infarction involving right coronary artery.

**Funding**

None

**Data Availability**

Available on reasonable request

**Competing Interest**

None

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Figure 1. Correlation of TAPSE with TIMI risk score and correlation of TAPSE and time to revascularization

|  |  |  |  |
| --- | --- | --- | --- |
| Spearman's rho | TIMISTEMI | Correlation Coefficient | .014 |
| Sig. (2-tailed) | .923 |
| N | 48 |
| Revasctime | Correlation Coefficient | -.056 |
| Sig. (2-tailed) | .708 |
| N | 48 |

Figure 2. Baseline Characteristics

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameters** | **N** | **Percentage** | **Mean ± SD** | **Median (Q1;Q3)** |
| Age, years |   |   | 57,92 ± 10,345 |   |
| Male sex | 38 | 79.2% |   |   |
| Body weight, kg |   |   |   | 65 (60;73) |
| Body height, cm |   |   |   | 165 (158,5;169) |
| BMI, kg m |   |   | 25,396 ± 3,8853 |   |
| SBP, mmHg |   |   | 122,458 ± 28,921 |   |
| DBP, mmHg |   |   | 76,563 ± 20,2924 |   |
| HR |   |   | 73,208 ± 19,383 |   |
| Killip classification |   |   |   |   |
| I | 34 | 70.8% |   |   |
| II | 10 | 20.8% |   |   |
| III | 0 | 0.0% |   |   |
| IV | 4 | 8.3% |   |   |
| Diabetes | 15 | 31.3% |   |   |
| Hypertension | 27 | 56.3% |   |   |
| Dyslipidemia | 18 | 37.5% |   |   |
| Current smoker | 17 | 35.4% |   |   |
| Heart failure | 1 | 2.1% |   |   |
| Stroke | 1 | 2.1% |   |   |
| PAD | 1 | 2.1% |   |   |
| Previous PCI | 4 | 8.3% |   |   |
| Previous CABG | 0 | 0.0% |   |   |
| History of premature CVD in family | 3 | 6.3% |   |   |
| Hemoglobin, g/dL |   |   | 13,88 ± 1,61 |   |
| Hematocrit |   |   | 41,43 ± 4,91 |   |
| Leukocyte, /mcL |   |   | 12377,27 ± 3114,44 |   |
| Total cholesterol, g/dL |   |   |   | 179 (140;209) |
| HDL-C, g/dL |   |   |   | 35 (29;41) |
| LDL-C, g/dL |   |   | 115,26± 42,38 |   |
| TG, g/dL |   |   |   | 116 (94;145) |
| Serum uric acid, mg/dL |   |   | 7,047 ± 2,2619 |   |
| Serum ureum, mg/dL |   |   |   | 29 (24,25;41,5) |
| Serum sodium, mEq/dL |   |   |   | 137 (133;139) |
| Serum potassium, mEq/dL |   |   |   | 4,1 (3,69;4,4) |
| CK-MB, U/L |   |   |   | 53 (28;133,5) |
| TnT, ng/L |   |   |   | 100 (0;439,75) |
| LVEF |   |   | 47,63 ± 12,02 |   |
| TAPSE, mm |   |   | 18,51 ± 3,63 |   |
| TIMI score |   |   |   | 4 (2;6) |
| Revascularization time (minutes) |   |   |   | 357,5 (204,5;2498,5) |