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Original Article

Right ventricular function in patients presenting with non-ST-segment elevation myocardial infarction undergoing an invasive approach

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ABSTRACT

Background: Right ventricular involvement in ST segment elevation myocardial infarction (STEMI) entails an increased morbidity and mortality. However, very scarce data is present on its affection in the setting of non-ST segment elevation myocardial infarction (NSTEMI).

Aim: To assess the affection of right ventricular function in patients presenting with NSTEMI undergoing an invasive procedure.

Subjects and methods: One hundred and fifty patients admitted with a first NSTEMI and eligible for reperfusion therapy via invasive percutaneous coronary intervention. These patients were divided in two groups; group A including patients with normal RV function, and group B including patients with impaired RV function as diagnosed by tricuspid annular plane systolic excursion (TAPSE) cutoff value < 17 mm. All patients underwent angioplasty and were followed up in-hospital and for 3 months.

Results: RV dysfunction occurred in ninety-five (61.3%) patients of the study population. Significant improvement occurred to TAPSE after 3 months in comparison to TAPSE at baseline (15.45 ± 3.21 versus 17.09 ± 4.17 mm). Those with impaired RV function showed improvement of TAPSE after three months as compared to baseline (13.62 ± 2.58 vs 17.16 ± 3.64 p = 0.008). Multivariate analysis determined the independent predictors of RV dysfunction as RVEDD > 26 mm, RVFAC < 35%, RAA > 20 cm^2, and TAPSE < 17 mm.

Conclusion: RV dysfunction is not uncommon in NSTEMI when using the definition of TAPSE < 17 mm. Following up RV function by TAPSE, showed significant improvement after 3 months with successful PCI as compared to baseline. We recommend assessing and following up RV function in all patients admitted with a NSTEMI.

1. Introduction

Right ventricular (RV) dysfunction is a powerful risk marker after acute myocardial infarction (MI).[1] Non–ST-segment elevation myocardial infarction (NSTEMI) is distinguished from unstable angina by elevated levels of cardiac enzymes and biomarkers of myocyte necrosis. Right ventricular (RV) involvement after an acute myocardial infarction (MI) has been shown to be associated with higher morbidity and mortality.[2] The prevalence of RV involvement in acute MI has been reported to range from 50% to 80% in postmortem and animal studies but is frequently underestimated in the clinical setting owing to the diagnostic limitations of the electrocardiogram (ECG) and echocardiography.[3]

Echocardiography remains the most commonly used technique for RV function assessment in clinical practice because of its widespread availability.[3] To differentiate normal RV structure and function from abnormal and to assess RV size, volume, and contractility, a complete set of standardized views must be obtained.[4] Quantitative assessment of RV function is often difficult using the various noninvasive imaging modalities owing to the inherently complex geometry of the right ventricle.[4] The assessment of the right ventricle is in a continuous state of "work in progress"[4]. Due to complex RV morphology, a quantitative assessment of systolic RV function is different with established methods, since a required cylindrical form is not available.[4] Therefore, systolic RV function is better assessed qualitatively. A regional or global RV dilatation must be documented, as well as the diameter.[4] It is not known if available parameters to assess diastolic LV function would have the same value when assessing diastolic RV function. However, others have found its place, e.g. parameters for

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assessment of global function (Tei-index) or longitudinal systolic function (tricuspid annular plane systolic excursion (TAPSE), RV-strain).[4]

2. Aim of the work

The aim of the study is to assess the affection of right ventricular function in patients presenting with Non-ST-segment elevation myocardial infarction (NSTEMI) who undergo an invasive procedure.

3. Patients and methods

This study included 150 patients who were admitted to the coronary catheter lab in Ain Shams University Hospitals with a first NSTEMI, eligible for reperfusion therapy via invasive percutaneous coronary intervention (PCI) during the period from December 2013 till June 2015. After approval of the ethics committee and signed consents, the patients were divided in two groups:

Group A: including patients with normal RV function.
Group B: including patients with impaired RV function as diagnosed by TAPSE cutoff value <17 mm which yields a high specificity, though low sensitivity to distinguish abnormal from normal subjects.[5]

3.1. Inclusion criteria

The diagnosis of NSTEMI was defined as detection of rise and or fall of cardiac biomarker values (we used troponin) with at least one value above the 99th percentile of the upper reference limit and with ischemic symptoms, and ECG changes such as ST-segment depression or T wave inversion or any dynamic changes at the 12 leads ECG. Eligibility for invasive PCI was based on risk stratification and the recent ESC guidelines for the management of NSTEMI.[6]

We enrolled patients with successful invasive PCI defined as successful deployment of stent in culprit infarct- related artery (IRA) with final TIMI flow grade 3, no residual dissection, and less than 30% residual stenosis in IRA.[7]

3.1.1. Exclusion criteria

Patients with any of the following criteria were excluded from the study including; NSTEMI with the presence of RV infarction, STEMI, previous coronary revascularization including PCI or CABG, presence of a coexisting clinical condition that might affect RV function, including pericardial disease, chronic lung disease, pulmonary hypertension, or connective tissue disorder. Those with moderate or severe valvular heart disease, and atrial fibrillation were also excluded.

After an informed consent, all patients had a history taken, a thorough physical examination, 12 lead ECG, and laboratory investigations including Troponin, liver and kidney function tests, blood sugar, and blood lipid profile, we assessed the urgency for coronary intervention.

Diabetes mellitus was diagnosed as having a history of intake of glucose lowering therapy or a HgA1c above 6.5 g%. Dyslipidemia was diagnosed as those taking lipid lowering therapy, hypertension was in those with previous anti-hypertensive treatment and obesity was diagnosed in those with a body mass index above 30 kg/m^2 on admission. Premature coronary artery disease was diagnosed at a cut off age of 55 years in males and 60 years in females.

After a femoral or radial artery approach according to the preference of the operator, angiography and intervention was done to lesion(s). An echocardiographic examination was conducted using a General Electric Vivid 3 as follows:

1. The tricuspid annular plane systolic excursion (TAPSE) was measured from the apical 4-chamber view at the RV free wall level by using an M-mode cursor passed through the tricuspid lateral annulus and measuring the amount of longitudinal displacement of the annulus at peak-systole[8]
2. The RV end-diastolic dimension was assessed at the mid-cavity of the right ventricle in the apical 4 chamber view.[9]
3. The transmitral and transtricuspid Doppler flow velocities was recorded from an apical 4-chamber view with the sample volume placed between the tips of the mitral and tricuspid valves, respectively, and the peak early filling velocity (E), peak atrial velocity (A), E/A ratio
4. The LV dimensional measurements were routinely obtained from an M-mode recording, the LV ejection fraction (LVEF) was estimated using the modified Simpson method.[10]

3.2. Follow up

Follow up of the patients included in-hospital and short term (3 months) for M.A.C.E.; including myocardial infarction, stroke, revascularization and death.

3.3. Data management and statistical analysis

Statistical analyses were performed by using SPSS system for Windows (version 20 Chicago, IL, USA), Continuous variables were presented as mean ± SD and categorical variables were expressed as percentages. Wilcoxon signed ranks test for comparing between results before and after PCI. The receiver operational characteristic (ROC) analyses was performed and best cut off value was determined and at that point sensitivity and specificity were determined, the results were considered significant when the p value was less than 0.05.

4. Results

4.1. Baseline demographic data

The mean age was 51.88 ± 11.18 years. Eighty-six (57.3%) were males, sixty-four (42.7%) were smokers, ninety-four (62.7%) were diabetic, and one hundred and seven (71.3%) were hypertensive, forty-eight (32%) were dyslipidemic, and forty-four (29.3%) had positive family history premature CAD (see Table 1).

During PCI predilatation was done in forty-three patients (28.7%), a single stent was performed in ninety-nine patients (66%), and two stents were used in fifty patients (33.3%), and three stents in one patient.

Laboratory investigations revealed that the mean CK total was (2216.92 ± 651.10) U/L, CK MB was (192.19 ± 59.10) U/L.

Table 1
Baseline characteristics of the study population.

	Number of patients	%
Smoker	77	51.3%
DM	94	62.7%
HTN	107	71.3%
Dyslipidemia	48	32.0%
Obese	80	53.3%
FH of CAD	44	29.3%

DM = Diabetes mellitus; HTN = Hypertension; FH of CAD = Family history of premature coronary artery disease.

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