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Significance of reciprocal ST segment depression in ST elevation myocardial infarction

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ABSTRACT

Background: The significance of reciprocal ST segment depression during acute myocardial infarction has been an area of debate, whether it is a sign of multivessel disease, ischemia at a distance or merely a benign electrical phenomenon.

Objective: To study the relation between the presence of reciprocal ST segment depression in ST elevation myocardial infarction, extent of coronary artery disease & left ventricular systolic function.

Patients and methods: A prospective, controlled study involving 200 ST elevation myocardial infarction patients (100 inferior, 100 anterior), each group was sub-grouped into 2 subgroups according to the presence of reciprocal ST segment depression or absence: in anterior STEMI group we had subgroup A1 with RSTD (41 patients) and subgroup A2 without RSTD (59 patients) while in inferior STEMI group each subgroup (B1 and B2) consisted of 50 patients. Echocardiography & coronary angiography were done for all patients.

Results: Patients with reciprocal ST segment depression showed a significant lower mean Left ventricular ejection fraction compared to those without (37 + 3% vs 53 + 5% P < 0.001, anterior ST elevation myocardial infarction subgroups) & (47 + 4% vs 60 + 3% P < 0.001, inferior ST elevation myocardial infarction subgroups). Higher incidence of multivessel disease was found in subgroups with reciprocal ST segment depression (80.5% vs 49.2%, P < 0.001 in anterior ST elevation myocardial infarction) & (60% vs 20%, P < 0.001 in inferior ST elevation myocardial infarction). The mean modified gensini score was higher in subgroups with reciprocal ST segment depression (64.2 + 12.6 vs 30.2 + 6.6, P < 0.001 in anterior infarction group) & (36.2 + 10.6 vs 20.4 + 4.2, p < 0.001 in inferior infarction group).

Conclusion: Reciprocal ST segment depression in acute myocardial infarction was associated with significant LV systolic dysfunction & greater extent of coronary artery disease.

1. Introduction

Among a lot of examinations performed in the Acute Myocardial Infarction (AMI) setting, the electrocardiogram (ECG) remains the broadly acknowledged and effectively done test for the diagnosis [1]. The ECG changes reflect the picture of the affected myocardial territory [2]. Reciprocal ST Segment depression (RSTD) is a typical ECG finding frequently going with ST segment myocardial infarction (STEMI). The ST depression may point to ischemia in a myocardial area other than the zone of infarction or may represent merely a benign electrical phenomenon. There is bottomless writing concerning the hugeness of various sorts of ST depression in STEMI [3]. In anterior myocardial infarction, ST depression encountered in inferior leads might be corresponding to contribution of the basal anterolateral region supplied by the first diagonal branch and observed as ST segment elevation in leads I and aVL [4]. In patients with inferior myocardial infarction, the presence of ST segment depression in lead aVL is a reciprocal change and is found in nearly all patients [5], while ST depression in leads V1-V3 most likely does not imply "ischemia at separate zone" yet rather reciprocal changes [6]. Interestingly, among patients with inferior STEMI, ST segment depression in leads V4-V6 is linked with associative left anterior descending coronary stenosis or three vessel disease representing ischemia at a distance [7].

2. Aim of work

To investigate the relationship between the presence of reciprocal ST depression in ST elevation myocardial infarction (STEMI) and the extent of coronary artery disease & left ventricular systolic function.

3. Material and methods

The current study was conducted as a prospective, controlled single center study involving two hundred patients with ST elevation Myocardial infarction who were admitted to the Critical Care Department (Cairo University) and had a successful Primary PCI result in the period between January 2011 and January 2014.

3.1. Inclusion criteria

The study included patients diagnosed to have either acute inferior wall myocardial infarction or acute anterior wall myocardial infarction [ECG was recorded on admission and revealed changes of acute myocardial infarction i.e. ST segment elevation $\geqslant 1$ mm in at least two adjacent leads representing either the inferior wall (leads II, III, aVF) or the anterior wall (V1-V6, I, aVL) together with typical chest pain for at least 30 min and up to 12 h duration and an increase in cardiac enzymes to more than twice the normal value]. The diagnosis of STEMI was then confirmed during coronary angiography by defining the culprit lesion (the thrombotically occluded infarct-related vessel) that was subsequently revascularized during the procedure.

3.2. Exclusion criteria

1. Patients with STEMI who were subjected to primary PCI and had an intra-procedural complication or absence of angiographic or procedural success were barred from the study (to avoid the confounding impact of procedural complications on the in hospital outcome that may interfere with the point of interest of the to evaluate only the impact of RSTD).
2. Other exclusion criteria were: left bundle branch block(LBBB), associated intra-ventricular conduction disturbances, right ventricular infarction, posterior infarction (diagnosed by horizontal ST depression, tall broad R waves > 30 ms, upright T waves and dominant R wave i.e. R/S proportion > 1 in V2, paced ECG rhythm& patients with disseminated malignancies.

   Data collection:

- We recorded data on age, sex, history of diabetes mellitus, history of essential hypertension, the presence of dyslipidemia, positive family history of coronary artery disease & any comorbidity (cerebrovascular accidents, chronic kidney disease, liver disease, COPD or bronchial asthma).
- A standard 12-lead ECG was recorded immediately after admission & the diagnosis of STEMI was confirmed (whether anterior or inferior STEMI). We define Reciprocal ST segment depression (RSTD) as the presence of ST depression >1 mm in at least two out of the precordial leads V1-V6 or I & aVL leads (anterior RSTD in inferior STEMI) or ST depression >1 mm in the inferior leads II, III, aVF leads (inferior RSTD in anterior STEMI).
- All the studied patients were subjected to a full echocardiography with special emphasis on the left ventricular ejection fraction (LVEF %). All patients had undergone coronary angiography to determine the culprit lesion followed by primary percutaneous coronary intervention (primary PCI) as the selected reperfusion therapy and the cut-point used to define a significant coronary stenosis was the presence of $\geqslant 70\%$ coronary luminal stenosis.
- We also recorded extent (single, two or multi vessel disease) & severity of CAD using modified Gensini Score [8] which graded the degree of narrowing of the coronary arteries as 1 point for 1–25% narrowing, 2 for 26–50% narrowing, 4 for 51–75% narrowing,8 for 76–90% narrowing,16 for 91–99% narrowing & 32 for total occlusion. After calculation, the score was then multiplied by a factor according to the lesion's location in the coronaries (5 for left main disease, 2.5 for proximal LAD & proximal LCX (3.5 if the LCX is dominant), 1.5 for mid-LAD, 1 for the distal LAD, 1st diagonal, proximal, mid & distal regions of RCA, mid & distal regions of LCX & obtuse marginal or posterior descending branch, 0.5 for the 2nd diagonal or posterolateral branch. Finally, the score was expressed as the sum of the scores for the all coronary arteries [8].

3.2. Statistical analysis

Numerical variables were described as Mean ± SD. Categorical variables were described as percentages. Comparisons were done using student *t*-test for numerical variables and chi square test for categorical variables. Value was considered significant if $\leqslant 0.05$.The independent contribution of variables was assessed using a multivariate regression analysis. Statistics were calculated using SPSS 17 package.

4. Results

A total of 200 patients were studied (44% females and 56% males). The mean age was 51.8 ± 15.6 years. One hundred patients were admitted with acute anterior wall myocardial infarction & one hundred patients were diagnosed as acute inferior wall myocardial infarction.

4.1. Acute anterior wall myocardial infarction (Table 1):

- Patients admitted with anterior wall myocardial infarction (group A 100 patients) were further subgrouped into two subgroups according to the presence of reciprocal ST segment depression (RSTD) in the inferior leads II, III, aVF (subgroup A1, 41 patients) or absence (subgroup A2, 59 patients).
- Comparing the two subgroups (A1 & A2) regarding the baseline demographic & clinical characteristics, we found that subgroup A1 showed a statistically significant higher prevalence of diabetes mellitus yet there was no statistically significant difference between the two subgroups regarding the prevalence of HTN, dyslipidemia, family history of CAD, cigarette smoking or any other co-morbid illness.
- There was no statistical significant difference between the 2 subgroups A1&A2 regarding either pain to balloon time (55 ± 22 versus 52 ± 26 min, p value 0.74) or door to balloon time (25 ± 10 versus 23 ± 12 min, p value 0.66).
- Regarding echocardiographic data, we found a statistically significant lower mean ejection fraction in subgroup A1 compared to subgroup A2 (37% vs 53%, P value <0.001). Echocardiographic evidence of regional wall motion abnormalities (RWMAs) in anterior segments were found in all patients in the 2 subgroups whereas RWMAs in areas of the left ventricle remote from the infarction were seen in the 2 subgroups (A1 & A2) yet with no statistical difference (48.8% versus 50.8%, p value 0.45).
- All patients in group A (anterior STEMI) were subjected to primary PCI of the culprit vessel (LAD in 100% of cases). Each patient included in the two subgroups received a single stent, the length of the stent was selected according to the discretion of the operator and based on the lesion length. There was no statistical significant difference between the 2 subgroups regarding the site of LAD occlusion whether proximal in 20 patients in subgroup A1(48.8%) and in 29 patients in subgroup A2(49.2%) or mid-part in 21 patients in subgroup A1(51.2%) and in 30 patients in subgroup A2(50. 8%).Procedural success (achieving TIMI III flow with residual diameter stenosis ⩽20%)