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ELECTROCARDIOGRAPHIC PRECORDIAL ST SEGMENT DEPRESSION AND ITS LOCALIZATION IN INFERIOR MYOCARDIAL INFARCTION: CORRELATION WITH LEFT ANTERIOR DESCENDING ARTERY OCCLUSION AND MULTIVESSEL DISEASE

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ABSTRACT

Aims: The etiology and pathophysiology of precordial ST segment depression seen in inferior myocardial infarction have been investigated in numerous studies. Still there is much debate going on about its clinical implications. This study will explore the correlation between precordial ST segment depression in acute inferior myocardial infarction and concomitant coronary artery pathology. We focus on this subject for the reason that it may help clinicians in treatment planning and stratification of patients into relative lowrisk and high risk groups.

Methods: Medical records of 77 patients who have been diagnosed with acute inferior myocardial infarction were retrospectively examined. Coronary angiography had been performed on all of them for the indication of inferior myocardial infarction. Patients' first 24 hour ECGs were scanned and classified into 3 groups. Group 1 consists of patients without any precordial ST segment depression; Group 2 consists of patients with maximum precordial ST segment depression in leads V1 to V3; Group 3 consists of patients with maximum precordial ST segment depression in leads V4 to V6. The presence of precordial ST segment depression and its correlation with the anatomy of left anterior descending artery and multivessel disease were examined to determine a statistical significance.

Results: When the data for 3 groups was examined in regards to occlusion of left anterior descending artery (>50%), no statistical significance was found (p=0.439). Likewise, the presence of precordial ST segment depression was not significant for multivessel disease in any of the groups (p=0.849).

Conclusion: Taking the amount of inconsistent results that are being gathered on this subject into account, our interpretation in respect of these results is that it would not be appropriate to make an inference about coronary occlusion based on the presence and distribution of precordial ST segment depression before coronary angiographic procedures. Yet, in the light of previous researches and the interpretation that precordial ST segment depression is correlated to cardiac reserve and mortality, the subject of precordial ST segment depression in inferior myocardial infarction still carries great importance.

Keywords: Metastasis, epithelial-mesenchymal transition, platelet

INTRODUCTION

Currently, ischemic heart disease is one of the leading causes of morbidity and mortality worldwide. Inferior myocardial infarction (MI) accounts for nearly half of all MIs. With a mortality rate of 29%, inferior MI is a serious burden on public health that not only cardiologists but all clinicians should be adept at diagnosing and treating. The condition in which the blood supply of the inferior myocardium fails to provide sufficient oxygen and nutrients results in irreversible damage to the heart when cellular repair mechanisms are overwhelmed by ischemia. Inferior MI may be the result of an increase in metabolic demand of the myocardium, as well as impairment of circulation due to coronary pathologies. On top of signs and symptoms attributable to ischemia, ECG changes are seen and emergency interventions and diagnostics are critical. The electrocardiographic changes seen in acute inferior MI are: ST elevations in leads II III aVF, conduction abnormalities and possibly accompanying reciprocal ST segment depression in leads aVL ± I. There are numerous studies that

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examine precordial ST segment depression (PSTD) seen in the early ECGs of some acute inferior MIs. Even in the light of these previous studies, the etiology and clinical significance of precordial ST depression remain unclear. The opinions formed on this subject until today may be classified in the following manner: The first is; PSTD is a pure reciprocal (electrical) phenomenon that arises due to inferior ST segment elevation. The second is; PSTD is ascribed to anterior myocardial ischemia that accompanies inferior MI, therefore is an indication of multivessel disease. The last one is that PSTD is the manifestation of a wider area of infarct such as posterolateral, right ventricle or both (1). Previous studies have emphasized anterior PSTD's correlation with larger infarction area (1-4); its tendency to be accompanied by smaller ejection fraction (2, 3, 5) and its correlation with high rates of atrial and/or ventricular fibrillation, atrioventricular block, post infarct angina and congestive heart failure (1, 2). One large (n=16521) study conducted by Peterson et al. (1) in 1996 on the etiology and prognostic significance of PSTD in acute inferior MI highlights the finding that the population of patients with PSTD have increased hospital length of stay, increased 1 month and 1 year mortality rates independent of other cardiovascular risk factors. In fact, in the same study authors have mentioned that the magnitude of ST depression (sum of leads V1 to V6) is associated to patient outcomes; every 0.5 mV of precordial ST segment depression adds 36% to the risk of 30 day mortality (1). Most of the studies have failed to demonstrate a statistically significant concurrence among ST segment depression in V1V3 and anterior subendocardial ischemia and left anterior descending (LAD) artery or multivessel disease (6-8). Some studies have discussed higher mortality rates among patients with maximum ST depression in V4V6 (9, 10). Other studies point out the increased frequency of LAD and multivessel disease in patients with maximum ST segment depression in V4V6 line (3, 6, 7).

In this study, the presence and distribution of PTSD in the ECGs of patients with acute inferior MIs will be examined and its correlation to multi vessel disease will be investigated. It will be deduced whether it is appropriate to make an inference about the presence of coronary occlusion (>50%) by examining patients' early ECGs.

MATERIAL AND METHODS

Patient Population:

This study included 77 patients,, who had been diagnosed with acute inferior MI in Trakya University Hospital Emergency Room or Cardiology inpatient unit. Their medical records were scanned retrospectively. Coronary angiography with cardiac catheterization had been performed on all of them with the indication of acute inferior MI. Their first 24 hour ECGs were examined. Among the ECGs with PSTD, ECGs with the maximum magnitude of ST segment depression were selected. Group 1 (n=25) consisted of patients who did not have any PSTD in V1V6. V1V6 was divided into two groups: V1V3 and V4V6. Patients who had maximum PSTD in V1V3 (sum of leads) made up Group 2 (n=32) and patients who had maximum PSTD in V4V6 included to Group 3 (n=20). Patients who were admitted to the hospital with a diagnosis other than acute inferior MI have not been included in the study.

ECG:

All of the ECGs examined were recorded with settings being 25 mm/s and 1cm=1mv. In the first 24 hour ECGs, ST segment elevation in leads II III and aVF was confirmed (>1mm). >1mm depression from J point was defined as ST segment depression. The sum of ST segment depression was stated in mm units. The patients were separated into groups depending on the comparison of total magnitudes of ST segment depression in leads V1 to V3 (Group 2) and leads V4 to V6 (Group 3).

Angiography:

Coronary angiography had been performed on all of the patients with the indication of inferior MI and the results of the procedure were reported. Their angiography reports were examined regarding 3 arteries: LAD, Circumflex (Cx) and Right Coronary Artery (RCA).

Occlusions that took up greater than 50% of the lumen were defined as significant occlusions. Coronary arteries that had >50% occlusion at their branches were also categorized as occluded. When evaluating multivessel disease, the presence of an occlusion was considered. The presence of occlusion in one of the 3 arteries was classified as one vessel disease. The presence of occlusion in 2 of the 3 arteries was classified as two vessel disease. The presence of occlusion in all of the 3 arteries was classified as three vessel disease.

Statistical design:

Statistical evaluation was made using SPSS 22 statistical software (New York, USA). Because the results of the study were qualitative, Pearson chi-square test and Two sample Kolmogorov-Smirnov test were used in

comparisons. Comparisons among groups in terms of age fit normal distribution with one sample Kolmogorov Smirnov test. Therefore, the data was evaluated using one dimensional variance analysis. Defining statistics were given as arithmetic mean ± standard deviation, numbers and percentages. The accepted threshold for statistical significance is $p<0.05$ in the study.

RESULTS

In our study, 83.1% of the patients comprised of males and 16.9% comprised of females. When mean age was compared among groups, it was found to be 58.5±11.8 for Group 1, 60.9±12.4 for Group 2 and 60.9±11.5 for Group 3 (p=0.714).

Results regarding the correlation among PSTD and LAD occlusion are as follows: 13 (52%) patients out of 25 in Group 1, 15 (46.9%) patients out of 32 in Group 2, 13 (65%) patients out of 20 in Group 3 had occlusion in the LAD (p=0.439). The correlation among PSTD and RCA occlusion are as follows: 19 (76%) patients out of 25 in Group 1, 29 (90.6%) patients out of 32 in Group 2, 13 (65%) patients out of 20 in Group 3 had occlusion in the RCA (p=0.076). PSTD and Cx occlusion correlation is as follows: 11 (44%) patients out of 25 in Group 1, 15 (46.9%) patients out of 32 in Group 2, 12 patients out of 20 in Group 3 (60%) had Cx occlusion (p=0.529). The correlation among PSTD and multivessel disease is as follows: In Group 1 (n=25), 11 (44%) patients had one-vessel disease; 10 (40%) patients had two-vessel disease; 4 (16%) patients had three-vessel disease. In Group 2 (n=32), 13 (40.6%) patients had one-vessel disease; 11 (34.4%) patients had two-vessel disease; 8 patients (25%) had three-vessel disease. In Group 3 (n=20), 8 (40%) patients had one-vessel disease; 6 (30%) patients had two-vessel disease; 6 (30%) patients had three-vessel disease (p=0.849).

Lastly, there was not any significant difference among groups in terms of independent risk factors associated with MI such as diabetes mellitus (DM), smoking, hyperlipidemia, obesity or hypertension; apart from DM being significantly higher in Group 2: 85.7% of all patients who had DM belonged to Group 2 (p=0.041).

DISCUSSION

Looking at our results, we saw that the frequency of multivessel disease did not vary by the presence or distribution (V1V4/V3V6) of PTSD. In studies by Gibson et al. (4, 8) and among other previous studies conducted on this subject, the results were nonsignificant with regard to multivessel disease, corresponding to our results (1). On the other hand, contradicting findings that emphasize the significance of left PSTD (V4V6) as an indicator of multivessel disease have also been obtained in some studies (3, 11, 12). Furthermore, Mager et al (11) have proposed that in addition to suggesting diffuse coronary pathology, PSTD is a predictor for extensive revascularization interventions.

Another focus point of this study was the correlation among PSTD and LAD pathology. We have not established a statistically significant result in this relation, conflicting with some of the previous studies that found LAD occlusion to be more frequent in Group 3 (6, 7).

Considering other major coronary arteries and their branches, there was not a significant difference among groups in relation to RCA occlusion which is the primary culprit artery in inferior MI. Lastly, when groups are evaluated in terms of their relation to Cx occlusion, no significant difference was found among them.

It is well established that coronary angiography with cardiac catheterization is a frequently used procedure in conventional cardiology, making percutaneous interventions possible. Still, if a noninvasive and costeffective method like the admission ECG could point the clinicians towards concomitant vessel disease, patients could have been sorted into relative high risk and low risk groups. This stratification would help the clinicians to prioritize tasks in a fast paced environment and work out the treatment plan.

As the limitations of the study, there was no regard to history of previous coronary artery disease in the chosen patients. This should be kept in mind when correlating the coronary artery anatomy from angiography reports with acute infarct manifestations on the ECG could as it could lead to misperceptions on such a relation among two variables.

One of the factors affecting the statistical power of the study was the fact that the population of patients was limited to 77. With margin of error being 0.05 it was initially calculated that with an effect size of 0.3731, 77 patients were sufficient to obtain a statistical power of 0.84. However, after the data was examined, the effect size turned out to be 0.2584 which was below the anticipated value. The study was completed with this effect size and the final statistical power turned out to be 0.5156. Assuming that distribution proportions among groups

remain the same, the study could be repeated with a larger sample size. Nonetheless, the same study has been conducted with a much larger sample (n=16521) and the results were not significant regarding LAD occlusion and multivessel disease (1). Thus, we conclude that it's unlikely that false negative results were obtained due to sample size in this study.

Taking the amount of inconsistent results that are being gathered on this subject into account, our interpretation in respect of these results is that it wouldn't be appropriate to make an inference about coronary occlusion (>50%) in the nonculprit arteries based on the presence and distribution of PSTD before coronary angiographic procedures. Yet, in the light of previous research and the interpretation that PSTD is correlated to mortality and infarct size, the subject of PSTD in inferior MI still carries great importance.

Ethics Committee Approval: This study was approved by Scientific Researches Ethics Committee of Trakya University Medical Faculty.
Informed Consent: Written informed consent was obtained from the participants of this study.
Conflict of Interest: The authors declared no conflict of interest.
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