Association of Monocyte/HDL-C Ratio with the Selvester QRS Score in Patients with ST Elevation Myocardial Infarction Undergoing Primary Coronary Intervention

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Abstract

Background and aim: Recently, monocyte to high density lipoprotein (MHR) has been recommended as a new prognostic factor for cardiovascular diseases. The value of this scoring system has been documented by previous studies in predicting prognosis ST elevation myocardial infarction (STEMI). However, no study is currently available regarding the association of MHR and the selvester score in predicting the outcomes among patients with STEMI.

Materials and methods: We evaluated a cohort of 99 consecutive patients who were admitted to our tertiary referral centre with STEMI and under went first primary percutaneous coronary intervention (pPCI) between June and September in 2017. The Selvester QRS score was estimated on the first electrocardiogram (ECC) after hospital admission. MHR was calculated for all patients. A total of 99 patients with ST elevation ACS were included in the study. They were divided into two groups. These were 52 patients in the low selvester score and 44 patients in the high selvester group. We investigate the relationship between selvester score and MHR ratio in this study.

Results: MHR was positively correlated with the Selvester score (r=0.467, P<0.001). In multivariate logistic regression analysis, MHR was an independent predictor of high selvester scores in prognosis of STEMI (odds ratio: 2.565, 95% CI: 1.509-4.361; P<0.001). The area under the receiver–operating characteristic curve of the MHR was 0.749 (0.647-0.852; P<0.001).

Conclusion: The results of this study have indicated that MHR is associated independently and significantly with high selvester score system in prognosis of STEMI.

Keywords: ST elevation; Myocardial infarction; Monocyte to HDL ratio; Receiver operating characteristic curve

Introduction

Atherosclerosis, is a multi-factorial disease and the main reason for coronary artery disease (CAD) [1]. In atherosclerotic disease, cause of inflammatory response and tissue remodeling is monocytes and differentiated macrophages [2]. High monocyte count has a function in plaque progression during the acute phase of STEMI [3]. Monocytes was decided as an independent marker for STEMI [4]. The protective role of serum HDL-cholesterol (HDL-C) levels has been proven and the other functions of HDL-C molecules prevent macrophages migration and remove cholesterol from these cells [5,6].

Recently, monocyte count/HDL-C ratio (MHR) has been reported as an independent predictor for major cardiovascular events in patients who have chronic kidney disease [7]. Clinicians use frequently the standard 12 lead electrocardiogram (ECC) nowadays to solve the electrical activation sequence of the human heart. Using the current 50-criteria, 31-point version in the score identical simulation of the electrical activation sequence of the human heart. The aim of this study is to research the value of MHR in predicting the myocardial infarct size as assessed by the simplified selvester score in patients with STEMI undergoing primary coronary intervention.

Materials and Methods

Study population

We retrospectively evaluated a cohort of 99 consecutive patients who were admitted to our tertiary referral centre with STEMI and under went first primary percutaneous coronary intervention (pPCI) between June-September in 2017. Patients were registered in this study if symptoms consistent with acute STEMI within 12 h of symptom onset or up to 24 h, ST-segment elevation ≥ 2 mm in at least 2 consecutive ECC leads, 3-fold increase in serum creatine kinase (CK) levels; (4) Patients with successful angioplasty (stable TIMI III flow and <30% residual stenosis). Patients were divided into groups; these are high selvester score and low selvester score according to...
baseline EKG selvester scoring - QRS system. The study complied with the Declaration of Helsinki and was approved by the hospital’s ethical review board. Informed consent was obtained from all participants.

Exclusion criteria of the study were subjects with known patients with CAD, active infection, haematological (including anaemia), oncological or inflammatory disease, renal or hepatic insufficiency, severe valvular disease, hypo and hyperthyroidism, treatment with fibrinolytic agents before pPCI were excluded.

Study protocol

In hospital admission, a 12-lead ECG was recorded for each patient. Hypertension was defined as receiving antihypertensive therapy and/or arterial blood pressure(BP) was >140/90. Diabetes mellitus was diagnosed either using of an antidiabetic drug or a postprandial blood glucose >200 mg/dl. total cholesterol >200 mg/dl was noted as hyperlipidaemia, low density lipoprotein-cholesterol (LDL-C) >130 mg/dl, triglyceride >150 mg/dl. Patients, who were smoking within the last year, were entitled as smokers.

Laboratory parameters

Peripheral venous blood samples were taken in the emergency room admission before pPCI. Dry tubes for biochemical tests and tubes with EDTA for the haematological test were used. An automated blood cell counter (Beckman Coulter analyzer; Brea, California, USA) was used to define complete blood count parameters. The levels of blood biochemical parameters including glucose (GLU), creatinine (Cre), urea, aspartat aminotransferaz (AST), alaninamotransferaz (ALT), Triglyceride (TG), total bilirubin, total cholesterol (TC), HDL-C, and LDL cholesterol (LDL-C). CBC parameters including hemoglobin (HGB), white blood cell (WBC), neutrophil (NEU), lymphocyte (LYM), monocyte (MONO), Red Cell Distribution Width (RDW), platelet (PLT), and mean platelet volume (MPV). The MHR was calculated as the ratio of the monocytes to HDL-C levels.

Electrocardiographic and echocardiographic analysis

The size of infarction was estimated by the Selvester QRS-scoring system. This QRS scoring system was based on 50 criteria, capable of generating a total of 31 points. Previously the complete selvester QRS scoring system with 54-criteria and 32-point system. In emergency unit an interpretable 12-lead ECG was recorded without poor quality electrocardiographic tracing, left or right bundle branch block, left anterior or posterior fascicular block, left ventricular hypertrophy, right ventricular hypertrophy, Wolff-Parkinson-White syndrome, low voltage, or ventricular paced ECG. These were confounders to QRS scoring system.

Patients were classified into two groups according to their estimated infarct size: QRS score <6 (small infarct) and QRS score ≥ 6 by median values. Echocardiographic recordings were performed with the patient on the left side supine position at the end of the expiration. In the images of parasternal long-axis, ejection fraction measurement was performed with M-mode.

Coronary angiography and percutaneous coronary intervention

Our hospital is education and research hospital with the facility to perform PCI 24 hours, seven days a week. Every patient who is admitted with chest paint our emergency department is assessed initially by a cardiology specialist. All patients received 300 mg aspirin, loading dose of 600 mg clopidogrel and maintenance dose of 75 mg, and bolus 5000 IU (70 IU/kg) unfractionated heparin during PCI processing. Primary PCI was performed to only culprit artery except for cardiogenic shock. The evaluation of coronary angiograms and determination of SYNTAX score were made by interventional cardiologists who were blinded to the laboratory and clinical follow-up data of the patients. Sx scores was calculated and used the online Sx Score Calculator, version 2.1 by two independent interventional cardiologists, who were unaware of the patients’ clinical data.

Statistical analysis

SPSS statistical software (SPSS for Windows, version 21.0, Inc., Chicago, IL, USA) was used for all statistical calculations. Categorical variables were expressed as number and proportions, while continuous variables were expressed as mean ± standard deviation. Normality of the data distribution was analyzed using the Kolmogorov–Smirnov test Chi-square (χ²) test was used to compare groups regarding categorical variables. Continuous variables were compared with Mann-Whitney U test (while comparing nonparametric variables between selvester score high and low groups). Correlation analysis was performed using Pearson or Spearman tests. Logistic regression analysis was used to explore the independent determinants of selvester score. Receiver operating characteristic (ROC) curve analysis was performed to determine cut off high risk value of selvester score with STEMI patients.

Results

A total of 99 patients with ST elevation ACS were included in the study. There were 52 patients (mean age 549.5 ± 12.3 and 84.6% male) in the low selvester score group and 44 patients (mean age 62.64 ± 11.5 and 63.8% male) in the high selvester group. The demographic and clinical characteristics of the study groups are given in Table 1. Hypertension, hyperlipidaemia, smoking, age and syntax score were similar between two groups. Serum TC, LDL, HDL, TG, urea, Cre, AST, ALT, GLU, HGB, WBC, HTC, MCV, MPV levels did not differ between two groups.

Regarding clinical and biochemical characteristics of the patients with ST elevation in Table 1, MHR was significantly different between high selvester score and low selvester score (P<0.001). Also, monocytes value were significantly different in two groups (P<0.001). Statically significant relation existed between MHR and selvester scores (r=0.467, P<0.001). significant interactions were seen between monocytes and selvester scores (r=0.423, P<0.001) (Figure 1; Table 2). The MHR values emerged as an independent predictor of selvester score (RR=2.565, 1.509-4.361 95% CI, p=0.001) (Table 3). The cut-off values of MHR for high selvester score were 1.95 with a sensitivity of 72% and specificity of 50% (AUC 0.749, 95% confidence interval 0.647 to 0.852<0.001).

Discussion

In this study we aimed to focus on the prognostic value of selvester scores and MHR in STEMI. To the best of our knowledge, this is the first study demonstrating the association of MHR with high selvester score, and the prognostic value of this in predicting in hospital and long-term major adverse cardiovascular events in patients with STEMI. Primary PCI protects patients significantly against cardiovascular mortality or reinfarction within 6 months in STEMI. The acute myocardial infarction currently responsible of a high risk for short-term and long-term cardiovascular mortality and risk stratification of patient’s prognosis is necessary [12]. A new predictor for plaque development is the circulating monocyte count, as the source of tissue macrophages and foam cells [13]. The subpopulations of intermediate (CD14+CD16+; IM) and nonclassical monocyte (CD-14+ CD16++; NCM) are pro-
Table 2: Clinical and biochemical characteristics between selvester score high and low groups in STEMI patients.  

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Selvester Score Low (n=52)</th>
<th>Selvester Score High (n=47)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (male, %)</td>
<td>84.6%</td>
<td>63.8%</td>
<td>0.017</td>
</tr>
<tr>
<td>Age (years)</td>
<td>59.5 ± 12.3 (37-82)</td>
<td>62.6 ± 11.5 (38-88)</td>
<td>0.239</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>69.2%</td>
<td>83%</td>
<td>0.111</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>28.8%</td>
<td>21.3%</td>
<td>0.387</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>67.3%</td>
<td>66%</td>
<td>0.887</td>
</tr>
<tr>
<td>Syntax scores</td>
<td>19.2 (2.0-42)</td>
<td>17.3 ± 9.8 (10.5-75.6)</td>
<td>0.161</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>0.89 ± 0.15 (0.6-1.4)</td>
<td>0.83 ± 0.27 (0.2-1.5)</td>
<td>0.217</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>107 ± 129 (13-516)</td>
<td>120 ± 116 (0-487)</td>
<td>0.224</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>49 ± 66 (6-331)</td>
<td>48 ± 63 (7-429)</td>
<td>0.408</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dl)</td>
<td>193 ± 57 (127-488)</td>
<td>184 ± 38 (110-259)</td>
<td>0.715</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>141 ± 97 (46-705)</td>
<td>144 ± 71 (37-437)</td>
<td>0.428</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>34.4 ± 6.3 (22-50)</td>
<td>32.5 ± 6.5 (20-62)</td>
<td>0.669</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>130 ± 44 (58-306)</td>
<td>123 ± 36 (55-196)</td>
<td>0.099</td>
</tr>
<tr>
<td>Monocytes (10^3/µL)</td>
<td>0.65 ± 0.24 (0.3-1.6)</td>
<td>0.91 ± 0.36 (0.3-1.8)</td>
<td>0.000</td>
</tr>
<tr>
<td>Monocytes/hdl</td>
<td>0.019 ± 0.0089 (0.07-0.64)</td>
<td>0.029 ± 0.0128 (0.09-0.68)</td>
<td>0.000</td>
</tr>
<tr>
<td>Hemoglobin (g/dl)</td>
<td>13.0 ± 1 (8.49-19.8)</td>
<td>13.4 ± 1.6 (9.9-17.1)</td>
<td>0.098</td>
</tr>
<tr>
<td>Htc (%)</td>
<td>44.8 ± 5.2 (31.0-53.7)</td>
<td>43.7 ± 5.1 (32-56)</td>
<td>0.270</td>
</tr>
<tr>
<td>MCV (FL)</td>
<td>86 ± 5.3 (72-100)</td>
<td>84 ± 7.9 (47-97)</td>
<td>0.129</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>27.7 ± 2 (22-34)</td>
<td>26.8 ± 2.4 (17-30)</td>
<td>0.076</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>32 ± 1.5 (30-38.9)</td>
<td>30.9 ± 4.3 (36-33.5)</td>
<td>0.112</td>
</tr>
<tr>
<td>MPV (FL)</td>
<td>7.9 ± 1.2 (5.8-11.1)</td>
<td>8.2 ± 1.7 (5.8-13.8)</td>
<td>0.531</td>
</tr>
<tr>
<td>RDW (%)</td>
<td>12.4 ± 1.6 (10.3-21.6)</td>
<td>12.9 ± 2.1 (10.8-22.4)</td>
<td>0.149</td>
</tr>
<tr>
<td>Pit (10^10 x µL)</td>
<td>237 ± 61 (111-385)</td>
<td>236 ± 60 (113-393)</td>
<td>0.958</td>
</tr>
<tr>
<td>WBC (10^9 x µL)</td>
<td>11.4 ± 3.8 (5.3-20.8)</td>
<td>12.9 ± 3.6 (7.1-25.5)</td>
<td>0.076</td>
</tr>
<tr>
<td>Lymphocytes (10^3/µL)</td>
<td>2.56 ± 0.98 (1.21-5.2)</td>
<td>2.49 ± 1.07 (1.02-5.2)</td>
<td>0.577</td>
</tr>
<tr>
<td>Eosinophils (10^3/µL)</td>
<td>0.12 ± 0.02 (0.01-0.69)</td>
<td>0.10 ± 0.12 (0.01-0.69)</td>
<td>0.326</td>
</tr>
<tr>
<td>Basophils (10^3/µL)</td>
<td>0.06 ± 0.04 (0.00-0.28)</td>
<td>0.12 ± 0.18 (0.01-0.93)</td>
<td>0.930</td>
</tr>
<tr>
<td>Neutrophils (10^3/µL)</td>
<td>7.7 ± 3.06 (2.4-13.3)</td>
<td>9.01 ± 2.82 (3.09-15.1)</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD or SD, median (interquartile range) or n (%). Aspartate Aminotransferase, ALT: Alanin Aminotransferase, LDL: Low density Lipoprotein, Htc: Hematocrit, MCV: Mean corpuscular volume, RDW: Red cell distribution with, Pit: platelet, WBC: White blood cells, *Mann-Whitney U test **Chi-square test

Table 3: Relation of high and low selvester scores with biochemical and clinical parameters in multivariate regression analyses.
Figure 1: Receiver operating characteristic (ROC) curves MHR in the prediction of high selvester score in STEMI patients.

selvester score and MHR ratio was found in our study. Also we found that a significant correlation between selvester score and monocytes value in laboratory parameters. Further studies are required to support this hypothesis.

Limitations

The primary limitations of the present study are the fact that this was a single-center study and the small number of patients included. Another limitation of this study is that only after the acute phase of the MI MHR levels were taken into consideration. The last limitation of this study is that the selvester QRS scoring system was applied to the standard 12-lead ECG only before the acute phase of the STEMI.

Conflicts of Interest

There are no conflicts of interest.

References


