American Journal of Emergency Medicine 34 (2016) 1037–1042

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Original Contribution

The relationship between fibrinogen to albumin ratio and severity of coronary artery disease in patients with STEMI☆

Oğuz Karahan, MD [a,*,1], Halit Acet, MD [b,2], Faruk Ertaş, MD [b,3], Orhan Tezcan, MD [a,4], Ahmet Çalişkan, MD [a,5], Muhammed Demir, MD [b,6], Ahmet Ferhat Kaya, MD [b,6], Sinan Demirtaş, MD [a,7], Mehmet Uğur Çevik, MD [c,8], Celal Yavuz, MD [a,9]

[a] Medical School of Dicle University, Department of Cardiovascular Surgery, Diyarbakır, Turkey
[b] Medical School of Dicle University, Department of Cardiology, Diyarbakır, Turkey
[c] Medical School of Dicle University, Department of Neurology, Diyarbakır, Turkey

ARTICLE INFO

Article history:
Received 2 February 2016
Received in revised form 23 February 2016
Accepted 1 March 2016

ABSTRACT

Objective: Previous studies show that serum fibrinogen levels are established risk factors for coronary artery disease (CAD) and that serum albumin levels are of a higher specificity and sensitivity in ST-elevation myocardial infarction (STEMI). In this study, we sought to evaluate the association between fibrinogen to albumin ratio (FAR) and the extent and severity of CAD evaluated by TAXUS Drug-Eluting Stent Versus Coronary Artery Bypass Surgery for the Treatment of Narrowed Arteries (SYNTAX) Score (SS) in patients with STEMI.
Methods: A total of 278 patients with STEMI were included in the study. FAR was calculated using specified variables. The extent and severity of CAD were evaluated using the SS. The patients were divided into low- ($SS < 22$) and high- ($SS \geq 22$) risk groups. A Spearman rank correlation coefficient analysis was used for the relationship between FAR and SS. The cutoff points for sensitivity and specificity of FAR in predicting SS were estimated by performing a receiver operator characteristic curve analysis.
Results: There were significant differences in the mean age ($P = .016$), admission serum albumin ($P = .041$), serum fibrinogen ($P < .001$), FAR ($P < .001$), and SS risk groups. Positive correlation was detected between FAR and SS ($r = 0.458$, $P < .001$). A cutoff level of >87 FAR predicted SS (sensitivity, 70%; specificity, 70%), and an area under the curve of 0.758 serum fibrinogen and albumin level was an independent predictor for SS in patients with STEMI ($b = 0.039$; 95% confidence interval, 0.016-0.062; $P = .001$ and $b = -6.906$; 95% confidence interval, -12.284 to -1.527; $P = .013$, respectively).
Conclusion: In the present study, we showed that FAR is significantly related to SS in predicting the severity of CAD in patients with STEMI.

1. Introduction

Coronary artery disease (CAD) and acute myocardial infarction (MI) are major causes of morbidity and death worldwide. Atherosclerosis is the major cause of cardiovascular disease [1,2]. Coronary atherosclerosis is the main cause of ST-elevation acute myocardial infarction (STEMI) which can affect vessel wall in different degrees. Therefore, clinicians focus on studying risk stratification in patients with acute coronary syndrome (ACS) for the prediction of CAD severity and complexity. In this context, a large number of scoring systems and laboratory parameters have been used recently in clinical practice. The SYNTAX score (SS) is one of the scoring systems used to determine the extent and severity of CAD [3–6].

Hypoalbuminemia has been found to be a risk factor for the development of a new MI in patients with CAD [7] and heart failure [8]. In addition, serum albumin (SA) is an important inhibitor of platelet activation and aggregation and is an important mediator of platelet-induced

☆ Conflict interest and funding: The authors of this study declare that there is no conflict of interest regarding the publication of this manuscript. There were no external funding sources for this clinical study.

* Corresponding author at: Medical School of Dicle University, Department of Cardiovascular Surgery, 21080, Diyarbakır, Turkey. Tel.: +90 5063929320 (GSM).
E-mail addresses: oguzk2002@gmail.com (O. Karahan), halitacet@gmail.com (H. Acet), farukertas@hotmail.com (F. Ertaş), dr.orhantezcan@gmail.com (O. Tezcan), drahmetcaliskan@hotmail.com (A. Çalişkan), drmdemirr@gmail.com (M. Demir), kayaferhatahmet@gmail.com (A.F. Kaya), sinandemirtas78@hotmail.com (S. Demirtaş), mehmetugur.cevik@gmail.com (M.U. Çevik), celalyav@hotmail.com (C. Yavuz).

[1] Contribution: study concept design, main researcher, and text writing.
[2] Contribution: main researcher and text writing.
[3] Contribution: data analysis and grouping.
[4] Contribution: patient record and follow-up.
[5] Contribution: data collection and analysis.
[6] Contribution: data collection.
[7] Contribution: drafting of manuscript.
[8] Contribution: recording of data.
[9] Contribution: supervisor and moderator of the study.

http://dx.doi.org/10.1016/j.ajem.2016.03.003
0735-6757/

coronary artery constriction [9,10]. In addition, hypoalbuminemia may increase blood viscosity and disrupt endothelial function because of increased concentrations of free lysophosphatidylcholine [11]. Several studies have shown a relationship between low SA levels and increased cardiovascular morbidity and mortality [12,13]. The SA might also have an important role in the acute phase of CAD, such as acute STEMI.

Several studies show that elevated fibrinogen is an established risk factor in CAD [14–16].

Although many studies have investigated the relationship between hypoalbuminemia, high fibrinogen levels, and CAD [9,10,14,15], to our knowledge, none have addressed the association between fibrinogen to albumin ratio (FAR) and the severity of CAD using SS in patients with STEMI.

Thus, the aim of the current study is to investigate whether a high FAR is associated with the extent and severity of CAD in patients with STEMI who underwent primary percutaneous coronary intervention (p-PCI) with SS.

2. Methods

2.1. Study population

This study was conducted prospectively. A total of 78 patients who presented with STEMIs and underwent p-PCI within 12 hours of symptom onset were included in the study. STEMI was defined based on the criteria created by the American College of Cardiology and the European Society of Cardiology and included the following: an increase in troponin I > 1 ng/mL; a new ST elevation as measured from the J-point in 2 or more contiguous leads with leads V1, V2, and V3 measuring at least 0.2 mV or at least 0.1 mV in the remaining leads; and measurement during the first 12 hours after symptom onset or new developed left bundle-branch block pattern [17].

Patients with severe liver disease, autoimmune diseases, cancer, hematological disorders, severe valvular disease, inflammatory or infectious diseases, and a history of bleeding diathesis were excluded from the study. Patients on the following medications were also excluded from the study: corticosteroids, cytotoxic drugs, thrombolytic therapy, glycoprotein IIb/IIIa inhibitors, and diuretics. Patients were also excluded if, during the study, the patients were not treated with p-PCI and did not follow up for blood work. After accounting for all of these exclusion criteria, a total of 78 patients remained in the study sample. All patients received a complete physical examination and an assessment of coronary risk factors; medical histories and the presenting clinical symptoms were also recorded.

2.2. Blood work analysis

Venous blood samples were collected when the patient initially presented to the emergency department or intensive coronary care unit before p-PCI. Hematologic indices were measured using an automated hematology analyzer system (Abbott Cell-Dyn 3700; Abbott Laboratories, Abbott Park, IL). Absolute cell counts were used to perform subsequent analyses. Total cholesterol, high-density lipoprotein, low-density lipoprotein, triglycerides, glucose, and creatinine levels were measured using the Abbott Architect C 16000 autoanalyzer (Abbott Laboratories).

2.3. Angiographic analysis and SS

All patients underwent selective coronary angiography using the Judkins percutaneous transfemoral technique. Coronary lesions leading to 50% diameter stenosis in vessels of 1.5 mm were scored separately and added together to provide the cumulative SS, which was prospectively calculated using the SS algorithm on the baseline diagnostic angiogram [18]. The latest updated online version was used for the calculation of the SS (http://www.SYNTAXscore.com). Two experienced interventional cardiologists analyzed the SS, the opinion of a third analyst was obtained, and the final judgment was made by consensus in cases of disagreement. The final score was calculated from the individual lesion scores by analysts who were blinded to procedural data and clinical outcomes.

2.4. Statistical analysis

All analyses were performed using SPSS for Windows version 18.0 (SPSS Inc, Chicago, IL). Continuous variables were expressed as mean ± standard deviation, and categorical variables were expressed as percentages. Distribution of continuous variables was assessed with a 2-sample Kolmogorov-Smirnov test. Comparisons of categorical and continuous variables between the 2 groups (high and low SS) were performed using the χ^2 or Fisher exact test, independent-samples *t* test, or the Mann-Whitney *U* test. The correlation between FAR and SS parameters was assessed by the Spearman correlation test. *Statistical significance* was defined as a *P* value <.05. The cutoff points for sensitivity and specificity of FAR in predicting SS were estimated by performing a receiver operator characteristic curve analysis. The determinant of the dependent SS variable was assessed with linear regression analyses using independent variables described. The study protocol was reviewed and approved by the Local Ethics Committee of University in accordance with the Declaration of Helsinki.

3. Results

A total of 78 patients (56 male [73%]; mean age, 61.5 ± 15.82 years) were enrolled in the study. Patients were divided into 2 groups according to SS (SS <22 as low group [n = 37] and ≥22 as high group [n = 41]). The mean age of the SS-high group was higher than that of the SS-low group (P = .016). The baseline characteristics and initial laboratory findings of the 2 groups are summarized in Table 1. The admission level of fibrinogen and FAR in the SS-high group was significantly higher

Table 1
Comparison of demographic characteristics and initial laboratory values of patients in SS groups

Variables	SS low (<22) n = 37	SS high (≥22) n = 41	*P* value
Age, y	57.02 ± 16.44	65.58 ± 14.24	**.016**
Sex, male, n (%)	30(81)	27(66)	.130
Previous history			
Hypertension, n (%)	5(14)	7(17)	.663
Diabetes mellitus, n (%)	7(19)	7(17)	.832
History of CAD, n (%)	2(5)	3(7)	.549[a]
Previous medication	3(8)	3(7)	.612[a]
Height	167.43 ± 7.10	167.80 ± 7.20	.819
Weight	71.81 ± 14.82	73.82 ± 13.05	.525
Laboratory findings			
WBC, K/μL	13.08 ± 4.80	13.21 ± 2.19	.300
Hemoglobin, g/dL	15.68 ± 10.8	13.21 ± 2.19	.157
RDW, %	12.06 ± 1.15	11.95 ± 2.03	.768
PDW, null	20.14 ± 1.29	19.90 ± 3.47	.684
Platelet count, K/μL	243.45 ± 76.50	239.14 ± 73.80	.801
Lymphocyte count, null	2.25 ± 1.60	2.09 ± 1.93	.692
Mean platelet volume, fL	7.37 ± 1.66	7.95 ± 1.94	.160
Eosinopil count, null	0.07 ± 0.10	0.06 ± 0.05	.682
Glucose, mg/dL	152.40 ± 70.23	173.80 ± 81.75	.221
Creatinine, mg/dL	0.85 ± 0.42	1.11 ± 0.92	.101
Total cholesterol, mg/dL	185.08 ± 58.03	185.36 ± 52.65	.982
LDL, mg/dL	121.20 ± 49.48	126.36 ± 43.49	.639
HDL, mg/dL	38.77 ± 15.04	33.65 ± 11.13	.096
Triglycerides, mg/dL	151.20 ± 117.17	161.56 ± 124.29	.711
D-Dimer, ng/L	1.56 ± 3.26	2.36 ± 4.56	.411
Fibrinogen, μg/mL	247.46 ± 82.50	354.51 ± 148.30	**.001**[b]
Albumin, g/dL	3.48 ± 0.64	3.21 ± 0.50	**.041**
FAR	81.45 ± 70.05	111.12 ± 42.33	<**.0001**[b]

Other statistics: χ^2 and *t* test. WBC, white blood cell; RDW, red cell distribution width; PDW, platelet distribution width; LDL, low-density lipoprotein; HDL, high-density lipoprotein.

[a] Fisher exact test.

[b] Mann-Whitney *U* test.