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ORIGINAL ARTICLE

Increased monocyte to high-density lipoprotein cholesterol ratio is associated with TIMI risk score in patients with ST-segment elevation myocardial infarction

Alper Sercelik*, **Abbas Fikret Besnili**

Sanko University, School of Medicine, Cardiology Department, Şehitkamil/Gaziantep, Turkey

Abstract
Introduction and Aim: The monocyte to high-density lipoprotein cholesterol ratio (MHR) has recently been proposed as a new predictor and prognostic indicator in cardiovascular disease. The TIMI risk score predicts short-term mortality in ST-elevation myocardial infarction (STEMI) patients. However, there have been no studies regarding the association between MHR and TIMI score in patients with STEMI.
Methods: A total of 161 patients admitted to our hospital were prospectively enrolled between January 2014 and June 2016. Of these, 111 consecutive patients with a diagnosis of STEMI who underwent primary percutaneous coronary intervention (PCI) were selected as the STEMI group, and the remaining 50 patients, who had angiographically normal coronary arteries, were selected as the control group. The 111 STEMI patients were then divided into two subgroups based on TIMI scores.
Results: MHR was significantly higher in the STEMI group than in the control group (1.71 ± 0.47 vs. 2.21 ± 0.98, p=0.001) and was significantly higher in the high TIMI score group than in the low TIMI score group (1.80 ± 0.59 vs. 2.42 ± 1.09, p=0.001). In multivariate logistic regression analysis, MHR was the only independent predictor of acute STEMI and high TIMI score. In correlation analysis, there was a significant positive correlation between MHR and TIMI score in STEMI patients (r=0.479, p<0.001). The cutoff value of MHR for high TIMI score in patients with STEMI was 2.409, with a sensitivity of 43.06% and a specificity of 87.18% (AUC 0.669; 95% CI 0.569-0.8769; p=0.003) on ROC curve analysis.

* Corresponding author.
  E-mail address: asercelik@hotmail.com (A. Sercelik).

Conclusion: This study indicates that MHR is independently and significantly associated with TIMI score in patients with STEMI. MHR is a novel inflammation-based marker and may be an independent predictor of future cardiovascular events in patients with STEMI.

Aumento da relação de monócitos para lipoproteinas de alta densidade do colesterol está associado ao *score* de risco TIMI em pacientes com enfarte agudo do miocárdio com elevação do segmento

Resumo
Introdução: A relação entre a contagem de monócitos e o nível de lipoproteína de alta densidade do colesterol (MHR) foi recentemente apresentada como um novo preditor e indicador prognóstico de doenças cardiovasculares. O *score* de risco TIMI prediz em curto prazo a mortalidade em doentes com STEMI. Contudo, não há estudo disponível acerca da associação entre o MHR e o *score* TIMI em doentes com STEMI.
Material e métodos: Foram recrutados 161 doentes prospetivamente entre janeiro de 2014 e junho de 2016. Dos 161 doentes, 111 foram admitidos consecutivamente no nosso hospital com o diagnóstico de STEMI e foram submetidos a PCI primária, foram designados como o grupo STEMI, os restantes 50 doentes fizeram angiografia com artérias coronárias normais e foram selecionados como grupo controle. Os 111 doentes com STEMI foram ainda divididos em dois subgrupos, de acordo com o *score* de risco TIMI.
Resultados: O MHR foi significativamente mais alto no grupo STEMI quando comparado com o grupo controle (1,71±0,47 *versus* 2,21±0,98, p=0,001) e foi significativamente mais alto no subgrupo de alto risco TIMI, quando comparado com o subgrupo de baixo risco TIMI (1,80±0,59 *versus* 2,42±1,09, p=0,001). O modelo de regressão logística multivariável demonstrou que o MHR só foi preditor independente no grupo STEMI com *score* TIMI de alto risco. Na análise de correlação, houve uma correlação positiva significativa entre o MHR e o *score* TIMI em doentes com STEMI (r=0,479, p<0,001). O valor de *cut-off* do MHR para o *score* TIMI alto em doentes STEMI foi 2,409 com uma sensibilidade de 43,06% e uma especificidade de 87,18% (AUC, 0,669; 95% com um intervalo de confiança de [CI], 0,569-0,8769; p=0,003) na análise de curva de ROC.
Conclusões: Este estudo indicou que o MHR está independente e significativamente associado ao *score* TIMI em doentes com STEMI. O MHR é um novo marcador de base inflamatória e pode ser um preditor independente de eventos cardiovasculares futuros em doentes com STEMI.

Introduction

ST-elevation myocardial infarction (STEMI) is a significant cause of morbidity and mortality in patients with coronary heart disease. Patients with STEMI are at high risk for complications and poor outcome, including death. All patients with STEMI should undergo early risk stratification soon after admission. Multiple methods have been developed for risk stratification in STEMI. Complicated multivariable models developed for predicting mortality in patients with STEMI identify independent clinical predictors and quantify their relative contribution to mortality risk.[1] One widely used and easily accessible model is the Thrombolysis in Myocardial Infarction (TIMI) risk score for STEMI, which is readily applied in routine clinical practice and is able to predict both early (30-day) and one-year mortality.[2]

The TIMI score was created and validated in a sample of patients with ST-segment elevation myocardial infarction. It is based on ten rapidly calculated clinical indices to provide a score between 0 and 14 points. The parameters included in the score are age, systolic blood pressure <100 mmHg, diabetes, angina, history of hypertension, heart rate >100 bpm, weight <67 kg, Killip class II-IV, anterior STEMI or left bundle branch block (LBBB), and time to treatment >4 hours. Time to treatment is defined as time from symptom onset to first balloon inflation.

The monocyte to high-density lipoprotein cholesterol (HDL-C) ratio (MHR) has emerged as a novel prognostic marker that has been reported to be related to cardiovascular outcomes in various cardiovascular diseases.[3–5] Monocytes are a source of various cytokines associated with inflammatory processes. It has been found that monocytes and differentiated macrophages can modulate inflammatory cytokines and tissue remodeling in the pathophysiology of coronary artery disease (CAD).[6] By contrast, the major function of HDL-C is to protect peripheral tissues through the removal of cholesterol and to suppress monocyte