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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Triglyceride/Glucose Index in Young Myocardial Infarction Patients

Genç Miyokard İnfarktüslü Hastalarda Trigliserid/Glukoz İndeksi

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ABSTRACT

Aim: Acute myocardial infarction (MI) is one of the most important causes of morbidity and mortality. Although MI is less common in young patients than in elderly patients, the mechanism of occurrence and risk factors are relatively different compared to elderly patients. The aim of this study was to investigate whether there is an association between young MI and Triglyceride/Glucose index (TyG), an easily calculated index used to predict insulin resistance.

Material and Method: A total of 130 patients, 65 of whom had acute MI under the age of 40 years and 65 of whom were controls, were included in the study. Clinical status, angiography results, comorbidities, hematologic and biochemical markers and TyG index were compared retrospectively.

Results: Glucose (p=0.001) and white blood cell (WBC) count (p<0.001) were higher, while high density lipoprotein (HDL) (p<0.001), albumin (p=0.006) and hemoglobin (p=0.005) were lower in the young MI group compared to the control group. There was no statistically significant difference in TyG between the young MI group and the control group.

Conclusion: In this study, although no association between TyG and young MI patients could be demonstrated, its use in elderly MI patients is beneficial as a result of previous studies in the literature.

Keywords: Young, myocardial infarction, NSTEMI, STEMI, triglyceride/glucose index.

ÖZ

Amaç: Akut miyokard infarktüsü (MI), morbidite ve mortalitenin en önemli nedenlerinden birisidir. Genç hastalarda, yaşlılara göre daha az olarak görülmekle beraber oluşum mekanizması ve risk faktörleri yaşlı hastalara göre nispeten farklıdır. Bu çalışmada genç miyokard infarktüsü ile insülin direncini predikte etmede kullanılan kolay hesaplanan bir indeks olan Trigliserid /Glukoz indeksi (TyG) arasında bir ilişki olup olmadığını incelemek amaçlandı.

Gereç ve Yöntem: 65'i 40 yaş altı akut MI geçiren, 65'i kontrol grubu olmak üzere toplam 130 hasta çalışmaya dahil edildi. Retrospektif olarak hastaların klinik durumu, anjiyografi sonuçları, ek hastalıkları, hematolojik ve biyokimyasal belirteçleri ve TyG indexi karşılaştırması yapıldı.

Bulgular: Genç MI geçiren hasta grubunda kontrol grubuna göre glukoz (p=0.001) ve beyaz küre (p<0.001) daha yüksek gözlenirken; yüksek dansiteli lipoprotein (HDL) (p<0.001), albümin (p=0.006) ve hemoglobin (p=0.005) daha düşük izlendi. Genç MI grubu ile kontrol grubu arasında TyG arasında istatiksel olarak anlamlı bir fark izlenmedi.

Sonuç: Bu çalışmada genç MI geçiren hastalar ile TyG arasında bir ilişki gösterilemese de literatürdeki önceki çalışmalar neticesinde yaşlı MI hastalarında kullanımı faydalıdır.

Anahtar Kelimeler: Genç, miyokard infarktüsü, NSTEMI, STEMI, trigliserid/glukoz indeksi.

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INTRODUCTION

Ischemic heart disease is one of the most common causes of mortality and morbidity worldwide. Ischemic heart disease is usually first recognized as an acute coronary syndrome (ACS). ACS is a spectrum of ischemic coronary disease that includes ST elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI) and unstable angina (UA)(1).

ACS, although its incidence increases with age, can also be seen in young patients under 40 years of age. Studies have shown that 2 % to 10 % of acute myocardial infarctions (MI) occur in patients under 40 years of age (2,3).

Investigation of the risk factors of young MI patients shows that risk factors such as smoking, hyperlipidemia, diabetes mellitus (DM) and hypertension (HT) are similar to those of middle-aged and elderly patients (4). In addition, stress, type A behavior, alcohol, cocaine and amphetamine use are more common in young myocardial infarction survivors than in middle-aged and older myocardial infarction survivors (2,5,6,7).

In young adults, insulin resistance, even if not converted to diabetes mellitus, has also been shown to be a risk factor for coronary artery disease (8). It was observed that triglyceride/glucose index (TyG) is an index that predicts insulin resistance, diabetes mellitus and metabolic syndrome in studies (9,10,11). In the literature, there are very few studies investigating the relationship between young MI and TyG. In this study, we aimed to investigate the relationship between TyG and MI in patients younger than 40 years of age.

MATERIAL AND METHOD

Study Design and Settings

The study was carried out with the permission of Gaziantep Islam Science and Technology University Non-Interventional Ethical Clinical Research Ethics Committee on 26.01.2023 with decision number 193.22.18.

The study was conducted in a hospital with a coronary angiography center and 24/7 primary percutaneous intervention. The study was performed retrospectively.

Selection of the Participants

The study included patients under 40 years of age who underwent angiography with the diagnosis of STEMI and NSTEMI between 01.06.2021-01.06.2022. The diagnosis of STEMI and NSTEMI was based on the ESC 4th Universal MI guidelines (12). As the control group in the study, volunteer healthcare workers under the age of 40 who had no history of coronary angiography and whose periodic controls were performed routinely and routinely every 6 months were included.

Measurements and Outcomes

In the study, the clinical status and angiography results of patients with STEMI/NSTEMI under 40 years of age were analyzed. Age, gender, comorbidities were analyzed in the patient group and healthy subjects. Creatinine, glucose, total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), triglycerides, albumin, hemogram and TyG index were compared between the groups.

In the calculation of the TyG index, fasting triglyceride and fasting glucose levels were taken and calculated with the formula Ln [triglyceride (mg/dl) x glucose (mg/dl) /2] (13).

Statistical Analysis

A statistical analysis was performed using "IBM SPSS Statistics for Windows. Version 25.0 (Statistical Package for the Social Sciences, IBM Corp., Armonk, NY, USA)". Descriptive statistics are presented as n and % for categorical variables and median (min-max) or median (IQR) for continuous variables. Data were analyzed for normality assumptions according to Kolmogorov-Smirnov test results, and Mann Whitney U test was used for continuous variables that did not show normal distribution in two-group comparisons. Pearson Chi Square test and Fisher's Exact test were used to compare categorical variables. $p<0.05$ was considered statistically significant.

RESULTS

A total of 130 patients were included in the study. 89.2% (n=116) of the patients were male. The presence of a medical history was found to be statistically significant in the MI group compared to the control group ($p <0.001$) When the diseases were analyzed, no statistically significant finding was found between DM, HT, heart failure (HF), chronic kidney failure (CKF), cerebrovascular disease (CVD) (p= 0058, p=0.244, p=0.496, p=1, p=1). Only a previous history of coronary artery disease (CAD) was statistically significant (p=0.013) (Table 1).

In terms of biochemical markers between the groups, it was observed that glucose level was statistically significantly higher in the patient group than in the healthy group (p=0.001). HDL cholesterol was statistically significantly higher in the healthy group (p< 0.001). Hemogram and albumin levels were significantly higher in the healthy group (p=0.005, p<0.001). In terms of triglyceride/glucose index, no statistically significant relationship was observed between the groups (p=0.444) (**Table 1**).

Table 2 shows the distribution of patients in the patient group according to clinical status as STEMI and NSTEMI. In the patient group, 37 patients were

in the NSTEMI clinic and 28 in the STEMI clinic. When the patients in the NSTEMI and STEMI clinic were evaluated among themselves, no significant difference was observed in terms of diseases in the patients' history. When biochemical markers were analyzed, a statistically significant difference was found between MI groups and triglyceride (p=0.015) and WBC (p<0.001) values. While triglyceride values were higher in the STEMI group, WBC values were higher in the NSTEMI group. In terms of triglyceride/glucose index, no statistically significant relationship was observed between the groups (p=0.083) (**Table 2**).

DISCUSSION

In this study, there was no significant association between young MI and TyG. While glucose and WBC levels were higher, albumin, HDL and hemogram levels were lower in the young myocardial infarction group compared to the healthy group.

When we look at the mechanisms of MI, bleeding into the plaque, inflammation and plaque rupture are at the forefront in middle-aged and elderly patients, while eccentric lesions, plaque erosion and thrombosis are frequently involved in young patients (14-16). Younger patients often have single-vessel MI, whereas older patients often have multivessel infarction(14).

Table 1: Comparison of Clinical Data of Patients in Terms of Groups

Variables	Total	Control	Patient	p
Angiography result, n (%)				
Medical	3 (4,6)	-	-	-
PCI	60 (92,3)	-	-	
CABG	2 (3,1)	-	-	
Gender, n (%)				
Male	116 (89,2)	58 (89,2)	58 (89,2)	1.000[a]
Female	14 (10,8)	7 (10,8)	7 (10,8)	
Medical history, n (%)				
No	119 (91,5)	65 (100)	54 (83,1)	<0.001[a]
Yes	11 (8,5)	0 (0)	11 (16,9)	
DM, n (%)				
No	125 (96,2)	65 (100)	60 (92,3)	0.058[b]
Yes	5 (3,8)	0 (0)	5 (7,7)	
HT, n (%)				
No	127 (97,7)	65 (100)	62 (95,4)	0.244[b]
Yes	3 (2,3)	0 (0)	3 (4,6)	
CAD, n (%)				
No	123 (94,6)	65 (100)	58 (89,2)	0.013[b]
Yes	7 (5,4)	0 (0)	7 (10,8)	
HF, n (%)				
No	128 (98,5)	65 (100)	63 (96,9)	0.496[b]
Yes	2 (1,5)	0 (0)	2 (3,1)	
CKF, n (%)				
No	130 (100,0)	-	-	-
Yes	0 (0,00)	-	-	
CVD, n (%)				
No	130 (100,0)	-	-	-
Yes	0 (0,00)	-	-	
Age, Median (Min-Max)	35,00(24,00-39,00)	31,00(24,00-39,00)	36,00(25,00-39,00)	0.001[c]
Creatinine (mg/dL), Median (IQR)	0,86(0,2)	0,9(0,19)	0,8(0,2)	0.006[c]
Glucose (mg/dL), Median (IQR)	98,5(28,75)	95(16,5)	106(54,5)	0.001[c]
Total Cholesterol (mg/dL), Median (IQR)	176(50,75)	176(47,5)	174(62,5)	0.725[c]
LDL (mg/dL), Median (IQR)	101(42,25)	98(34,5)	104(44,75)	0.183[c]
Triglyseride (mg/dL), Median (IQR)	118(98)	120(96)	116(116,5)	0.500[c]
HDL (mg/dL), Median (IQR)	42(13,25)	47(13,5)	38(11)	<0.001[c]
Albumin (g/L), Median (IQR)	4,2(0,5)	4,3(0,45)	4(0,6)	0.006[c]
Hemoglobin (g/dL), Median (IQR)	15,3(1,6)	15,6(1,45)	14,8(2)	0.005[c]
WBC(10 9/L), Median (IQR)	8,78(4,65)	7,6(2,8)	11,4(5,7)	<0.001[c]
TyG, Median (IQR)	8,75(0,91)	8,74(0,86)	8,78(1,1)	0.444[c]

a:Pearson Chi Square test, b:Fischer Exact Test c:Mann Whitney U test, p<0.05 statistically significant PCI: Percutaneous coronary intervention, CABG: Coronary artery bypass grafting, DM: Diabetes mellitus, HT: Hypertension, CAD: Coronary artery disease, HF: Heart failure, CKF: Chronic kidney failure, CVD: Cerebrovascular disease

Table 2: Comparison of Clinical Data of Patients in Terms of MI Groups

Variables	NSTEMI	STEMI	p
Angiography result , n (%)			
Medical	1 (2,7)	2 (7,1)	0.218[b]
PCI	36 (97,3)	24 (85,7)	
CABG	0 (0)	2 (7,1)	
Gender, n (%)			
Male	33 (89,2)	25 (89,3)	1.000[b]
Female	4 (10,8)	3 (10,7)	
Medical history , n (%)			
No	33 (89,2)	21 (75)	0.184[b]
Yes	4 (10,8)	7 (25)	
DM, n (%)			
No	35 (94,6)	25 (89,3)	0.644[b]
Yes	2 (5,4)	3 (10,7)	
HT, n (%)			
No	36 (97,3)	26 (92,9)	0.573[b]
Yes	1 (2,7)	2 (7,1)	
CAD, n (%)			
No	35 (94,6)	23 (82,1)	0.224[b]
Yes	2 (5,4)	5 (17,9)	
HF, n (%)			
No	36 (97,3)	27 (96,4)	1.000[b]
Yes	1 (2,7)	1 (3,6)	
Age, Median (Min-Max)	35,00(25,00-39,00)	36,00(27,00-39,00)	0.130[c]
Creatinine (mg/dL), Median (IQR)	0,8(0,2)	0,805(0,3)	0.900[c]
Glucose (mg/dL), Median (IQR)	106(50,5)	104(64,75)	0.243[c]
Total Cholesterol (mg/dL),, Median (IQR)	168(51)	184,5(69,5)	0.168[c]
LDL (mg/dL), Median (IQR)	104(43,5)	106(45,13)	0.725[c]
Triglyseride (mg/dL), Median (IQR)	86(90)	142(166)	0.015[c]
HDL (mg/dL), Median (IQR)	38(9,5)	38,5(12,75)	0.614[c]
Albumin (g/L), Median (IQR)	4(0,6)	4,2(0,7)	0.365[c]
Hemoglobin(g/dL), Median (IQR)	14,6(2,1)	14,95(2,03)	0.735[c]
WBC (10 9/L), Median (IQR)	12,64(6,48)	9,325(4,58)	<0.001[c]
TyG, Median (IQR)	8,68(1,03)	8,92(1,32)	0.083[c]

a:Pearson Chi Square test, b:Fischer Exact Test c:Mann Whitney U test, p<0.05 statistically significant. PCI: Percutaneous coronary intervention, CABG: Coronary artery bypass grafting, DM: Diabetes mellitus, HT: Hypertension, CAD: Coronary artery disease, HF: Heart failure, CKF: Chronic kidney failure, CVD: Cerebrovascular disease

As the mechanisms of myocardial infarction change with age, the impact of risk factors leading to myocardial infarction also changes. In young myocardial infarction patients, smoking, obesity, and male gender are the most prominent risk factors (14,17,18). Other risk factors include DM, dyslipidemia, HT, coagulopathy, genetic mutations, type A behavior, alcohol, cocaine and amphetamine use (2,5-14).

DM is less common in younger patients, but its incidence increases with age (19). When we look at the mechanisms of DM, it is known that the mechanism of insulin resistance plays a role in the mechanism of Type 2 DM, which increases in frequency with age (20).

To identify insulin resistance, the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR index) is widely used (21). Recent studies have shown that the TyG index is a simple index that will be useful in predicting insulin resistance like HOMA-IR (10,11,21).

Considering the acute MI studies on the TyG index; in a study analyzing 1092 acute STEMI patients, major adverse cardiac and cerebrovascular events (MACCE) were found to be higher in patients who underwent percutaneous coronary intervention (PCI) for STEMI in those with a higher TyG index (22). In another study in patients with NSTEMI, another type of acute myocardial infarction, high major adverse cardiovascular events (MACE) were observed in patients with high TyG index (23). Moreover, another study on the TyG index showed that a high TyG index was also associated with a high prevalence of CAD (24).

In this study, no significant TyG difference was found between the acute MI group and the healthy control group. One of the reasons for this may be that patients were younger than 40 years of age, while the mean age was approximately 60 years in the studies in which significant differences were observed (22,23,24). This may be related to the fact that patients were younger

and the contribution of insulin resistance to the occurrence of myocardial infarction was less.

The fact that the patient group had a history of CAD between the two groups was found to be statistically significant in this study. Patients with CAD usually use statins in addition to antiaggregants due to lower lipid targets. Therefore, there may not have been a significant difference in triglyceride levels between the patient group and the control group. A limitation of this study is that the medications used by patients with CAD were not questioned.

CONCLUSION

TyG index is an easily calculable index that predicts insulin resistance and has been shown to be associated with acute MI in many studies. Although its association with young MI patients could not be demonstrated in this study, its use in elderly MI patients is useful.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Gaziantep Islam Science and Technology University Non-Interventional Ethical Clinical Research Ethics Committee on 26.01.2023 with decision number 193.22.18.

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The author has no conflicts of interest to declare.

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REFERENCES

1. Byrne RA, Rossello X, Coughlan JJ, et al. ESC Scientific Document Group. 2023 ESC Guidelines for the management of acute coronary syndromes. European heart journal, 2023; ehad191. Advance online publication.
2. Trzos E, Uznańska B, Rechciński T, Krzemińska-Pakuła M, Bugała M, Kurpesa M. Myocardial infarction in young people. Cardiology Journal, 2009; 6(4): 307-311.
3. Jalowiec DA, Hill JA. Myocardial infarction in the young and in women. Cardiovascular clinics, 1989; 20(1):197-206.
4. Sood A, Singh A, Gadkari C. Myocardial Infarction in Young Individuals: A Review Article. Cureus, 2023;15:4.
5. Faresjo A, Karlsson JE, Segerberg H, Faresjo T, Lebena, A. Cardiovascular and psychosocial risks among young patients with Acute Myocardial Infarction.2023;23:121
6. Spencer FA, Goldberg RJ, Becker RC, Gore JM. Seasonal distribution of acute myocardial infarction in the second National Registry of Myocardial Infarction. J Am Coll Cardiol 1998;31:61226–33.
7. Gao H, Wang Y, Shen A, Chen H, Li H. Acute myocardial infarction in young men under 50 years of age: clinical characteristics, treatment, and long-term prognosis. International Journal of General Medicine, 2021; 9321-9331.
8. Eddy D, Schlessinger L, Kahn R, Peskin B, Schiebinger R. Relationship of insulin resistance and related metabolic variables to coronary artery disease: a mathematical analysis. Diabetes care, 2009; 32 (2): 361–366.
9. Çetin Şanlıalp S , Nar G, Gunver MG. Elevated triglyceride glucose index is related to the presence of heart failure. Journal of Istanbul Faculty of Medicine ,2022; 85(1): 51-58 .
10. Selvi NMK, Nandhini S, Sakthivadivel V, Lokesh S, Srinivasan AR, Sumathi S. Association of Triglyceride-Glucose Index (TyG index) with HbA1c and Insulin Resistance in Type 2 Diabetes Mellitus. Maedica, 2021;16(3): 375–381.
11. Zhang X, Zhang T, He S. et al. Association of metabolic syndrome with TyG index and TyG-related parameters in an urban Chinese population: a 15-year prospective study. Diabetol Metab Syndr 2022;14: 84
12. Thygesen K, Alpert JS, Jaffe AS, et al. Executive Group on behalf of the Joint European Society of Cardiology (ESC)/American College of Cardiology (ACC)/American Heart Association (AHA)/ World Heart Federation (WHF) Task Force for the Universal Definition of Myocardial Infarction. Fourth universal definition of myocardial infarction. Circulation, 2018;138(20): e618-e651.
13. Simental-Mendía LE, Rodríguez-Morán M, Guerrero-Romero F. The product of fasting glucose and triglycerides as surrogate for identifying insulin resistance in apparently healthy subjects. Metabolic syndrome and related disorders,2008; 6(4): 299–304.
14. Sagris M, Antonopoulos AS, Theofilis P, et al. Risk factors profile of young and older patients with myocardial infarction. Cardiovascular Research,2022: 118(10):2281-2292.
15. Kitulwatte ID, Pollanen MS. A comparative study of coronary atherosclerosis in young and old. Am J Forensic Med Pathol 2015;36:323–326.
16. Virmani R, Kolodgie FD, Burke AP, Farb A, Schwartz SM. Lessons from sudden coronary death: a comprehensive morphological classification scheme for atherosclerotic lesions. Arterioscler Thromb Vasc Biol 2000;20:1262–1275.
17. Larsen GK, Seth M, Gurm HS. The ongoing importance of smoking as a powerful risk factor for ST-segment elevation myocardial infarction in young patients. JAMA Intern Med 2013;173:1261–1262.
18. Roever L, Resende ES, Diniz AL, Penha-Silva N, Veloso FC, Casella-Filho A, Dourado PM, Chagas AC. Ectopic adiposopathy and association with cardiovascular disease risk factors: the Uberlandia Heart Study. Int J Cardiol 2015;190:140–142.
19. Lovic D, Piperidou A, Zografou I, Grassos H, Pittaras A, Manolis A. The Growing Epidemic of Diabetes Mellitus. Current vascular pharmacology, 2020;18(2):104–109.
20. Petersen KF, Dufour S, Morino K, Yoo PS, Cline GW, Shulman GI. Reversal of muscle insulin resistance by weight reduction in young, lean, insulin-resistant offspring of parents with type 2 diabetes. Proceedings of the National Academy of Sciences of the United States of America,2012; 109 (21): 8236–8240.
21. Tahapary DL, Pratisthita LB, Fitri NA, et al. Challenges in the diagnosis of insulin resistance: Focusing on the role of HOMA-IR and Tryglyceride/glucose index. Diabetes & metabolic syndrome, 2022;16(8): 102581.
22. Luo E, Wang D, Yan G, et al. High triglyceride-glucose index is associated with poor prognosis in patients with acute ST-elevation myocardial infarction after percutaneous coronary intervention. Cardiovascular diabetology, 2019; 18(1): 150.
23. Mao Q, Zhou D, Li Y, Wang Y, Xu SC, Zhao XH. The Triglyceride-Glucose Index Predicts Coronary Artery Disease Severity and Cardiovascular Outcomes in Patients with Non-ST-Segment Elevation Acute Coronary Syndrome. Disease markers, 2019; 6891537.
24. da Silva A, Caldas APS, Hermsdorff HHM, et al. Triglyceride-glucose index is associated with symptomatic coronary artery disease in patients in secondary care. Cardiovasc Diabetol 2019;18: 89