

Comparison of Clinical Profiles, Angiographic Features and Outcomes of Young and Elderly Patients with ST-Segment Elevation Myocardial Infarction

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ABSTRACT

Objective: It is to reveal the differences between clinical, angiographic, in-hospital and one-year follow-up results between young and elderly patients with acute ST-segment elevation myocardial infarction.

Materials and Methods: This study was designed retrospectively in two centers. 2891 patients were screened; 260 of which were young. 260 elderly patients were randomly selected among the patients and the differences between both groups were evaluated.

Results: The median age of the young patients was 37 (34-39) years and the median age of the elderly patients was 65 (56-73) years, and male gender was dominant in both groups. Young patients were more likely to be admitted with Killip class 1, while older patients were more likely to be admitted with Killip class 2 ($P=0.002$). Single-vessel disease was more common in young patients (81.0% vs. 46.3%; $P<0.001$), while multi-vessel disease was more common in the elderly patients (19.0% vs. 53.7%; $P<0.001$). In one-year follow-up, all-cause hospitalization was lower in younger patients, but there was no significant difference in mortality between elderly and young patients.

Conclusion: Young patients presenting with ST-segment elevation myocardial infarction were more frequent smokers, obese and dyslipidemic and although in-hospital outcomes were better than the elderly, one-year mortality was similar to those of the elderly.

Keywords: Myocardial infarction, young patients with MI, elderly patients, outcome

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INTRODUCTION

ST-segment elevation myocardial infarction (STEMI) is one of the most common causes of emergency room admission and cardiovascular death and therefore currently poses a major burden on healthcare worldwide [1,2]. Although the incidence of acute coronary syndrome has decreased in the elderly population in recent years, unfortunately, there is no decrease in the incidence of STEMI in young people [3]. In some studies, although the short-term prognosis of acute STEMI is favorable in young patients, it has been reported that the long-term prognosis is unfavorable [4]. STEMI,

with an increasing incidence in young adults, is an important problem for both the patient and the treating physician [5,6]. In recent studies, it was stated that the prevalence of acute STEMI increased significantly in young people. Therefore, recent studies have focused on the clinical profile, risk factors, treatment and long-term consequences of premature myocardial infarction (MI) in young people [7]. While it is important to have MI at an early age, there is not enough data on the etiology and long-term prognosis of this disease, since the most productive life years of the society are at risk

due to this disease. In this study, it was aimed to compare the clinical profiles, risk factors, in-hospital and one-year clinical outcomes of young and old patients with STEMI.

MATERIALS AND METHODS

Study population

This study was carried out retrospectively at two centers between June 2015 and June 2020. The study included 260 patients younger than 45 years of age who applied to the emergency department with the diagnosis of acute STEMI and were hospitalized in the coronary intensive care unit who underwent reperfusion therapy. 260 patients older than 45 years who were admitted to the hospital during the study period were randomly selected. The clinical profiles, risk factors, angiographic features, in-hospital and one-year clinical outcome of these patient groups were compared. Demographic information of the patients, age, gender, coronary artery disease (CAD) risk factors, cardiovascular disease histories, laboratory results were obtained from the records in the electronic system of the hospitals. The family histories and one-year results of the patients were learned by telephone call method.

Definitions

In this study, patients were divided into two groups, according to the current European Society of Cardiology guidelines, patients younger than 45 years were defined as "young" and patients older than 45 years were defined as elderly [8]. STEMI was defined according to the 4th universal MI guideline [9]. The type and localization of myocardial infarction were determined according to electrocardiographic (ECG) findings. The patients were divided into two groups according to their body mass index (BMI) (<25 and >25 kg/m²). Patients with a body mass index >25 kg/m² were defined as obese. Dyslipidemia was defined as serum total cholesterol (TC) ≥ 200 mg/dl; triglyceride (TG) >150 mg/dl; low-density lipoprotein (LDL) >130 mg/dl; high-density lipoprotein (HDL) <50 mg/dl in men and <40 mg/dl in women; and/or those receiving lipid-lowering therapy [10]. The term re-infarction was defined as the ischemic symptoms lasting 20 minutes or longer and at least one of the following: recurrence of ≥ 0.1 mV ST-segment elevation in

at least two contiguous leads on the ECG, or the appearance of new pathognomonic Q waves, and a 20% or greater increase in cardiac troponin [11]. TIMI thrombus scale was used to evaluate thrombus burden [12]. Then, the TIMI thrombus score was divided into two classes as large thrombus grade (4 and 5) and small thrombus grade (1-3 grade)[13]. Castelli's risk index 1 and 2 (CRI-1 and CRI-2) were defined as TC/HDL-c and LDLc/HDL-c ratios. In-hospital outcomes included left ventricular ejection fraction (LVEF) before discharge, reinfarction, cardiogenic shock, stroke, major bleeding, non-major bleeding, blood transfusion and all-cause mortality. One-year clinical outcome was defined as hospitalization for any cause, MI, coronary angiography, cardiovascular death and all-cause death. Patients with the following conditions were excluded from the study: Congenital heart disease, cardiomyopathy, myocarditis, MI due to aortic dissection, Takayasu arteritis or vascular dysplasia, those who did not undergo coronary angiography who had an acute MI during pregnancy and in-hospital. The study was approved by the local ethics committee.

Statistical Analysis

Continuous data are given as median (Q1 - Q3). Categorical data are given as a percentage (%). Shapiro Wilk's test was used to investigate the suitability of the data for normal distribution. The Mann-Whitney U test was used for the cases with two groups in the comparison of those which did not conform to the normal distribution. Pearson Exact Chi-Square analyzes were used in the analysis of the created cross tables. IBM SPSS Statistics 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) program was used in the analysis. A value of $p < 0.05$ was accepted as a criterion for statistical significance.

RESULTS

Demographic findings and risk factors

A total of 2891 acute STEMI patients, 260 (9%) of which were young (≤ 45 years), were screened for inclusion in the study. The median age of the young patients was 37 (34-39) years and the median age of the elderly patients was 65 (56-73) years. While the male gender was dominant in both groups,

there was no statistically significant difference in both groups ($P=0.529$). When evaluated in terms of CAD risk factors, diabetes mellitus (DM) (35.5% vs. 13.8%; $P<0.001$), hypertension (HT) (52.5% vs. 15.4%; $P<0.001$), CAD history (28.6% vs. 10.0%; $P<0.001$), chronic renal failure (CRF) (5.4% vs. 0.4%; $P<0.001$) were significantly more common in the elderly than in the young patients. Smoking (65.1% vs. 43.4%; $P<0.001$), dyslipidemia (34.5% vs. 16.6%; $P<0.001$), family history (23.6% vs. 5.0%; $P<0.001$) and BMI >25 kg/m² (25.0% vs. 20.0%; $P=0.035$) were more common in young people. Considering the duration of admission to the hospital and symptoms, younger patients were more likely to be admitted with Killip class 1, while the elderly were more likely to be admitted with Killip class 2 ($P=0.002$). The median time from symptom onset to admission to the emergency department was detected longer in the elderly [60(45-120) vs. 45(35-90); $P<0.001$]. When evaluated in terms of the type of MI, while young people were more likely to present with anterior MI, the elderly were more likely to present with inferior MI [55.8% vs. 36.2%), (52.3% vs. 28.5%); $P<0.001$ for both] (Table 1).

Laboratory findings

When evaluated in terms of laboratory parameters, hemoglobin (Hgb) (15.4 \pm 1.5 vs. 14.4 \pm 1.89; $P<0.001$), TC (209.4 \pm 55.2 vs. 189.3 \pm 43.8; $P<0.001$), LDL-C (132.3 \pm 45.0 vs. 125.4 \pm 36.4; $P=0.049$) and TG (187.4 \pm 123.4 vs. 148.2 \pm 86.1) values were found to be higher in young patients, while HDL-C (40.9 \pm 9.6 vs. 37.4 \pm 7.1; $P<0.001$) was lower in young patients than in the elderly (Table 2).

Angiographic findings

In terms of coronary angiographic findings, the duration of fluoroscopy was shorter in the young compared to the elderly (25.06 \pm 11 vs. 33.9 \pm 12; $P<0.001$). As a result of coronary angiography performed after STEMI, normal coronary arteries (5.1% vs. 1.2%; $P<0.005$) and single vessel disease (81.0% vs. 46.3%; $P<0.001$) was more common in the young, whereas multivessel disease was more common (53.7% vs. 19.0%; $P<0.001$) in the elderly. When the thrombus burden was examined, there was no significant difference between both groups in terms of small thrombi, while large thrombi (50.4% vs. 33.1%; $P<0.001$) were significantly more common in the young than in the elderly. Angiographic findings are summarized in table 3 in detail.

Comparison of findings of in-hospital and one-year clinical outcomes

When evaluated in terms of in-hospital clinical outcomes, length of stay in intensive care unit (2(2-3) vs. 1(1-1) days; $P=0.026$), major bleeding (3.1% vs. 0.4%; $P=0.018$), re-infarction (5.4% vs. 2.3%), cardiogenic shock (12.7% vs. 3.1%; $P<0.001$), LVEF before discharge (54.56 \pm 8.6 vs. 46.36 \pm 10.9%, and in-hospital mortality (8.8% vs. 1.9%; $P<0.001$) differed significantly between both groups.

In 1-year clinical outcomes, all-cause hospitalizations (43.0% vs. 25.7%; $P=0.001$) and hospitalizations due to heart failure (HF) (12.7% vs. 5.1%; $P=0.005$) were more common in the elderly, but there was no difference between both groups in terms of MI, revascularization, stroke, all-cause death and cardiovascular death. In-hospital and one-year outcomes are detailed in Table 4.

DISCUSSION

In this retrospective study performed in two centers evaluating 520 patients including 260 young and 260 elderly, patients aged ≤ 45 years constituted 9% of the total study population and male gender was more dominant (83.8%). More than half (65.1%) of the young patients were smokers, one-third (34.5%) had dyslipidemia and 23.1% had a history of CAD in their first-degree relatives, and also 25% of the youth were obese. Low density lipoprotein cholesterol in the blood values taken in the first 24 hours were found to be higher in young patients, while HT, DM and kidney failure were higher in the elderly. Castelli risk index (CRI) 1 and 2 were found to be higher in young patients than in the elderly. Although the in-hospital outcomes of patients aged ≤ 45 were better, there was no difference in mortality in the one-year follow-up compared to patients aged >45 years. Although there is not enough data on the incidence of acute MI in young people, it has been reported to be between 4-10%. In our study, the incidence of MI was found to be 9%, which is consistent with other studies, although it is higher than the Norwegian registry study [14]. Because the definition of acute MI has changed a few times over the past decade and various studies have used different inclusion criteria, it is difficult to compare incidence rates through different time periods and in different populations [15,16]. The clinical presentation of CAD in patients younger than 45

Table 1. Comparison of baseline characteristics and risk factors of the study population.

Variables	≤45 years, STEMI n=260	>45 years, STEMI n=260	P
Median (IQR), age, years	37(34-39)	65(56-73)	<0.001
Male, n (%)	218(83.8%)	195(75%)	0.529
CAD Risk factors			
DM, n (%)	36(13.8%)	92(35.5%)	<0.001
HT, n (%)	40(15.4%)	136(52.5%)	<0.001
Chronic renal failure, n (%)	1(0.4%)	14(5.4%)	<0.001
CAD history, n (%)	26(10.0%)	74(28.6%)	<0.001
Smoking, n (%)	168(65.1%)	112(43.4%)	<0.001
Dyslipidemia, n (%)	82(34.5%)	43(16.6%)	<0.001
Family history, n (%)	61(23.6%)	13(5.0%)	<0.001
BMI >25 kg/m ² , n (%)	65(25%)	52(20%)	0.035
Hospital admission symptom			
Typical angina, n (%)	248(95.4%)	233(90.0%)	<0.001
Dyspnea, n (%)	44 (16.9%)	75(29%)	<0.001
Syncope, n (%)	0(0.0%)	15(5.8%)	0.073
Prehospital cardiac arrest, n (%)	14 (5.4%)	15 (5.8%)	0.500
Killip classification			
• Class I	223 (85.5%)	188 (72.3%)	0.002
• Class II	23 (8.8%)	37 (14.2%)	
• Class III	8 (3.1%)	20(7.7%)	
• Class IV	6(2.3%)	15(5.8%)	
Time from symptom onset - to ED (Q1-Q3) ^a	45(35-90)	60(45-120)	<0.001
Type of myocardial infarction			
Anterior myocardial infarction, n (%)	145 (55.8%)	94 (36.2%)	<0.001
Anterolateral myocardial infarction, n (%)	17 (6.5%)	5 (1.9%)	0.007
Inferior myocardial infarction, n (%)	74 (28.5%)	136 (52.3%)	<0.001
Posterior myocardial infarction, n (%)	15 (5.8%)	11(4.2%)	0.273
Other type of MI	9 (3.5%)	14 (5.4%)	0.197

^a These times were calculated on 426 patients due to the missing data of some patients.

Abbreviations: BMI: body mass index, CAD: coronary artery disease, ED: emergency department, DM: diabetes mellitus, HT: hypertension, MI: myocardial infarction.

Table 2. Comparison of laboratory values between the two groups.

Variables	≤45 years, STEMI n=260	>45 years, STEMI n=260	P
Hemoglobin, g/dL, ±SD	15.4±1.5	14.4±1.89	<0.001
WBC, g/dl, (Q1-Q2)	11.5(9.0-14.8)	11.4(9.31-14.8)	0.832
Neutrophil, 10 ³ /μL, (Q1-Q2)	7.13(5.2-10.3)	7.7(5.63-10.71)	0.150
PLT, (Q1-Q2)	254(215.5-314.2)	237(193.0-289.0)	0.005
Glucose, mg/dL, (Q1-Q2)	112(98-142)	150(120.5-216.7)	<0.001
Creatinine, mg/dL, (Q1-Q2)	0.86(0.76-1.03)	0.98(0.82-1.19)	<0.001
Na, ±SD	137±3.1	137±3.44	0.701
K, ±SD	4.2±0.4	4.38±0.63	0.010
Total cholesterol, g/L, ±SD	209.4±55.2	189.3±43.8	<0.001
LDL cholesterol, g/L, ±SD	132.3±45.0	125.4±36.4	0.049
HDL cholesterol, g/L, ±SD	37.4±7.1	40.9±9.6	<0.001
TG, g/L, ±SD	187.4±123.4	148.2±86.1	<0.001
Castelli 1, ±SD	5.78±2.1	4.8±1.3	<0.001
Castelli 2, ±SD	3.63±1.65	3.18±1.05	0.001

Abbreviations: HDL: high density lipoprotein, K: potassium, LDL: low density lipoprotein, Na: sodium, PLT: platelets, TG: triglyceride, WBC: white blood cell.

Table 3. Comparison of angiographic findings and in-hospital medications of the young and old patients.

Variables	≤45 years, STEMI n=260	>45 years, STEMI n=260	P
Radial access, n (%)	11(4.2%)	3(1.2%)	0.020
Femoral access, n (%)	245(94.6%)	256(98.8%)	0.010
Fluoroscopy time, ±SD	25.06±11	33.9±12	<0.001
Fibrinolytic, n (%)	1(0.4%)	1(0.4%)	-
Primary coronary intervention, n (%)	237 (97.1%)	243(98.3%)	0.590
DES, n (%)	211(87.2%)	213(82.9%)	0.054
BMS, n (%)	12(5.0%)	6(2.3%)	0.019
CABG, n (%)	14(5.4%)	37(14.3%)	0.001
Number of involved vessels			
Normal coronary, n (%)	13 (5.1%)	3(1.2%)	0.011
Single vessel, n (%)	200(81.0%)	118(46.3%)	<0.001
More than one vessel, n (%)	47(19.0%)	137(53.7%)	<0.001
Culprit coronary artery			
LMCA, n (%)	6(2.3%)	4(1.6%)	0.385
LAD, n (%)	151(58.1%)	97(37.9%)	<0.001
CX, n (%)	31(11.9%)	38(14.8%)	0.199
RCA, n (%)	55(21.2%)	104(40.6%)	<0.001
Other coronary arteries, n (%)	6 (2.3%)	10 (3.9%)	0.214
Thrombus burden			
Small thrombus, n (%)	82(31.5%)	72(27.7%)	0.194
Large thrombus, n (%)	131(50.4%)	86(33.1%)	<0.001
Thrombus aspiration, n (%)	20 (7.8%)	3(1.2%)	0.001
Before the procedure TIMI flow 0-1	243(93.5%)	225 (87.9%)	0.021
After the procedure TIMI flow 3	252(96.9%)	232(89.9%)	0.001
Medications			
Acetylsalicylic acid, n (%)	252(99.6%)	259(100%)	0.494
Clopidogrel / prasugrel / ticagrelor, n (%)	252(99.6%)	247(96.6%)	0.386
LMWH, n (%)	236(92.6%)	251(97.3%)	0.008
Glycoprotein 2b/3a inhibitors, n (%)	73 (28.6%)	23(8.3%)	<0.001
Betablockers, n (%)	127(50.4%)	158(61.2%)	0.008
Statin, n (%)	246(95.3%)	231(90.6%)	0.026
ACEI/ARB, n (%)	104(40.8%)	144(55.8%)	<0.001

Abbreviations: ACE: angiotensin converting enzyme, ARB: angiotensin receptor blocker, BMS: Bare metal stent, CABG: Coronary bypass graft surgery, DES: Drug eluting stent, IV: Intravenous, PCI: Percutaneous coronary intervention, PTCA: percutaneous coronary angioplasty.

years old may differ from that in older patients. Typical chest pain, which is the first symptom of acute MI, was more common in the young than in the elderly, consistent with previous studies [6,17]. While young people were mostly admitted with Killip class 1, the elderly were admitted more with Killip class 2, 3 or 4. In previous studies, it was stated that elderly patients were more likely to present with HF symptoms due to the prevalence of advanced CAD and low LVEF [18-20].

In young people with acute MI, it is common to have multiple risk factors and the majority of these patients are reported to have at least

one traditional cardiovascular risk factor [21,22]. Smoking is the most preventable universal cause of death by leading to the initiation and progression of atherosclerosis [23]. Smoking cessation greatly reduces the risk of CAD and there are striking results reporting that giving up before age 40 reduces the risk of death by 90% [23]. Consistent with previous studies, in our study, the rate of smoking was higher in young people than in the elderly (43.4% versus 65.1%)[7,24,25]. These data explain the importance of smoking cessation over early MI [26]. Low density lipoprotein cholesterol and TG values were found to be higher in young people than in

Table 4. Comparison of in-hospital and one-year clinical outcomes of young and elderly patients.

Variables	≤45 years, STEMI n=260	>45 years, STEMI n=260	P
In-hospital clinical outcomes			
Total hospital stay, days (IQR)	4(3-5)	4(3-6)	0.232
ICU stay, days (IQR)	1(1-1)	2(2-3)	0.026
Major bleeding, n (%)	1(0.4%)	8(3.1%)	0.018
Requiring for blood transfusion, n (%)	1(0.4%)	9(3.5%)	0.010
Re-infection, n (%)	6(2.3%)	14(5.4%)	0.054
Cardiogenic shock, n (%)	8(3.1%)	33(12.7%)	<0.001
Stroke, n (%)	1(0.4%)	2(0.8%)	0.499
AV block, n (%)	4(1.5%)	16(6.2%)	0.005
VT, n (%)	9(3.5%)	17(6.5%)	0.079
VF, n (%)	23(8.8%)	17(6.5%)	0.205
AF, n (%)	7(2.7%)	17(5.4%)	0.095
LVEF before discharge ±SD ^a	54.5±8.6	46.3±10.9	<0.001
Death, n (%)	5(1.9%)	23(8.8%)	<0.001
One-year clinical outcome			
All-causes hospitalization ^b , n (%)	66(25.7%)	95(43.0%)	0.001
Hospitalization due to HF, n (%)	11(5.1%)	33(12.7%)	0.005
Myocardial infarction ^c , n (%)	11(4.3%)	12(5.5%)	0.349
Revascularization ^c , n (%)	44(17.1%)	44(20.1%)	0.237
Stroke, n (%)	1(0.5%)	3(1.2%)	0.400
Cardiovascular mortality ^c , n (%)	4(1.6%)	7(3.2%)	0.189
All-causes death ^d , n (%)	1(0.4%)	2(0.9%)	0.444

^a Since 20 patients did not have LVEF information, it was calculated over 500 patients.

^b Since the data of 42 patients could not be reached; analysis was performed on 478 patients.

^c Since the data of 44 patients could not be reached; analysis was performed on 476 patients.

^d The data of 3 patients from the young patient group and 39 patients from the elderly patient group could not be reached.

Abbreviations: AV: Atrioventricular, AF: Atrial fibrillation, ICU: Intensive care unit, LVEF: Left ventricular ejection fraction, VF: Ventricular fibrillation, VT: Ventricular tachycardia.

the elderly, while HDL was found to be lower in this study, as well. These results were consistent with previous studies [27,28]. High TG and low HDL levels, which characterize the dyslipidemia aspect of the metabolic syndrome, have a significant role in the development of atherosclerosis and coronary heart disease. In addition, BMI>25 kg/m² was also significantly higher in the young than in the elderly in this study. All these results show that it is important to carefully examine young patients in terms of metabolic syndrome, which is one of the most important causes of CAD and atherosclerosis [29]. In previous studies, it has been reported that CRI is an important risk index in terms of CAD and cardiovascular outcomes in the elderly and in patients with DM [30,31]. However, there is no information regarding its importance in young people with CAD. Although it has been reported that LDL increases with age in some previous studies [14], it has been shown that LDL value is higher in young people in recent studies.

In this study, both CRI 1 and CRI 2 were found to be higher in young people. Of course, the results of our study may not be sufficient to predict future clinical outcomes of CRI alone. Larger prospective studies are required on this subject.

The relationship between a positive family history and early CAD and increased plaque burden is well known. In our study, 1 out of every 5 young patients had a positive family history, and it was significantly higher in younger patients than in patients aged >45 years. Although this rate was reported as 10% in some previous studies, the results of our study were similar to those of most recent studies [23,32].

Consistent with the results of previously reported studies, in our study, normal coronary (5.1%) and single vessel disease (81.0%) were more common in patients aged ≤ 45 years, while multi-vessel disease (53.7%) was dominant in patients aged >45 years [20,23,29,32,33]. In the meanwhile, similar to the results of previous studies, in our study, left

anterior descending artery (LAD) was the most common involved artery (58.1%) in the young, so was the right coronary artery (RCA) (40.6%) in the elderly [20,34]. In addition, the thrombus load was significantly higher in young patients than in the elderly, and therefore more thrombus aspiration was performed in young patients. This result can be attributed to the fact that younger patients with acute MI are more prone to thrombus formation. Consistent with our study, a high thrombus burden was reported in young patients in the study of Shalaby et al. [7].

Under the light of clinical outcomes, the outcomes of our study are similar to previous studies in terms of in-hospital clinical outcomes, but differ in one-year mortality (Table 4). As in this study, in previous studies, young patients with acute MI had a better prognosis than the elderly in terms of length of stay in the intensive care unit, in-hospital cardiogenic shock, HF and mortality. These results can be attributed to the earlier admission of young patients to the hospital, fewer co-morbidities, more frequent single vessel involvement and less frequent severe atherosclerosis [20,35,36]. Previous data suggest that younger patients with MI have a relatively favorable short and long-term prognosis compared with older patients. However, some studies have shown an alarming 15% reduction in survival at 7 years, after 5 years of MI [37-39]. In a recent study, in which the age of 35 was taken into account, it was shown that there was no significant difference in prognosis between both groups in a 4-year follow-up [39]. In our study, in terms of one-year results, while young patients were more advantageous in terms of all-cause hospitalization and hospitalization due to HF, there was no statistically significant difference between elderly and young patients in terms of mortality. In a study published by Fach A et al. in 2019, only a few of 277 young MI patients achieved the risk control goals planned for long-term follow-up after MI. The target level was achieved in 14.8% for body mass index and 27% for LDL level, and the results were shown to be even worse in the follow-up [40]. One of the reasons why the mortality result in our study differs from previous studies can be explained by the progressively worsening of MI prognosis in younger patients over time compared to the past. Another reason may be the small number of

patients included in the study and the fact that 43 patients could not be reached during one-year follow-up.

Our study has some limitations. Firstly, it is a retrospective study with most of the patients' data from hospital records. Secondly, the patients were divided into two groups and the control group was randomly selected from the entire patient population as the number of young patients. Third, conditions such as genetic diseases and spontaneous coronary artery dissection, which are among the most important etiologies of acute MI at an early age, could not be evaluated due to the retrospective nature of the study.

CONCLUSION

Young patients presenting with STEMI were more frequent smokers, obese and dyslipidemic. These patients also had greater thrombus burden and a greater prevalence of single vessel disease. In addition, one-year mortality outcomes were similar to those in the elderly although in-hospital outcomes were better in younger patients. These results highlight the importance of smoking cessation, weight loss programs and health education, especially for the population of this age.

Author contribution

Study conception and design: BM; data collection: SM and BM; analysis and interpretation of results: BM; draft manuscript preparation SM and BM. All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by the Eskisehir Osmangazi University ethical committee (2020-438/03/11.2020).

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Conflict of interest

The authors declare that there is no conflict of interest.

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