Baseline clinical characteristics and patient profile of the TURKMI registry: Results of a nation-wide acute myocardial infarction registry in Turkey

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Abstract

Objective: The TURKMI registry is designed to provide insight into the characteristics, management from symptom onset to hospital discharge, and outcome of patients with acute myocardial infarction (MI) in Turkey. We report the baseline and clinical characteristics of the TURKMI population.

Methods: The TURKMI study is a nation-wide registry that was conducted in 50 centers capable of percutaneous coronary intervention selected from each EuroStat NUTS region in Turkey according to population sampling weight, prioritized by the number of hospitals in each region. All consecutive patients with acute MI admitted to coronary care units within 48 hours of symptom onset were prospectively enrolled during a predefined 2-week period between November 1, 2018 and November 16, 2018.

Results: A total of 1930 consecutive patients (mean age, 62.0±13.2 years; 26.1% female) with a diagnosis of acute MI were prospectively enrolled. More than half of the patients were diagnosed with non-ST elevation MI (61.9%), and 38.1% were diagnosed with ST elevation MI. Coronary angiography was performed in 93.7% and, percutaneous coronary intervention was performed in 73.2% of the study population. Fibrinolytic therapy was administered to 13 patients (0.018%). Aspirin was prescribed in 99.3% of the patients, and 94% were on dual antiplatelet therapy at the time of discharge. Beta blockers were prescribed in 85.0%, anti-lipid drugs in 96.3%, angiotensin converting enzyme inhibitors in 58.4%, and angiotensin receptor blockers in 7.9%. Comparison with European countries revealed that TURKMI patients experienced MI at younger ages compared with patients in France, Switzerland, and the United Kingdom. The most prevalent risk factors in the TURKMI population were hypercholesterolemia (60.2%), hypertension (49.5%), smoking (48.8%), and diabetes (37.9%).

Conclusion: The nation-wide TURKMI registry revealed that hypercholesterolemia, hypertension, and smoking were the most prevalent risk factors. TURKMI patients were younger compared with patients in European Countries. The TURKMI registry also confirmed that current treatment guidelines are largely adopted into clinical cardiology practice in Turkey in terms of antiplatelet, anti-ischemic, and anti-lipid therapy. *(Anatol J Cardiol 2020; 24: 43-53)*

Keywords: acute myocardial infarction, registry, Turkey, coronary artery disease

Introduction

Management of acute coronary events has evolved rapidly during the past decades (1, 2). Practice guidelines have also improved recommendations with more aggressive targets based on the results of randomized controlled trials. Implementation of these guidelines is associated with an improvement in care and a significant reduction of major adverse coronary events. However, national registries have shown significant gaps between the recommendations of guidelines and their implementation into clinical practice in real-life settings (2). Many countries have reviewed national health policies with the help of these registries to address the extent to which current guidelines have been implemented (3-7). Moreover, many countries continuously revise their health policies to capture updated standards by repeating the national acute coronary registrations in certain time periods. In Turkey, there is no up-to-date registry representing the country's population of patients with acute myocardial infarction (MI), but there are a few registries that provide information regarding the management of acute MI. Some of these are generalized and based on localized data; most are not representative of the Turkish population (8-10). The only acute MI registry with a high level of representation, TUMAR, was conducted 20 years ago, at a time when noninvasive treatment was more popular and new treatment modalities were not available. Therefore, the results of TUMAR cannot be compared with current practice (11). TURKMI, a nation-wide registry, was conducted to provide insight into the current real-life management of patients with acute MI in cardiology centers representing the population of Turkey. TURKMI also includes demographic information about patients presenting with acute MI in Turkey. In this study, we report the baseline characteristics and patient profile of the TURKMI population (3, 5, 6).

Methods

TURKMI was conducted as a 15-day snapshot registry to enroll consecutive patients with acute MI and evaluate the burden and variation of MI care and outcomes regarding adherence to current practice guidelines in Turkey. The rationale and design of the study have been described in detail previously (12). Briefly, all consecutive patients with acute MI who were admitted to the coronary care units of 50 cardiology clinics within 48 hours of symptom onset were prospectively enrolled between the dates of November 1 and November 15, 2018. The 50 cardiology clinics represented the 12 EuroNUTS statistical regions of Turkey proportional to Turkey's 2018 census (12, 13). Figure 1 shows the distribution of centers representing Turkey's population in the 12 EuroNUTS regions. All centers were chosen as emergent centers capable of percutaneous coronary intervention (PCI). There was an angiography team on duty 24 hours a day in 34 centers and an on-call team was available in 16 locations. The study protocol has been reviewed and approved by the Ethics Committee University of Health Sciences, Istanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital (No: 2018-46 on October 9, 2018). Written informed consent was obtained from all participants.

Men and women aged 18 years or older were enrolled if they fulfilled the following inclusion criteria; 1) hospitalized within 48 hours of onset of symptoms of the index event, 2) had a final (discharge) diagnosis of acute MI, either ST elevation MI (STEMI) or non-ST elevation (NSTEMI) with positive troponin levels, and 3) provided signed informed consent. Patients unwilling or unable to provide consent were excluded (n=3).

Diagnosis of MI was based on both elevated troponin levels and presence of at least 1 of the criteria (12, 14), including symptoms compatible with myocardial ischemia, new, or presumed new significant ST-T wave changes, left bundle branch block

(LBBB) on 12-lead electrocardiogram (ECG) or new pathological Q wave on ECG (14). ST elevation consistent with MI was defined as new ST elevation at the J point in at least 2 contiguous leads with the cutoff value of 0.1 mV or higher in all leads except V2 and V3, in which the cutoff values were 0.2 mV or higher in men 40 years or older, 0.25 mV or higher in men younger than 40 years, or 0.15 mV or higher in women (14). In patients who met the MI criteria, STEMI was diagnosed if ST elevation criteria or new or presumed new LBBB was present. Otherwise, a diagnosis of NSTEMI was made. Posterior STEMI was diagnosed if ST depression in leads V1 to V3 accompanied ST elevation in the inferior and/or lateral leads, or if total or near total lesion was detected in the right coronary artery or circumflex artery in patients who underwent coronary angiography.

All enrolled patients underwent routine clinical assessments and received the standard medical care currently performed in routine clinical practice. According to the TURKMI protocol, prescriptions of drugs and indications of diagnostic or therapeutic procedures were left to participating cardiologists' decision (12). As an observational protocol, patients did not receive any experimental intervention or treatment because of their participation. Baseline information included patient characteristics, medical history, presenting symptoms, clinical characteristics, electrocardiographic findings, and use of cardiac medications. Each patient's hospital course was recorded in detail. All medications, including doses used before (on admission), in-hospital, and at the time of discharge, were captured. All available laboratory values, including lipid profile, fasting blood sugar, creatinine, white blood cell count, hemoglobin, hematocrit, platelet count, triglyceride, HbA1c, thyroid stimulating hormone, and troponin, were also recorded. ECG, echocardiography, and coronary angiography results were recorded and uploaded to an electronic data capture program.

Statistical analysis

All analyses were performed using SPSS 18.0 for Windows (IBM Corp., Armonk, NY), and a P value of less than 0.05 was considered significant. Categorical variables were presented as number and percentage, and were compared using the χ^2 test or Fisher's exact test between independent groups such as sex and risk categories. Graphical methods (e.g., histogram and probability plot) and analytical methods (e.g., Komogrov-Smirnov test) were used to assess whether continuous variables have normal distribution. These variables were given as means ± standard deviation or medians and interquartile range, depending on whether they have normal distribution or not, and were compared using an independent t test or the Mann-Whitney U test.

Results

A total of 1930 consecutive patients (mean age, 62.0±13.2 years; 26.1 % female) in 50 centers with a diagnosis of acute MI were prospectively enrolled between November 1 and November 16, 2018. Women were older than men (68.3±12.8 years vs. 59.8±12.6 years). The centers participating in the study and the number of patients enrolled are shown in Figure 1. Table 1 presents the baseline clinical characteristics of patients regarding presence of ST elevation (38.1% STEMI; 61.9% NSTEMI). A total of 726 (37.6%) patients were admitted to the study centers by referral from other centers that do not have PCI capability (STEMI: 39.9%, n=288; NSTEMI, 36.6%, n=438).

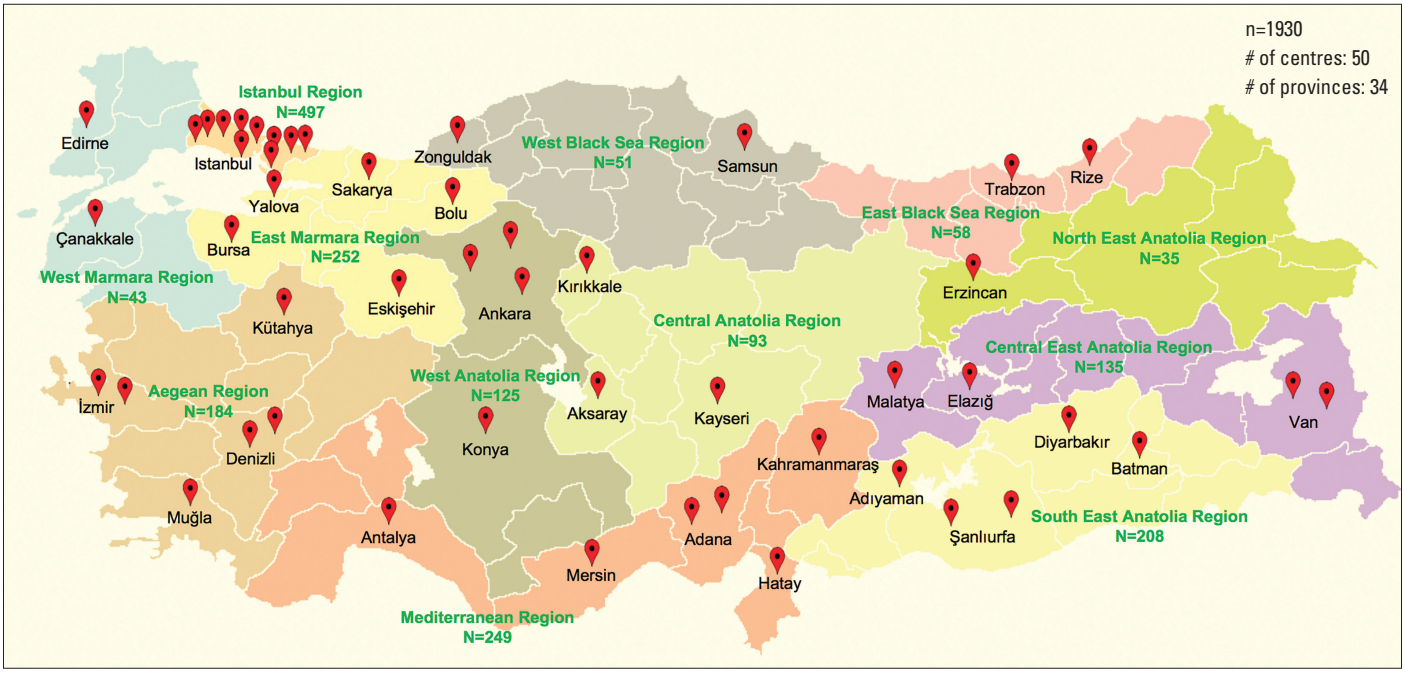

Figure 1. Centers participating in the TURKMI study and the number of patients enrolled

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Table 1. Baseline characteristics, cardiovascular risk factors, and clinical history of the TURKMI population

	Total n=1930	NSTEMI n=1195	STEMI n=735	*P* value*
Age, years (median, Q1-Q3)	62 (53-71)	63 (54-72)	60 (51-70)	**<0.001**
Age, year (mean±SD)	62±13.2	63±12.7	60.4±13.8	
Female patients, n (%)	504 (26.1)	343 (28.7)	161 (21.9)	**<0.001**
Body mass index (kg/m^2) (median, Q1-Q3)	27.4 (25-30.8)	27.7 (25.2-31.1)	27.1 (24.78-30.1)	0.071
Risk factors				
Hypertension, n (%)				
Based on patient's self-report	955 (49.5)	672 (56.2)	283 (38.5)	**<0.001**
Dyslipidemia, n (%)				
Based on patient's self-report	233 (12.1)	161 (13.5)	72 (9.8)	**0.016**
Hypercholesterolemia (LDL ≥130 mg/dL or total cholesterol ≥200 mg/d or use of LDL-lowering agents)**	875 (60.2)	588 (64.3)	287 (53.1)	**<0.001**
Low HDL cholesterol (men: <40 mg/dL; women: <50 mg/dL)	837 (56.6)	523 (56.5)	314 (56.8)	0.928
Elevated triglycerides (≥150 mg/dL)	612 (43.7)	418 (47.6)	194 (37.2)	**<0.001**
Dyslipidemia (Presence of any of the above criteria), n (%)	1333 (88.3)	850 (89.7)	483 (86.1)	**0.037**
Diabetes, n (%)				
Based on patient's self-report	654 (33.9)	448 (37.5)	206 (28)	**<0.001**
Based on patient's self-report and/or use of anti-diabetic agents	691 (37.9)	472 (41.6)	219 (31.9)	**<0.001**
Obesity, n (%)				
Based on patient's self-report	112 (5.8)	66 (5.5)	46 (6.3)	0.502
Body mass index ≥30 kg/m^2	497 (28.7)	326 (30.5)	171 (25.8)	**0.034**
Smoking, n (%)	942 (48.8)	529 (44.3)	413 (56.2)	**<0.001**
Family history of premature CVD, n (%)	188 (9.7)	109 (9.1)	79 (10.7)	0.242
Alcohol, n (%)	46 (2.4)	24 (2)	22 (3)	0.168
History of CVD, n (%)				
Coronary involvement (MI and/or CABG and/or PCI)	550 (28.5)	418 (35)	132 (18)	**<0.001**
Myocardial infarction	262 (13.6)	190 (15.9)	72 (9.8)	**<0.001**
Percutaneous coronary intervention	339 (17.6)	258 (21.6)	81 (11)	**<0.001**
Coronary bypass grafting	165 (8.5)	139 (11.6)	26 (3.5)	**<0.001**
Transient ischemic attack or stroke	29 (1.5)	13 (1.1)	16 (2.2)	0.056
Peripheral arterial disease	17 (0.9)	10 (0.8)	7 (1)	0.792
Heart failure	45 (2.3)	35 (2.9)	10 (1.4)	**0.027**
Atrial fibrillation	23 (1.2)	16 (1.3)	7 (1)	0.447
Valve surgery	5 (0.3)	5 (0.4)	0 (0)	0.164
Pacemaker/intracardiac defibrillator	7 (0.4)	5 (0.4)	2 (0.3)	0.715
Other	25 (1.3)	19 (1.6)	6 (0.8)	0.144
Concomitant disease, n (%)				
Cancer	54 (2.8)	30 (2.5)	24 (3.3)	0.329
Thyroid disease	50 (2.6)	30 (2.5)	20 (2.7)	0.777
Renal failure	103 (5.3)	72 (6.0)	31 (4.2)	0.086
Chronic obstructive lung disease	95 (4.9)	68 (5.7)	27 (3.7)	**0.047**
Asthma	35 (1.8)	24 (2)	11 (1.5)	0.413
History of bleeding	10 (0.5)	7 (0.6)	3 (0.4)	0.750
Connective tissue disease	9 (0.5)	6 (0.5)	3 (0.4)	1.000
Other	142 (7.4)	93 (7.8)	49 (6.7)	0.362

**P* value denotes the comparison of STEMI and NSTEMI.
**As there were missing values in both statin use and lipid levels, analysis was conducted by excluding the missing values.
CABG - coronary artery bypass grafting; CVD - cardiovascular disease; HDL - high density lipoproteins; LDL - low density lipoproteins; MI - myocardial infarction; NSTEMI - non-ST elevation MI; PCI - percutaneous coronary intervention; SD - standard deviation; STEMI - ST elevation MI

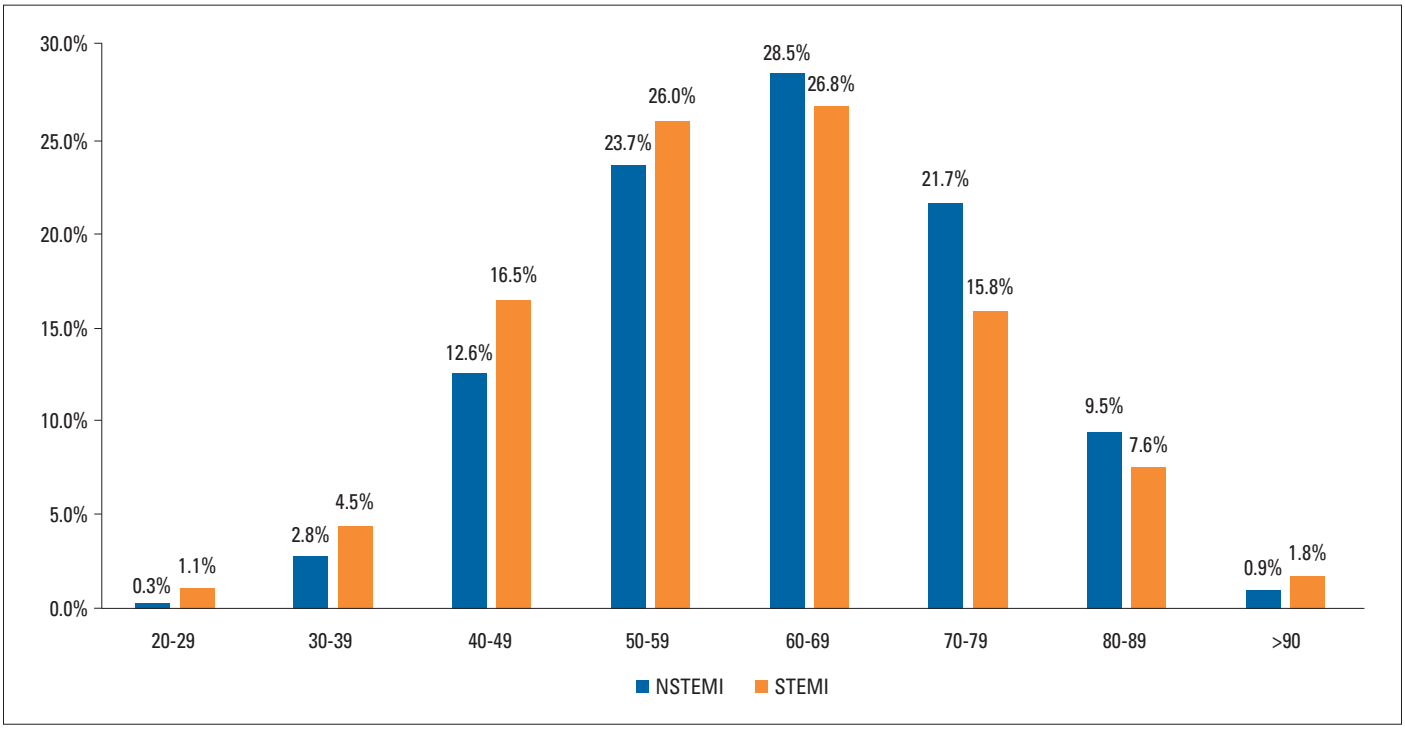

Figure 2. The distribution of age groups of patients hospitalized with acute myocardial infarction in Turkey

Patients with NSTEMI were older (p<0.001) (Fig. 2, Table 1). However, 22.1% of the STEMI and 15.7% of the NSTEMI patients were younger than 50 years (Fig. 2). Based on the patients' self-reporting, half had hypertension and one-third were diabetic. Hypercholesterolemia based on the total cholesterol, LDL cholesterol levels, or use of anti-lipid agents was present in 60.2% of the TURKMI population. Diabetes mellitus, hypertension, and hypercholesterolemia were more common in NSTEMI patients than STEMI patients, whereas smoking was more common in STEMI patients than in NSTEMI patients. In both groups, fewer than 30% were women, and the number of women in the NSTEMI group was significantly higher than in the STEMI group (28.7% vs. 21.9%, p=0.001). History of previous coronary event was documented in 550 (28.5) of the patients. History of previous MI, previous coronary artery bypass surgery, or previous PCI was significantly higher in NSTEMI patients than in STEMI patients. In terms of comorbidities, chronic obstructive pulmonary disease was significantly more common in NSTEMI patients than in STEMI patients (Table 1).

The primary complaints of the patients admitted with acute MI were chest pain (95%), dyspnea (17.8%), palpitations (4.1%), cardiac arrest (1.8%), and syncope (1.7%) (Table 2). Although the prevalence of chest pain was similar in both groups, more patients presented with dyspnea or palpitation in the NSTEMI group than in the STEMI group, whereas cardiac arrest was significantly more frequent in the STEMI group (Table 2). Chest pain was the most common presenting symptom in both women (95.4%) and men (94.8%) (p=0.580), whereas shortness of breath (25.8% vs. 15.4%, p<0.001) and palpitation (6.5% vs. 3.3%, p<0.005) were more common in women. There was no difference

Table 2. Presenting symptoms on admission

	All	STEMI	NSTEMI	*P* value*
Typical chest pain, n (%)	1833 (95)	698 (95)	1135 (95)	0.990
Dyspnea, n (%)	345 (17.9)	112 (15.2)	233 (19.5)	0.018
Palpitation, n (%)	80 (4.1)	22 (3)	58 (4.9)	0.046
Cardiac arrest, n (%)	35 (1.8)	29 (3.9)	6 (0.5)	<0.001
Syncope, n (%)	33 (1.7)	17 (2.3)	16 (1.3)	0.109
Other, n (%)	129 (6.7)	53 (7.2)	76 (6.4)	0.467
Pain in left and/or right arm, n (%)	22 (1.1)	9 (1.2)	13 (1.1)	0.784

**P* value denotes the comparison of STEMI and NSTEMI.
NSTEMI - non-ST elevation myocardial infarction; STEMI - ST elevation myocardial infarction

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in the frequency of chest pain in diabetic and non-diabetic patients (94.4% vs. 94.2%), but diabetic patients had more symptoms of dyspnea than non-diabetic patients (23.7% vs. 14.9%, p<0.001). Cardiac arrest was also significantly higher in patients without diabetes (2.3% vs. 0.9%, p=0.035). The primary symptom was chest pain when the elderly (>70 years) and younger (≤70 years) patients were compared (94.6% vs. 95.2%, p=0.538). In the elderly, dyspnea (27.9% vs. 13.7%, p<0.001) and palpitation (6.0% vs. 3.4%, p=0.009) were significantly more frequent than in younger patients.

On admission, both mean systolic and diastolic blood pressure (BP) levels were significantly higher in NSTEMI patients compared with STEMI patients (systolic BP: 139±25 mm Hg vs. 127±26 mm Hg, p<0.001; diastolic BP: 81±15 mm Hg vs. 77±16 mm Hg, p<0.001). The laboratory and ECG findings of the TURKMI population are presented in Table 3.

NSTEMI patients were classified according to the European Society of Cardiology guideline criteria (15) as low risk (29.4%), moderate risk (34.3%), high risk (33%), and very high risk (3.2%) at admission. Meanwhile, at the time of admission, 76.3% STEMI patients were Killip class I, 17.2% were class II, 2.7% were class III, and 3.7% were class IV (Fig. 3). Patients' medications on admission and at the time of discharge are summarized in Table 4. On admission, more NSTEMI patients were on anti-platelets (aspirin, clopidogrel), beta blockers, calcium antagonists, anti-lipid agents, ACE inhibitors, diuretics, and anti-diabetic drugs compared with STEMI patients.

Coronary angiography was performed in 93.7% of the study population, and PCI was performed in 73.2% at index hospitalization. The proportions of coronary angiography and PCI were significantly higher in STEMI patients compared with NSTEMI patients (98.8% vs. 90.5%, p<0.001; 94.4% vs. 60.2%, p<0.001, respectively). Fibrinolytic therapy was administered to only 13 patients (0.018%).

During the PCI mostly unfractionated heparin was used as an anticoagulant (96.3% overall; 97.0% in STEMI; 95.7% in NSTEMI). The use of low molecular weight heparin was exceptionally low. In 12.4% of the patients, a GPIIb/IIIa inhibitor was used during the procedure, with use being significantly higher in patients with STEMI (18.5% vs. 8.5%). The drugs given at discharge are noted

Table 3. Laboratory and electrocardiographic findings of the TURKMI patients

	NSTEMI	STEMI	Total	*P* value*
Laboratory findings (Mean±SD)				
Blood glucose, mg/dL	128.94±57.51	138.01±64.59	132.31±60.37	**0.001**
Creatinine	1.17±2.02	1.03±0.72	1.12±1.66	**0.019**
White blood cell	10.2±3.49	13.45±29.14	11.44±18.25	**<0.001**
Total cholesterol, mg/dL	194.23±52	193.12±49.73	193.81±51.15	0.499
LDL cholesterol, mg/dL (median 25%–75%)	119 (90.1-148.0)	121 (98-150)	120 (94-149)	0.135
HDL cholesterol, mg/dL	41.42±10.82	40.92±9.76	41.23±10.43	0.543
Triglycerides, mg/dL	171.5±121.17	151.91±119.65	164.15±120.93	**<0.001**
Electrocardiography findings on admission				
Rhythm, n (%)				
Sinus	1083 (90.6)	679 (92.4)	1762 (91.3)	0.185
Atrial fibrillation/flutter	78 (6.5)	33 (4.4)	110 (5.7)	**0.046**
Pacemaker	5 (0.4)	0 (0)	5 (0.3)	0.164
Ventricular fibrillation/flutter	2 (0.2)	7 (1)	9 (0.5)	**0.032**
Others	10 (0.8)	13 (1.8)	23 (1.2)	0.067
Rate (pulse/min), median (Q1-Q3)	79 (70-91)	80 (68-92)	79 (69-91)	0.319
New LBBB, n (%)	22 (1.9)	12 (1.7)	34 (1.8)	0.680
New RBBB n (%)	41 (3.5)	27 (3.7)	68 (3.6)	0.846
AV block, n (%)	14 (1.2)	30 (4.2)	44 (2.3)	**<0.001**
ST segment depression in 2 adjacent derivations ≥1 mm, n (%)	362 (31)	467 (64.6)	829 (43.8)	**<0.001**
T wave inversion, n (%)	353 (30.3)	124 (17.2)	477 (25.3)	**<0.001**
Non-specific ST/T changes, n (%)	353 (30.3)	78 (10.9)	431 (22.9)	**<0.001**

**P* value denotes the comparison of STEMI and NSTEMI.
AV- atrioventricular block; LBBB - left bundle branch block; HDL - high density lipoprotein; LDL - low density lipoprotein; NSTEMI - non-ST elevation myocardial infarction; RBBB - right bundle branch block; STEMI - ST elevation myocardial infarction

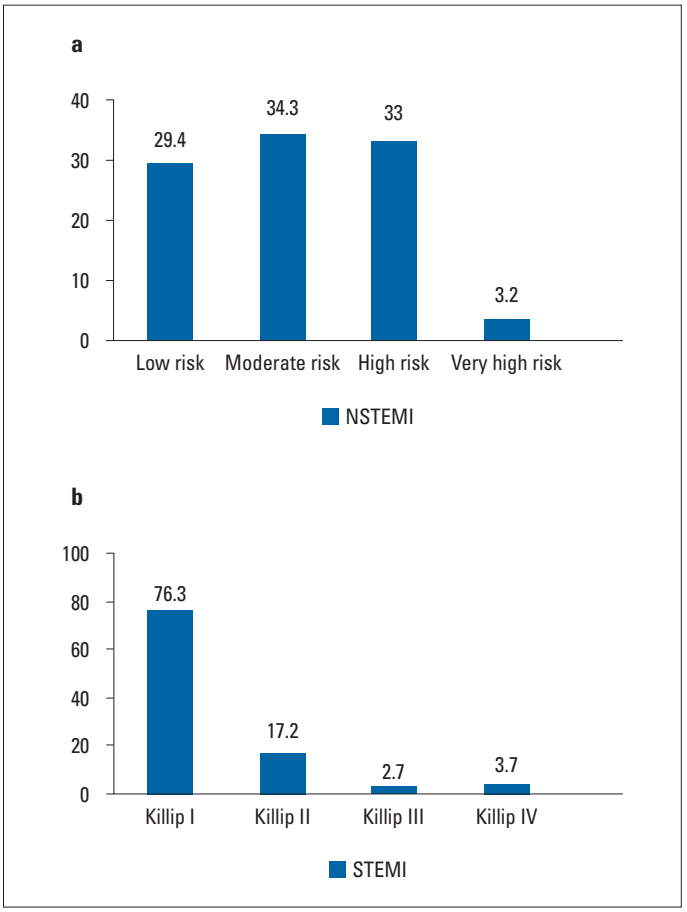

Figure 3. (a) Risk classification of patients with NSTEMI. (b) Killip classification of patients with STEMI

in Table 4. Almost all patients were put on antiplatelet therapy. Aspirin was prescribed in 99.3% of the patients, and 94% were on dual antiplatelet therapy (DAPT). Among the DAPT drugs used, clopidogrel was the most preferred drug at 50.5%, followed by ticagrelor in 40.7% and prasugrel in 3.1%. Beta blockers were prescribed in 85.0% of patients, anti-lipid drugs in 96.3%, ACE inhibitors in 58.4%, and angiotensin receptor blockers in 7.9%.

Discussion

The baseline characteristics of the TURKMI study provided important information regarding clinical characteristics and the current clinical management of 1930 consecutive patients admitted to cardiology clinics in Turkey with acute MI within 48 hours of the onset of symptoms. A previous registry in Turkey, the TUMAR study, enrolled 3358 patients in 1998 and 1999 with the diagnosis of acute MI who were hospitalized in coronary intensive care units within 24 hours of symptom onset (11). The TUMAR study covered 52 centers from 23 provinces for a period of 1 year. Like the TURKMI study, the TURK-AKS study (16) was designed as a snapshot registry of 1 month, but the primary limitation was a lack of enrollment of consecutive patients. Similar to the TURKMI registry, this study was conducted to evaluate patient profiles, as well as diagnostic and practice patterns in acute coronary syndrome in Turkey. TURKMI enrolled 1930 patients with NSTEMI or STEMI (excluding unstable angina) within a prespecified 2-week period. The TURK-AKS study enrolled 3695 participants with acute coronary syndrome, including unstable angina, within a 3-year period between 2007 and 2010. However, because the TURK-AKS study enrolled patients in a non-consecutive way, its level of representation is expected to be low.

The number of patients in TURKMI registry presenting with NSTEMI was higher; 6 out of every 10 MIs are NSTEMI. This proportion of NSTEMI patients (61.9%) was similar to those observed in the American National Registry of Myocardial Infarction and English Myocardial Ischemia National Audit Project registries (Fig. 4) (17, 18). The proportion of NSTEMI patients was slightly higher in the Saudi Arabian registry (66%) than in the TURKMI registry. NSTEMIs constitute 58% of the Algerian and 51% of the French (FAST-MI) registries (6, 7, 19, 20). Meanwhile, in both the Iranian registry and the Japanese Acute Myocardial Infarction Registry, the rate of NSTEMI was much lower (27% and 20%, respectively) (21, 22).

The mean age of the TURKMI population was 62±13 years. Patients with STEMI were significantly younger than the patients with NSTEMI, which might be explained by the higher rates of collaterals in older patients. TURKMI patients were similar in age compared with Iranian (21), Mexican (23), and Algerian (20) MI patients at the time of the index MI (Fig. 5), whereas the average MI age was younger (56 years) in Saudi Arabian MI patients (19). TURKMI patients experienced MI at younger ages compared with patients in other countries, including France (6, 7), Switzerland (24), the United Kingdom (18), and Japan (Fig. 6) (22). This is most likely associated with the high prevalence of dyslipidemias and smoking in Turkey. Moreover, the high prevalence of consanguinity probably has an important contribution to earlier MIs in Turkey (25).

Evaluation of cardiovascular risk factors revealed that hypercholesterolemia, hypertension, smoking, and diabetes were the most prevalent risk factors in patients presenting with MI in Turkey, as stated in previous analysis (26). The prevalence of smoking was significantly higher than the registries of France (36%), the United States (31%), and England (29%) (6, 7, 17, 18). TURKMI harbors higher smoking rate, with almost half of the MI population being current smokers.

The primary complaint was chest pain regardless of the type of MI, sex, age, and presence of diabetes. In the TURKMI study, the proportion of chest pain was 95% compared with 80% in the FAST-MI registry. This difference is probably due to typical chest pain being used as an inclusion criterion in the FAST-MI registry (6, 7). Similar to the FAST-MI study, cardiac arrest was more common in patients with STEMI, and shortness of breath was more prevalent in NSTEMIs in the TURKMI study. This is likely because the NSTEMI group had a higher proportion of women,

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Table 4. Medications on admission and prescribed at discharge

	Total	NSTEMI	STEMI	*P* value*
Medications on admission, n (%)				
Antiplatelet agents				
Acetyl salicylic acid	534 (29.8)	395 (35.3)	139 (20.7)	**<0.001**
Clopidogrel	208 (11.6)	168 (15)	40 (6)	**<0.001**
Ticagrelor	26 (1.5)	18 (1.6)	8 (1.2)	**0.475**
Prasugrel	3 (0.2)	2 (0.2)	1 (0.1)	-†
Beta blockers	397 (22.2)	311 (27.8)	86 (12.8)	**<0.001**
Calcium antagonists	243 (13.6)	170 (15.2)	73 (10.9)	**0.010**
Nitrates	70 (3.9)	64 (5.7)	6 (0.9)	**<0.001**
Anti-lipid agents	256 (14.3)	203 (18.2)	53 (7.9)	**<0.001**
ACE inhibitors	284 (15.9)	205 (18.3)	79 (11.8)	**<0.001**
Medications prescribed at discharge, n (%)				
Antiplatelet agents				
Acetyl salicylic acid	1830 (99.3)	1141 (99)	689 (99.9)	**0.038**
Clopidogrel	930 (50.5)	689 (59.8)	241 (34.9)	**<0.001**
Ticagrelor	750 (40.7)	354 (30.7)	396 (57.4)	**<0.001**
Prasugrel	58 (3.1)	22 (1.9)	36 (5.2)	**<0.001**
Dual antiplatelet therapy	1731 (94)	1059 (91.9)	672 (97.4)	**<0.001**
Anticoagulant agents	68 (3.5)	53 (4.4)	15 (2)	
Warfarin	28 (1.5)	21 (1.8)	7 (1)	
Dabigatran	7 (0.4)	6 (0.5)	1 (0.1)	0.270
Rivaroxaban	9 (0.5)	6 (0.5)	3 (0.4)	1,000
Apiksaban	20 (1.1)	17 (1.4)	3 (0.4)	**0.040**
Edoxaban	4 (0.2)	3 (0.3)	1 (0.1)	-†
Beta blockers	1544 (85.0)	965 (84.5)	579 (85.9)	0.418
Calcium antagonists	246 (13.5)	192 (16.8)	54 (8.0)	**<0.001**
Anti-lipid agents	1756 (96.3)	1103 (96.2)	653 (96.3)	0.944
Diuretics	298 (16.4)	204 (17.9)	94 (13.9)	**0.029**
ACE inhibitors	1061 (58.4)	645 (56.5)	416 (61.7)	**0.029**
Angiotension receptor blockers	144 (7.9)	103 (9.0)	41 (6.1)	**0.025**
Digitalis	9 (0.5)	7 (0.6)	2 (0.3)	0.498
Anti-arrhythmic agents	24 (1.3)	16 (1.4)	8 (1.2)	0.700
Nitrates	152 (8.4)	124 (10.9)	28 (4.2)	**<0.001**
Anti-diabetic agents	208 (11.5)	145 (12.7)	63 (9.3)	**0.030**

**P* value denotes the comparison of STEMI and NSTEMI. †Not analyzed.
ACE - angiotension converting enzyme; NSTEMI - non-ST elevation myocardial infarction; STEMI - ST elevation myocardial infarction

previous MI, and heart failure. As expected, because of the high proportion of previous cardiovascular disease, the use of aspirin or other anti-platelets, beta blockers, and lipid lowering therapies was prevalent in patients presenting with NSTEMI on admission.

TURKMI revealed that guideline-recommended cardivascular medication at discharge is acceptable for many drugs, and that compliance was better than that seen in other national registries. At discharge, almost all patients were on aspirin therapy (99.3%), and 94% were on DAPT. The European Society of Cardiology guideline recommends ticagrelor or prasugrel in preference to clopidogrel as second antiplatelet agents for DAPT. These 3 antiplatelet agents are reimbursed in Turkey. However, other than aspiring, the most common drugs prescribed were

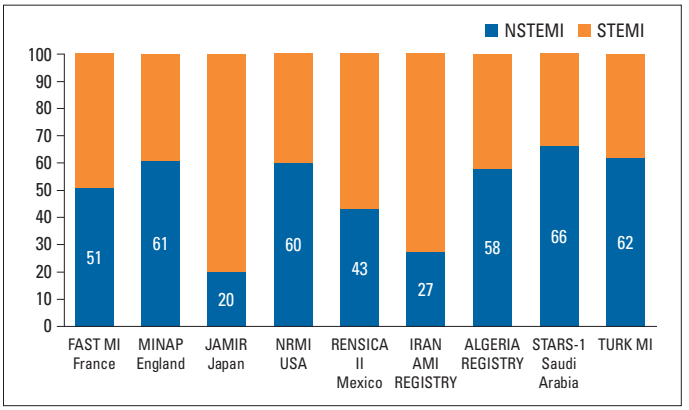

Figure 4. NSTEMI rates (%) in TURKMI and other country's registries

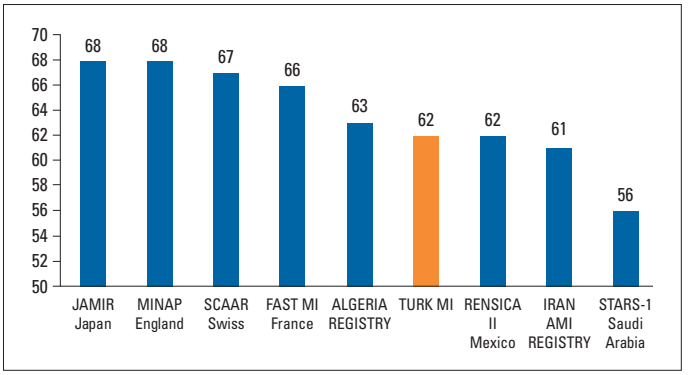

Figure 5. Mean age in TURKMI verses other acute myocardial infarction registries

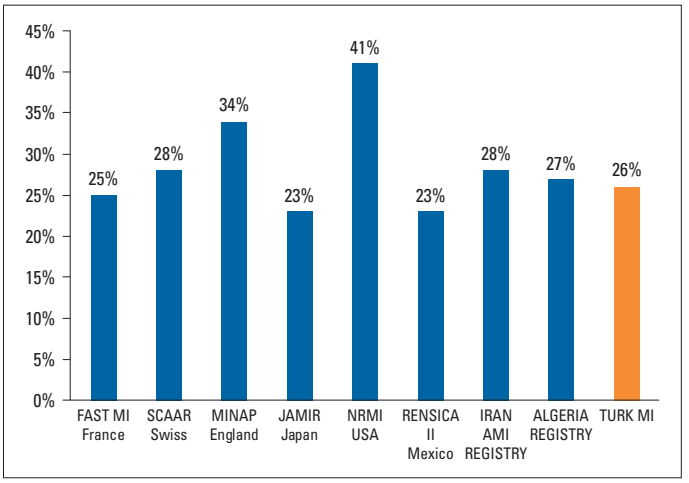

Figure 6. Percentage of women enrolled in TURKMI and other registries

clopidogrel (50.5%) and by ticagrelor (40.7%). Only 3.1% of the patients were on prasugrel. Most patients (96.3%) were on lipid lowering treatment at the time of discharge.

Study limitations

As stated in the rationale and design paper (12), TURKMI harbors the same major drawbacks of registries in general. In addition, the number of centers (n=50) could be considered a limitation. However, this number was selected because of budget restrictions. The number of centers in each EurNUTS region was determined proportional to the population to represent the Turkish people appropriately. Also, we selected hospitals capable of PCI, assuming that nearly all acute MI patients would eventually be directed to these centers. Otherwise, we would have missing values for patients who were transferred to other centers. Of note, coronary angiography units and interventional cardiologists are available in all provinces and most major towns in Turkey (27). Therefore, all patients with acute MI in all geographical regions in the country could reach cardiology centers with the capability of performing coronary angiography and percutaneous procedures within 1 hour. Therefore, with the assumption that all acute MI patients, including those who first presented to non-PCI centers, would be admitted or transferred to PCI-capable centers in the index region, all patients admitted within the first 48 hours of symptom onset were included. In contrast to previous registries in Turkey, we enrolled patients consecutively within a prespecified 2-week period, which also increases the level of representation of MI patients in Turkey. However, this type of enrollment might preclude obtaining information regarding seasonal variations of MI (28). Moreover, enrolling only patients presenting alive to cardiology centers will also lead to a bias of exclusion of those who cannot admit to care centers (death, elderly, bedridden, etc.).

Conclusion

The nation-wide TURKMI study outlined the characteristics of patients admitted with acute MI within 48 hours of the onset of symptoms to the selected cardiology centers capable of PCI in Turkey. Turkish MI patients were more likely to have dyslipidemia, diabetes, and smoking history and were younger compared with patients in European Countries. TURKMI also confirmed that current treatment guidelines have largely been adopted into clinical cardiology practice in Turkey in terms of antiplatelet, anti-ischemic, and anti-lipid therapy.

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