Comparative Analysis of Angiographic Parameters and Percutaneous Coronary Intervention Outcomes in Diverse Populations in Türkiye

Türkiye'de Perkütan Koroner Girişim Yapılan Hastaların Etnik Gruplara Göre Anjiyografik Özellikleri ve Klinik Sonuçlarının Karşılaştırılması

ABSTRACT

Objective: Due to the conflict in Syria since 2011, more than 3.5 million Syrian citizens reside in Türkiye. Because Syrian patients were underrepresented in previous studies on percutaneous coronary intervention (PCI) outcomes, we aimed to analyze the severity of coronary artery disease and in-hospital outcomes of PCI in this population.

Methods: We retrospectively analyzed 142 Syrian patients who underwent PCI at our center between June 2020 and October 2022 and compared the data with that of age- and sex-matched Turkish patients (n = 271) who also underwent PCI. We assessed comorbidities, coronary anatomy features, procedural complications, and in-hospital cardiovascular outcomes (Major Adverse Cardiac and Cerebrovascular Events, MACCE).

Results: The mean age of the study population was 57 ± 12 years, with 15% being female. Clinical indication and coronary anatomy features did not differ between the groups. However, the Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery (SYNTAX) score was higher in Syrian patients compared to Turkish patients (16 [11–22] vs. 12 [8–20]; $P < 0.001$). Complex PCI rates, in-hospital bleeding and contrast nephropathy were similar in both groups. MACCE was comparable between Syrian and Turkish patients (13 [4.8%] vs. 13 [9.2%], $P = 0.083$).

Conclusion: Comparable MACCE rates were observed in both ethnic groups undergoing PCI, despite a higher SYNTAX score in Syrian patients. Future research should investigate whether similar in-hospital MACCE rates are observed in other regions of Türkiye and whether long-term cardiovascular outcomes differ between Turkish and Syrian patients.

Keywords: Coronary artery disease, ethnicity, mortality, percutaneous coronary intervention, predictors

ÖZET

Amaç: Suriye'de 2011'den bu yana yaşanan çatışmalar nedeniyle Türkiye'de 3,5 milyondan fazla Suriye vatandaşı yaşamaktadır. Perkütan koroner girişim (PKG) sonuçlarına ilişkin önceki çalışmalarda Suriyeli hastalar ile ilgili yeterli bilgi olmaması nedeniyle, PKG yapılan Türk ve Suriyeli hastaların koroner arter hastalığının ciddiyeti ve hastane içi sonuçlarının kıyaslanması hedeflendi.

Yöntem: Haziran 2020 ile Ekim 2022 tarihleri arasında merkezimizde PKG uygulanan Suriyeli hastalar (n = 142) retrospektif olarak analiz edildi ve PKG uygulanan yaş ve cinsiyet uyumlu Türk hastalarla (n = 271) verileri karşılaştırıldı. Komorbiditeleri, koroner anatomi özellikleri, işlem komplikasyonları ve hastane içi kardiyovasküler sonuçları (MACCE) değerlendirildi.

Bulgular: Araştırma grubunun ortalama yaşı 57 ± 12 idi, grubun %15'i kadındı. Klinik endikasyon ve koroner anatomi özellikleri gruplar arasında farklılık yoktu. Ancak Suriyeli hastalarda SYNTAX skoru Türk hastalara göre daha yüksekti (16 [11–22] ila 12 [8–20; $P < 0,001$). Kompleks PKG, hastane içi kanama ve kontrast nefropatisi oranları her iki grupta da benzerdi. MACCE gruplar arasında karşılaştırılabilir düzeydeydi (13 [%4,8] ila 13 [%9,2], $P = 0,083$).

Sonuç: Suriyeli hastalarda SYNTAX skorunun daha yüksek olmasına rağmen PKG yapılan hastalarda MACCE oranları her iki etnik grupta benzerdi. Gelecekteki araştırmalar, hastane içi MACCE oranlarının Türkiye'nin diğer bölgelerinde de benzer olup olmadığını ve uzun vadeli kardiyovasküler sonuçların Türk ve Suriyeli hastalar arasında farklı olup olmadığını ele almalıdır.

Anahtar Kelimeler: Koroner arter hastalığı, etnik köken, mortalite, perkütan koroner girişim, öngördürücüler

Mehmet Rasih Sonsöz (ID)

İlyas Çetin (ID)

Cemal Ozanalp (ID)

Şevval Kılıç (ID)

Göksenin Cansu Özdoğan (ID)

Gamze Acar (ID)

Gamze Gençol Akçay (ID)

Yelda Saltan Özateş (ID)

Yeliz Güler (ID)

Ahmet Güler (ID)

Department of Cardiology, Başakşehir Çam and Sakura City Hospital, İstanbul, Türkiye

Corresponding author:
Mehmet Rasih Sonsöz
✉ mrsonsoz@gmail.com

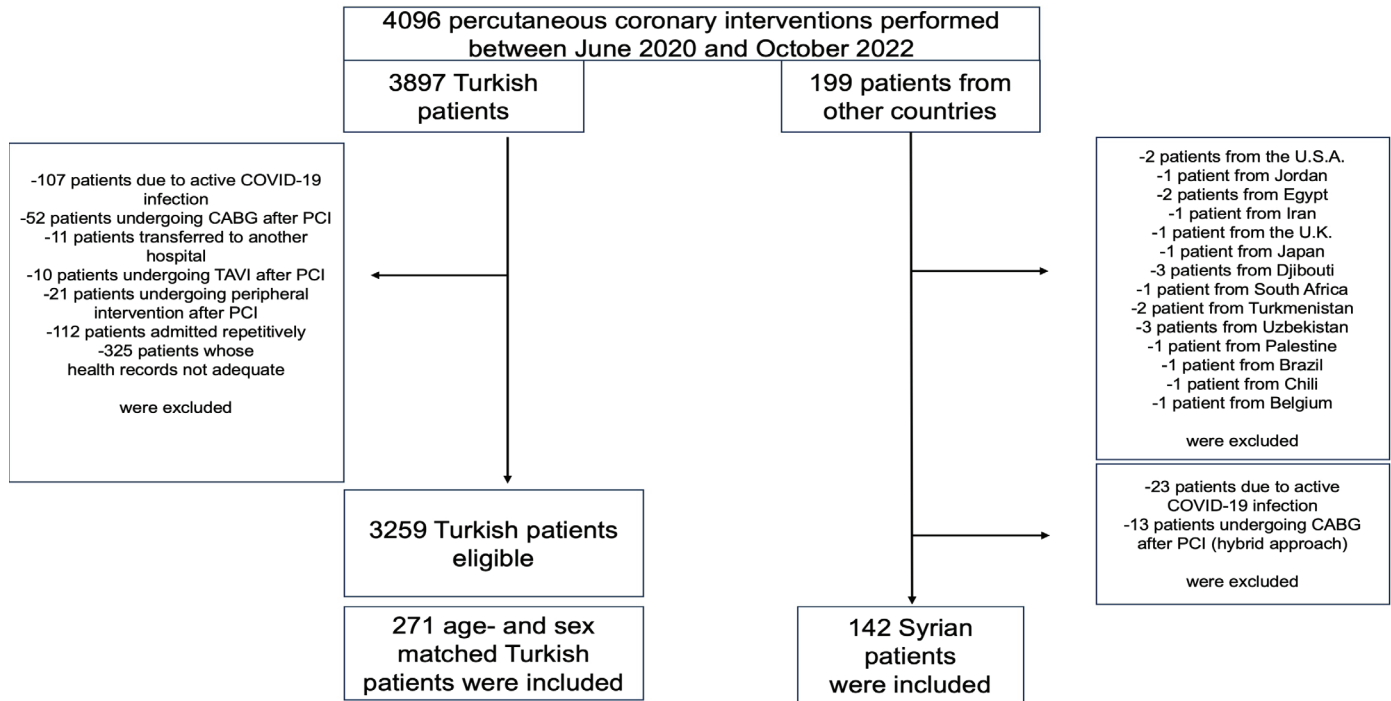**Figure 1. Study flow chart illustrating the inclusion process for patients undergoing percutaneous coronary intervention.**

The efficacy and safety of percutaneous coronary intervention (PCI) have been extensively studied globally. Nevertheless, only a small number of studies—despite some recent publications—have focused on outcomes among various ethnic groups within certain regions.[1,2] Understanding how different ethnic backgrounds may influence PCI outcomes is essential to optimize patient care and address potential disparities in healthcare.

The conflict in Syria since 2011 has caused more than 5 million refugees worldwide.[3] By 2022, more than 3.5 million Syrians with temporary protection were living in Türkiye.[4] However, the success of Türkiye in delivering healthcare to refugees has been reported by international delegations.[5] Cardiovascular disease was the primary cause of death in Syria before the civil war,[6] but studies focusing on cardiovascular disease in Syrian refugees are limited.[7,8] Previous studies conducted in Türkiye have predominantly focused on overall PCI outcomes without considering the influence of ethnicity–specific factors.[9–12] Thus, the objective of this study was to investigate and compare the in–hospital outcomes of PCI procedures among patients belonging to different ethnic groups in Türkiye.

ABBREVIATIONS

BARC	Bleeding Academic Research Consortium
CABG	Coronary artery bypass grafting
CAD	Coronary artery disease
COVID-19	Coronavirus Disease 2019
ICC	Intraclass correlation coefficient
MACCE	Major Adverse Cardiac and Cerebrovascular Events
PCI	Percutaneous coronary intervention
SCr	Serum creatinine
SYNTAX	the Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery
TIMI	Thrombolysis in myocardial infarction

Materials and Methods

The study was approved by the Başakşehir Çam and Sakura City Hospital Clinical Research Ethics Committee (Approval Number: 2022-393, Date: 17.10.2022) and the provincial health directorate (Approval Number 2023/01, Date: 26.01.2023). It was conducted in accordance with the Declaration of Helsinki. We retrospectively analyzed Turkish and Syrian patients aged ≥ 18 years undergoing PCI at our tertiary referral hospital between June 2020 and October 2022. Of the 178 Syrian patients undergoing PCI, 23 were excluded due to Coronavirus Disease 2019 (COVID-19) infection, and 13 were excluded because they were referred for coronary artery bypass grafting (CABG) after initial treatment with PCI. We compared the data of Syrian patients with that of 271 age– and sex–matched Turkish patients undergoing PCI between June 2020 and October 2022 (Figure 1). We collected demographic, electrocardiographic, echocardiographic, angiographic, clinical, and treatment data from the hospital's electronic records.

The coronary anatomy features and the Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery (SYNTAX) scores of the patients, as well as coronary complications during PCI, were independently noted and analyzed by two experienced operators (İ.Ç. and Y.G.). Patients with a previous history of CABG were not included. The SYNTAX score was calculated from coronary angiographic views for each patient using the SYNTAX Score Calculator, Version 2.28 (available at https://syntaxscore.org/calculator/syntaxscore/frameset.htm). Vessels with a diameter of ≥ 1.5 mm and lesions with ≥ 50% stenosis were scored. The following categories were assessed: coronary dominance; number of lesions; presence of total occlusion, bifurcation, trifurcation, aorto–ostial lesion, severe tortuosity, calcification, thrombus, and diffuse disease; and

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lesion length > 20 mm. Interobserver correlation for determining the SYNTAX score was assessed using the intraclass correlation coefficient (ICC) test, and a strong correlation between observers was found (ICC: 0.81, *P* < 0.001).

Multivessel disease was defined as the presence of at least 50% stenosis involving two or more major epicardial coronary arteries. PCI was considered complex if any of these criteria were present: total stent length ≥ 60 mm, total number of stents implanted ≥ 3, total number of lesions ≥ 3, total number of target vessels ≥ 3, bifurcation lesion with ≥ 2 stents, and chronic total occlusion. No-reflow was defined by the presence of thrombolysis in myocardial infarction (TIMI) flow grade < 3 and myocardial blush grade < 3, manifesting as abnormal epicardial blood flow despite relief of coronary obstruction.[13]

The primary endpoint was a composite of mortality, myocardial infarction, or stroke (hemorrhagic and ischemic) during hospitalization (Major Adverse Cardiac and Cerebrovascular Events, MACCE). Contrast-induced nephropathy was defined as impairment of kidney function—measured as either a 25% increase in serum creatinine from baseline or a 0.5 mg/dL increase in absolute serum creatinine (SCr) value—within 48-72 hours after intravenous contrast administration.[14] Bleeding Academic Research Consortium (BARC) type > 2 was used for clinically relevant bleeding complications.[15]

Statistical Analysis

Continuous data are expressed as mean ± standard deviation or median (interquartile range [IQR]) values, while categorical data are described as proportions and were evaluated via chi-square test or Fisher's exact test. The Kolmogorov-Smirnov test was used to evaluate the distribution of the data. Student's t-test or the Mann-Whitney U test was utilized to compare continuous variables. Logistic regression test was used to identify independent risk factors for in-hospital MACCE after PCI in both Turkish and Syrian patients. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 29.0 (SPSS Inc., Chicago, IL, USA). A two-sided *P* value < 0.05 was considered statistically significant.

Results

We included 413 patients who underwent PCI and divided them into two groups: 142 Syrian and 271 Turkish patients. The mean age of the study population was 57 ± 12 years, and 62 (15%) of all patients were female. The prevalence of hyperlipidemia in Syrian patients was 73.9%, smoking 64.9%, hypertension 62.4%, and diabetes mellitus 29.8%, which were similar to those in Turkish patients, except hyperlipidemia was more common in the latter. Whether PCI was performed for acute or chronic coronary syndrome did not differ between groups. Table 1 summarizes the demographics, comorbidities, and clinical presentation of the study population.

Table 1. Demographics, Comorbidities, and Clinical Presentation of the Study Population

	All Patients (n = 413)	Turkish Patients (n = 271)	Syrian Patients (n = 142)	P
Age (years)	57 ± 12	57 ± 12	57 ± 11	0.786
Female	62 (15%)	42 (14.8%)	22 (15.5%)	0.843
BMI (kg/m^2)	27 ± 4	27 ± 3.9	27.2 ± 4.3	0.636
Hypertension	240 (58.3%)	152 (56.1%)	88 (62.4%)	0.217
Diabetes Mellitus	125 (30.3%)	83 (30.6%)	42 (29.8%)	0.860
Smoking	265 (65%)	176 (65.1%)	91 (64.9%)	1.000
History of Percutaneous Coronary Intervention	94 (22.8%)	68 (25.1%)	26 (18.3%)	0.118
History of Coronary Artery Bypass Grafting	19 (4.6%)	15 (5.5%)	4 (2.8%)	0.210
History of Lung Disease	17 (4.1%)	12 (4.4%)	5 (3.5%)	0.659
History of Cerebrovascular Disease	15 (3.6%)	10 (3.7%)	5 (3.5%)	0.931
Chronic Kidney Disease	42 (10.2%)	23 (8.5%)	19 (13.5%)	0.115
Peripheral Artery Disease	14 (3.4%)	11 (4.1%)	3 (2.1%)	0.299
Dyslipidemia	311 (79.9%)	212 (83.1%)	99 (73.9%)	0.030
Clinical Presentation				0.954
Acute Coronary Syndrome	328 (79.4%)	215 (79.3%)	113 (79.6%)	
Chronic Coronary Syndrome	85 (20.6%)	56 (20.7%)	29 (20.4%)	
Revascularization Indications for Chronic Coronary Syndrome				0.797
Refractory Angina	64 (75.3%)	41 (73.2%)	23 (79.3%)	
High-Risk Anatomy*	8 (9.4%)	6 (10.7%)	2 (6.9%)	
Extensive Myocardial Ischemia**	13 (15.3%)	9 (16.1%)	4 (13.8%)	
LVEF, %	50 ± 12	50 ± 12	49 ± 12	0.924

*High-risk anatomy (where revascularization is associated with survival benefit) includes critical left main coronary artery disease or left main coronary artery disease equivalent, proximal left anterior descending artery disease, and two- or three-vessel disease with left ventricular ejection fraction ≤ 35%.
**Extensive myocardial ischemia: defined as a large area of ischemia (> 10% of the left ventricle) on stress myocardial perfusion imaging.
BMI, Body Mass Index; LVEF, Left Ventricular Ejection Fraction.

Table 2 shows the coronary anatomy and percutaneous coronary intervention characteristics of the study population. Femoral access was preferred in 96.6% of the study population. Multivessel disease was prevalent in 50.6%, moderate/heavy calcification in 16.9%, true bifurcation lesions in 33.3%, thrombotic lesions in 48.7%, and chronic total occlusion in 11.9% of all patients, and these parameters were comparable between Syrian and Turkish patients. However, the SYNTAX score was higher in Syrian patients compared to Turkish patients (16 [11-22] vs. 12 [8-20]; P < 0.001).

PCI was most commonly performed for lesions in the left anterior descending artery, followed by the right coronary artery and then the circumflex artery in the study population. Drug-eluting stents were the preferred stent type, used in 94.7% of all patients. However, bare-metal stents were implanted in 9.4% of patients. Complex PCI was performed in 142 (36.8%)

patients, a rate that was comparable between Turkish and Syrian patients.

All patients were treated with acetylsalicylic acid and a $P2Y_{12}$ inhibitor. Sixty-nine percent of all patients recevied clopidogrel, 27.6% ticagrelor, and 2.9% prasugrel. Glycoprotein IIb/IIIa inhibitors were used in 13.8% of all patients, and statins were prescribed for 67.8% of all patients. Beta-blockers and renin–angiotensin–aldosterone system blockers were utilized at similar rates in both groups.

The primary composite endpoint during hospitalization occurred in 26 (6.3%) patients, of whom 13 (4.8%) were Turkish and 13 (9.2%) were Syrian (P = 0.083). Mortality and myocardial infarction rates did not differ between groups. However, stroke was more frequent in Syrian patients compared to Turkish patients (3 [2.1%] vs. 0 [0%]; P = 0.016). All strokes were ischemic. No-reflow occurred in 36 (8.7%) patients, contrast-

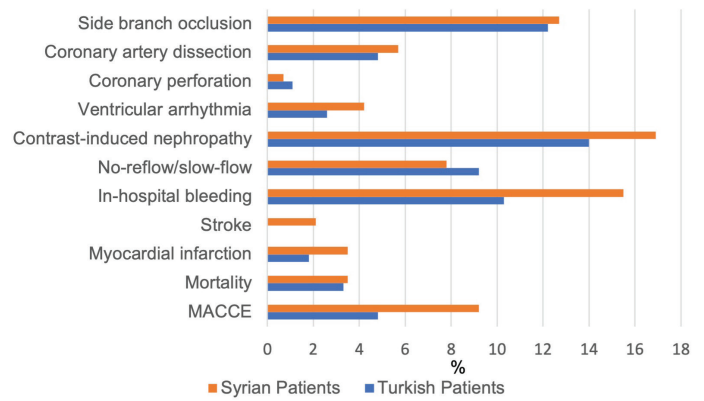**Table 2. Coronary Angiography and Percutaneous Coronary Intervention Properties of the Study Population**

	All Patients (n = 413)	Turkish Patients (n = 271)	Syrian Patients (n = 142)	*P*
Femoral Access	398 (96.6%)	260 (95.9%)	138 (97.2%)	0.305
Treated Lesion Distribution				
LMCA	8 (1.9%)	8 (3%)	0 (0%)	0.055
LAD	208 (50.4%)	133 (49.1%)	75 (52.8%)	0.534
Cx	111 (26.9%)	78 (28.8%)	33 (23.2%)	0.244
RCA	150 (36.3%)	103 (38%)	47 (33.1%)	0.335
Saphenous Graft	6 (1.5%)	4 (1.5%)	2 (1.4%)	1.000
Coronary Anatomy Characteristics				
Multivessel Disease	225 (50.6%)	155 (51.3%)	69 (48.9%)	0.640
Moderate/Heavy Calcification	70 (16.9%)	51 (18.8%)	19 (13.4%)	0.162
Bifurcation	137 (33.3%)	86 (31.9%)	51 (35.9%)	0.471
Thrombotic	201 (48.7%)	124 (45.8%)	77 (54.2%)	0.102
In-Stent Thrombosis	10 (2.2%)	5 (1.7%)	5 (3.5%)	0.215
Chronic Total Occlusion	49 (11.9%)	32 (11.8%)	17 (12%)	0.961
Total Lesion Length, mm	28 ± 18	28 ± 17	29 ± 18	0.537
SYNTAX Score	14 [9-21]	12 [8-20]	16 [11-22]	<0.001
Stent Profile				
Bare-Metal Stent	39 (9.4%)	28 (10.3%)	11 (7.7%)	0.393
Drug-Eluting Stent	391 (94.7%)	255 (94.1%)	136 (95.8%)	0.471
Total Stent Length, mm	37 ± 22	37 ± 21	36 ± 22	0.654
Total Implanted Stent Count	1 [1-2]	1 [1-2]	1 [1-2]	0.582
Thrombus Aspiration	9 (2.2%)	8 (3%)	1 (0.7%)	0.137
Complex PCI	142 (36.8%)	108 (39.9%)	44 (31%)	0.076
Bifurcation Lesions				0.753
Provisional Stent Strategy	124 (90.5%)	78 (28.8%)	46 (32.3%)	
Two-Stent Strategy	13 (9.5%)	8 (3%)	5 (3.5%)	
Fluoroscopy Duration, min	22 ± 17	21 ± 16	22 ± 18	0.637

Cx, Circumflex Artery; LAD, Left Anterior Descending Artery; LMCA, Left Main Coronary Artery; PCI, Percutaneous Coronary Intervention; RCA, Right Coronary Artery.

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induced nephropathy in 62 (15%), and BARC type > 2 in 50 (12.1%) patients, with similar rates in both groups (Figure 2). Table 3 summarizes the periprocedural complications, in-hospital outcomes, and medications of the study population.

We analyzed the predictors of in-hospital MACCE after PCI in Turkish patients. Male sex, left ventricular ejection fraction, SYNTAX score, and total stent length may be risk factors (all $P < 0.1$). Multivariable logistic regression analysis showed that left ventricular ejection fraction was an independent risk factor for in-hospital MACCE after PCI in Turkish patients (odds ratio = 0.93, 95% Confidence Interval (CI): 0.88-0.98; $P = 0.008$) (Table 4).

We analyzed the predictors of in-hospital MACCE after PCI in Syrian patients. SYNTAX score and the no-reflow phenomenon may be risk factors (all $P < 0.1$). Multivariable logistic regression analysis demonstrated that the SYNTAX score was an independent

Figure 2. Bar graph demonstrating both complications and clinical outcomes for both groups undergoing percutaneous coronary intervention. MACCE refers to major cardiovascular and cerebrovascular events.

Table 3. Complications During the Procedure, In-Hospital Outcomes, and Medications of the Study Population

	All Patients (n = 413)	Turkish Patients (n = 271)	Syrian Patients (n = 142)	P
Primary Composite Endpoint of Mortality, MI, or Stroke	26 (6.3%)	13 (4.8%)	13 (9.2%)	0.083
Mortality	14 (3.4%)	9 (3.3%)	5 (3.5%)	0.915
Cardiovascular Death	10 (2.4%)	7 (2.6%)	3 (2.1%)	1.000
Non-Cardiovascular Death	3 (0.7%)	1 (0.4%)	2 (1.4%)	0.240
Death due to PCI Complication	1 (0.2%)	1 (0.3%)	0 (0%)	1.000
Myocardial Infarction	10 (2.4%)	5 (1.8%)	5 (3.5%)	0.293
Stroke	3 (0.7%)	0 (0%)	3 (2.1%)	0.016
Coronary Artery Dissection	21 (5.1%)	13 (4.8%)	8 (5.7%)	0.701
Side Branch Occlusion	51 (12.3%)	33 (12.2%)	18 (12.7%)	0.876
No-Reflow/ Slow Flow	36 (8.7%)	25 (9.2%)	11 (7.8%)	0.715
Coronary Perforation	4 (1%)	3 (1.1%)	1 (0.7%)	0.691
Femoral Artery Pseudoaneurysm	6 (1.4%)	2 (0.7%)	4 (2.9%)	0.112
Contrast-Induced Nephropathy	62 (15%)	38 (14%)	24 (16.9%)	0.437
In-Hospital Bleeding	50 (12.1%)	28 (10.3%)	22 (15.5%)	0.127
Ventricular Arrhythmia	14 (3.1%)	8 (2.6%)	6 (4.2%)	0.372
Length of Stay, days	3 [2-5]	3 [2-5]	3 [2-5]	0.627
In-Hospital Medication				
Acetylsalicylic Acid	413 (100%)	271 (100%)	142 (100%)	–
Clopidogrel	284 (68.8%)	183 (67.5%)	101 (71.2%)	0.386
Ticagrelor	114 (27.6%)	77 (28.4%)	37 (26.1%)	0.643
Prasugrel	12 (2.9%)	8 (3%)	4 (2.8%)	1.000
Tirofiban	57 (13.8%)	35 (12.9%)	22 (15.5%)	0.473
Statin	280 (67.8%)	180 (66.4%)	100 (70.4%)	0.346
Beta-Blocker	341 (82.6%)	225 (83%)	116 (81.7%)	0.814
ACE-i/ARB	285 (68.1%)	184 (67.9%)	101 (71.1%)	0.733

ACE-I, Angiotensin-Converting Enzyme Inhibitor; ARB, Angiotensin Receptor Blocker; MI, Myocardial Infarction; PCI, Percutaneous Coronary Intervention.

Table 4. Independent Predictors of Major Cardiovascular and Cerebrovascular Events During Hospitalization After Percutaneous Coronary Intervention in Turkish Patients

	Odds Ratio (95% CI)	*P*	Odds Ratio (95% CI)	*P*
Age	1.019 (0.976–1.064)	0.399	–	–
Male Gender	0.251 (0.078–0.811)	0.021	0.412 (0.076–2.222)	0.302
Diabetes Mellitus	3.299 (2.145–5.074)	0.991	–	–
Left Ventricular Ejection Fraction	0.923 (0.877–0.971)	0.002	0.929 (0.880–0.981)	0.008
SYNTAX Score	1.071 (1.000–1.147)	0.049	1.011 (0.917–1.114)	0.831
Total Stent Length	1.022 (1.002–1.043)	0.028	1.023 (0.994–1.054)	0.120
No-Reflow	2.468 (0.800–7.607)	0.116	–	–
BARC > 2 Bleeding	2.796 (0.722–10.834)	0.137	–	–

BARC, Bleeding Academic Research Consortium.

Table 5. Independent Predictors of Major Cardiovascular and Cerebrovascular Events During Hospitalization After Percutaneous Coronary Intervention in Syrian Patients

	Odds Ratio (95% CI)	*P*	Odds Ratio (95% CI)	*P*
Age	0.988 (0.940–1.039)	0.649	–	–
Male Gender	1.009 (0.208–4.901)	0.991	–	–
Diabetes Mellitus	0.769 (0.198–2.996)	0.705	–	–
Left Ventricular Ejection Fraction	0.958 (0.911–1.008)	0.101	–	–
SYNTAX Score	1.250 (1.116–1.399)	<0.001	1.238 (1.103–1.390)	<0.001
Stent Length	0.976 (0.941–1.012)	0.183	–	–
No-Reflow	3.396 (1.052–10.965)	0.041	1.626 (0.430–6.148)	0.473
BARC > 2 Bleeding	2.829 (1.717–4.660)	0.137	–	–

BARC, Bleeding Academic Research Consortium.

risk factor for in-hospital MACCE after PCI in Syrian patients (odds ratio = 1.24, 95% CI: 1.10-1.39; *P* < 0.001) (Table 5).

Discussion

We retrospectively analyzed the coronary anatomy and in-hospital outcomes of Turkish and Syrian patients undergoing PCI at our center. The main findings can be summarized as follows: 1) both groups had a high burden of cardiovascular risk factors; 2) among the patients who underwent PCI, Syrian patients had a higher SYNTAX score compared to Turkish patients; 3) in-hospital MACCE rates did not differ between groups. Our study was the first to compare the severity of coronary artery disease and PCI outcomes between these two populations.

Cardiovascular risk factors are common in Syrian patients.[16] In a study of 5,760 Syrian refugees in our country, 58.7% of the participants had three or more risk factors for cardiovascular disease.[17] In a recent registry study from Türkiye, the authors found that hyperlipidemia was present in 60.2% of the study population, hypertension in 49.5%, smoking in 48.8%, and diabetes mellitus in 37.9%. However, the authors did not report the ethnicity-specific evaluation. In our study, the high prevalence of cardiovascular risk factors in both groups may be attributed to the selection of patients at a tertiary referral hospital who were scheduled for PCI. Additionally, the pandemic may have led to treatment deficiencies in primary and secondary

prevention[18] that could have influenced the cardiovascular risk profile of the patients.

Another significant finding of the present study was that Syrian patients had a higher SYNTAX score compared to Turkish patients. Şahin et al.[7] reported the outcomes of coronary artery bypass grafting in Syrian patients compared to Turkish patients, finding that Syrian patients had a higher SYNTAX score.[7] Forced migrants are more vulnerable to noncommunicable diseases due to migration-specific factors such as unhealthy living conditions, psychosocial stress, and limited access to timely care.[19] In addition to classic risk factors for coronary artery disease (CAD) such as hypertension, hyperlipidemia, and smoking, psychological factors and post-traumatic stress disorder may contribute to CAD.[20,21] Al-Makhamreh et al.[22] showed that chronic war-related stressors significantly contributed to the higher complexity and severity of CAD in Syrian refugee patients.[22]

We found that in-hospital MACCE did not differ between Turkish and Syrian patients who underwent PCI. This suggests that the proficiency and expertise of the healthcare providers involved in performing PCI procedures were consistent across ethnic groups, minimizing potential procedural biases. Our findings align with a recent registry from Türkiye, which reported in-hospital MACCE as 6.2%.[23] However, stroke occurred more frequently in Syrian patients than in Turkish patients. This observation should be interpreted with caution as our study

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was underpowered to assess each of the secondary outcomes individually. Nevertheless, several factors could have contributed to this observation, including greater severity of coronary artery disease, genetic predisposition, differences in comorbidities, socioeconomic factors, or disparities in access to health care services and follow-up.

To date, there are no high-quality studies of PCI outcomes in the Syrian population. A study from Jordan evaluated the burden of heart disease in Syrian refugees at a university hospital. Cardiac catheterization was performed in 828 patients, 585 of whom had multivessel disease. PCI was offered to 408 patients, but only 296 received it. The reported in-hospital mortality after treatment was 1.8%. However, the authors included both percutaneous and surgical interventions in their analysis, so the results were not clearly distinguished. Additionally, there were no SYNTAX data on the patients. Nevertheless, the authors emphasized the high burden of cardiovascular disease risk factors and the challenges of providing optimal care in this population.[16]

Limitations of the Study

It is important to acknowledge some limitations of the study. First, the sample size might have limited the power to detect statistically significant differences, particularly for certain outcomes. Additionally, the study focused on short-term outcomes, and long-term follow-up data would provide a more comprehensive understanding of the ethnic disparities in PCI outcomes. In our center, we also performed PCI on patients from other ethnic groups but the number of these patients was too small to make a comparison, which may have introduced a selection bias. Moreover, the study did not explore other potentially relevant variables, such as socioeconomic status, educational level, or cultural factors, which could impact outcomes and contribute to the observed disparities.

Conclusion

This study provides initial insights into the coronary anatomy characteristics and outcomes of PCI in different ethnic groups in Türkiye. The SYNTAX score was higher in Syrian patients. While the overall in-hospital MACCE rates were comparable between the groups, it is also noteworthy that bleeding complications and contrast nephropathy did not differ between groups. Future research should investigate whether similar in-hospital MACCE rates are observed in other regions of Türkiye and whether long-term cardiovascular outcomes differ between Turkish and Syrian patients.

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References

1. Mahajan AM, Claessen BE, Chandrasekhar J, Sartori S, Aquino M, Baber U, et al. Outcomes by Gender and Ethnicity After Percutaneous Coronary Intervention. *Am J Cardiol*. 2019;123(12):1941-1948. [CrossRef]
2. Golomb M, Redfors B, Crowley A, Smits PC, Serruys PW, von Birgelen C, et al. Prognostic Impact of Race in Patients Undergoing PCI: Analysis From 10 Randomized Coronary Stent Trials. *JACC Cardiovasc Interv*. 2020;13(13):1586-1595. [CrossRef]
3. The UN Refugee Agency. Syria Emergency. Accessed September 21, 2023. Available at: https://reporting.unhcr.org/operational/situations/syria-situation#:~:text=Over%2012%20million%20Syrians%20remained,from%205.7%20million%20in%202021.
4. The UN Refugee Agency. Refugees and Asylum Seekers in Türkiye. Accessed September 21, 2023. Available at: https://www.unhcr.org/tr/en/refugees-and-asylum-seekers-in-Türkiye
5. Sahlool Z, Sankri-Tarbichi AG, Kherallah M. Evaluation report of health care services at the Syrian refugee camps in Turkey. *Avicenna J Med*. 2012;2(2):25-28. [CrossRef]
6. Maziak W, Rastam S, Mzayek F, Ward KD, Eissenberg T, Keil U. Cardiovascular health among adults in Syria: a model from developing countries. *Ann Epidemiol*. 2007;17(9):713-720. [CrossRef]
7. Sahin M, Öztürk S, Mert TI, Durmuş G, Can MM. Coronary artery bypass surgery in Syrian refugees. Outcomes in a Turkish tertiary center. *Saudi Med J*. 2018;39(8):781-786. [CrossRef]
8. Collins DRJ, Jobanputra K, Frost T, et al. Cardiovascular disease risk and prevention amongst Syrian refugees: mixed methods study of Médecins Sans Frontières programme in Jordan. *Confl Health*. 2017;11:14. [CrossRef]
9. Kırma C, Oduncu V, Tanalp AC, et al. Primary angioplasty in a high-volume tertiary center in Turkey: in-hospital clinical outcomes of 1625 patients. *Turk Kardiyol Dern Ars*. 2011;39(4):300-307. [CrossRef]
10. Ulucan S, Kaya Z, Keser A, et al. Outcomes of transradial primary percutaneous intervention from a tertiary cardiac centre in Turkey. *Int J Clin Exp Med*. 2015;8(7):11404-11411.
11. Ciçek D, Pekdemir H, Haberal C, et al. Two-year outcome of Turkish patients treated with Zotarolimus versus Paclitaxel eluting stents in an unselected population with coronary artery disease in the real world: a prospective non-randomized registry in southern Turkey. *Int J Med Sci*. 2011;8(1):68-73. [CrossRef]
12. Erol MK, Kayıkçıoğlu M, Kılıçkap M, et al. Baseline clinical characteristics and patient profile of the TURKMI registry: Results of a nation-wide acute myocardial infarction registry in Turkey. *Anatol J Cardiol*. 2020;24(1):43-53. [CrossRef]
13. Rezkalla SH, Kloner RA. No-reflow phenomenon. *Circulation*. 2002;105(5):656-662. [CrossRef]
14. Mehran R, Nikolsky E. Contrast-induced nephropathy: definition, epidemiology, and patients at risk. *Kidney Int Suppl*. 2006;(100):S11-15. [CrossRef]
15. Mehran R, Rao SV, Bhatt DL, et al. Standardized bleeding definitions for cardiovascular clinical trials: a consensus report from the Bleeding Academic Research Consortium. *Circulation*. 2011;123(23):2736-2747. [CrossRef]
16. Bani Hani A, Abu Abeeleh M, Al Smady M, et al. Heart Disease in Adult Syrian Refugees: Experience at Jordan University Hospital. *Ann Glob Health*. 2019;85(1):36. [CrossRef]

17. Balcılar M. *Türkiye'deki Suriye'li Mültecilerin Sağlık Durumu Araştırması.* AFAD;2016.
18. Raisi-Estabragh Z, Mamas MA. Cardiovascular Health Care Implications of the COVID-19 pandemic. *Cardiol Clin.* 2022;40(3):389-396. [CrossRef]
19. Al-Oraibi A, Hassan O, Chattopadhyay K, Nellums LB. The prevalence of non-communicable diseases among Syrian refugees in Syria's neighbouring host countries: a systematic review and meta-analysis. *Public Health.* 2022;205:139-149. [CrossRef]
20. Akosile W, Colquhoun D, Young R, Lawford B, Voisey J. The association between post-traumatic stress disorder and coronary artery disease: a meta-analysis. *Australas Psychiatry.* 2018;26(5):524-530. [CrossRef]
21. Edmondson D, Richardson S, Falzon L, Davidson KW, Mills MA, Neria Y. Posttraumatic stress disorder prevalence and risk of recurrence in acute coronary syndrome patients: a meta-analytic review. *PLoS One.* 2012;7(6):e38915. Erratum in: *PLoS One.* 2019;14(3):e0213635. [CrossRef]
22. Al-Makhamreh H, Alkhulaifat D, Al-Ani A, et al. The Impact of War-Related Stress on Coronary Artery Disease Severity in War Survivors: A SYNTAX Study. *Int J Environ Res Public Health.* 2021;18(6):3233. [CrossRef]
23. Kilickap M, Erol MK, Kayikcioglu M, et al. Short and Midterm Outcomes in Patients With Acute Myocardial Infarction: Results of the Nationwide TURKMI Registry. *Angiology.* 2021;72(4):339-347. [CrossRef]