

Early outcomes of cardiac surgery in Syrian refugees: A propensity-matched study from Türkiye

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ABSTRACT

Objectives: This study aims to evaluate Syrian refugees (SRs) undergoing adult cardiac surgery at a tertiary cardiovascular surgery hospital in İstanbul, Türkiye.

Patients and methods: Between January 2015 and January 2020, 7,923 patients (5,509 males, 2,414 females; mean age: 57.7±12.4 years; range, 26 to 93 years) who underwent cardiac surgery were retrospectively analyzed. The patients were divided into two groups: SR group (n=166) and control group (n=7,757). A 1:1 propensity score matching (PSM) was performed to balance the effect of selection bias and the influence of potential confounding factors. Finally, a total of 165 patients in each group were evaluated. The pre-, intra- and postoperative data of both groups were analyzed.

Results: No significant differences were found between the matched groups in terms of in-hospital mortality (p=0.46), length of intensive care unit (ICU) stay (p=0.96), prolonged ventilation (p=0.88), and sternal wound infection with dehiscence (p=0.12). However, the SR group exhibited significantly lower hematocrit and albumin levels (p=0.004, p=0.001).

Conclusion: Although SRs have access to the comprehensive healthcare system of the Republic of Türkiye, they still face challenges such as language barriers, cultural differences, and limited understanding of the healthcare system. Nevertheless, early mortality and morbidity outcomes in cardiac surgery for Syrian refugees are comparable to non-refugees.

Keywords: Cardiac surgical procedures, healthcare disparities, postoperative complications, propensity score, refugees.

War, migration, and future anxiety are the main sources of intense stress. The risk of cardiovascular disease increases in populations exposed to stress.^[1] In case of war or migration, access to nutrition, accommodation, and medical care is frequently limited, thereby leading to increased mortality and morbidity from various diseases.^[2]

Republic of Türkiye has experienced a large-scale migration from Syria as a result of the political turmoil since March 2011. At the beginning of 2025, the official number of Syrian refugees (SR) under temporary protection of Türkiye is 2,758,039. More than half of the SRs scattered across Türkiye live in four cities, mostly in İstanbul, Gaziantep, Hatay and Şanlıurfa, respectively. There are 529,718 SRs in İstanbul, accounting for 3.27% of its entire population.^[3]

Syrian refugees in İstanbul are attempting to survive outside the refugee camps. The healthcare costs of all SRs, including the refugees outside the refugee camps, are provided by the Republic of Türkiye. Also, identity numbers are given to SRs to ensure that they can benefit from healthcare system without any problems and Arabic interpreters work in the hospitals for this population.^[4]

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In the literature, there are several studies evaluating the cardiac health status of SR living in Türkiye, Jordan, and Palestine. In the present study, we aimed to evaluate Syrian patients undergoing adult cardiac surgery in a tertiary cardiovascular surgery hospital in İstanbul, Türkiye.

PATIENTS AND METHODS

This single-center, retrospective cohort study was conducted at İstanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, Department of Cardiovascular Surgery between January 2015 and January 2020. All patients with a history of cardiac surgery, including conventional open surgery, minimally invasive surgery, and robotic surgery were included in the study. Exclusion criteria were as follows: patients younger than 18 years and patients who underwent cardiac surgery for medical tourism. After exclusion, 7,923 patients (5,509 males, 2,414 females; mean age: 57.7 ± 12.4 years; range, 26 to 93 years) were recruited for the study. Two groups were formed as SRs and other operated patients. The SR group consisted of 166 SR patients, while the control group consisted of the remaining 7,757 patients. A 1:1 propensity score matching (PSM) was performed to balance the effect of selection bias and the influence of potential confounding factors. Finally, two groups of 165 patients were established with a caliper of 0.2 and a total of 330 patients were matched using PSM analysis. Demographic, intraoperative, and postoperative data of the patients were obtained from the hospital database. Written informed consent was obtained from each patient. The study protocol was approved by the İstanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital Ethics Committee (Date: 15.03.2022, No: 2022.03-14). The study was conducted in accordance with the principles of the Declaration of Helsinki.

The preoperative demographic, laboratory and clinical characteristics of the two groups were compared. Operation types, myocardial ischemia time, cardiopulmonary bypass (CPB) time, and emergency operation requirement were recorded. Prolonged ventilation, development of acute kidney injury (AKI), renal replacement therapy (RRT), development of mediastinitis, length of hospital and intensive care unit (ICU) stay, and in-hospital

mortality rates were compared in the postoperative period.

Prolonged ventilation was defined as mechanical ventilation support more than 24 h, AKI was defined as an increase in the baseline creatine value by more than 50% or urine volume $<0.5 \mu\text{mL/kg/h}$ for 6 h, RRT was defined as new initiation of continuous veno-venous hemofiltration (CVVH) or hemodialysis, and in-hospital mortality was defined as death occurring within 30 days postoperatively. The patients were followed in the cardiovascular surgery clinic within the first week and first month after discharge, and then in the cardiology clinic at three-month intervals postoperatively.

Statistical analysis

Statistical analysis was performed using the R version 4.0.3 software (R Foundation for Statistical Computing, Vienna, Austria). Continuous data were expressed in mean $\pm$ standard deviation (SD) or median and interquartile range (IQR: Q1-Q3), while categorical data were expressed in number and frequency. Categorical variables were compared using a chi-squared analysis or Fisher exact test. Normal and abnormal continuous variables were compared using the Student t-test and the Mann-Whitney U test. The PSM method was utilized to balance the effect of selection bias and potential confounding factors based on the logistic regression model. The propensity score was calculated according to the age, sex, body mass index (BMI), diabetes mellitus (DM), hypertension (HT), chronic obstructive pulmonary disease (COPD), ejection fraction (EF), and patients' need for emergency surgery. A two-sided p value of <0.05 was considered statistically significant.

RESULTS

After PSM, the mean left ventricular EF was 56.09 ± 9.71 in the SR group and 55.94 ± 8.79 in the control group ($p=0.88$). In the preoperative period, hematocrit and albumin values of the SRs were statistically significantly lower than other operated patients ($p=0.004$, $p=0.001$).

Before PSM, emergency operation was performed in 514 patients. The rate of emergency operations in the SR group was 12% and 6.37% in the control group. The need for emergency surgery was statistically significantly higher in the SR group ($p=0.003$).

	Before PSM						After PSM					
	SR patients (n=166)			Control group (n=7,757)			SR patients (n=165)			Control group (n=165)		
	n	%	Mean±SD	n	%	Mean±SD	n	%	Mean±SD	n	%	Mean±SD
Age (year)			56.1±13.1			57.7±12.4			56.3±12.9			57.3±11.7
Sex												
Female	43	25.9		2371	30.6		43	26.1		45	27.3	
Body surface area (kg/m ²)			1.98±0.21			2.06±0.22			1.89±0.17			1.87±0.21
Arterial hypertension	90	54.2		4039	52.1		89	53.9		96	58.2	
Diabetes mellitus	52	31.3		2232	28.8		51	30.9		53	32.1	
Chronic obstructive pulmonary disease	27	16.3		1308	16.9		27	16.4		25	15.2	
Ejection fraction (%)			55.96±6.81			55.87±8.12			56.09±9.71			55.94±8.79
Infective endocarditis	7	4.21		122	1.57		7	4.2		5	3.0	
Emergency surgery requirement	20	12.0		494	6.37		19	11.5		26	15.8	
Preoperative laboratory finding												
Hematocrit value (%)			34.74±2.11			36.43±2.13			34.78±6.74			36.98±6.98
Leucocytes (10 ³ /μL)			9.07±0.52			8.93±0.74			9.00±2.83			9.08±2.84
Albumin (gr/dL)			3.58±0.43			3.98±0.42			3.58±0.86			3.92±0.91
C reactive protein (mg/L)			21.07±12.8			17.11±8.72			20.97±28.67			21.63±35.95

PSM: Propensity score matching; SR: Syrian refugees; SD: Standard deviation; p<0.05 is considered as significant; * p<0.05 is considered as significant.

Of the 129 patients who were operated for infective endocarditis, seven were SR patients. Patients who underwent surgery for infective endocarditis were statistically significantly higher in the SR group ($p=0.027$). Following PSM, no statistically significant difference was observed between the two groups regarding emergency surgery and infective endocarditis. Preoperative demographic, laboratory, and clinical data of the two groups are shown in Table 1.

In both groups, the most performed cardiac surgery was coronary artery bypass grafting (CABG). This procedure was performed in 58.7% of all patients in the cohort. Isolated valve surgeries were the second most common surgical group. There was no statistically significant difference in the operation types between SRs and control patients. The mean CPB time was 98.65 ± 42.68 min and the mean myocardial ischemia time was 60.64 ± 14.25 min for all patients. Before and after PSM, there was no statistically significant difference between the two groups in terms of CPB time and myocardial ischemia time. Operative data and types of the two groups are shown in Table 2.

Overall, in-hospital mortality occurred in a total of 296 (3.74%) patients: 11 (6.63%) in the SR group and 285 (3.67%) in the control group. After PSM, there was no statistically significant difference between the two groups in terms of in-hospital mortality ($p=0.468$).

There was no statistically significant difference between the two groups regarding prolonged ventilation, AKI, RRT, the necessity for surgical re-exploration, and the occurrence of new-onset atrial fibrillation. Before PSM, however, postoperative sternal wound infection with dehiscence was statistically significantly higher in the SR group ($p=0.007$). Postoperative complications and length of hospital and ICU stay of two groups are shown in Table 3.

DISCUSSION

In the present study, we evaluated Syrian patients undergoing adult cardiac surgery in a tertiary cardiovascular surgery hospital in Istanbul, Türkiye. Our study results showed striking results in this largest cohort study assessing the case of SRs undergoing cardiac surgery. No significant

difference were found between the groups in terms of postoperative surgery types, cardiopulmonary bypass duration, myocardial ischemia duration, in-hospital mortality, length of ICU stay and hospital stay. However, preoperative albumin and hematocrit values were found to be lower in Syrian refugees. In their study, Maziak et al.^[5] reported that cardiovascular events accounted for more than 45% of deaths in Syria before the onset of the turmoil. As expected, CABG was the most performed cardiac operation in our study. However, in SRs, CABG was not performed more than other cardiac operations compared to the control group. In the study by Acartürk et al.,^[6] post-traumatic stress disorder in SRs was found to be 83.4%.^[5] The relationship between post-traumatic stress disorder and coronary artery disease is well known.^[7]

Before PSM, preoperative C-reactive protein (CRP) values of SRs were found to be higher. Although we believe that the main reason for the high CRP is due to the higher rate of infective endocarditis and emergency surgery in SRs, some studies have shown that high CRP values are associated with psychological stress.^[8] After applying PSM to balance the effect of selection bias and the effect of potential confounding factors, there was no significant differences on CRP values between two groups in our study.

In the whole cohort and propensity-matched cohorts, preoperative serum albumin and hematocrit values of SRs were found to be lower. Low serum albumin and preoperative anemia are strong independent predictors of worse outcomes in cardiovascular disease.^[9,10] The nutritional and economic challenges faced by SRs may be a contributing factor to this situation.

In particular, in cardiac surgeries performed with median sternotomy, the patient's compliance and cooperation is of utmost importance in the postoperative period in reducing sternal dehiscence and mediastinitis. Syrian refugees pay less attention to sternal stability due to language problems and may cause them to encounter more sternal wound infections caused by dehiscence. In addition, low albumin levels have been shown to increase sternal dehiscence including in-hospital mortality.^[11]

In our study, the rates of emergency operations increased among SRs. This finding indicates that individuals have access to prompt surgical intervention when required; nevertheless, many are

either incapable or unwilling to visit cardiology outpatient clinics for early diagnosis, which is crucial for scheduling elective cardiac procedures.

Currently, healthcare expenses of all SRs are provided by the Republic of Türkiye without cost sharing. Syrian patients are given full medical care, but there are problems with follow-up. In particular, follow-up of warfarin monitoring in SRs with mechanical heart valves are impaired due to socioeconomic and language problems, affecting long-term mortality.

The healthcare access of SRs is a multifaceted challenge which necessitates careful attention to migrant health policies, cultural adaptation strategies, and language barriers. These factors create significant hurdles for both healthcare providers and refugee patients. Refugees' limited knowledge of the healthcare system, including uncertainty about which hospital or center to approach and a lack of understanding of appointment and family doctor systems, may hinder their access to preventive healthcare services. In particular, lack of access to preventive treatment for cardiovascular diseases would likely result in a rise in emergency cardiac interventions, as well as increased mortality and morbidity within this patient group.

Language barriers and cultural differences can prevent patients from being adequately informed when they consent to treatment. Language barriers can increase patients' anxiety and stress levels, complicating accessing health information, benefiting refugees from preventive services, and understanding their own health conditions. In particular, in cardiac interventions, sharing the operation details and risks with the patient and their relatives is of utmost importance. To reduce these problems, expanding professional translation services, providing healthcare professionals with training in communication with refugees and cultural awareness, and strengthening psychosocial support units would increase both patient satisfaction and treatment effectiveness.

To the best of our knowledge, our study is the most comprehensive study on SRs undergoing heart surgery. Previous studies have only focused on CABG patients including small populations. Despite its strengths, this study has certain limitations including single-center, retrospective design, and lack of long-term results after surgery.

In conclusion, although SRs have access to the comprehensive healthcare system of the Republic of Türkiye, they still face non-clinical challenges such as language barriers, cultural differences, and limited understanding of the healthcare system. These factors can hinder timely access to preventative care and chronic disease management, which are critical for optimizing health outcomes. Nevertheless, early mortality and morbidity outcomes in cardiac surgery for Syrian refugees are comparable to non-refugees. Based on these findings, future policies should focus on culturally sensitive education programs and navigation support to bridge these gaps and enhance the accessibility and effectiveness of healthcare services for SRs.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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