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Acute Appendicitis Severity in the Early Phase of Syrian Migration to Türkiye: A Comparative Study of Syrian Immigrants and Turkish Citizens

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Abstract

Objective: Migration-related barriers may influence access to timely healthcare, potentially leading to more severe disease presentations in acute conditions. Acute appendicitis (AA) is a time-sensitive surgical emergency in which delays are strongly associated with progression to complicated disease. Evidence regarding disparities between migrant and native populations remains limited, particularly in Türkiye.

Aim: To compare the clinical and histopathological characteristics of AA between Syrian immigrants and Turkish citizens, and to identify factors associated with complicated appendicitis.

Methods: This retrospective comparative cohort study included 138 adult patients (69 Syrian immigrants and 69 Turkish citizens) who underwent appendectomy between 2016 and 2018 at a tertiary care center. Appendicitis was classified histopathologically as simple or complicated (gangrenous or perforated). Demographic and clinical variables were compared between groups. Binary logistic regression analysis was performed to identify independent predictors of complicated appendicitis.

Results: Syrian patients were significantly younger than Turkish patients (median age: 23 vs. 32 years; p<0.001), while gender distribution was similar. Complicated appendicitis was more frequent among Syrian immigrants compared to Turkish citizens (31.9% vs. 17.4%; p=0.048). In multivariable analysis, Syrian nationality was independently associated with an increased risk of complicated appendicitis (OR: 2.56; 95% CI: 1.17–5.60; p=0.018). Age >45 years was also an independent predictor (OR: 3.06; 95% CI: 1.06–8.98; p=0.039). Gender was not associated with disease severity.

Conclusion: Syrian immigrants exhibited a higher rate of complicated appendicitis compared to Turkish citizens. In the absence of direct measures of delay, complicated appendicitis should be interpreted as a proxy indicator of delayed presentation and disparities in healthcare access rather than a direct measure of care-seeking behavior. These findings underscore the potential impact of structural barriers on disease severity and highlight the need for interventions aimed at improving timely access to emergency care in vulnerable populations.

Keywords: Acute appendicitis; Complicated appendicitis; Migration; Refugees; Health disparities; Healthcare access; Delayed presentation; Syrian immigrants; Türkiye; Emergency surgery

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Introduction

Migration has become one of the most defining global phenomena of the 21st century, with substantial implications for healthcare systems and population health. The number of international migrants continues to rise, largely driven by conflict and socioeconomic instability. The Syrian civil war has resulted in one of the largest forced displacement crises worldwide, with Türkiye hosting approximately 3.6 million Syrian refugees, representing the largest refugee population globally [1–3] .

Migrant populations are known to face multiple barriers in accessing healthcare, including language difficulties, limited health literacy, socioeconomic constraints, and challenges in navigating healthcare systems [4–6]. Although healthcare services are officially provided free of charge to Syrian refugees in Türkiye, disparities in healthcare utilization and timely access to care may persist, particularly in acute and emergency conditions [7,8].

Acute appendicitis (AA) is the most common cause of acute surgical abdomen and a leading indication for emergency surgery worldwide [9]. The disease spectrum ranges from uncomplicated (simple) appendicitis to complicated forms, including gangrenous and perforated appendicitis, which are associated with significantly higher morbidity, mortality, and healthcare costs [10–12]. Timely diagnosis and surgical intervention are therefore critical, as delays in presentation are strongly associated with disease progression and adverse outcomes [13,14].

Vulnerable populations, including migrants, may be at increased risk for delayed presentation due to structural and individual-level barriers. Previous studies have reported higher rates of perforated or complicated appendicitis among migrant and socioeconomically disadvantaged populations; however, the evidence remains heterogeneous and methodologically limited [15–18]. Many studies are restricted to pediatric populations, lack standardized histopathological classification, or do not adequately capture both clinical and pathological disease severity. Furthermore, studies specifically comparing Syrian immigrants with native populations in Türkiye remain limited, particularly those integrating clinicopathological outcomes with risk factor analysis.

Addressing this gap is important, as disease severity at presentation may serve as a proxy indicator of disparities in access to timely healthcare. A clearer understanding of these differences could inform targeted interventions aimed at reducing preventable complications in vulnerable populations.

Therefore, the present study aimed to compare the clinical and histopathological characteristics of AA between Turkish citizens and Syrian immigrants treated in a tertiary care center. We hypothesized that Syrian immigrant patients would present with a higher proportion of complicated appendicitis, potentially reflecting delays in accessing timely healthcare services.

Methods

This study was designed as a retrospective comparative cohort study. A total of 69 Syrian patients who were admitted to the adult emergency department of our hospital between 2016 and 2018 and underwent surgery for AA were included in the study group. The comparison group consisted of Turkish citizens who underwent appendectomy during the same period. Demographic and clinical variables, including age, sex, nationality, and histopathological stage of appendicitis, were compared between the two groups.

The study protocol was approved by the Ethics Committee of the hospital, and all procedures were conducted in accordance with the Declaration of Helsinki and relevant institutional guidelines. Informed consent was obtained from all participants.

Cases with histopathological findings inconsistent with AA were excluded from the analysis. In total, 140 patients were initially assessed for eligibility; two were excluded (one Turkish patient with appendiceal malignancy and one patient with normal histopathological findings), resulting in a final study population of 138 patients.

Patient data were retrieved from electronic medical records. Histopathological diagnoses were based on routine pathology reports. Appendicitis cases were classified into two categories—simple and complicated—based on histopathological findings. Simple appendicitis included acute focal appendicitis and acute suppurative appendicitis, whereas complicated appendicitis comprised gangrenous and perforated appendicitis.

Acute focal appendicitis was defined as polymorphonuclear leukocyte (PMNL) infiltration confined to the mucosa and submucosa. Acute suppurative appendicitis was characterized by extension of PMNL infiltration into the muscularis propria. Gangrenous appendicitis was defined by transmural necrosis of the appendiceal wall in addition to inflammatory infiltration. Perforated appendicitis was defined as disruption of appendiceal wall integrity due to inflammation and necrosis, accompanied by spillage of inflammatory contents into the peritoneal cavity.

Perforation was considered both a clinical and histopathological diagnosis. In cases with suspected perforation, the operating surgeon provided additional information to the pathologist to facilitate accurate macroscopic and microscopic evaluation of the specimen.

Statistical Analysis

Shapiro-Wilk test was used for assessing whether variables followed normal distribution. Variables were reported as mean ± standard deviation or median (minimum: maximum) values. According to the normality test, Mann–Whitney U test was used for between group comparisons. Categorical variables were compared by Chi-square test or Fisher's exact test. Binary logistic regression analysis was performed to identify independent predictors of complicated appendicitis. Variables included in the multivariable model were selected based on clinical relevance (age, sex, and nationality). Age group 15–25 years and Turkish nationality were used as reference categories. SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) Software was used for performing statistical analysis and $p<0.05$ was set as statistical significance.

Results

A total of 138 patients diagnosed with AA were included, comprising 69 Syrian immigrants and 69 Turkish citizens. Baseline demographic and clinical characteristics are summarized in Table 1.

Table 1. Baseline characteristics of Syrian and Turkish patients with acute appendicitis

Variable	Syrian (n=69)	Turkish (n=69)	p-value
Age, years	23 (15–58)	32 (15–65)	<0.001[a]
Female, n (%)	20 (29.0)	20 (29.0)	1.00[b]
Male, n (%)	49 (71.0)	49 (71.0)	
Simple appendicitis, n (%)	47 (68.1)	57 (82.6)	0.048[b]
Complicated appendicitis, n (%)	22 (31.9)	12 (17.4)	

Values are presented as median (min–max) or n (%).
[a] Mann–Whitney U test; [b] Chi-square test.

Comparison According to Nationality

Age distribution differed significantly between the groups. Turkish patients were older compared to Syrian immigrants (median: 32 vs. 23 years, $p<0.001$). In contrast, gender distribution was identical between the groups (female/male: 29%/71% in both; $p=1.00$).

A significant difference was observed in the pathological classification of appendicitis. Simple appendicitis was more frequent among Turkish patients (82.6%) compared to Syrian immigrants (68.1%), whereas complicated appendicitis was

more common in Syrian patients (31.9% vs. 17.4%; p=0.048).

Comparison by Appendicitis Phase

When patients were stratified according to appendicitis phase (simple vs. complicated), no statistically significant differences were observed in terms of age (p=0.249) or gender (p=0.419) (Table 2).

Table 2. Comparison of patients according to appendicitis severity

Variable	Simple (n=104)	Complicated (n=34)	p-value
Age, years	27.5 (15–60)	23 (16–65)	0.249[a]
Female, n (%)	32 (30.8)	8 (23.5)	0.419[b]
Male, n (%)	72 (69.2)	26 (76.5)	

Values are presented as median (min–max) or n (%).

[a] Mann–Whitney U test; [b] Chi-square test.

Risk Factors for Complicated Appendicitis

Binary logistic regression analysis identified nationality and age as independent predictors of complicated appendicitis (Table 3).

Syrian nationality was associated with a significantly increased risk of complicated appendicitis compared to Turkish citizenship (OR: 2.56; 95% CI: 1.17–5.60; p=0.018).

Age was also a significant determinant. Patients older than 45 years had a higher risk of complicated appendicitis compared to those aged 15–25 years (OR: 3.06; 95% CI: 1.06–8.98; p=0.039). No significant association was found between gender and complicated appendicitis (p=0.131).

The overall logistic regression model was statistically significant (p<0.001).

Table 3. Multivariable logistic regression analysis for factors associated with complicated appendicitis

Variable	OR (95% CI)	p-value
Age 15–25	1 (reference)	-
Age 26–35	0.63 (0.25–1.60)	0.334
Age 36–45	1.73 (0.60–4.99)	0.310
Age >45	3.06 (1.06–8.98)	0.039
Male vs Female	0.56 (0.26–1.60)	0.131
Syrian vs Turkish	2.56 (1.17–5.60)	0.018

Overall model p <0.001

Age-Stratified Distribution

Age-stratified analysis demonstrated that AA cases were most concentrated in the 15–25 age group. Among Syrian immigrants, complicated appendicitis was predominantly observed at younger ages. In contrast, Turkish patients exhibited a bimodal distribution, with peaks in both the 15–25 and >45 age groups (Figure 1).

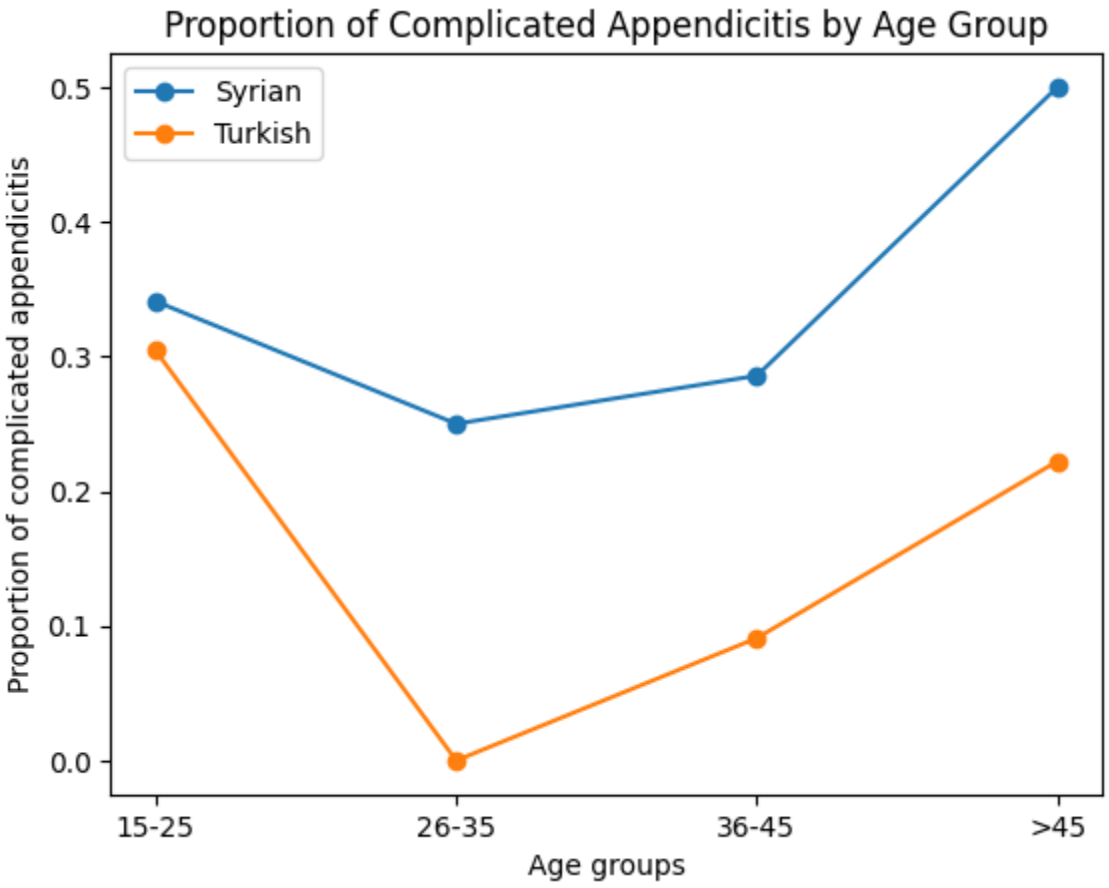

Figure 1. Age-specific proportion of complicated appendicitis by nationality

Syrian patients exhibited consistently higher rates of complicated appendicitis across all age groups, with a pronounced increase in older patients. In contrast, Turkish patients demonstrated lower proportions, with a modest rise in middle and older age groups. These patterns suggest potential disparities in disease severity at presentation between the two populations. The absence of complicated appendicitis in the 26–35 age group among Turkish patients should be interpreted with caution, as it may be attributable to the relatively small subgroup sample size.

Discussion

This study provides a comparative evaluation of clinicopathological characteristics of AA between Turkish citizens and Syrian immigrants, highlighting important disparities in disease presentation and severity. The principal findings can be summarized as follows: (i) Syrian immigrants presented at a younger age, (ii) complicated appendicitis was significantly more frequent among Syrians, and (iii) advanced age independently increased the risk of complicated disease. Importantly, the study period (2016-2018) corresponds to the early phase of large-scale Syrian migration to Türkiye, during which the healthcare system was still undergoing adaptation to a rapidly expanding refugee population.

One of the most notable findings is the higher prevalence of complicated appendicitis among Syrian immigrants. This observation is consistent with previous studies reporting increased rates of perforated or complicated appendicitis among migrant and socioeconomically disadvantaged populations [19, 20]. Although symptom duration and time to presentation were not directly available in our dataset, complicated appendicitis is widely recognized as a proxy marker of delayed presentation in AA. Therefore, our findings should be interpreted within this context rather than as direct evidence of delayed care.

The observed disparity is likely multifactorial and may be partly explained by structural barriers to healthcare access. Although healthcare services are officially provided free of charge to Syrian immigrants in Türkiye, practical and structural barriers—such as language difficulties, administrative

challenges, and indirect costs (e.g., transportation and opportunity costs)—may still delay timely access to care. Migrant populations frequently encounter additional challenges, including limited health literacy, socioeconomic constraints, and difficulties navigating healthcare systems [4–6]. Even in settings where healthcare services are formally accessible, these barriers may influence care-seeking behavior and delay presentation [7,8]. Taken together, these findings support the interpretation that disparities in appendicitis severity are more likely related to differences in healthcare access and utilization rather than intrinsic biological factors [9,10].

From a systems perspective, the results support a predominantly system-level explanation, indicating that differences in healthcare access and care utilization may play a central role in shaping disease severity at presentation. Once patients reach the hospital setting, diagnostic and treatment pathways for AA are relatively standardized [12–14]; therefore, pre-hospital factors likely contribute more substantially to the observed differences. This interpretation reinforces the concept that complicated appendicitis may function as a pragmatic indicator of inequities in timely access to emergency care.

The younger age distribution among Syrian patients likely reflects the demographic structure of the refugee population in Türkiye, which is predominantly composed of younger individuals [21]. Additionally, environmental and contextual factors, including differences in living conditions or exposure to infectious agents, may contribute to disease patterns, although these were not directly evaluated in the present study.

Consistent with previous literature, advanced age emerged as an independent predictor of complicated appendicitis. Older patients are more likely to experience atypical clinical presentations and diagnostic delays, which may increase the risk of disease progression [22,23]. In contrast, although some studies have suggested that female sex may be associated with more severe acute appendicitis and delayed presentation, our findings did not demonstrate a significant difference by sex in this regard [24,25].

This study has several strengths. It provides one of the limited comparative analyses focusing specifically on appendicitis severity among Syrian immigrants in Türkiye. The use of histopathological classification enhances the objectivity of outcome assessment, and the inclusion of a balanced comparison group strengthens internal validity.

However, several limitations should be acknowledged. First, the retrospective single-center design may introduce selection bias and limit the generalizability of the findings. Second, key variables directly reflecting delay—such as symptom duration and time to hospital presentation and in-hospital intervals (e.g., time from emergency department admission to surgery)—were not available, precluding direct assessment of delay-related mechanisms. Third, potential unmeasured confounders, including socioeconomic status, comorbidities, and health literacy, were not captured. Finally, although the sample size was balanced, it remains relatively modest for detailed subgroup analyses.

From a clinical and public health perspective, these findings have important implications. Interventions aimed at reducing structural barriers—such as improving health system navigation, providing language support services, and enhancing community-level awareness—may facilitate earlier presentation and reduce the burden of complicated appendicitis. More broadly, the findings highlight the importance of addressing healthcare inequities in migrant populations as part of efforts to improve outcomes in time-sensitive surgical conditions.

In conclusion, the higher rate of complicated appendicitis observed among Syrian immigrants likely reflects disparities in healthcare access and patterns of care utilization rather than intrinsic biological differences. These findings highlight that formal entitlement to healthcare does not necessarily translate into equitable access in practice. Addressing structural barriers through targeted, system-level interventions may help reduce preventable complications and improve outcomes in vulnerable populations.

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