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Biological treatment predictors and gender-based clinical features in Takayasu arteritis: A single-center cohort from Western Türkiye

Takayasu arteritinde biyolojik tedavi belirleyicileri ve cinsiyete dayalı klinik özellikler: Batı Türkiye'den tek merkezli bir kohort çalışması

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Abstract

Objective: Takayasu arteritis (TAK) is a rare large-vessel vasculitis with female predominance, affecting the aorta and its branches. Although many cohorts have been described, predictors of biologic therapy use and gender-related differences in clinical features remain insufficiently characterized. This study aimed to investigate clinical characteristics, imaging findings, and treatment approaches of patients with TAK from Western Türkiye, focusing on factors associated with initiation of biologic therapy and gender-based comparisons of clinical features.

Methods: A retrospective observational study was conducted among patients diagnosed with TAK between 2017 and 2025. Demographic, clinical, laboratory, and angiographic data, as well as disease activity indices, were collected. Treatment regimens and interventional procedures were documented. Comparative analyses were performed by gender, and predictors of biologic therapy use were assessed.

Results: The cohort consisted of 34 women (85%) and 6 men (15%), with a mean age of 43.5 years. Disease onset occurred later in males (42.8 vs. 32.1 years, p=0.048). The most frequent angiographic type was type 1 (42.5%). Fatigue (45%) and claudication (37.5%) were common, whereas a decreased radial pulse was more frequent among women. All patients received glucocorticoids; methotrexate was the most common immunosuppressant. Biologic therapy was administered to 45% of patients. Higher baseline C-reactive protein, erythrocyte sedimentation rate, disease severity score, and positron emission tomography-computed tomography (PET-CT) vascular activity score were associated with biologic use.

Conclusion: This single-center cohort highlights comparable clinical features across genders in TAK. Elevated inflammatory markers and PET-CT vascular activity correlated with biologic therapy initiation, yet robust predictive factors were not identified.

Keywords: Takayasu arteritis, antirheumatic agents, sex differences

Özet

Amaç: Takayasu arteritis (TAK), kadınlarda daha sık görülen, aort ve dallarını etkileyen nadir bir büyük damar vaskülitidir. Birçok kohort tanımlanmış olmasına rağmen, cinsiyete bağlı farklılıklar ve biyolojik tedavi kullanımının belirleyicileri henüz yeterince tanımlanmamıştır. Bu çalışma, Türkiye'de tek bir merkezdeki TAK hastalarının klinik özelliklerini, görüntüleme bulgularını ve tedavi yaklaşımlarını, cinsiyete dayalı karşılaştırmalara ve biyolojik tedavi başlangıcıyla ilişkili faktörlere odaklanarak incelemeyi amaçlamaktadır.

Yöntem: Üçüncü basamak bir romatoloji kliniğinde 2017-2025 yılları arasında TAK tanısı almış hastalarda retrospektif bir gözlemsel analiz gerçekleştirildi. Demografik, klinik, laboratuvar ve anjiyografik veriler ile hastalık aktivite indeksleri toplandı. Tedavi rejimleri ve girişimsel işlemler belgelendi. Cinsiyete göre karşılaştırmalı analizler yapıldı ve biyolojik tedavi kullanımının öngörücüleri lojistik regresyon ile değerlendirildi.

Bulgular: Kohort 34 kadın (%85) ve 6 erkekten (%15) oluşuyordu ve yaş ortalaması 43,5 idi. Hastalığın başlangıcı erkeklerde daha geç ortaya çıktı (42,8'e karşı 32,1 yıl, p=0,048). En sık görülen anjiyografik tip tip 1'di (%42,5). Yorgunluk (%45) ve kladikasyo (%37,5) yaygınken, radial nabız azalması kadınlarda daha sıktı. Tüm hastalar glukokortikoid aldı ve metotreksat en sık kullanılan immünosüpresandı. Hastaların %45'ine biyolojik tedavi uygulandı. Biyolojik ajan kulllananlarda daha yüksek bazal C-reaktif protein, eritrosit sedimentasyon hızı, hastalık şiddet skoru ve pozitron emisyon tomografisi-bilgisayarlı tomografi (PET-BT) vasküler aktivite skoru saptandı ancak hiçbiri çok değişkenli analizde bağımsız öngörücüler olarak görülmedi.

Sonuç: Bu tek merkezli kohort kadınlarda daha sık görülen radial nabız kaybı dışında, cinsiyetler arasında genel olarak benzer klinik özellikler olduğunu ortaya koymaktadır. Yükselmiş inflamatuar belirteçler ve PET-BT vasküler aktivitesi biyolojik tedavi başlangıcıyla ilişkili bulunmuş, ancak güçlü öngörücü faktörler tanımlanamamıştır.

Anahtar Kelimeler: Takayasu arteriti, antiromatizmal ilaçlar, cinsiyet farklılıkları

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Introduction

Takayasu arteritis (TAK) is a chronic large-vessel vasculitis that predominantly affects individuals under the age of 50, primarily involving the aorta and its major branches.[1] Granulomatous inflammation of large vessels leads to diffuse wall thickening, resulting in stenotic and occlusive lesions.[2] The overall incidence has been reported to range between 0.3 and 3.4 per million, while prevalence varies from 0.9 to 40 per million.[3] The disease predominantly affects young women of reproductive age.[4]

The exact etiology of TAK remains uncertain; however, genetic predisposition, environmental triggers, and autoimmune mechanisms are thought to contribute.[5] The disease progresses through distinct phases, beginning with inflammation of the arterial wall and followed by stenotic lesions. In the later stages, clinical manifestations such as ischemia may emerge, along with hypertension and diminished pulses.[6] In the early stages of TAK, non-specific symptoms such as fever, weight loss, and fatigue are often predominant.[7] Cardiovascular involvement may occur, including renovascular hypertension and heart failure. Patients may also experience claudication of the extremities, as well as neurological and gastrointestinal symptoms.[2]

Glucocorticoids constitute the first-line treatment. In addition to corticosteroids, conventional non-biologic immunosuppressive agents are commonly used, while tumor necrosis factor (TNF) inhibitors and tocilizumab have shown efficacy in refractory cases.[8] Contrast-enhanced magnetic resonance angiography (MRA), positron emission tomography (PET), and computed tomography angiography (CTA) are key modalities for the diagnosis and monitoring of the disease. These imaging techniques are effective in evaluating vascular lumen, wall thickness, and assessing disease activity.[9,10] Vascular surgery and endovascular interventions are frequently required during the disease course.[11]

Although numerous studies have addressed the epidemiology of TAK, relatively few have specifically examined predictors of biologic therapy use and gender-based differences in clinical features.[12,13] Although data on gender related differences in TAK symptoms remain limited, contemporary cohorts suggest that women more frequently present with upper extremity claudication and pulse deficits, whereas men more commonly exhibit renovascular and lower extremity ischemic manifestations, including hypertension.[14,15] In a large Indian cohort, approximately five percent of patients received biologic agents.[16,17] Similarly, data from a Brazilian cohort showed that biologics were used in 11 percent of patients. Although the association between gender and clinical involvement in TAK has been previously reported, emerging evidence suggests that patterns of vascular involvement may differ across ethnic and geographic populations. The aim of the current study is to evaluate the clinical characteristics, imaging findings, and treatment approaches of patients with TAK who are followed in a specific region of Türkiye. Additionally, gender-based differences in clinical features within the cohort were analyzed, and potential predictors of biologic therapy use were investigated.

Materials and Methods

Study Design and Population

This retrospective observational study included 40 patients with TAK who were followed between 2017 and 2025 in the rheumatology outpatient clinic of the tertiary care institution. All participants were assessed according to the 2022 American College of Rheumatology (ACR)/European Alliance of Associations for Rheumatology classification criteria, with each scoring ≥5 points, confirming a diagnosis consistent with TAK.[18] Patients under the age of 18 were excluded. Additional exclusion criteria included other systemic vasculitides at the time of diagnosis, such as Behçet's disease and polyarteritis nodosa, or meeting the ACR criteria for giant cell arteritis, as well as other inflammatory or immune-mediated conditions, including IgG4-related disease, relapsing polychondritis, and sarcoidosis. Patients with infectious conditions, including human immunodeficiency virus infection, syphilis, tuberculosis, and infectious aortitis, were also excluded. Furthermore, individuals with a history of malignancy or hematologic disorders, prior radiotherapy, cocaine use and those with insufficient clinical or imaging data were not included in the study.[19] Furthermore, age at disease onset in all included patients was consistent with TAK.

Data Collection

Demographic, clinical, laboratory, and treatment characteristics of the patients were analyzed using the hospital's electronic medical records system. Demographic data included age, gender, age at disease onset, and diagnostic delay. Recorded comorbidities comprised diabetes mellitus, hypertension, hyperlipidemia, and coronary artery disease (CAD). Diagnoses of diabetes, hypertension, CAD and dyslipidemia were based on either a prior medical diagnosis or the use of related medications. Individuals who were current or former smokers were grouped together as having a history of smoking.

Clinical manifestations, physical examination findings, and laboratory data at the time of diagnosis were reviewed. Systemic and ischemic symptoms evaluated included exertional claudication in the upper and lower extremities, headache, chest pain, dyspnea, generalized fatigue, dizziness, amaurosis fugax, fever, night sweats, arthritis, and Raynaud's phenomenon. Physical examination findings included the presence of cardiac murmurs, a marked reduction in radial pulse, a systolic blood pressure difference of ≥10 mmHg between arms, and vascular bruits. Laboratory parameters assessed at initial presentation

included C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR).

To assess vascular involvement, conventional imaging modalities such as contrast-enhanced MRA, CTA, and digital subtraction angiography were used. Additionally, PET-CT was employed in selected cases. Angiographic assessments focused on identifying vascular wall abnormalities such as stenosis, occlusion, segmental narrowing, aneurysmal dilatation, and signs of vasculitis. Based on these findings, patients were classified into angiographic types I-V according to the system proposed by Hata et al.[20] Imaging data were reviewed by an experienced rheumatologist.

Interventional procedures performed during the disease course, such as bypass surgery and angioplasty, were evaluated. Complications developing during follow-up, including hypertension, heart failure, renal dysfunction, aneurysm formation, and recurrent vascular stenosis after interventional procedures, were documented. In addition, the presence of active arteritis was recorded and defined as vascular wall inflammation detected on PET-CT imaging.

The treatment approach included glucocorticoids, statins, and antiplatelet agents, alongside immunosuppressive therapies. Immunosuppressive regimens included both conventional agents, such as methotrexate (MTX), leflunomide, mycophenolate mofetil, and azathioprine, and biologic agents, including TNF inhibitors and tocilizumab. The decision to initiate biologic therapy was based on refractory disease activity, defined as persistent clinical symptoms, elevated inflammatory markers, and/or radiological progression despite adequate treatment with corticosteroids and conventional immunosuppressive agents. Biologic agents were considered for patients who experienced disease relapse or an insufficient response to at least one corticosteroid-sparing immunosuppressive therapy.

Disease Activity Assessment

To quantitatively assess disease activity at presentation, criteria established by the Japanese Research Committee for Intractable Vasculitis were applied,[21] along with the Indian Takayasu Arteritis Activity Score (ITAS-2010).[22] The ITAS score and disease activity score were calculated at the time of diagnosis. To assess the correlation between imaging findings and disease activity, the PET-CT vascular activity score (VAS) was evaluated.[23] Mortality and intensive care unit admissions were recorded.

Subgroup analyses by gender compared age, diagnostic delay, inflammatory markers, disease activity scores, vascular involvement patterns, and treatment approaches. Regarding treatment, patients receiving biologic agents (TNF inhibitors and tocilizumab) were compared with those not receiving biologic agents. Factors associated with the initiation of biologic therapy were analyzed in relation to age, age at disease onset, CRP and ESR levels, disease severity, and PET-CT VAS.

Statistical Analysis

All statistical procedures were carried out using IBM SPSS Statistics version 26.0. Continuous variables were described as either mean ± standard deviation or median with interquartile range, depending on the distribution pattern assessed by the Kolmogorov-Smirnov test. Categorical data were presented as counts and percentages. Comparisons between two independent groups were made using the independent samples t-test for normally distributed variables or the Mann-Whitney U test for non-normally distributed data. For categorical variables, Pearson's chi-square test or Fisher's exact test were applied where appropriate. To identify factors associated with the use of biologic therapy, logistic regression analysis was performed. Variables with a p-value below 0.1 in univariate comparisons were entered into the multivariate model. Results were expressed as odds ratios (ORs) with corresponding 95% confidence intervals (CIs). A p-value less than 0.05 was considered statistically significant.

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Tekirdağ Namık Kemal University Ethics Committee (date: 25.03.2025; approval number: 2025.60.03.18). Due to the retrospective design of the study, the requirement for informed consent was waived.

Results

Study Cohort

Among the 40 patients included in the study, 6 (15.0%) were male and 34 (85.0%) were female. The mean age of the cohort was 43.5±13.0. Age at disease onset was significantly higher in males (42.8±10.1) (40-55) compared to females (p=0.048). 27.5% of patients had disease onset after the age of 40. This was significantly more common in males than in females (p=0.038). Mean length of follow-up was 36±12 months. During the follow-up period, two patients (both female) died (Table 1). Comorbidities included hypertension (17.5%), diabetes mellitus (12.5%), CAD and hyperlipidemia (10.0% each), hypothyroidism and Crohn's disease (5.0% each), and, less commonly, breast cancer, psoriasis, ankylosing spondylitis, and hepatitis B virus carrier status (2.5% each).

Clinical Features and Treatment Modalities

Among clinical features, the most frequently reported symptoms were fatigue (45.0%), malaise (40.0%), myalgia (40.0%), and claudication (37.5%). Weight loss and upper

Table 1. Demographic characteristics of Takayasu arteritis patients by gender				
	Male (mean ± SD)	Female (mean ± SD)	Total (mean ± SD)	p-value
Age (years)	47.0±7.9	42.8±13.7	43.5±13.0	0.326
Age at onset (years)	42.8±10.1	32.1±9.7	33.7±10.4	0.048
Age at onset >40 years n (%)	4 (66.7)	7 (20.5)	11 (27.5)	0.038
Diagnostic delay (years)	3.2±1.0	3.6±2.7	3.4±2.0	0.668
Smokers (ever) n (%)	4 (66.7)	12 (35.3)	16 (40)	0.195
P-values <0.05 were considered statistically significant, SD: Standard deviation				

extremity claudication were also relatively common. On physical examination, a decreased radial pulse was the most prominent finding: it was observed in 52.5% of patients and was not detected in any male patient. Blood pressure discrepancy and vascular bruits were present in 52.5% and 40.0% of patients, respectively.

Regarding treatment modalities, all patients received corticosteroids. The most commonly used immunosuppressive agents were MTX, azathioprine, and leflunomide. Among biologic therapies, infliximab and tocilizumab were the most frequently administered. Antiaggregant therapy was used in 75% of patients. Except for a decreased radial pulse, no significant gender-based differences were observed in the use of treatment modalities or in the frequency of presenting clinical symptoms (Table 2).

Laboratory Findings

In the overall cohort, the mean CRP level was 32.9±23.5 mg/L, and the mean ESR was 44.5±20.8 mm/h. The average disease severity score was 3.1±0.78, while the mean ITAS was 8.45±4.85. In gender based subgroup analysis, female patients had a mean CRP of 32.4±23.0 mg/L and ESR of 46.0±20.9 mm/h, whereas in male patients, these values were 35.5±28.9 mg/L and 36.0±19.7 mm/h. The mean disease severity score was 3.18±0.80 in females and 2.67±0.52 in males, while the mean ITAS was 8.85±5.00 and 6.17±3.31, respectively. No statistically significant differences were observed between genders for CRP (p=0.955), ESR (p=0.256), disease severity (p=0.131), or ITAS scores (p=0.246).

Imaging Findings, Interventions and Complications

Among males, the most common angiographic type was type 1 (33.3%), followed by types 2A, 2B, 4, and 5. No males had type 3. In females, type 1 was also the most frequent (44.1%). In the total cohort, type 1 was the most common (42.5%), followed by types 2B and 5.

At least one vascular stenosis was identified in 85% of patients. Multivessel involvement was relatively common, occurring in 11 patients (27.5%). Based on angiographic findings, the most commonly affected vessels were the bilateral common carotid arteries, the left and right subclavian arteries, the abdominal aorta, and the renal arteries. Aneurysms were detected in 22% of patients. Aneurysms were most frequently located in the aortic arch (n=5), followed by the thoracic descending aorta (n=2) and the abdominal aorta (n=2).

Interventional procedures were performed in a subset of patients, including stenting in 9 patients (22.5%), graft placement in 3 patients (7.5%), and bypass surgery in 2 patients, one undergoing aortofemoral bypass and the other undergoing coronary bypass. All interventions were performed on female patients; no male patients required intervention during follow-up. Complications were mainly observed among female patients. 1 patient underwent embolectomy. Among those who received stents, 2 were placed in the left carotid artery, 2 in the left subclavian artery, 5 in the renal arteries, and 1 in the superior mesenteric artery and abdominal aorta. No histopathological samples were obtained from any of the patients.

PET-CT scan was performed in nearly half of the cohort and arteritis was identified in 47.5% of patients and defined by the presence of vascular wall inflammation on PET-CT imaging. Hypertension was the most common complication. There were no statistically significant gender-based differences in the distribution of vascular involvement (Table 3).

Factors Associated with the Use of Biologic Therapies in the Cohort

Patients who received biologics had significantly higher baseline CRP and ESR values. Disease severity scores were also higher in this group. Moreover, PET-CT VAS were markedly elevated among those receiving biologics. No statistically significant differences were found in age, age at disease onset, or baseline ITAS scores between patients who did and those who did not receive biologic therapy. Multivariable logistic regression analysis showed that none of the variables were statistically significant predictors of biologic therapy use. However, the initial CRP level remained marginally associated with biologic treatment (adjusted OR: 1.05, 95% CI: 0.99-1.10, p=0.087) (Table 4).

Table 2. Gender based comparison of clinical manifestations, physical examination findings and treatment modalities in patients with Takayasu arteritis

	Male, n (%)	Female, n (%)	Total, n (%)	p-value
Clinical features at initial presentation				
Fatigue	1 (16.7)	17 (50.0)	18 (45.0)	0.196
Malaise	1 (16.7)	15 (44.1)	16 (40.0)	0.372
Myalgia	1 (16.7)	15 (44.1)	16 (40)	0.372
Claudication	3 (50.0)	12 (35.3)	15 (37.5)	0.654
Weight loss	0 (0)	15 (44.1)	15 (37.5)	0.067
Upper extremity claudication	1 (16.6)	20 (58.8)	21 (52.5)	0.085
Light Headedness	1 (16.7)	11 (32.4)	12 (30)	0.647
Headache	2 (33.3)	9 (26.5)	11 (27.5)	1.000
Chest pain	2 (33.3)	9 (26.5)	11 (27.5)	1.000
Fever	1 (16.7)	9 (26.5)	10 (25)	1.000
Carotidynia	1 (16.7)	8 (23.5)	9 (22.5)	1.000
Abdominal pain	1 (16.7)	8 (23.5)	9 (22.5)	1.000
Raynaud	0 (0)	4 (11.8)	4 (10)	1.000
Lower extremity claudication	0 (0)	3 (8.8)	3 (7.5)	1.000
Night sweats	0 (0)	3 (8.8)	3 (7.5)	1.000
TIA-stroke	0 (0)	3 (8.8)	3 (7.5)	1.000
Amaurosis fugax	0 (0.0%)	2 (5.9)	2 (5.0)	1.000
Dyspnea	1 (16.7)	0 (0)	1 (2.5)	0.150
Physical examination findings				
Decreased radial pulse	0 (0)	21 (61.8)	21 (52.5)	NA
Blood pressure Discrepancy	1 (16.7)	20 (58.8)	21 (52.5)	0.085
Bruit	1 (16.7)	15 (44.1)	16 (40.0)	0.372
Cardiac murmur	2 (33.3)	9 (26.5)	11 (27.5)	1.000
Arthritis	0 (0)	3 (8.8)	3 (7.5)	1.000
Treatment modalities				
Corticosteroids	6 (100)	34 (100)	40 (100)	NA
Statins	3 (50)	10 (29.4)	13 (32.5)	0.603
Antiaggregants	6 (100)	24 (70.6)	30 (75)	0.306
Methotrexate	3 (50)	24 (70.6)	27 (67.5)	0.603
Leflunomid	3 (50)	5 (14.7)	8 (20)	0.150
Tocilizumab	0 (0)	6 (17.6)	6 (15)	1.000
Azathioprine	1 (16.7)	14 (41.2)	15 (37.5)	0.493
Adalimumab	0 (0)	4 (11.7)	4 (10)	1.000
Infliximab	1 (16.7)	11 (32.3)	12 (30)	0.648
Certolizumab	0 (0)	2 (5.8)	2 (5)	1.000
Mycophenolate mofetil	0 (0)	3 (8.8)	3 (7.5)	1.000

P-values <0.05 were considered statistically significant, NA: Not applicable, TIA: Transient ischemic attack

Discussion

This study demonstrates that, in a regional Turkish cohort, patients with TAK exhibit diverse patterns of vascular involvement, while gender does not significantly influence clinical features, treatment strategies, or use of biologic therapy. By integrating an assessment of potential treatment predictors and gender-based comparative analyses of clinical features, it seeks to address a gap in the national literature on TAK.

Regarding demographic characteristics, TAK shows a marked female predominance in the literature, with reported female to male ratios ranging between 5:1 and 14:1[24] and most studies indicating an average ratio of approximately 8-9:1,[25] which is consistent with the 5:1 ratio observed in the present cohort. In this study, the age at disease onset was higher among male patients, a trend also reported in previous studies. For instance, Watanabe et al.[21] observed a median onset age of 43.5 years in

Table 3. Gender based comparison of angiographic findings, interventions and complications in patients with Takayasu rtearitis				
	Male n, (%)	**Female n, (%)**	**Total n, (%)**	**p-value**
Angiographic stenosis areas				
Left subclavian artery	3 (50)	10 (29.4)	13 (32)	0.369
Bilateral common carotid arteries	3 (50)	6 (17.6)	9 (22.5)	0.114
Abdominal aorta	0 (0)	5 (14.7)	5 (12.5)	1.000
Renal arteries	0 (0)	6 (17.6)	6 (15)	0.565
Right subclavian artery	0 (0)	4 (11.8)	4 (10)	1.000
Superior mesenteric artery	0 (0)	2 (5.9)	2 (5)	1.000
Bilateral iliac arteries	0 (0)	2 (5.9)	2 (5)	1.000
Descending aorta	1 (16.7)	1 (2.9)	2 (5)	0.280
Left internal carotid artery	1 (16.7)	1 (2.9)	2 (5)	0.280
Aortic arch	1 (16.7)	1 (2.9)	2 (5)	0.280
Bilateral subclavian arteries	0 (0)	2 (5.9)	2 (5)	1.000
Right common carotid artery	0 (0)	1 (2.9)	1 (2.5)	1.000
Brachial artery	0 (0)	1 (2.9)	1 (2.5)	1.000
Ascending aorta	0 (0)	1 (2.9)	1 (2.5)	1.000
Coronary arteries	0 (0)	1 (2.9)	1 (2.5)	1.000
Aneurysm in angiography	2 (33.3)	7 (20.6)	9 (22)	0.601
Patients undergoing PET-CT	5 (83.3)	12 (35.3)	17 (42.5)	0.066
Arteritis	5 (83.3)	14 (41.2)	19 (47.5)	0.080
Interventions				
Patients undergoing intervention	0 (0)	12 (35.3)	12 (30)	NA
Stent placement	0 (0)	9 (26.5)	9 (22.5)	NA
Vascular graft	0 (0)	3 (8.8)	3 (7)	NA
Bypass surgery	0 (0)	2 (5.9)	2 (5)	NA
Complications				
Hypertension	3 (50.0)	10 (29.4)	13 (32.5)	0.369
Aortic insufficiency	0 (0)	4 (11.8)	4 (10)	NA
Heart failure	0 (0)	3 (8.8)	3 (7.5)	NA
Abdominal aortic thrombosis	0 (0)	1 (2.9)	1 (2.5)	NA
Mesenteric ischemia	0 (0)	1 (2.9)	1 (2.5)	NA
Gastrointestinal hemorrhage	0 (0)	1 (2.9)	1 (2.5)	NA
Pulmonary hypertension	0 (0)	1 (2.9)	1 (2.5)	NA
Angına pectoris	0 (0)	2 (5.9)	2 (5)	NA
Renal failure	0 (0)	1 (2.9)	1 (2.5)	NA
Myocardial infraction	0 (0)	1 (2.9)	1 (2.5)	NA
Pericardial effusion	0 (0)	1 (2.9)	1 (2.5)	NA
Lymphadenopathy	0 (0)	1 (2.9)	1 (2.5)	NA
Mortality	0 (0)	2 (5.9)	2 (5)	NA
Intensive care unit admissions	0 (0)	4 (11.8)	4 (10)	NA

P-values <0.05 were considered statistically significant, PET-CT: Positron emission tomography-computed tomography, NA: Not applicable; arteritis was defined as active vascular wall inflammation detected on PET-CT imaging

men compared with 34 years in women, and similar findings were noted by Wan and Wang.[26] The relatively later onset observed in male patients may be influenced by gender-related biological factors, environmental exposures, or differences in healthcare-seeking behavior, although the underlying reasons remain unclear. This finding should be interpreted cautiously due to the insidious and often delayed diagnosis of TAK, which may influence the accuracy of reported symptom onset. Regarding comorbidities, the prevalence of hypertension, dyslipidemia, and diabetes mellitus was broadly comparable to that reported in previous series, such as the Italian cohort, although hypertension was slightly less frequent.[27]

Table 4. Predictive factors for biologic therapy use in patients with Takayasu arteritis				
	Patients receiving biologic therapy	Patients not receiving biologic therapy	p-value	OR and CI
Age (years)	41.7±12.3	44.7±13.6	0.600	0.98 and 0.93-1.03
Initial ITAS score, mean ± SD	10.0±5.34	7.3±4.22	0.113	1.07 and 0.85-1.35
Age at onset (years), mean ± SD	31.5±10.8	35.4±10.0	0.150	0.96 and 0.90-1.03
Initial CRP value, mean ± SD	**48.1±26.8**	21.7±14.3	**<0.001**	1.07 and 1.02-1.12
Initial ESR, mean ± SD	**58.2±22.3**	34.4±17.6	**<0.001**	1.08 and 1.03-1.14
Disease severity score, mean ± SD	**3.41±0.70**	2.87±0.73	**0.019**	2.85 and 1.03-7.89
PET-CT VAS, mean ± SD	3.86±1.40	1.76±1.04	**<0.001**	4.04 and 1.66-9.83

P-values <0.05 were considered statistically significant, CI: Confidence interval, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, ITAS: Indian Takayasu arteritis activity score, PET-CT VAS: Positron emission tomography-computed tomography vascular activity score, SD: Standard deviation, OR: Odds ratio

The clinical presentation of the disease ranges from asymptomatic cases to very severe manifestations. In a cohort from Türkiye, the most common clinical characteristics were constitutional symptoms (84%) and limb claudication (31%), consistent with the most frequently reported clinical features and physical examination findings in the current study. On physical examination, asymmetric blood pressure was observed in 52% of patients, and loss of peripheral pulses was noted in 47%.[28] In a United States study, the most frequently reported symptoms were fatigue and upper-extremity claudication, and the most common physical examination finding was reduced radial pulse; no gender-based differences were reported. In the current study, however, radial pulse loss was detected only among female patients.

Regarding treatment modalities, consistent with current findings, glucocorticoids were the most commonly used treatment (96.5%), followed by immunosuppressive agents, primarily MTX (56%) and azathioprine. Among biologic treatments, infliximab was the most frequently administered, used in 22% of cases.[6] In a large cohort from China, the majority of patients received glucocorticoid therapy (85.9%), and only a small number required immunosuppressive agents due to resistance.[29] These findings suggest that regional differences and access to treatment may influence therapeutic strategies.

In this cohort, the only gender-based difference was a higher frequency of decreased radial pulse in females; there were no differences between genders in presenting symptoms, inflammatory markers, disease severity indices, or vascular involvement. This relatively limited gender-based difference contrasts with larger datasets reporting more pronounced divergence between sexes. The Japanese national registry found that women had a younger age at onset and longer disease duration, whereas men accumulated more complications overall, notably ischemic heart disease, ocular complications, aortic aneurysm, aortic dissection, and renal dysfunction, while women more often had aortic regurgitation.[30] Similarly, the large single center Chinese series showed that men more frequently had iliac and renal artery disease and higher prevalences of systemic hypertension, renal dysfunction, and aortic aneurysm, whereas women had greater involvement of aortic-arch branches, a pattern consistent with upper-extremity ischemia and compatible with current observation of more frequent decreased radial pulse in females.[14,15]

Taken together, these external data, including findings from the Italian cohort, suggest a recurring phenotype of supradiaphragmatic vessel predominance in women and abdominal/lower-extremity vessel predominance with more hemodynamic complications in men.[31] In the current cohort, the most frequent angiographic subtype was type 1. This distribution was consistent across both genders. By contrast, the Korean cohort demonstrated that female patients more commonly exhibited thoracic aorta and branch involvement, corresponding to types I, whereas male patients more frequently had abdominal aorta and branch involvement, reflected by a higher proportion of type IV disease.[13] The absence of parallel, gender-stratified differences in this study may reflect limited power in a single-center sample, shorter or heterogeneous follow-up, and regional or referral-pattern effects. Differences in imaging modalities, timing, and disease-duration structure at enrollment may further attenuate detectable gender-related contrasts in smaller cohorts.

In the present study, higher baseline inflammatory markers, disease severity scores, and PET-CT vascular activity were associated with subsequent biologic therapy use; however, none of these parameters remained independent predictors in multivariable analysis; only baseline CRP showed a borderline association. These findings emphasize the clinical and laboratory disease burden in patients requiring biologics. In contrast, a recent Turkish cohort employing the Combined Arteritis Damage Score (CARDS) demonstrated that imaging-based parameters at diagnosis, particularly the modified CARDS, were independent predictors of biologic treatment requirement.[32] More broadly, the identification of factors predicting the use of biologics in TAK remains largely unexplored. In adult cohorts, available studies have primarily described clinical features, angiographic patterns or treatment responses, but few have systematically analyzed

predictors of biologic therapy, with most reports noting biologics only as rescue treatment for refractory or relapsing disease.[33] Pediatric studies have provided some additional insight; however, data remain limited. Studies from Türkiye have largely emphasized treatment outcomes and safety of biologic agents, with limited investigation into predictors of biologic initiation.[34] Conversely, international data, including the study by Aeschlimann et al.[35], have demonstrated an association between biologic use and baseline disease activity. A recent systematic review emphasized that, even in children, no robust predictors for biologic initiation have been identified, with treatment decisions still largely driven by persistent activity, relapses, or steroid dependence.[36] Thus, both adult and pediatric literature highlight a knowledge gap, underlining the importance of further studies to correlate laboratory and imaging parameters with subsequent biologic requirements.

Study Limitations

This study is subject to several limitations. First, its retrospective single-center design may limit the external validity of the results, particularly given possible geographic and ethnic differences in disease presentation and treatment practices. Second, the small sample size, especially in subgroup analyses by gender and exposure to biologic therapy, may have reduced statistical power. Third, although a broad range of laboratory and imaging data were evaluated, potentially influential variables such as treatment compliance, socioeconomic background, and access to biologic medications were not systematically captured. In addition, variability in follow-up duration among patients may have affected the identification of long-term outcomes and predictors for biologic therapy. Lastly, the multivariable regression did not reveal independent predictors; this may be explained by the limited cohort size and potential collinearity among clinical and imaging parameters. Larger, multicenter, prospective studies with standardized imaging protocols will be essential to confirm and extend these observations.

Conclusion

In this single-center cohort from Western Türkiye, TAK showed a marked female predominance, with women presenting at a younger age but otherwise demonstrating similar clinical, laboratory, and angiographic characteristics and treatment approaches compared with men. The only significant gender-based difference was that female patients had a higher frequency of decreased radial pulse. Higher inflammatory markers, disease severity scores, and PET-CT vascular activity were associated with subsequent use of biologic therapy, although no independent predictors were identified. Overall, the results underscore the need for larger, multicenter, prospective studies integrating standardized imaging and clinical assessments to better define reliable prognostic markers of the requirement for biologic therapy and of gender-related differences in clinical features in TAK.

Ethics

Ethics Committee Approval: This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Tekirdağ Namık Kemal University Ethics Committee (date: 25.03.2025; approval number: 2025.60.03.18).

Informed Consent: Due to the retrospective design of the study, the requirement for informed consent was waived.

Footnotes

Authorship Contributions

Surgical and Medical Practices: D.B.G., R.M., Concept: D.B.G., R.M., Design: D.B.G., R.M., Data Collection and Processing: D.B.G., Ö.A.S., Analysis or Interpretation: D.B.G., Ö.A.S., Literature Search: D.B.G., Ö.A.S., R.M., Writing: D.B.G.

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