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Original Article

# Uveitis in Internal Medicine in Tunisia: Epidemiology, Etiology, and Predictors of Progression

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## Abstract

**Introduction**: Uveitis, a potentially sight-threatening ocular inflammation, represents a major diagnostic and therapeutic challenge in Tunisia, where its etiological profile remains insufficiently characterized. Given the complexity of its clinical presentation, the involvement of an internal medicine department is often crucial to identify underlying systemic pathologies. This study aimed to describe the epidemiological, clinical, and therapeutic features of uveitis managed in a specialized internal medicine setting, while identifying the specific factors associated with disease recurrence and therapeutic failure in our local context.

**Methods**: We conducted a retrospective, single-center descriptive and analytical study of 80 patients hospitalized for uveitis in the Internal Medicine Department of Razi Hospital, Tunis, between January 2014 and December 2024. Data were meticulously collected from medical records using a pre-established standardized survey form. Statistical analysis was performed using SPSS software (version 25.0), employing Chi-square tests for categorical variables and T-tests for continuous data to identify prognostic factors.

**Results**: A total of eighty patients were included. The mean age was 48.1 years, with a marked female predominance (male-to-female ratio of 0.42). The disease onset was acute in 71.3% of cases. Uveitis was bilateral in 57.5% and granulomatous in 53.8%. Anatomically, anterior uveitis was the most frequent (52.5%), followed by panuveitis (32.5%). Extra-ophthalmic manifestations were observed in 41.3% of patients, guiding the etiological search. Etiologies were non-infectious in 45% of cases, predominantly represented by systemic diseases such as sarcoidosis and Behçet's disease. Infectious causes accounted for 13.7%, with tuberculosis being identified in 8.8% of cases. Idiopathic uveitis remained significant at 41.3%. Treatment was strictly tailored to the etiology, localization, and severity of the inflammation. Systemic corticosteroids were prescribed in 73.8% of patients, and immunosuppressive therapy was required in 31.3%, with azathioprine being the most frequently used agent (26.3%). The clinical course was chronic in 42.5%, acute in 27.5%, and recurrent in 30%. Major complications included synechiae, cataracts, and papilledema. Statistical analysis revealed that recurrence and therapeutic failure were significantly associated with the presence of retinal vasculitis and the initial need for immunosuppressive agents ($P<0.05$). Furthermore, therapeutic failures were closely linked to non-anterior anatomical forms ($P<0.05$).

**Conclusion**: Systemic diseases and tuberculosis represent the primary identifiable causes of uveitis in our internal medicine department, although idiopathic forms remain frequent. Our results highlight that retinal vasculitis and the requirement for early immunosuppression are independent predictors of poor therapeutic outcomes. These findings emphasize the necessity of a multidisciplinary approach and early risk stratification to implement personalized treatment strategies and preserve visual function.

## Introduction

Uveitis comprises a heterogeneous group of diseases characterized by intraocular inflammation of the uveal tract [1]. They represent a significant public health concern due to their frequency, the complexity of their diagnosis, and their potential complications. Epidemiologically, uveitis has a moderate incidence worldwide, estimated at approximately 50.4 cases per 100,000 persons per year [2]. Responsible for approximately 5–20% of cases of legal blindness in high-income countries, it ranks among the leading causes of preventable blindness [3]. In Tunisia, data on uveitis remain limited, although several studies have attempted to describe its epidemiological, clinical, and etiological characteristics in various hospital settings [4]. This situation highlights the need for updated studies to better understand the specific features of uveitis in our context, in order to optimize diagnostic and therapeutic strategies tailored to our population.

Our study was conducted in this context with the objectives of describing the epidemiological, clinical, etiological, therapeutic, and disease progression profiles of uveitis in an internal medicine department in Tunisia, and of identifying factors predisposing to recurrences and predictors of therapeutic failure.

## Methods

This was a retrospective, single-center, descriptive and analytical study including patients hospitalized for uveitis in the Internal Medicine Department of Razi Hospital between January 2014 and December 2024.

Inclusion criteria were patients aged 18 years or older, hospitalized and followed for uveitis, with a comprehensive etiological workup allowing precise classification, and a minimum follow-up duration of three months. Exclusion criteria included patients lost to follow-up and those with incomplete or unusable medical records. Non-inclusion criteria encompassed uveitis of traumatic or post-surgical origin.

Data were collected from medical records. Uveitis was classified according to the 2021 Standardization of Uveitis Nomenclature (SUN) Working Group criteria [1].

## Results

We included 80 patients hospitalized for uveitis, with an average annual incidence of 7.3 cases. The mean age was 48.1 ± 15.8 years, with the majority of cases occurring in the 40–50 year age group (28.7%). A female predominance was observed, with a sex ratio of 0.42.

Clinically, the main presenting symptom was ocular redness, reported in 90% of cases, followed by blurred vision in 82.5% and decreased visual acuity in 72.5% of cases. Ocular pain and tearing were each noted in 40% of patients. Photophobia was observed in 23% of cases, and floaters (myodesopsia) in 13%.

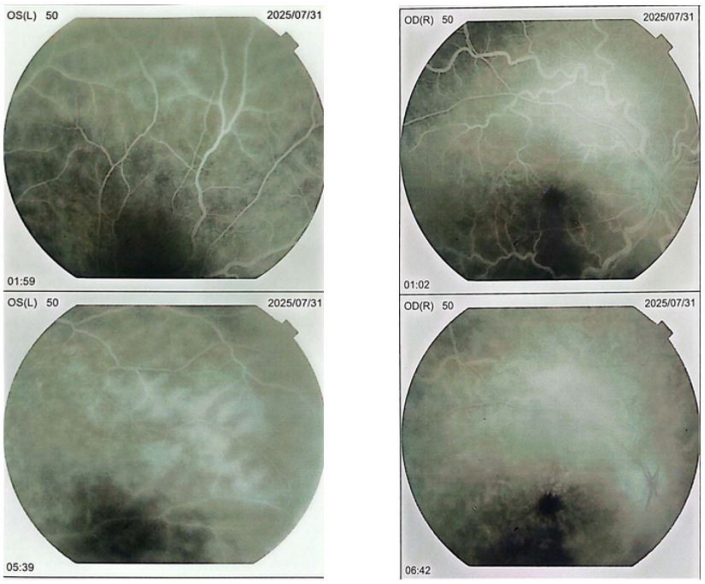


***Figure 1: Angiographic findings**: bilateral retinal vasculitis and macular edema*

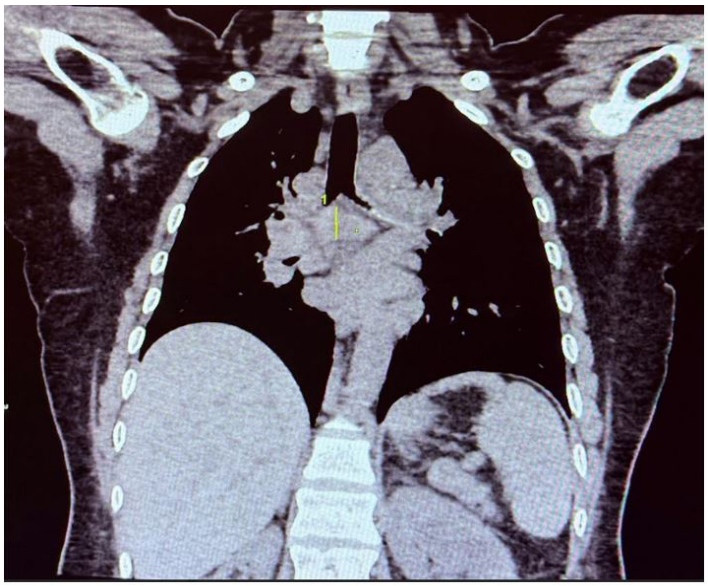

***Figure 2:** Subcarinal lymphadenopathy on CT scan*

L'examen ophtalmologique a objectivé une acuité visuelle moyenne initiale de 5/10 ±3/10 au niveau de l'œil atteint L'examen à la lampe à fente a montré un Tyndall de la chambre antérieure (91,3% des cas), des précipités rétro-cornéens (51,3%), des synéchies irido-cristalliennes (46,3%), un hypopion (41,2%), et des nodules iriens (30%). Une hypertonie oculaire a été objectivée chez quartes patients et une hypotonie oculaire chez un seul patient. L'examen du vitré a montré la présence d'hyalite dans 62,5% des cas et un aspect en « œuf de fourmis » chez deux patients. L'examen du fond d'œil a permis de suspecter une vascularite rétinienne dans 20% des cas, une choroïdite dans 14% des cas, un œdème maculaire dans 12,5%, un œdème papillaire dans 11%, une rétinite et un décollement

rétinien dans 4% des cas chacun.

L'angiographie rétinienne à la fluorescéine a été réalisée chez 93% des patients ayant permis de confirmer la présence de vascularite dans 16 cas, une choroïdite dans 7 cas, une papillite et un œdème papillite dans 6 cas. Elle a objectivé aussi un œdème maculaire dans 5 cas et un décollement séreux de la rétine dans 4 cas. La figure n°1 illustre la présence de vascularite rétinienne et d'un œdème maculaire bilatéraux objectivés à l'angiographie rétinienne pratiquée chez un patient ayant une maladie de Behçet.

Optical coherence tomography (OCT) was performed in 73% of patients, revealing macular edema in 20 patients, an epiretinal membrane in 3 patients, and macular atrophy, papillary edema, and papillitis in one patient each.

Following this evaluation, anterior uveitis was observed in 52.5% of cases, intermediate uveitis in 6.3%, posterior uveitis in 8.7%, and panuveitis in 32.5%. Uveitis was bilateral in 57.5% of cases and granulomatous in 53.8%. Retinal vasculitis was associated in 20% of cases.

In the etiological work-up, clinical history and general examination revealed extra-ocular manifestations in 33 patients, with cutaneous (n=14), neurological (n=13), and rheumatologic (n=10) findings being the most frequent. Laboratory investigations showed biological inflammatory syndrome in 13.7% of cases, lymphopenia in 25%, and anemia in 18.7%. Hypercalcemia was observed in 4 patients and hypercalciuria in 8 patients. Infectious work-up showed a positive tuberculin intradermal reaction in 10% of cases and a positive Quantiferon test in 12.5%. Toxoplasmosis serology was positive in 2 patients, while Toxocariasis and syphilis serologies were positive in 1 patient each.

Immunological assessment revealed positive antinuclear antibodies with a speckled pattern but negative typing in 5 cases. HLA-B27 and HLA-B51 were positive in 2 patients each. Angiotensin-converting enzyme levels were elevated in 11 patients. Cerebrospinal fluid (CSF) analysis was performed in 30 patients with neurological abnormalities, showing aseptic lymphocytic meningitis in 2 patients and a type 2 iso-electrofocusing CSF profile in 1 patient.

Radiological evaluation included chest X-ray, which revealed interstitial syndrome (n=1), mediastinal enlargement (n=4), and bilateral basal opacities (n=1). One patient had stage IV bilateral sacroiliitis in the context of HLA-B27-associated spondyloarthritis. Thoraco-abdominal CT scan identified mediastinal lymphadenopathy in 8 patients (Figure 2), pulmonary nodules in 3 patients, and diffuse interstitial lung disease in 1 patient.

Orbital and brain magnetic resonance imaging (MRI), with or without spinal MRI, was performed in 35 patients. Abnormal findings were observed in 12 patients (15%), including supra- and infratentorial T2 and FLAIR hyperintensities (n=9), spinal cord atrophy (n=1), cortico-subcortical atrophy (n=1), and ischemic sequelae (n=1).

Bronchoscopy with bronchoalveolar lavage revealed four cases of lymphocytic alveolitis, with a CD4/CD8 ratio >3.5 in two cases. Eight patients underwent lymph node biopsies at various sites (cervical, mediastinal, axillary), with histopathology showing non-caseating granulomatous lymphadenitis in seven cases and reactive changes in one case. A splenic biopsy performed in a single patient demonstrated a granuloma with caseous necrosis.

An etiological diagnosis was established in 58.7% of patients. Infectious uveitis accounted for 13.7% of cases, predominantly due to tuberculosis. Non-infectious uveitis represented 45% of cases, with a predominance of systemic diseases, notably sarcoidosis, Behçet's disease, and Vogt-Koyanagi-Harada disease. Uveitis remained idiopathic in 41.3% of cases.

The etiologies identified in our series are detailed in Table I.

The distribution of etiologies according to the anatomical location of uveitis showed a predominance of idiopathic forms, particularly in anterior uveitis (23 cases) and panuveitis (6 cases). Ocular sarcoidosis was mainly associated with anterior and intermediate forms, while multiple sclerosis (MS) preferentially affected the anterior segment and, to a lesser extent, panuveitis. Tuberculosis predominantly resulted in posterior uveitis and panuveitis. Table II summarizes the etiologies of uveitis in our series according to anatomical location.

The therapeutic approach for each case of uveitis was tailored according to its etiology, anatomical location, and

***Table 1:*** *Etiologies of uveitis in our series*

| Etiologies | Number of patients | Percentage |
|---|---|---|
| Sarcoïdosis | 11 | 13,8% |
| Behçet Disease | 9 | 11,3% |
| Tuberculosis | 7 | 8,8% |
| Multiple sclerosis | 6 | 7,5% |
| Vogt-Koyanagi-Harada syndrome | 4 | 5% |
| Primary Sjögren's syndrome | 2 | 2,5% |
| Uveitis associated with spondyloarthritis / HLA-B27 | 2 | 2,5% |
| Ocular toxoplasmosis | 1 | 1,2% |
| Ocular toxocariasis | 1 | 1,2% |
| Ocular co-infection with Toxoplasmosis and Tuberculosis | 1 | 1,2% |
| Ocular syphilis | 1 | 1,2% |
| Fuchs' heterochromic uveitis | 2 | 2,5% |
| Idiopathic uveitis | 33 | 41,3% |
| Total | 80 | 100% |

severity. In the majority of cases, management was based on corticosteroid therapy, with or without specific treatment (antibiotics, antiparasitic agents, immunosuppressants, or biologics).

Systemic corticosteroids were administered in 73.8% of patients, including some with infectious etiologies, to control intraocular inflammation. Due to the severity of clinical presentation, intravenous methylprednisolone pulses were required in 40% of cases. Immunosuppressive therapy was initiated in 31.3% of patients, with azathioprine being the most frequently prescribed agent (26.3%), followed by methotrexate (5%) and cyclophosphamide (3.8%). Cyclosporine and mycophenolate mofetil (MMF) were used in only one patient each. Biologic therapy was indicated in two patients with uveitis associated with multiple sclerosis (MS).

Additionally, antituberculous therapy was administered to 11 patients, including eight with confirmed ocular tuberculosis, for a mean duration of 8.3 ± 3 months. As prophylaxis, the same regimen was prescribed for three patients receiving immunosuppressants (two with idiopathic uveitis and one with Vogt-Koyanagi-Harada syndrome) for a period of three months.

Regarding local therapy, mydriatic agents were prescribed in 82.5% of patients, and topical corticosteroids were used in 86.3% of cases. Carbonic anhydrase inhibitors were indicated in 11.3% of patients to control ocular hypertension. In one patient with severe macular edema, intravitreal anti-vascular endothelial growth factor (anti-VEGF) injection was required.

The course of uveitis was chronic in 42.5% of cases, acute in 27.5%, and recurrent in 30%. Complications were observed in 50% of patients, predominantly synechiae, cataract, and papillary edema.

In univariate analysis, recurrence was significantly associated with the presence of retinal vasculitis (OR = 8.63; 95% CI: 2.55–29.23; $p < 0.001$) and the use of immunosuppressive therapy (OR = 5.73; 95% CI: 2.01–16.29; $p = 0.001$), particularly azathioprine (OR = 3.89; 95% CI: 1.36–11.18; $p = 0.013$).

Similarly, therapeutic failure was significantly associated with a non-anterior location of uveitis, with anterior involvement exerting a protective effect (OR = 0.26; 95% CI: 0.07–0.90; $p = 0.043$). The presence of retinal vasculitis was strongly linked to therapeutic failure (OR = 8.14; 95% CI: 2.32–28.58; $p = 0.001$). Furthermore, the use of immunosuppressive therapy was more frequent among patients who experienced therapeutic failure (OR = 3.23; 95% CI: 1.02–10.25; $p = 0.041$).

## Discussion

To our knowledge, this is the most recent study on uveitis in Tunisia. Conducted over an 11-year period, our study provides an updated perspective on the epidemiological, clinical, diagnostic, and therapeutic characteristics of uveitis in a North African hospital setting.

Our study identified ocular redness as the main presenting symptom of uveitis (90% of cases), followed by blurred vision and decreased visual acuity. These findings are consistent with previously reported Tunisian data [4,7,8,9-11]. Decreased visual acuity was also very frequent, reaching up to 100% in some studies compared to 72.5% in our series, while blurred vision was reported in more than half of cases in other reports, exceeding 80% in our cohort [8,10,11]. Eye pain was a common complaint, present in 52.5% of patients in our series, which is higher than most previously published Tunisian data [4,7,8,9-11].

***Table 2:*** *The distribution of etiologies according to the anatomical classification of uveitis.*

| Etiologies | Anterior | Intermediate | Posterior | Panuveitis | Total |
|---|---|---|---|---|---|
| Idiopathic | 23 | 0 | 4 | 6 | 33 |
| Sarcoidosis | 5 | 3 | 0 | 3 | 11 |
| Multiple sclerosis | 3 | 1 | 0 | 2 | 6 |
| Behçet's disease | 4 | 1 | 0 | 4 | 9 |
| Uveitis associated with spondyloarthritis / HLA-B27 | 2 | 0 | 0 | 0 | 2 |
| Vogt-Koyanagi-Harada (VKH) syndrome | 1 | 0 | 0 | 3 | 4 |
| Primary Sjögren's syndrome | 1 | 0 | 0 | 1 | 2 |
| Tuberculosis | 0 | 0 | 3 | 4 | 7 |
| Toxoplasmosis | 0 | 0 | 0 | 1 | 1 |
| Co-infection (Tuberculosis + Toxoplasmosis) | 0 | 0 | 0 | 1 | 1 |
| Toxocariasis | 0 | 0 | 0 | 1 | 1 |
| Syphilis | 1 | 0 | 0 | 0 | 1 |
| Fuchs' heterochromic uveitis | 2 | 0 | 0 | 0 | 2 |
| Total | 42 | 5 | 7 | 26 | 80 |

***Table 3:*** *The standardized initial etiological workup for uveitis, as proposed by the ULISSE study.*

| Type of uveitis | Paraclinical workup |
|---|---|
| Any uveitis | (CBC), C-reactive protein (CRP)<br>Tuberculin skin test<br>Chest X-ray<br>VDRL and TPHA tests |
| Acute anterior uveitis (non-granulomatous) | HLA B27 typing<br>Sacroiliac imaging if insidious back pain present |
| Unilateral acute granulomatous anterior uveitis of unknown origin | Anterior chamber tap (for herpes group viruses) |
| Chronic uveitis | Angiotensin-converting enzyme (ACE) Quantiferon®<br>Chest CT scan (thoracic CT) |
| Posterior segment uveitis (>40 years old) | Brain MRI |
| Bilateral papilledema | Brain MRI<br>Cerebrospinal fluid analysis (with opening pressure measurement) |
| Intermediate uveitis (> 40 years) [a] | Anterior chamber paracentesis (PCR for herpesviruses, 16S rRNA PCR, Bartonella, Tropheryma whipplei, Leptospira, Toxoplasma gondii, IL-10/IL-6 ratio) |
| Corticosteroid-dependent uveitis[a] | Anterior chamber tap and/or vitrectomy (lymphoma protocol) |

[a] *If uveitis remains unexplained after performing the aforementioned investigations.*

***Table 4:*** *Additional investigations proposed by the ULISSE study in cases of uveitis remaining unexplained after the standardized workup.*

| Examinations | Indications |
|---|---|
| Minor salivary gland biopsy | Mediastinal lymphadenopathy<br>Elevated angiotensin-converting enzyme (ACE) |
| Cerebrospinal fluid (CSF) analysis | Suspicion of lymphoma, multiple sclerosis, Vogt-Koyanagi-Harada disease<br>Neurological signs |
| PET scan | Unexplained uveitis (sarcoidosis-like):<br>>54 years; synechiae; juxta-centimetric mediastinal-hilar lymph nodes |
| Bronchoalveolar lavage | Abnormal chest CT<br>Chronic unexplained posterior segment uveitis with indication for systemic therapy |

Anterior uveitis was the most frequent anatomical form, both in regional and international series, with reported prevalences generally ranging from 39% to 72.5%, consistent with our findings (52.5%) [4,7,16,18]. Intermediate uveitis, reported in 6.3% of cases in our study, appears to be a relatively rare anatomical form in the literature, with rates varying widely between 2.9% and 32% across studies [13,16-19]. Posterior uveitis, reported in 8.7% of cases in our series, shows significant inter-study variability, with prevalences ranging from 5.7% to 30% [7,13,17,20]. Panuveitis, observed in 32.5% of our patients, also exhibits wide prevalence variability in the literature, with rates ranging from 2.85% to 51.9% depending on the study [17,20,21,32].

Our study revealed a predominance of chronic uveitis (42.5%), in agreement with Tunisian data [9,28]. Acute forms accounted for 27.5% of cases, contrasting with several other reports [20,22,23]. Recurrent uveitis represented 30% of our cohort, a proportion similar to that observed in Asian series [4,22,23].

Extraocular manifestations varied widely across studies, ranging from 4.5% to 63%, reflecting the heterogeneity of systemic etiologies and diagnostic strategies [4,7,8,9-11]. Their notable proportion in our cohort (41.25%) underscores the importance of a systematic etiological workup to identify associated systemic disease.

In our study, granulomatous uveitis was slightly more frequent (53.8%) than non-granulomatous forms (46.3%). This trend aligns with observations reported by Luca et al. in Italy, where granulomatous uveitis represented 55% of cases [12]. However, the majority of regional and international studies report a predominance of non-granulomatous forms [4,9,13-15].

**Etiological Workup:** A group of European experts, coordinated by Sève et al., relied on the results of the ULISSE study (Randomized Controlled Trial Evaluating a Standardized Strategy for Uveitis Etiologic Diagnosis) to establish recommendations for the diagnostic approach to uveitis [24]. This study helped define a standardized initial workup, structured around three main axes: anatomoclinical

***Table 5:*** *Distribution of uveitis by etiological groups according to studies.*

| Etudes | Number of cases | Infectious uveitis | Non Infectious uveitis | Idiopathic uveitis |
|---|---|---|---|---|
| Ben Yedder and al. [4] | 90 | 11,1% | 53,4% | 35,5% |
| Tekaya and al. [10] | 127 | 5,5% | 74,8 | 19,7% |
| Neiter and al. [13] | 690 | 13% | 35% | 52% |
| Guellab and al. [18] | 1082 | 31,1% | 33,2% | 35,7% |
| Pandurangan and al. [23] | 102 | 23,4% | 19,9% | 56,7% |
| Our cohort | 80 | 13,7% | 45% | 41,3 |

***Table 6:*** *Distribution of panuveitis etiologies according to studies.*

| | Chebil and al.[7] Tunisia 2013 | Ben Yedder and al.[4] Tunisia 2018 | Guellab and al.[18] France 2025 | Luca and al.[15] Italy 2018 | De la Torre and al.[29] Colomby 2024 | Our cohorte Tunisia 2025 |
|---|---|---|---|---|---|---|
| Idiopathic uveitis | 50,9% | 48,5% | 35,3% | 22% | 25% | 57,1% |
| Behçet Disease | 22,4% | 27,3% | 6% | 24,3% | 0,4% | 0 |
| Toxoplasmosis | 12,1% | 0 | 20,3% | 9,9% | 35% | 0 |
| Tuberculosis | 0,9% | 0 | 2,3% | 23% | 1,3% | 42,9% |
| Sarcoïdosis | 5,2% | 3% | 13,5% | 23% | 2% | 0 |
| Vogt-Koyanagi-Harada (VKH) syndrome | 4,3% | 3% | 0 | 19,7% | 8,3% | 0 |

classification, anatomical location of the uveitis, and its evolutionary pattern (Table III).

When the initial workup fails to identify the etiology, additional investigations are indicated. These should be guided by the clinical context, the patient's medical history, and the findings from the physical examination (Table IV) [24,25].

The French National Diagnostic and Care Protocol (PNDS) follows the same rationale, proposing a comparable diagnostic approach inspired by the principles of the ULISSE study [24]. This targeted and rational approach aims to minimize unnecessary tests, which are often uninformative, while optimizing diagnostic yield [5,24,25].

To date, Tunisia lacks formal national guidelines for the diagnostic management of uveitis, despite notable epidemiological features, including a high prevalence of certain etiologies such as ocular tuberculosis and Behçet's disease [26].

In our study, all patients underwent a standardized minimal workup, which included a complete blood count (CBC), C-reactive protein (CRP), renal and liver function tests, serum and urinary phosphocalcic assessment, syphilis serology, chest radiography, Mycobacterium tuberculosis testing (BK), and a tuberculin skin test (TST).

The diagnostic strategy was subsequently tailored according to the initial results and the patient's clinical presentation. In cases of atypical manifestations or inconclusive minimal workup, a multidisciplinary discussion—involving ophthalmologists, internists, infectious disease specialists, and rheumatologists—was conducted to guide targeted additional investigations. This approach aimed to minimize unnecessary testing, which is often uninformative, costly, and of limited diagnostic yield [25,27].

**Etiological distribution of uveitis**: Idiopathic uveitis was the most frequent etiology in our cohort, accounting for 41.3% of cases. This finding is consistent with data from numerous Tunisian and international studies (Table V). The high proportion of idiopathic cases highlights the persistent challenges in identifying precise causes, despite often extensive and systematic etiological investigations.

Non-infectious uveitis represented the second most common etiology in our series, with a frequency of 45%. Data from the literature are heterogeneous (Table V), likely reflecting differences in recruitment strategies and sample sizes.

Infectious uveitis accounted for 13.7% of cases in our study. This result is comparable to other Tunisian series but lower than that reported in some international cohorts (Table V). These figures emphasize that, although infections are well-recognized causes of uveitis, they remain relatively uncommon in our population.

**Etiology of uveitis by anatomical type:**

**Anterior uveitis**: Idiopathic anterior uveitis was the predominant etiology in our series (41.3%), consistent with Tunisian and international reports, where it typically accounts for 17.3% to 51% of cases [4,7,8,14,18,28–30]. Sarcoidosis and Behçet's disease ranked as the second most frequent causes of anterior uveitis in our study, in contrast to the literature, where viral infections and HLA-

B27-associated uveitis usually occupy the second position [3,17,18,27–30].

**Intermediate uveitis**: Idiopathic intermediate uveitis represented the most common etiology in most Tunisian and European series, with prevalence ranging from 60% to 86% [4,18,28–30]. Sarcoidosis, which was the leading cause of intermediate uveitis in our series, ranks second in other studies, with reported frequencies between 5% and 14.5% [3,18,28,30]. Multiple sclerosis (MS), the second most frequent cause in our study, represents the third most common etiology in the literature, with frequencies ranging from 4.1% to 22.4% [18,28,30,31].

**Posterior uveitis**: The etiological distribution of posterior uveitis varies across regions. Ocular toxoplasmosis is the leading cause in most series, representing 17.5% to 70% of cases [29–33]. International studies report similar frequencies for other major causes—idiopathic uveitis, sarcoidosis, tuberculosis, and viral infections—though prevalence varies by geographic context [18,22,29,30]. In Tunisia, following toxoplasmosis, the most frequent causes are idiopathic forms and Behçet's disease [4,31–33].

**Panuveitis**: Idiopathic panuveitis is the most frequently reported cause in the literature, with rates ranging from 18% to 50% in different Tunisian and international series. Other major etiologies include Behçet's disease, ocular toxoplasmosis, sarcoidosis, and Vogt-Koyanagi-Harada (VKH) syndrome (Table VI).

This variability highlights the need to adapt diagnostic strategies to the specific epidemiological characteristics of each region [25].

### Risk factors for uveitis recurrence

Our study identified retinal vasculitis and the use of immunosuppressive therapy as risk factors for uveitis recurrence. Few studies have successfully identified risk factors for uveitis recurrence across all anatomical locations (anterior, intermediate, posterior, and panuveitis), regardless of etiology [4,34].

Ben Yedder et al. reported several factors associated with an increased risk of recurrence, including younger age, ocular redness, and association with systemic disease [4]. Chan et al. highlighted complicated uveitis and posterior segment involvement as additional risk factors [34]. Most existing studies, however, have focused primarily on anterior uveitis. Identified risk factors in this subset include younger age, viral etiology, association with ankylosing spondylitis or HLA-B27 positivity, and certain ethnic backgrounds, particularly Asian and Maori populations [35–37].

**Recurrence risk factors also vary according to specific etiologies**: in ocular toxoplasmosis, age >40 years and macular or bilateral involvement are associated with recurrence [38]; in ocular tuberculosis, an initially unfavorable course increases risk [39]; in Behçet's uveitis, advanced age, oral ulcers, elevated triglycerides, LDL-cholesterol, and serum amyloid A (SAA) levels are implicated [40]; and in Vogt-Koyanagi-Harada disease, the presence of posterior synechiae is associated with recurrence [41].

In our study, uveitis recurrence was significantly associated with retinal vasculitis, in agreement with the findings of Chan et al. [34]. The use of immunosuppressive therapy—specifically azathioprine—was also significantly associated with recurrence. To our knowledge, the literature does not report immunosuppressive therapy as a factor promoting recurrence; rather, it is generally considered a predictor of potential treatment failure [42,43].

### Predictive factors of treatment failure

In our study, non-anterior uveitis location, the presence of retinal vasculitis, and the use of immunosuppressive therapy were identified as predictive factors of treatment failure. To our knowledge, few studies have specifically focused on predictive factors of treatment failure in uveitis. Most existing studies have concentrated either on remission factors in anterior uveitis or on treatment response to biologic therapies [43–47].

A French study by Prot-Leurent et al. demonstrated that, in patients with non-anterior, non-infectious uveitis, macular thickening greater than 350 microns and posterior uveitis location were significantly associated with treatment failure under mycophenolate mofetil or methotrexate [48]. The MUST (Multicenter Uveitis Steroid Treatment) trial reported that the presence of macular edema was associated with lower baseline visual acuity and poorer visual prognosis during follow-up. Additionally, non-anterior uveitis is generally linked to a worse visual prognosis. However, in this trial, uveitis anatomical location did not have a significant impact on visual acuity outcomes at two years under treatment [48,49].

In our cohort, treatment failure was significantly associated with a non-anterior uveitis location, consistent with previous studies [47,49]. Conversely, anterior uveitis location appeared to exert a protective effect, suggesting it can be considered a predictive factor for remission. These findings align with data from studies evaluating the efficacy of adalimumab [44,50].

## Conclusions

Uveitis is a common and potentially vision-threatening condition, encompassing multiple heterogeneous clinical entities. Its clinical diagnosis is generally straightforward, but identifying the underlying etiology remains challenging. Despite the existence of international guidelines for the

management of uveitis, Tunisia still lacks specific national recommendations. Large-scale, multicenter, prospective studies would help establish Tunisian, or even Maghrebian, guidelines, thereby promoting a more standardized and appropriately adapted management approach.

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**Ethical Considerations:** This article does not report on a study involving human participants or animals.

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