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ORIGINAL RESEARCH article

Demographic and clinical pattern of non-infectious uveitis in the Tripoli Children's Hospital

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Abstract: Uveitis is relatively rare in the pediatric population, but it leads to considerable ocular morbidity. This study aims to describe the clinical, etiological, and treatment features of noninfectious uveitis in Libyan children in a pediatric rheumatology clinic. A retrospective analysis of medical records of pediatric patients who were diagnosed with noninfectious uveitis from January 2000 to December 2021 at the pediatric rheumatology clinic at Tripoli Children's Hospital, Tripoli, Libya, was conducted. All the cases of uveitis in patients under 18 years of age at diagnosis were included. The collected data included age at diagnosis, anatomical location of uveitis, laterality, associated systemic disease, used medications, and visual outcome. 75 patients (137 eyes) comprised the study sample. The mean age at the onset of uveitis was 8.9 ± 3.5 years. The female-to-male ratio was 1: 1.7. Pan uveitis was the most frequent anatomical location (54.7%), followed by anterior uveitis (36%), posterior (8%), and intermediate (1.3%). The bilateral eye was involved in 82.7%, and the unilateral eye was involved in 17.3%. The common causes of non-infectious uveitis are chronic idiopathic (52%), which was the most frequent etiology. Other causes associated with systemic diseases. The most frequent systemic disease was juvenile idiopathic arthritis (20.0%), frosted form-associated uveitis (10.7%), followed by Behcet disease (10.7%), HLA B27-associated uveitis (2.7%), and Vogt-Koyanagi-Harada disease (2.7%). Complications occurred in 78.8% of affected eyes. The most common complications were posterior synechia (41.3%), cataract (18.7%), glaucoma (21.3%), and cystoid macular edema (20%).

Introduction

Uveitis represents a significant cause of visual morbidity in children [1]. Its potential to cause vision-threatening complications such as cataracts, glaucoma, cystoid macular edema (CME), and irreversible vision loss necessitates prompt diagnosis and aggressive management [1, 2]. Uveitis arises from a breakdown in ocular immune privilege, leading to an inappropriate immune response against intraocular antigens [1, 3]. Uveitis is uncommon in the pediatric population, with an estimated annual incidence of 4.3 per 100,000 children and a prevalence of 27.9 per 100,000. It accounts for 5.0-10.0% of all uveitis cases across all age groups [4]. A significant majority of pediatric uveitis cases are classified as non-infectious [4]. This highlights the substantial role of immune dysregulation and systemic autoimmune diseases in pediatric ocular inflammation. Juvenile idiopathic arthritis (JIA) stands as the most critical systemic association, linked to 75% of all pediatric anterior uveitis cases [4, 5]. JIA is a prevalent chronic rheumatologic disease [4, 6]. Anterior uveitis is the most common presentation in children, while posterior uveitis is the least frequent [7]. Ocular

complications are alarmingly common, affecting up to 76% of children with uveitis, and include sequelae such as cataract formation, secondary glaucoma, and macular edema [7]. Studies indicate visual impairment in at least one affected eye, with rates of visual acuity worse than 20/50 and 20/200 over five years reaching 36% and 15%, respectively [4, 7, 8]. In the USA, uveitis is responsible for an estimated 10% of all blindness cases, primarily due to untreated or uncontrolled inflammation [9].

Pediatric uveitis presents a distinct and formidable set of challenges, often leading to delays in diagnosis and suboptimal outcomes [10]. Young children may be entirely asymptomatic due to an inability to articulate complaints like blurred vision or photophobia, or because the inflammation itself is silent, particularly in JIA-associated uveitis (JIA-U) [3]. This asymptomatic nature means unilateral vision loss can go unnoticed, and parents may recognize a problem with the emergence of strabismus, leukocoria, or band keratopathy, signs that often indicate advanced disease [11]. The examination of a young child is intrinsically difficult, making it easy to miss subtle signs of early inflammation [3, 12]. The consequences of uncontrolled inflammation are more severe in the developing visual system. Complications like amblyopia, which can result from media opacities or uncorrected refractive errors secondary to inflammation, can lead to permanent, irreversible vision loss if not addressed during the critical amblyogenic period [3]. These factors coalesce into a clinical scenario where diagnosis is frequently delayed, and children often present with significant, sight-threatening complications at their initial ophthalmologic consultation [11]. Crucially, the absence of a red eye does not rule out serious intraocular inflammation, a common pitfall in diagnosing JIA-U. Uveitis is classified based on the primary site of inflammation within the eye [13]. These include: Anterior uveitis: iritis and/or iridocyclitis, localized to the anterior chamber, which is the most common form in children, especially when associated with JIA [3, 14], intermediate uveitis often with involvement of pars planitis [14], posterior uveitis: choroiditis and/or retinitis, chorioretinitis. This includes conditions of toxoplasmosis and certain forms of Vogt-Koyanagi-Harada (VKH) disease [14], and panuveitis: inflammation of the uveal tract-anterior chamber, vitreous, and retina/choroid-without a single predominant site [14]. The pathophysiology of non-infectious uveitis (NIU) is complex, involving a breach of the eye's immune privilege, dysregulation of adaptive immunity, and contributions from genetic and epigenetic factors. The studied animal model, experimental autoimmune uveitis, involves B cells, and autoantibodies are present and may contribute to pathogenesis, potentially through immune complex deposition or other mechanisms. No model has shown that uveitis can be initiated by autoantibodies alone, underscoring the primary role of cellular immunity [1]. Genetic predisposition plays a role in pediatric NIU. Specific HLA-DR alleles are linked to susceptibility to JIA-U, while HLA-B27 is strongly associated with acute anterior uveitis in the context of spondyloarthropathies [15]. HLA-B51 is a major genetic risk factor for Behçet's disease (BD) [16, 17]. Beyond HLA, polymorphisms in various immune-regulatory genes and epigenetic modifications are also implicated in disease susceptibility and severity [1]. Identifying reliable biomarkers for diagnosis, monitoring activity, and predicting treatment response is an active area of research. For instance, elevated levels of IL-6 are found in BD, and specific chemokine profiles may differentiate active from quiescent disease. These biomarkers can even be detected in tears, suggesting the potential for future non-invasive monitoring [1].

Uveitis in children has a broad differential diagnosis, categorized into infectious, non-infectious, masquerade syndromes, and idiopathic causes. Infectious causes, while less common than non-infectious in many settings, are critical to recognize as they require specific antimicrobial therapy. Etiologies span bacterial, viral, fungal, and parasitic agents [18]. Bacterial/spirochetal includes Cat-Scratch disease (*Bartonella henselae*), a leading cause of neuroretinitis; Lyme disease (*Borrelia burgdorferi*), which can cause various uveitic manifestations; Syphilis (*Treponema pallidum*), a great mimicker presenting with granulomatous or non-granulomatous inflammation, and tuberculosis (*Mycobacterium tuberculosis*), often presenting as focal or multifocal choroiditis or retinal vasculitis [18]. Viral infections are a cause of anterior uveitis, often associated with elevated intraocular pressure and iris atrophy, herpesviruses, which can cause devastating necrotizing retinitis, cytomegalovirus, and Epstein-Barr virus. HIV is an important consideration [18]. Toxoplasmosis is

the cause of posterior uveitis worldwide, classically presenting as a focal necrotizing retinochoroiditis with overlying vitritis [18]. JIA is the single most important systemic disease associated with pediatric uveitis [6]. JIA-U is a chronic, anterior, and asymptomatic inflammation, most frequently linked to the oligoarticular and rheumatoid factor-negative polyarticular subtypes of JIA [14, 19]. It affects young, ANA-positive girls. The risk is highest within the first four years of arthritis diagnosis, necessitating strict screening protocols to detect silent inflammation before complications like posterior synechiae, cataract, and glaucoma develop [14, 15, 19]. Management escalates from topical corticosteroids to systemic immunomodulators [19]. BD is a systemic vasculitis characterized by recurrent oral and genital ulcers, skin lesions, and uveitis [16]. Ocular BD is often severe, involving bilateral panuveitis or posterior uveitis with retinal vasculitis, and is a major cause of visual loss. BD shows a strong genetic association with HLA-B51 and a distinct geographic prevalence along the historic Silk Road [16, 17]. Pediatric sarcoidosis has early-onset presenting with the classic triad of uveitis, arthritis, and dermatitis, and later-onset disease resembling adult pulmonary sarcoidosis [7, 14, 20]. Ocular involvement occurs in 30%-60% of cases, often as chronic granulomatous anterior uveitis with mutton-fat keratic precipitates and iris nodules [11, 20]. VKH is a multisystem autoimmune disease targeting melanocytes. It presents with an acute bilateral panuveitis featuring exudative retinal detachments, followed by a chronic phase with depigmentation and complications like cataract and glaucoma [20, 21]. Spondylo-arthropathy and inflammatory bowel disease: Acute, recurrent, unilateral anterior uveitis is a common extra-articular feature of HLA-B27-associated spondyloarthropathies [18]. Uveitis can occur in children with Crohn's disease or ulcerative colitis, often with an insidious onset [18]. A significant proportion of pediatric uveitis cases remain idiopathic after thorough investigation [22]. This highlights the limits of current diagnostic capabilities and the likely existence of yet-uncharacterized autoimmune or genetic factors. The primary goals of treating pediatric NIU are to achieve prompt suppression of inflammation, prevent ocular complications and vision loss, minimize treatment-related side effects, and preserve the child's quality of life and visual development [9, 23]. Treatment is stratified based on disease location, severity, and the patient's age. Topical corticosteroids are the mainstay for anterior uveitis. Prednisolone acetate is used to minimize the risks of cataract and glaucoma. Difluprednate is a more potent ester used for severe inflammation or CME [23]. Local corticosteroid delivery is used for intermediate, posterior, or persistent anterior uveitis. Periocular steroid injections or intravitreal implants provide higher local drug levels while minimizing systemic side effects [9, 15, 23]. Systemic steroids are used as a bridge therapy to rapidly control severe inflammation while a slower-acting steroid-sparing agent is initiated. Long-term monotherapy with systemic steroids is avoided due to their adverse effect profile [15]. Systemic immunomodulatory therapies are steroid-sparing agents used for chronic or refractory uveitis. Methotrexate is the conventional first-line, supported by evidence of its efficacy [19, 24]. TNF-α inhibitors are the best-established, with adalimumab approved for pediatric NIU; tocilizumab or abatacept are options for refractory cases [25-27]. Treatment decisions are often guided by consensus plans, due to the relative paucity of large randomized controlled trials in pediatric uveitis [15, 23, 25]. The CARRA guidelines emphasize early introduction of steroid-sparing and provide structured treatment plans for different disease severities. Despite advances in understanding and therapy, pediatric NIU remains a leading cause of preventable blindness in children. Epidemiological and clinical patterns of the disease show considerable geographic and ethnic variation influenced by genetic, environmental, and healthcare access factors [28, 29]. Data characterizing pediatric NIU from North Africa, and Libya in particular, are scarce. To address this gap, the rheumatology clinic at Tripoli Children's Hospital occupies a unique position, which is essential to inform region-specific clinical guidelines, screening protocols, and resource allocation.

Materials and methods

Study design: Retrospective cohort study, as a cross-sectional study of the medical records of all patients diagnosed as juvenile uveitis, followed up at the rheumatology clinic in Tripoli Children's Hospital, Libya.

Study setting: The study will be carried out in Tripoli Children's Hospital, which is the teaching hospital providing tertiary health care services with several pediatric subspecialty clinics, including the rheumatology clinic, which is the clinic offer pediatric rheumatology services covering all western and southern areas of Libya.

Study population: Paediatric patients diagnosed with juvenile uveitis at Tripoli Children's Hospital, from 2005 to 2024.

Study tool: A preformed case sheet will be used to obtain the relevant data from the medical records, including the following: demographic data, clinical presentation, and inflammatory markers.

Ethical considerations and consent process: Ethical approval was obtained from the scientific institutional committee (CTH: 19-2023) and the Tripoli Children's Hospital before starting the study.

Statistical analysis: The study used SPSS version 2025 for the statistical analysis, beginning with descriptive statistics (frequencies; mean ± SD or median [IQR]). Group comparisons will use Chi-square/Fisher's exact test, the t-test, and the Mann-Whitney test for appropriate analysis.

Results

A total of 75 pediatric patients diagnosed with NIU were included in this retrospective study. The cohort consisted of 48 females (64.0%) and 27 males (36.0%), yielding a female-to-male ratio of 1.8: 1. The mean age at diagnosis was 8.9 ± 3.5 years (range: 1.6 - 19.3 years). The geographic distribution of patients reflected the national referral role of the center, with the majority from Tripoli, followed by the Western region (28%), Central region (16%), Southern region (5.3%), and Benghazi (1.3%). In **Figure 2**, uveitis was bilateral in the majority of cases (82.7%), resulting in the evaluation of 137 affected eyes. The mean follow-up period for the cohort was 2.5 ± 2.5 years (median: 1.83 years).

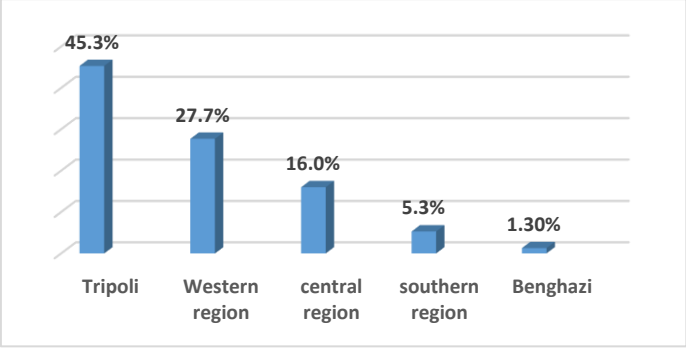

Figure 1: Geographic distribution of patients' residence

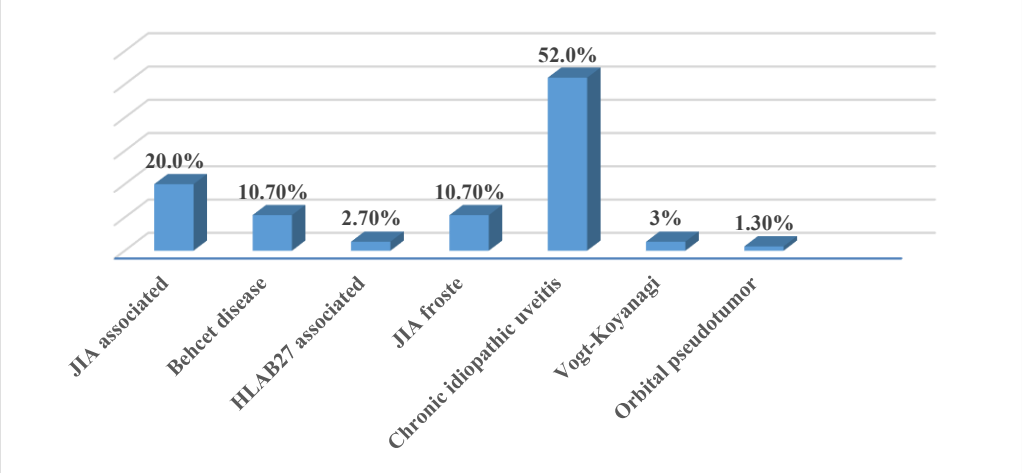

Figure 2: Etiological distribution of the Libyan patients

In **Figure 2**, the most frequent diagnosis was chronic idiopathic uveitis, accounting for 52.0% of cases. JIA was the most common systemic association, present in 30.7% of patients. This JIA-associated group was further subdivided into classic JIA-associated uveitis (20%) and a distinctive JIA froste form (10.7%). BD was diagnosed in 10.7% of patients. Less common etiologies included HLA-B27-associated uveitis (2.7%), VKH disease (2.7%), and orbital pseudotumor (1.3%). In **Figure 3**, panuveitis was the predominant subtype, observed in 54.7% of pediatric patients. This was followed by anterior uveitis (36%), posterior uveitis (8%), and intermediate uveitis (1.3%).

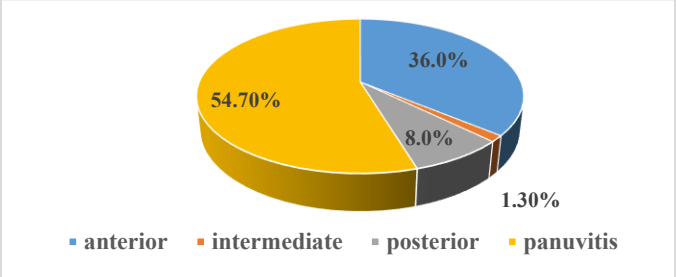

Figure 3: Anatomical classification: Location of uveitis

Most patients (85.3%) were symptomatic at diagnosis. The most common presenting symptom was red eye (65.3%), followed by decreased vision (29.3%), eye pain (13.3%), blurred vision (9.3%), photophobia (9.0%), and squint (6.7%). A substantial minority (14.7%) were asymptomatic, with uveitis detected during routine screening. In **Figure 4**, at the time of initial referral, VA was impaired in a substantial proportion of eyes. VA was decreased in 52.0% of right eyes and 58.6% of left eyes. Complications were present in the majority of patients at baseline. The frequent complications were posterior synechiae (56.0%), followed by cataract (32.0%), CME (9.3%), band keratopathy (6.7%), and glaucoma (5.3%).

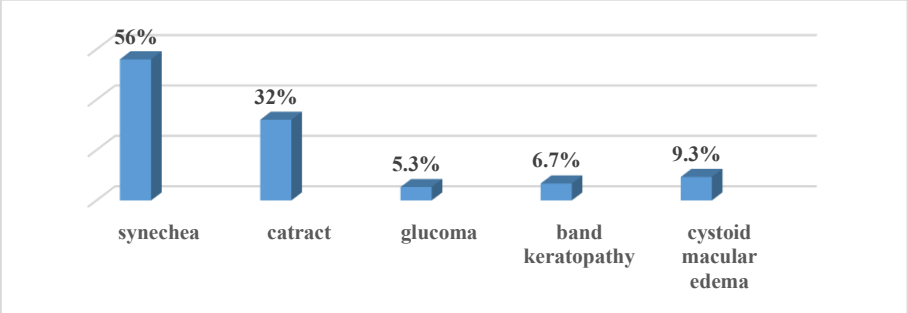

Figure 4: Complications of the Libyan patients at referral

Serological testing revealed that most patients were negative for common autoantibodies **(Table 1**). Antinuclear antibody (ANA) was positive in 32.0% of patients. HLA-B51 was positive in 13.3%, primarily in patients with BD. HLA-B27 was positive in 9.3%. Rheumatoid factor was positive in 1.3% of the cohort. In **Table 2**, methotrexate was the most frequently used cDMARD, administered to 86.7% of patients. Oral prednisolone was used in 77.3%, while topical corticosteroids were used (61.3%). Biologic DMARDs were required for refractory disease (17.3). The drugs used included infliximab (12.0%), tocilizumab (9.3%), and adalimumab (2.7%).

Table 1: Serological findings in the cohort

Serology Test	Positive finding
Rheumatoid Factor	1.3%
Antinuclear Antibody	32.0%
HLA-B27	9.3%
HLA-B51	13.3%

Table 2: Treatment modalities for the patients

Treatment	Patients receiving
Topical Corticosteroids	61.3%
Oral Prednisolone	77.3%
IV Methylprednisolone Pulses	4.0%
IV Methylprednisolone Pulses	86.7%
Methotrexate	12.0%
Infliximab	12.0%
Tocilizumab	9.3%
Mycophenolate Mofetil	8.0%
Adalimumab	2.7%
Any biologic agent	**17.3%**

In **Table 3**, a significant association was found between ANA status and symptomatic presentation ($p = 0.001$). Among the 11 asymptomatic patients, the majority (81.8%) were ANA-positive. In contrast, among the 64 symptomatic patients, most (64.1%) were ANA-negative. This suggests that ANA-positive uveitis, often associated with JIA, is more likely to have an insidious, asymptomatic onset.

Table 3: Association between symptoms and Antinuclear antibody status

Symptoms at presentation	Antinuclear antibody			
	Negative	Positive	Not done	**Total**
No	2	9	0	11
Yes	41	15	8	64
Total	43	24	8	75

In **Table 4**, a significant relationship was observed between the specific uveitis diagnosis and the presence of complications at presentation. Complications were nearly universal in patients with BD (100%, 6/6) and VKH disease (100%, 2/2), and were very common in chronic idiopathic uveitis (89.5%, 34/38) and JIA froste form (87.5%, 7/8). No significant correlations were found between patient sex and the presence of symptoms or ANA status, nor between ANA status and the presence of complications.

Table 4: Relationship between primary diagnosis and presence of complications

Diagnosis	No complications	With complications	Total
JIA-associated	7	7	47
Behçet's disease	0	6	6
Chronic idiopathic	4	34	38
JIA Froste form	1	7	8
VKH disease	0	2	2
Total	13	59	72

In **Figure 5**, about chronic idiopathic uveitis, the largest subgroup (52%) had a female-to-male ratio of 2: 1 and a mean age of 9.3 years. All patients were symptomatic, most commonly with red eye (79.5%).

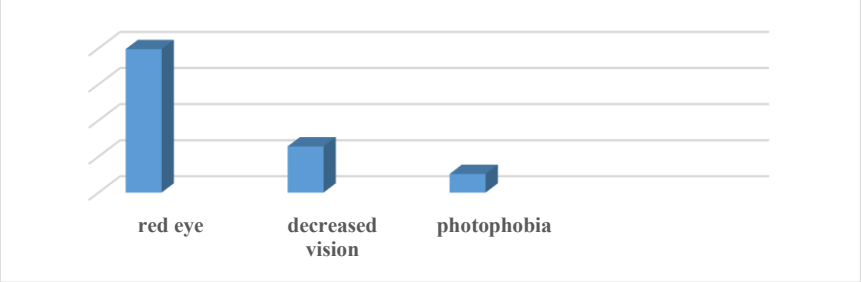

Figure 5: Symptomatology of the eye's patients

Panuveitis (56.4%) and bilateral disease (87.2%) were predominant. ANA was negative in 84.6% of tested patients. At referral, 58.9% of right eyes and 66.7% of left eyes had decreased VA. In **Figure 6**, common complications included posterior synechiae (48.7%) and cataract (35.9%). Treatment involved methotrexate (82.1%) and oral prednisolone (74.4%), with biologics required in 12.8% of cases (**Table 5**).

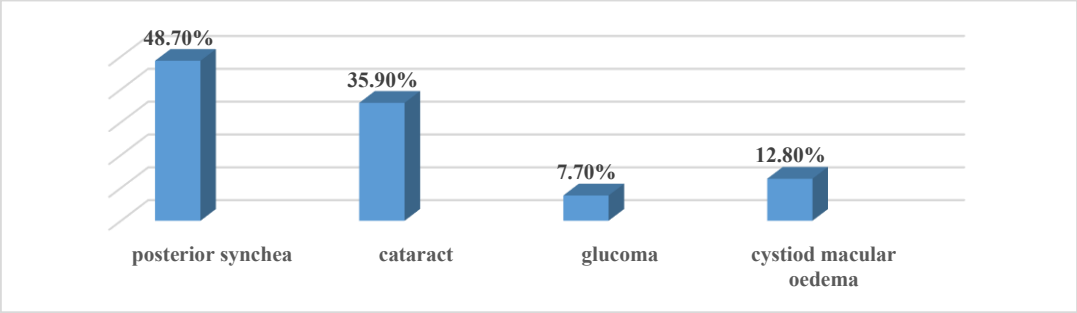

Figure 6: Complications at presentation of the Libyan patients

Table 5: Treatment modalities of the Libyan patients

Treatment	Patients
Local steroids	76.9%
Oral prednisolone	74.4%
Methotrexate	82.1%
Mycophenolate mofetil	12.8%
Infliximab	10.3%
Tocilizumab	7.7%

Regarding JIA-associated uveitis, this group was predominantly female (F: M = 2: 1) with a young mean age at diagnosis (5.7 years). Oligoarticular JIA was the most common subtype (46.7%), **Figure 7**.

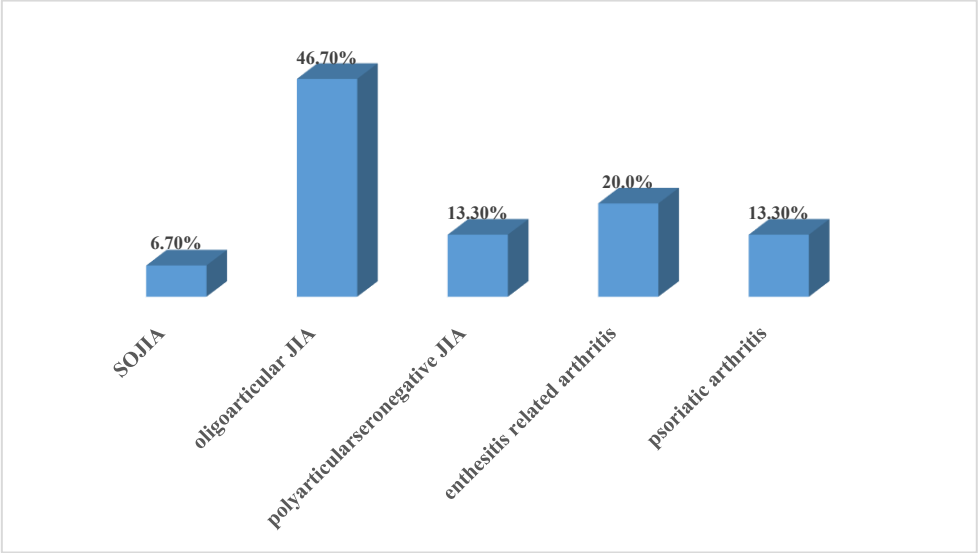

Figure 1: Juvenile idiopathic arthritis classification

Crucially, 66.7% of patients were asymptomatic, and uveitis was detected via screening. Anterior uveitis was the main anatomical type (73.3%), and ANA was positive in 66.7%. Despite screening, complications at referral were common: posterior synechiae (60.0%) and cataract (26.7%), as shown in **Figure 8**. Treatment with methotrexate was used in 80% of patients. At the final follow-up assessment, disease activity was well-controlled for the majority of patients. Uveitis was inactive in 12 patients (85.7%), while two patients (14.3%) had persistently active disease. Visual outcomes demonstrated significant improvement from baseline. In the right eye, VA was normal in eight patients (61.5%), improved in two patients (15.4%), remained static in two

patients (15.4%), and declined to light perception in one patient (7.7%). When expressed in decimal units, seven patients (53.8%) achieved a VA of 1.0 (Snellen equivalent 6/6 or 20/20), with the remaining ranging from 0.001 to 0.8. Outcomes in the left eye were similarly positive: VA was normal in nine patients (69.2%), improved in three patients (23.1%), and static in one patient (7.7%). A VA of 1.0 was achieved by eight patients (61.5%), with the others between 0.05 and 0.8. The mean VA at the final visit was 0.7 (Snellen ~6/9.5 or 20/32) in the right eye and 0.8 (Snellen ~6/7.5 or 20/25) in the left eye. Intraocular pressure (IOP) was adequately managed in most patients. In the right eye, IOP was normal in 53.8%, low in 23.1%, and high in 7.7% patients; data were not recorded for 15.4% of the patients. In the left eye, IOP was normal in 69.2% patients, low in 7.7%, high in 7.7%, and not recorded in 15.4% of the patients. A total of 46.7% patients had persistent ocular complications at their last visit. A higher proportion of these patients with complications were ANA-positive (85.7%, 6 of 7) compared to those without complications (50%, 4 of 8). The Oligoarticular JIA subgroup accounted for five of the seven patients with complications. The status of specific complications at the final visit was as follows: *Posterior synechiae:* Absent in 42.9%, static in 35.7%, improved in 14.3%, and worsened in 7.1%. *Cataract:* Absent in 64.3% patients, static in 21.4% patients, improved in 7.1%, and worsened in 7.1% of the patients. *Glaucoma:* Absent in 57.1% and static in 42.9% of the patients. *Band Keratopathy:* Absent in 57.1%, static in 35.7% patients, and improved in 7.1% of the patients. *CME:* Absent in 53.3% and static 46.7% of the patients. Overall, the most common persistent complications were posterior synechiae (in 12 eyes, 12.5% of all affected eyes), cataract (6.2%), and profound vision loss (3.1%).

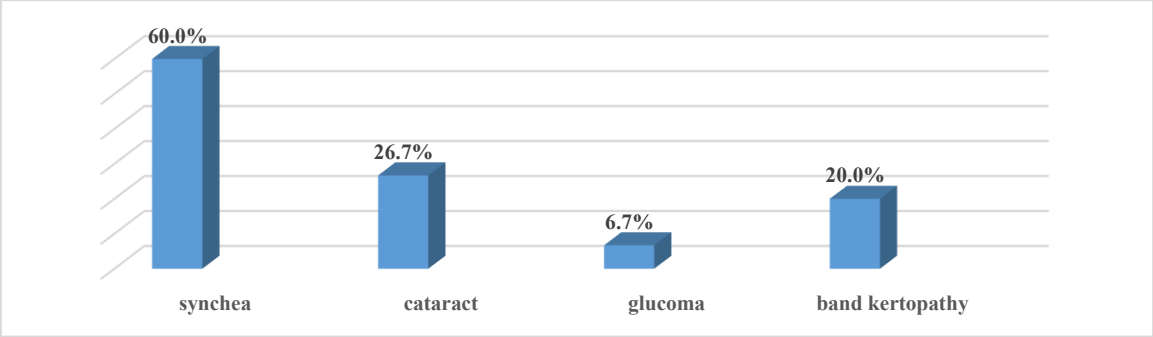

Figure 2: Complications of the visual of the patients

With respect to BD-associated uveitis, this group had an equal gender distribution. All patients had bilateral panuveitis and were symptomatic, primarily with red eye (87.5%). HLA-B51 was positive in 87.5% of patients. Severe complications at presentation were universal, with posterior synechiae in 87.5% and cataract in 37.5%. All patients required aggressive immunosuppression with methotrexate and oral prednisolone, and 37.5% needed adjunct biologic therapy. With JIA froste form uveitis, this distinct subgroup showed female predominance (F: M = 1.6: 1). Panuveitis (62.5%) was most common. In contrast to classic JIA-U, 87.5% were symptomatic, and 100% were ANA-positive. Posterior synechiae were the most frequent complication (62.5%). All patients were treated with methotrexate and corticosteroids. With other etiologies, smaller subgroups included HLA-B27-associated uveitis (n = 2), presenting with anterior or panuveitis, and VKH disease (n = 2), both presenting with bilateral panuveitis and significant visual impairment, requiring intensive immunosuppressive therapy.

Discussion

Pediatric non-infectious uveitis represents a significant clinical challenge due to its diverse etiologies, often subtle or asymptomatic presentation in young children, and the risk of severe, vision-threatening complications from delayed diagnosis or inadequate treatment [30]. This study provides an analysis of the demographic, clinical, and etiological patterns of NIU in a cohort of children. The findings offer valuable insights into the local epidemiology and contribute to the broader understanding of this condition within the

North African context. The mean age at diagnosis is 8.9 years. This aligns closely with reported ages in the regional study, 8.4 years [31], and falls within the typical age range reported in larger international cohorts, where median ages range from 7.4 to 9.4 years [32, 33]. The current study showed a female predominance, a finding consistent with several other reports on pediatric NIU [32]. This reflects, in part, the high prevalence of conditions like JIA-associated uveitis, which disproportionately affects girls, within the NIU spectrum. In this study, the majority of patients presented with ocular symptoms, with red eye and decreased vision being the most common. This contrasts with some international studies where a higher proportion of asymptomatic cases are detected through routine screening, particularly in populations with a high burden of JIA-U [34, 35]. For instance, Yalçındağ et al. [34] reported 40% of patients were asymptomatic, and BenEzra et al. [35] found 30%. This discrepancy may be explained by differences in referral patterns, access to routine ophthalmological screening for at-risk children, or the underlying etiological mix within the studied population. Our data revealed a high association between clinical presentation and serological markers. It is found that ANA-positive status was strongly correlated with an asymptomatic presentation. Among the asymptomatic patients in our cohort, the overwhelming majority were ANA-positive. Equally, symptomatic presentation was predominant in ANA-negative cases. This finding supports the observations of Marino et al. [32], who linked ANA positivity to a lower likelihood of symptomatic uveitis. This underscores a critical clinical point: The most common form of pediatric NIU-JIA-associated anterior uveitis is frequently silent. The current results reinforce the absolute necessity of proactive, protocol-driven screening in at-risk populations rather than relying on symptom-driven presentation, which inevitably leads to delayed diagnosis and a higher burden of complications at first examination. Panuveitis was the most frequent finding in our patients, followed by anterior uveitis. This distribution, with a high rate of panuveitis, aligns with reports from regional centers in the Middle East and North Africa [31, 32]. In contrast, studies from Western Europe and North America often report a higher preponderance of anterior uveitis, largely driven by JIA-U [33, 36]. This geographical variation likely reflects differences in the prevalence of underlying systemic diseases; for example, our cohort included a notable proportion of BD, a condition that typically manifests as panuveitis or posterior uveitis and is more prevalent along the historic Silk Road. Bilateral involvement was observed in 80% of our patients, a rate comparable to or higher than reports from Turkey, France, and South Africa [17, 30, 32]. High bilateral rates are characteristic of many autoimmune and autoinflammatory conditions, such as BD, VKH, and idiopathic panuveitis, which were well-represented in our study population.

The etiological classification of pediatric uveitis broadly encompasses infectious, non-infectious, and masquerade syndromes, with non-infectious causes predominating in many settings [28, 37]. In our tertiary rheumatology setting, each patient undergoes a standardized diagnostic protocol involving a detailed history, systemic and slit-lamp examinations, and targeted laboratory investigations. The most frequently identified specific systemic associations were JIA and BD. A substantial proportion of cases, however, were classified as idiopathic uveitis. This high rate of idiopathic disease is a common finding, with studies from diverse geographic regions reporting idiopathic uveitis as the leading category [15, 17, 18, 21, 32, 33, 38, 39]. The variability in the prevalence of specific systemic associations, such as the lower reported rates of JIA-U in some Middle Eastern and Asian cohorts compared to Western studies, highlights the significant influence of ethnic and geographic factors on disease patterns, as noted by Lamattina et al. [29]. Our own proportion of JIA-U may be influenced by our clinic's role as a specialist rheumatology center and the implementation of routine uveitis screening in JIA patients. Pediatric uveitis carries a significant risk of vision loss, with children often faring worse than adults despite a lower overall incidence [11, 34]. Complications were highly prevalent at presentation, affecting 80% of patients. The common complications were posterior synechiae, glaucoma, cystoid macular edema, and cataract. The spectrum and frequency of complications show notable regional variation. Our rate of posterior synechiae is broadly consistent with reports from Lebanon and France [35, 36], though our cataract rate was markedly lower than the 50% reported in studies from India [37, 40]. Ganesh et

al. [40] attributed the high cataract burden in their population to delayed referral, over-reliance on topical corticosteroids, and late initiation of steroid-sparing immunomodulatory therapy.

The relatively lower rate of cataracts and the low incidence of legal blindness, which compares favorably to rates in other studies [18, 17, 31-33], may reflect our center's early and aggressive use of DMARDs and judicious corticosteroid management. However, the high overall complication rate at presentation still signals a critical need for earlier diagnosis and referral in the wider healthcare system, a concern echoed by Slamang et al. [41]. The management of pediatric NIU necessitates a multidisciplinary approach, typically following a stepwise strategy from topical corticosteroids to systemic immunosuppressants and biologic agents [25, 26]. The treatment data reflect this standard-of-care escalation. The vast majority of patients received topical corticosteroids and systemic corticosteroids as bridging therapy. Methotrexate was the cornerstone steroid-sparing agent, used in 85% of patients, aligning with its established role as a first-line DMARD. A systematic review by Simonini et al. [24] confirmed the efficacy of Methotrexate, with a pooled response rate of 0.73 (95% CI: 0.66-0.1). For patients with refractory disease, biologic therapies are essential. In this cohort, 25% of patients required biologic agents, primarily TNF-α inhibitors. While adalimumab is the FDA-approved biologic for NIU, adalimumab and infliximab are used with significant success, in a recent meta-analysis by Norcia et al. [27], confirming their superiority over placebo in reducing inflammation and steroid dependence. Notably, we observed successful responses to adalimumab in patients who had previously failed infliximab, underscoring the importance of having multiple therapeutic options. However, a minority of patients remain refractory to TNF inhibition, as highlighted by the APTITUDE trial, which reported a 40% non-response rate to MTX and TNFi in JIA-U, pointing to the need for alternative pathways of interleukin-6 inhibition with tocilizumab [32]. This study characterizes the significant burden of pediatric NIU in Libya, outlining a profile marked by a high rate of panuveitis, bilateral disease, and frequent complications at diagnosis, yet demonstrating that favorable visual outcomes can be achieved through systematic, stepwise immune-suppression. The current findings are constrained by some limitations of a single-center, retrospective design. The high proportion of idiopathic uveitis likely reflects the inherent diagnostic challenges of the condition and the limited availability of advanced genetic and specific immunologic testing in our setting. To advance care, future efforts must focus on improving early detection and referral pathways in primary care, increasing access to advanced diagnostics, and ensuring the availability of a broader range of biologic therapies. Prospective, multi-center studies in the region are needed to define etiologies, validate treatment protocols, and establish long-term outcome data, ultimately working towards standardized, evidence-based guidelines for the management of pediatric NIU in North Africa [40-43].

Table 6: Comparison of previous studies of non-infectious uveitis in pediatrics

Study / variable	Current study	Jordon [31]	Lebanon [35]	Tunisia [45]	Turkey [34]	Frence [36]	Italy [46]	S. Africa [44]	China [47]	Egypt [48]
Patients, n	**75**	**96**	**49**	**64**	**76**	**147**	**257**	**29**	**209**	**201**
Anterior	36.0%	44.8%	40.8%	31.2%	32.8%	93.0%	47.8%	72.4%	29.2%	47.3%
Intermediate	1.3%	8.3%	12.3%	31.2%	34.2%	2.0%	19.4%	3.5%	22.0%	3.0%
Posterior	8.0%	5.2%	20.4%	20.3%	2.6%	1.0%	24.9%	3.4%	10.0%	15.4%
Panuveitis	54.7%	41.7%	26.5%	17.2%	30.2%	6.0%	7.8%	33.4%	29.2%	34.3%
Bilaterality	82.7%	59.3%	63.0%	48.4%	86.6%	79.0%	67.3%	75.8%	61.2%	72.6%
JIAU	20.0%	35.5%	12.2%	6.2%	25.0%	56.0%	19.9%	48.3%	8.1%	6.5%
Idiopathic	52.0%	46.9%	51.0%	50.0%	50.0%	24.5%	12.8%	41.4%	71.3%	28.9%
Behcet disease	10.7%	11.4%	6.1%	6.2%	19.7%	2.7%	2.9%	3.5%	0.5%	51.2%
Most common complication	Posterior synechiae (56.0%)	Posterior synechiae (12.5%)	Posterior synechiae (32.5%)	Optic disc edema (32.6%)	Glaucoma (7.7%)	Posterior synechiae (27.0%) Visu. loss (27.0%)	Not applicable	Cataract (53.8%)	Posterior synechiae (26.1%)	Visual loss (22.3%)

Conclusion: Uveitis ranks as the third leading cause of blindness globally, following cataract and glaucoma. Our study shows that bilateral panuveitis was reported in the majority of non-infectious uveitis cases, and that idiopathic uveitis is the most common classification. The initiation of systemic conventional immune-suppressive therapy and the timely use of biological therapy in severe cases have improved outcomes in our cohort and reduced complications. , and that increasing awareness among healthcare professionals who engage with pediatric populations could facilitate earlier identification and referral.

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