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Uveitis in children: epidemiological, clinical and prognostic characteristics

Les uvéites pédiatriques : caractéristiques épidémiologiques, cliniques et pronostiques

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ABSTRACT:

PURPOSE: The purpose of this study is to describe the characteristics and prognostic factors of pediatric uveitis in a French university referral hospital.

METHODS: We performed a retrospective study of all cases of all pediatric uveitis seen at our institution over a 7-year period.

RESULTS: A total of 141 eyes of 86 children were included. The mean age was 10.7 years, and 61.6% were girls. The uveitis was bilateral in 64.0% of cases. Anterior uveitis (41.0%) and intermediate uveitis (32.0%) were the most frequent forms. The most frequent etiologies were idiopathic (27.9%), juvenile idiopathic arthritis (25.6%) and pars planitis (18.6%). During the follow-up period, systemic corticosteroids were received by 43.0% of children, immunosuppressive drugs by 31.4% and biological agents by 18.6%. At the final examination, complications were present in 67.0% of patients: 18.0% had cataracts, and 11.3% had intraocular hypertension. Posterior synechiae were present in 27.6% of eyes, optic disc edema in 10.5% and macular edema in 16.2%. At the last visit, visual acuity was better than 20/200 in 97.0% of cases. The presence of band keratopathy, cataract or glaucoma was an independent predictor of impaired visual outcomes at follow-up.

CONCLUSION: Juvenile idiopathic arthritis is one of the most frequent and severe pediatric uveitides. Close monitoring and early treatment could prevent complications.

Keywords: uveitis, children, epidemiology, prognosis, France

RESUME:

OBJECTIF: L'objectif de cette étude est de décrire les caractéristiques et les facteurs pronostiques des uvéites pédiatriques dans un hôpital français universitaires de référence.

METHODES: Nous avons réalisé une étude rétrospective de l'ensemble des cas d'uvéites pédiatriques vues dans notre centre sur une durée de 7 ans.

RESULTATS: 141 yeux de 86 enfants ont été inclus. L'âge moyen était de 10.7 ans et 61.6% étaient des filles. Les uvéites étaient bilatérales dans 64.0% des cas. Les uvéites antérieures (41.0%) et les uvéites intermédiaires (32.0%) étaient les formes les plus fréquentes. Les étiologies les plus représentées étaient les formes idiopathiques (27.9%), l'arthrite juvénile idiopathique (25.6%) et les pars planites (18.6%). Lors du suivi, la corticothérapie systémique a été prescrite chez 43.0% des enfants, les immunosuppresseurs chez 31.4% et les anti TNF α chez 18.6% des enfants. Lors de l'examen final, les complications étaient présentes chez 67.0% des patients: 18.0% avaient une cataracte et 11.3% avaient une hypertension intraoculaire. Les synéchies postérieurs étaient retrouvés dans 27.6% des yeux, l'œdème papillaire dans 10.5% et l'œdème maculaire dans 16.2% des yeux. Lors de la dernière consultation, l'acuité visuelle était supérieure à 20/200 dans 97.0% des cas. La présence d'une kératite en bandelette, d'une cataracte ou d'un glaucome étaient des facteurs de risques indépendants d'une mauvaise acuité visuelle finale.

CONCLUSION: L'arthrite juvénile idiopathique est une des uvéites les plus fréquentes et les plus sévères chez l'enfant. Un suivi rapproché ainsi qu'un traitement précoce pourraient en prévenir les complications.

Mots-clés: uvéite, pédiatrie, épidémiologie, pronostic, France

1 INTRODUCTION

2 Uveitis among children is rare and constitutes 5.0-10.0% of uveitis cases in tertiary referral
3 centers [1–3]. It is a complex disease with many etiologies and presentations. Diagnosis is
4 essential but may be difficult as symptoms are sometimes absent and may be different from
5 those present in adults. They can include redness, watering or visual loss, as in adults but also
6 leukocoria or strabismus [4]. Moreover, the association with systemic diseases is different
7 than in adult and depends on the population; for example, one of the most common causes in
8 western countries is juvenile idiopathic arthritis whereas in developing countries is infectious
9 [5–7]. In children, the prognosis is generally poorer than in adults due to late diagnosis and
10 presence of secondary ocular complications; such as cataracts, increased ocular pressure,
11 posterior synechiae or band keratopathy [4,7]. Pediatric uveitis leads to legal blindness in
12 about 7.0%-23.0% of cases [8,9]. For children under the age of 8-10 years, the risk of
13 amblyopia must also be considered. The objective of treatment is to prevent the occurrence of
14 these severe complications. Systemic treatments used in uveitis, such as corticosteroids or
15 immunosuppressive drugs, have serious long-term side effects: growth retardation,
16 hyperglycemia or osteoporosis [10]. The management of uveitis in childhood is therefore a
17 diagnostic and a therapeutic challenge. Considering the lifespan of children and potential
18 long-term social impact from loss of vision, uveitis in the pediatric population is a very
19 serious disease for ophthalmologists but also for pediatricians. However, there are few studies
20 on pediatric uveitis in France [11,12].

21 The aim of this study is to provide the epidemiological, clinical and prognostic characteristics
22 of children with uveitis seen in a French referral centre.

23

24 MATERIALS AND METHODS

25 We performed a retrospective study of patients under the age of 18 years, presenting with
26 uveitis at the Croix Rousse University Hospital in Lyon between April 2005 and September
27 2012. Patients were systematically questioned about their personal and family medical history
28 as well as their physical signs that would help to establish an etiological diagnosis. All
29 patients underwent a complete ophthalmic examination, including visual acuity (VA),
30 intraocular pressure, slit-lamp biomicroscopy and fundus examination. Systematic macular
31 and papillary tomography (OCT) and also laser flare photometry were performed, if permitted
32 by the child's age. Fluorescein angiography and visual field test were also performed, if
33 necessary, according to the child's age and the results of the clinical examination. The
34 findings of ophthalmological examination were based on the Standardization of Uveitis
35 Nomenclature criteria[13]. The type of complementary evaluation was based on the results of
36 the initial examination:

- 37 • Anterior uveitis: erythrocyte sedimentation rate (ESR), complete blood count (CBC),
38 C-reactive protein (CRP), serum angiotensin converting enzyme (ACE), antinuclear
39 antibody (ANA), HLA B-27 (non-granulomatous inflammation), quantiferon TB-GIT,
40 lysozyme and serology for *Toxoplasma gondii* and herpes viruses (HSV, VZV, CMV,
41 EBV). A thoracic X-ray and a tuberculin skin test were also recommended.
- 42 • Intermediate, Posterior and Panuveitis: evaluation of anterior uveitis and serology for
43 *Borrelia burgdorferi*, *Bartonella henselae*, *Toxocara* and syphilis. A thoracic X-ray
44 and a cerebral MRI (Magnetic Resonance Imaging) may have been prescribed
45 secondarily.

46 In cases of intermediate uveitis, an examination using scleral depression was always
47 performed to search for the characteristic snow banks associated with pars planitis. Generally,
48 with children, this examination is performed in an operating room using a simple local

49 anesthetic. With older and more compliant children, snow banks were observed directly
50 during the ophthalmologic consultation.

51 In each case, the patient was also referred to a pediatric specialist. Because congenital
52 toxoplasmic retinochoroiditis had a specific protocol, this etiology was systematically
53 excluded from our analysis. However, cases of ocular toxoplasmosis that were seen outside
54 this protocol were included.

55 The research conformed to the tenets of the Declaration of Helsinki and the ethical guidelines
56 for medical and health research involving human subjects

57 The data were collected in an Excel database with doubly secure access. The statistical
58 analysis was performed using SPSS software version 22.0 (IBM, Chicago, IL, USA). The
59 Pearson Chi² test was used to calculate the risk factor for final visual acuity of 20/40 or
60 worse. In all cases, the significance level was set at $p < 0.05$.

61

62 **RESULTS**

63 *Demographic characteristics*

64 Over a seven-year period a total 141 eyes in 86 children with uveitis were included. At first
65 examination, age ranged from 3 to 17 years (mean: 10.7 years; median: 10.2 years). There
66 were 53 girls and 33 boys. The majority of children (55.8%) had been referred by a non-
67 hospital ophthalmologist, 14.0% by a pediatric and 7.0% by another hospital ophthalmologist.
68 Only 12.0% of the children were not referred and 11.0% were seen in the ophthalmic
69 emergency. Children were seen in the department with a mean of 1.5 years after the diagnosis
70 of the uveitis. The mean age at diagnosis was 9.2 years (range: 1.1 to 17.5; median at 8.3
71 years). In a quarter of cases (22/86), they came for a single consultation, usually for an
72 opinion on the treatment and they were then referred back to their ophthalmologist. The mean
73 initial visual acuity was of 20/32 (or 0.2 log MAR; median 0.1; range; 0 to 1.3). The mean
74 duration of follow-up in our center was 1.8 years (range: 0.2 to 7.2 years). All children had a
75 paraclinical evaluation and 83.0% of them saw a specialized consultant during this
76 assessment.

77

78 *Types of uveitis and etiology*

79 Almost two-thirds (63.9%) of patients had bilateral uveitis. Anterior uveitis was the most
80 predominant mode of presentation (40.7%, 35/86) followed by intermediate uveitis (32.6%),
81 panuveitis (15.1%) and posterior uveitis (11.6%). The etiologies most often encountered were
82 idiopathic uveitis (24/86), juvenile idiopathic arthritis (22/86) and pars planitis (16/86, **Table**
83 **1**). Girls represented 82.0% of the patients with juvenile idiopathic arthritis and 56.0% of pars
84 planitis. Among the idiopathic uveitis cases (24/86), 46.0% were intermediate, 29.0% were
85 anterior, 21.0% were panuveitis and 4.0% were posterior. Among the anterior uveitis cases
86 (35/86), 57.0% were linked to juvenile idiopathic arthritis followed by idiopathic uveitis

87 (20.0%), HLA B27 uveitis (8.0%) and sarcoidosis (6.0%). For intermediate uveitis (28/86),
88 pars planitis was the most frequent cause (57.0%), followed by idiopathic causes (39.0%) and
89 juvenile idiopathic arthritis (4.0%). Among cases of panuveitis (13/86), idiopathic uveitis and
90 uveitis of toxoplasmic origin were the most common (38.0% and 23.0% respectively). The
91 cases of posterior uveitis (10/86) were most frequently caused by toxoplasmosis (60.0%) and
92 toxocarosis (20.0%; **Figure 1**). In the subgroup of children under 10 years old, the most
93 common etiology was juvenile idiopathic arthritis (19/48) followed by idiopathic causes
94 (11/48) and pars planitis (10/48). In the subgroup of children over 10 years old, juvenile
95 idiopathic arthritis accounted for only 7.9% (3/38) of etiologies. The etiologies most often
96 encountered were idiopathic uveitis (13/38), pars planitis (6/38), toxoplasmosis (5/38) and
97 HLA B27 disease (3/38, **Figure 2**).

98

99 ***Ocular complications:***

100 Among the 86 children, 64 were followed in the department and 22 came only for a single
101 consultation. At final examination 66.7% of patients had complications. The frequency of
102 complications was analyzed with respect the total number of eyes with uveitis (n=141). The
103 most frequent complications found on initial examination were posterior synechiae (30.5%),
104 followed by optic disc edema (24.0%), macular edema (13.5%), cataract (8.5%) and glaucoma
105 (8.0%; **Table 2**). In the subgroup of children under 10 years old, the most common
106 complication was posterior synechiae (34.2%) followed by optic disc edema (17.7%), macular
107 edema (16.4%) and glaucoma (12.6%). In the subgroup of children over 10 years old, the
108 most common complication was optic disc edema (37.1%) followed by posterior synechiae
109 (27.4%) and macular edema (25.8%, **Figure 3**). At final examination (105 eyes; **Table 2**),
110 18.0% of eyes had cataract, 47.0% of these (9/19) underwent surgery. A single child with
111 bilateral cataracts, in a context of juvenile idiopathic arthritis, was left aphakic in both eyes.

112 Raised IOP was present in 11.4% of eyes (12 eyes), at final examination. Of these 66.7%
113 (8/12) had glaucoma, of which 75.0% (6/8) were not controlled by medical treatment and then
114 received filtering surgery consisting of trabeculectomy with application of mitomycin in all
115 cases. At final examination, posterior synechiae were present in 27.6% of eyes (29/105),
116 macular edema in 16.2% (17/105) and optic disc edema in 10.5% (11/105). Band keratopathy
117 (7 eyes) were mainly found in patients with juvenile idiopathic arthritis (85.7%, 6/7) or pars
118 planitis (14.3%, 1/7). Posterior synechiae were due in 44.8% of cases to juvenile idiopathic
119 arthritis (13/29), as were 53.0% of cataracts (10/19) and two-thirds of glaucoma cases (5/8).
120 Macular (45.0%, 5/11) or optic disc (30.0%, 5/17) edemas were most often found in cases of
121 pars planitis. A retinal detachment was present in 7 eyes with pars planitis: a single case was
122 bilateral. The retinal detachments were all, except one, exudative. They were peripheral,
123 inferior and did not affect vision. One retinal detachment, in the context of a toxocariasis
124 uveitis, was tractional. Children with juvenile idiopathic arthritis had ocular complications in
125 64.9% (24/37) of cases and includes posterior synechiae (35.1%), cataract (27.0%) glaucoma
126 (21.6%), band keratopathy (16.2%), and optic disc edema (10.8%). Children with idiopathic
127 uveitis had complications in 56.1% (23/41) of cases and includes posterior synechiae (34.1%),
128 optic disc edema (31.7%) and macular edema (12.2%). Children with pars planitis had
129 complications in 63.3% (19/30) of cases and includes macular edema (50.0%), optic disc
130 edema (30.0%), posterior synechiae (20.0%), and retinal detachment (16.6%).

131

132 ***Therapeutic management:***

133 During the follow-up (mean 1.8 years, range: 0.2 to 7.2 years), systemic corticosteroids were
134 received by 43.0% of children (37/86). This therapy was used mainly for cases of juvenile
135 idiopathic arthritis (45.9%, 17/37), pars planitis (32.4%, 12/37) and idiopathic uveitis cases
136 (10.8%, 4/37). Methotrexate (immunosuppressive drug) was used in 31.4 % of cases (27/86).

137 It was used for cases of juvenile idiopathic arthritis (62.9%, 17/27) and pars planitis (29.2%,
138 7/27). Biological agents (anti-TNF α therapy) were prescribed in 18.6% of cases (16/86),
139 adalimumab being the most commonly used (**Table 3**). Juvenile idiopathic arthritis was
140 treated with systemic corticosteroids in 77.3% of cases (17/22), with Methotrexate in 77.3%
141 of cases (17/22) and with biological agent in 40.9% of cases (9/22).

142

143 ***Visual prognosis:***

144 The visual prognosis was good at the end of the study with a mean final visual acuity of 20/25
145 (or 0.086 log MAR; median 0; range; 0 to 1.3). At the beginning of the follow-up, 80.8% of
146 patients had a visual acuity greater than 20/40 and 56.7% greater than 20/25 whereas 7.8% of
147 patients had a visual acuity under 20/200. The final visual acuity was greater than 20/200 in
148 97.2% of cases, greater than 20/40 in 90.5% and in 82.0% was greater than 20/25. Band
149 keratopathy, cataract and glaucoma were associated with a significant risk for developing
150 visual acuity below 20/40; there was trend towards an association for the presence of at least
151 one complication during the initial examination (**Table 4**).

152

153 **DISCUSSION**

154 We report here one of the largest cohort of pediatric uveitis in France [11,12]. The results of
155 this study are in line with the available data from the literature from tertiary centres in
156 developed countries (**Table 5**) [8,9,11,14–42]. The mean age at diagnosis is generally
157 between 8 and 10 years and classically there are a predominance of female and bilateral cases
158 [17,21,23,26,31]. Our study confirms these data showing an average age at diagnosis of 9
159 years, a predominance of girls and bilateral uveitis (64.0%).

160 In the present study, there was a predominance of anterior uveitis (41.0%) followed by
161 intermediate uveitis (32.0%), panuveitis (15.0%), and posterior uveitis (12.0%). This
162 distribution is similar to previous recent studies from developed countries [9,16,21,23,30,31]
163 and anterior uveitis is probably due to the high prevalence of juvenile idiopathic arthritis in
164 these countries [17,30,31]. In our study, 57.0% of anterior uveitis cases were related to
165 juvenile idiopathic arthritis. **which was mainly found in the subgroup of children under 10**
166 **years old (86.4% of cases)**. It's important to note that slightly more than one third (36.0%) of
167 these patients had granulomatous inflammation and so not the typical form of anterior non-
168 granulomatous synechia uveitis with fine keratic precipitates. Moreover the low prevalence of
169 posterior uveitis can be explain by a decreased proportion of infectious diseases in developed
170 countries [16]. The aetiological distribution varies markedly with the size of the studies and
171 their geographic locations. In our study, infectious uveitis represented 15.0% of cases, with
172 toxoplasmosis as the main cause. The level is higher than in other studies conducted in the
173 USA and Europe where 3.0–10.0% of cases were of infectious etiology [8,16,23,31]. We can
174 explain it by a probably higher seroprevalence of toxoplasmosis in France [43,44]. In
175 comparison, in Japan [24] infectious uveitis was found to be rare, while in Colombia [25], or
176 in India [18] it was one of the most common etiology. In the majority of our cases, the uveitis
177 was classified as idiopathic, which is consistent with several recent reports

178 [17,20,21,23,26,31]. **In our study, idiopathic uveitis, juvenile idiopathic arthritis,**
179 **toxoplasmosis and pars planitis accounted for 91.6% of etiologies in the subgroup of**
180 **children under 10 years old against 71.3% in the subgroup of children over 10 years old.**
181 **In the subgroup children over 10 years old there were several etiologies, also present in**
182 **adults, which were not found in the subgroup children under 10 years old, such as HLA**
183 **B27, Behcet's disease, Fuch's uveitis, Vogt-Koyanagi-Harada disease or multifocal**
184 **choroidosis.**

185

186 Systemic treatment (43.0% steroids, 31.0% immunosuppressive drugs and 18.6% biological
187 agents) seem to be used in the same proportions as in the study reported by Smith et al [17]
188 and Rosenberg et al [29]. Juvenile idiopathic arthritis-related uveitis was the main indicator
189 for systemic treatments. This may be due to the fact that this type of uveitis is associated with
190 a high level of complications.

191

192 The majority of the patients herein presented complications, which is in agreement with that
193 reported in the literature, (between 50.0% and 78.0% of complications [16,19,24,29,31,33])
194 and confirms the higher frequency of complications in children than in adults. This high rate
195 of complications can also be explained by a delay in specialized care. Indeed, in our study
196 children were seen on average 1.5 years after the diagnosis of their uveitis and 57.5% of them
197 already had complications. The complications found most frequently were posterior
198 synechiae, macular and optic disc edema, cataract and glaucoma, in proportions equivalent to
199 those in the reference studies [16,17,24,29,30]. A lower level of maculopathy was found
200 herein, however, particularly for epiretinal membranes. This is probably due to the difficulty
201 of carrying out an OCT in children. In fact, portable OCT wasn't available when this study
202 was carried out. Therefore the presence of early macular edema or epiretinal membranes may

203 be underestimated. It has been reported that juvenile idiopathic arthritis accounted for the
204 highest number of complications in pediatric patients [16,21]. These data are also present in
205 our study where 35.0% of patients had posterior synechiae, 27.0 % had cataract, 21.0% had
206 glaucoma and 16.2% had band keratopathy. **This explains why children under 10 years old,**
207 **where juvenile idiopathic arthritis is more frequent, had a higher rate of glaucoma,**
208 **cataract and band keratopathy.** The prevalence of surgeries performed in other studies
209 ranged from 7.8% to 45.9% [29,30], consistent with our prevalence of surgical management.

210

211 Only 3.0% of patients had visual acuity less than 20/200 at the end of the study. Several
212 studies from other countries [21,24,26,31] showed also good visual outcome, similar to our
213 study results (1 – 8%). It is important to note that the length of follow-up in our study is
214 relatively short (1.8 years), so the low percentage of worse prognosis could change with time.
215 In the present study, the risk factors for poor visual acuity were the initial presence of band
216 keratopathy or cataract or glaucoma; all indicating the presence of chronic inflammation.
217 They can also be related to long-term local steroids [45]. On the contrary, the presence of
218 posterior synechiae or maculopathy was not considered a significant risk factor. These risks
219 were studied in juvenile idiopathic arthritis by Gregory et al [6]. In this study, the risk factors
220 for poor visual acuity were posterior synechiae, abnormal intraocular pressure, and a medical
221 history of eye surgery (cataract, glaucoma). On the other hand, the presence of band
222 keratopathy was not significant. The initial presence of a single ocular complication was an
223 indicator for poor prognosis, whereas in our study the presence of at least one complication
224 during the initial examination was at the limit of statistical significance.

225

226 One of the limitations of the present study is its retrospective design. Moreover, collecting
227 data from a single tertiary centre does not reflect the distribution of the pediatric uveitis in all

228 the country. In fact, 78.0% of children had been referred 1.5 years after the beginning of their
229 uveitis. Therefore, most children had severe uveitis requiring a specialized opinion. Most non-
230 severe uveitis is treated only by non-hospital ophthalmologists, thus leading to a bias in
231 recruitment which is also present in most of the published studies. This could explain the
232 relatively high prevalence of complications, use of systemic treatment and uveitis associated
233 to juvenile idiopathic arthritis.

234

235 **CONCLUSION**

236 Uveitis in children is rare but can lead to serious visual consequences. The occurrence of
237 ocular complications is the principal factor of poor prognosis. Complications can only be
238 prevented by following these children carefully and early treatment. Monitoring of the
239 benefit/risk ratio must be central to patient management.

240

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Diagnosis	Number of cases	Percentage
Idiopathic	24	27.9%
Juvenile Idiopathic Arthritis	22	25.6%
Pars Planitis	16	18.6%
Toxoplasmosis	9	10.4%
HLA B27	3	3.4%
Toxocara	3	3.4%
Sarcoidosis	2	2.3%
Behcet's disease	1	1.2%
Multifocal choroidosis	1	1.2%
Chronic endophtalmitis	1	1.2%
Vogt-Koyanagi-Harada disease	1	1.2%
Fuch's uveitis	1	1.2%
Herpes	1	1.2%
TINU	1	1.2%

Table 1: Distribution of uveitis by etiology in the populatin (n = 86). (TINU = Tubulointerstitial nephritis and uveitis, HLA = Human Leukocyte Antigen)

Complication	Initial examination		Final examination	
	Number of eyes	Percentage (141 eyes)	Number of eyes	Percentage (105 eyes)
Band keratopathy	8	5.5%	7	6.7%
Posterior synechiae	43	30.5%	29	27.6%
Cataract	12	8.5%	19	18.0%
Glaucoma	11	8%	8	7.6%
Macular edema	19	13.5%	17	16.2%
Epiretinal membrane	5	3.5%	8	7.6%
Optic disc edema	34	24%	11	10.5%
Retinal detachment	7	5%	7	6.7%
At least one complication	81	57.5%	70	66.7%

Table 2: Presence of ocular complication at initial examination (n = 141 eyes) and at final examination (n = 105 eyes) with a mean duration of follow-up of 1.8 years.

	Juvenile Idiopathic Arthritis (n = 22)	Pars Planitis (n = 16)	Idiopathic Uveitis (n = 24)	All Etiology (n = 86)
Systemic corticosteroid	77.3%	75.0%	16.7%	43.0%
Methotrexate	77.3%	43.7%	8.3%	31.4%
Biological agent	40.9%	25.0%	8.3%	18.6%

Table 3: Percentage of children treated with corticosteroid therapy, methotrexate and biologic agent in the population during the follow-up

Risk factor for final visual acuity of 20/40 or worse	Odds-Ratio	95% confidence interval	P
Band keratopathy	31.0	5.7-168.1	0.0001
Cataract	15.0	3.4-66.5	0.0001
Glaucoma	8.5	1.9-3.7	0.005
At least one complication	2.5	0.9-6.3	0.057

Table 4: Ocular complications associated with a significant risk factors for poor final visual acuity.

	Location	Sample size	Main causes of uveitis			Type of uveitis			
			Idiopathic	JRA	Infectious	Anterior	Intermediate	Posterior	Panuveitis
STUDY 2021	France	86	27,90%	25,60%	16,28%	41%	32%	12%	15%
BenEzra¹⁴, 2005	Israel	276	25,40%	14,90%	33,30%	13,40%	41,70%	14,10%	30%
De Boer⁹, 2003	Netherlands	123	24 à 53,7%	20%	13,00%	36%	24%	19%	21%
Kadayifcilar¹⁵, 2003	Turkey	219	24,20%	13,20%	24,00%	43,40%	11,90%	31%	13,00%
Edelsten⁸, 2003	England	249	44%	47%	2,00%	70,00%	0,00%	30,00%	0,00%
Kump¹⁶, 2004	USA	269	52%	33%	5,20%	56,90%	20,80%	6,30%	16%
Smith¹⁷, 2009	USA	527	28,80%	20,90%	11,00%	44,60%	28%	14,40%	12,90%
Gautam¹⁸, 2016	North India	369	34,15%	15,99%	26,83%	42,81%	9,21%	27,64%	20,32%
Kitano¹⁹, 2020	Japan	98	35,70%	3,10%	5%	52%	0,00%	10,20%	37,80%
Yalçındağ²⁰, 2019	Turkey	76	50%	25%	0,00%	32,80%	34,20%	2,60%	30,20%
Habot-Wilner²¹, 2018	Israel	107	53,30%	25,20%	6,50%	48%	25%	10%	17%
Rahimi⁴², 2016	Iran	54	63%	9,20%	18,50%	40,70%	33,30%	18,50%	7,50%
Takkar²², 2017	India	134	54%	16,40%	15%	40%	25%	17%	18%
Dajee²³, 2016	USA	46	74%	2%	9%	42%	33%	7%	20%
Keino²⁴, 2016	Japan	64	57,80%	17%	6%	56,30%	0%	15,60%	28,10%
Lonngi²⁵, 2016	Colombia	310	34,20%	1,90%	58,40%	14,20%	16,50%	58,70%	10,60%
Clarke²⁶, 2013	Switzerland	79	34,20%	22,80%	30,40%	39,20%	32,90%	22,80%	5,10%
Ganesh²⁷, 2016	India	190	37,40%	13%	23%	52%	26%	14%	7,90%
Stoffel²⁸, 2000	Switzerland	70	54%	34,20%	0,00%	57%	0,00%	14%	29%
Rosenberg²⁹, 2004	USA	148	26,50%	23%	24,30%	30,40%	27,70%	23,70%	18,20%
Paroli³⁰, 2009	Italy	257	12,80%	19,90%	31%	47,80%	19,40%	24,90%	7,80%
Ferrara³¹, 2019	USA	286	51,40%	34,96%	3,50%	61,90%	20,60%	3,20%	14,30%
Päivönsalo-Hietanen³², 2000	Finland	55	44,50%	36,30%	12,80%	90,90%	1,80%	5,50%	1,80%
Hamade³³, 2009	Saudi Arabia	163	11,00%	14,70%	12,00%	42,00%	20,00%	7,00%	31,00%
Azar³⁴, 2004	Australia	40	60,00%	17,50%	20,00%	66,00%	5,70%	13,20%	15,10%
Khairallah³⁵, 2006	Tunisia	64	50,00%	15,40%	25,00%	31,25%	31,25%	20,30%	17,20%
Friling³⁶, 2005	Israel	38	39,50%	23,70%	5,20%	39,50%	39,50%	2,60%	18,40%
Morelle¹¹, 2019	France	147	25,00%	56,00%	0,00%	93,00%	1,00%	0,00%	6,00%
Al-Haddad³⁷, 2019	Lebanon	49	51,00%	12,20%	20,40%	40,80%	12,30%	20,40%	26,50%
Abd El Latif³⁸, 2018	Egypt	413	28,60%	6,50%	36,30%	27,10%	30%	18,60%	24,20%
Ozdal³⁹, 2012	Turkey	121	16,50%	6,60%	21,50%	31,40%	25,60%	24,80%	18,20%
Chebil⁴⁰, 2012	Tunisia	49	57,20%	6,20%	14,10%	44,90%	14,3	8,10%	32,70%
Narayana⁴¹, 2003	India	31	29,03%	29,03%	29,03%	12,91%	22,60%	12,90%	25,80%
Osswald¹², 2018	France	90	44,40%	15,50%	16,70%	48,90%	3,30%	17,80%	30,00%

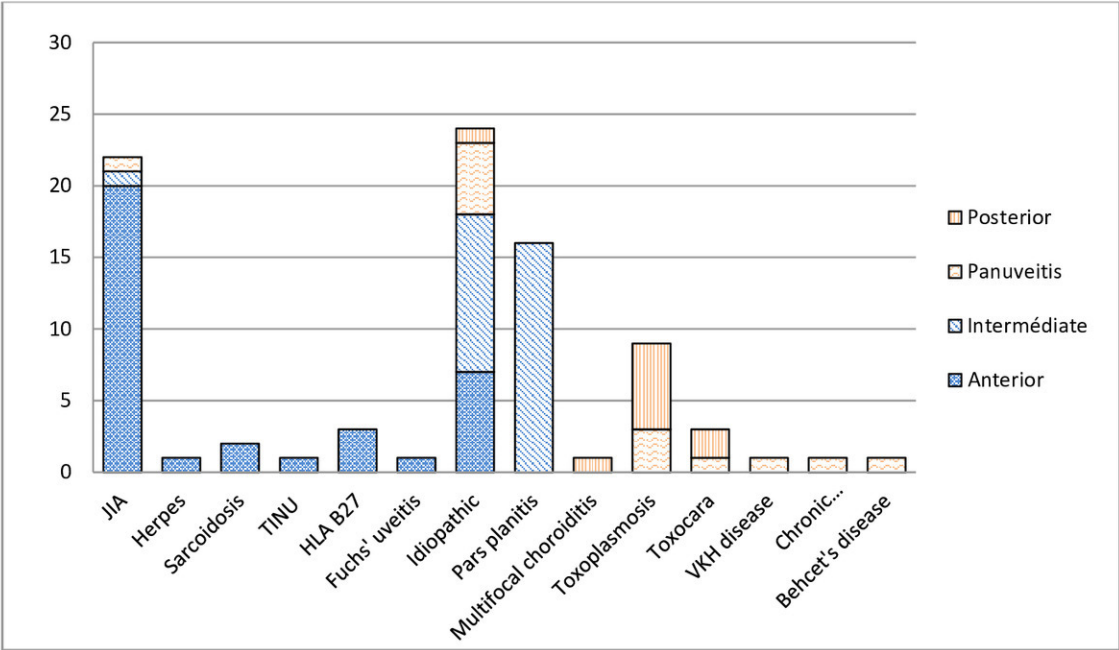
Treatments			Initial VA		Final Visual Acuity		Main complications		
Systemic Corticotherapy	Methotrexate	Biological Agent	< 20/200	> 20/40	< 20/200	> 20/40	Cataract	Glaucoma	Synechiae
43%	31%	19%	8%	81%	3%	91%	18%	7,60%	27,60%
/	/	/	/	/	/	/	/	/	/
32%	9%	/	/	/	19,00%	63,00%	35	19	/
/	/	/	/	/	/	/	/	/	/
21%	/	/	/	/	/	/	/	/	/
/	/	/	9,00%	71%	6%	77%	40%	15%	35%
/	26,80%	5,90%	9,23%	80,19%	7,70%	69,20%	19,90%	/	33,80%
/	/	/	/	/	/	/	/	/	/
36,70%	25,50%	5,10%	3,00%	85,00%	6,20%	90,00%	25,50%	33,70%	26,50%
28,90%	44,70%	30,30%	/	/	5,70%	82,90%	5,70%	7,70%	/
67%	51%	15%	1%	74%	1%	93%	9,90%	1,60%	19,20%
/	/	/	/	/	/	/	18,80%	3,80%	20,70%
/	/	/	/	/	/	/	30,60%	4,40%	/
21%	52%	0%	24%	28%	30%	44%	26%	16%	24%
3,10%	12,50%	3,10%	1,00%	95,00%	1,00%	98,00%	14,10%	17,10%	18,70%
19,40%	13,90%	/	/	/	/	/	4,80%	5,20%	13,50%
56%	29%	24%	12%	/	6%	/	8%	8%	18%
28%	24%	/	/	/	/	/	44%	14%	/
/	/	/	/	/	/	/	/	/	/
26,3	23	8,1	47,30%	53%	62,60%	39,30%	52%	33%	55%
/	/	/	9,50%	/	7%	> 79,3%	16%	13%	29%
/	66,70%	/	8,65%	73,27%	7,69%	83,50%	43,84%	23,27%	19,60%
/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	20%	64%	47,80%	49,70%	79,20%
22,50%	2,50%	0%	/	/	15%	67%	26,40%	7,50%	/
51,60%	/	/	/	/	/	/	17,90%	9,50%	28,40%
/	/	/	/	/	/	/	26,50%	14,70%	14,70%
42%	57,10%	41,00%	/	/	11,00%	70-84%	22%	39%	/
/	/	/	18,40%	57,90%	13,20%	68,40%	25%	22,50%	32,50%
39,20%	27,60%	2,90%	23,00%	30,40%	19,70%	49,60%	31,10%	29,40%	4,50%
19%	26,40%	/	20,70%	54,20%	17,90%	69,80%	21,20%	17,80%	1,80%
/	/	/	/	/	18,30%	/	24,50%	16,30%	/
/	/	/	42%	/	/	/	44,50%	22,20%	/
46,70%	6,70%	15,50%	/	/	/	/	7,20%	4,40%	32,80%

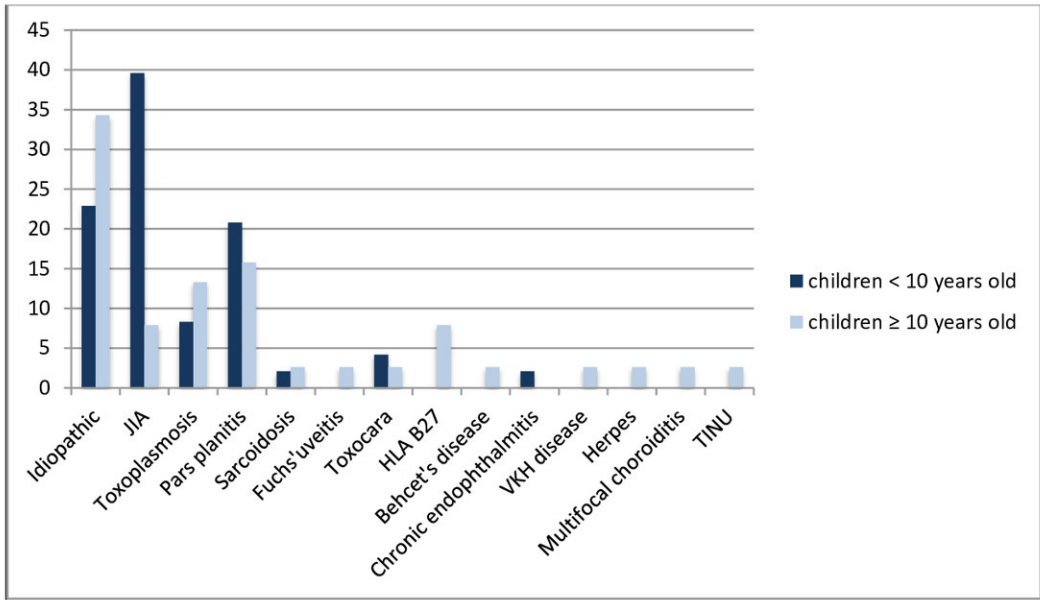
Table 5 : Review of pediatric uveitis studies since 2000

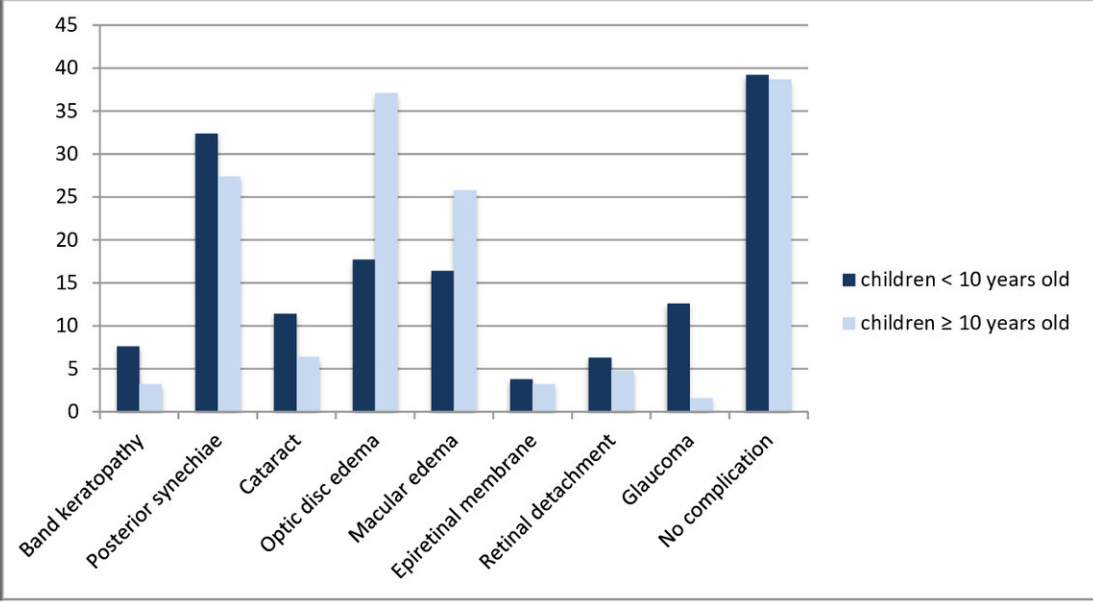
Figure 1: Distribution of uveitis by etiology and by type in the population (n = 86). (JIA = Juvenile idiopathic arthritis, VKH = Vogt-Koyanagi-Harada disease, TINU = Tubulointerstitial nephritis and uveitis)

Figure 2: Distribution of uveitis by etiology in the subgroup of children under 10 years (n = 48) and in the subgroup of children over 10 years (n = 38) (JIA = Juvenile idiopathic arthritis, VKH = Vogt-Koyanagi-Harada disease, TINU = Tubulointerstitial nephritis and uveitis)

Figure 3: Distribution of ocular complication at initial examination in the subgroup of children under 10 years (n = 79) and in the subgroup of children over 10 years (n = 62)







Diagnosis	Number of cases	Percentage (n = 86)
Idiopathic	24	27.9%
Juvenile Idiopathic Arthritis	22	25.6%
Pars Planitis	16	18.6%
Toxoplasmosis	9	10.4%
HLA B27	3	3.4%
Toxocara	3	3.4%
Sarcoidosis	2	2.3%
Behcet's disease	1	1.2%
Multifocal choroidosis	1	1.2%
Chronic endophtalmitis	1	1.2%
Vogt-Koyanagi-Harada disease	1	1.2%
Fuch's uveitis	1	1.2%
Herpes	1	1.2%
TINU	1	1.2%

Table 1: Distribution of uveitis by etiology in the population (n = 86). (TINU = Tubulointerstitial nephritis and uveitis, HLA = Human Leukocyte Antigen)

Complication	Initial examination		Final examination	
	Number of eyes	Percentage (141 eyes)	Number of eyes	Percentage (105 eyes)
Band keratopathy	8	5.5%	7	6.7%
Posterior synechiae	43	30.5%	29	27.6%
Cataract	12	8.5%	19	18.0%
Glaucoma	11	8%	8	7.6%
Macular edema	19	13.5%	17	16.2%
Epiretinal membrane	5	3.5%	8	7.6%
Papillary edema	34	24%	11	10.5%
Retinal detachment	7	5%	7	6.7%
At least one complication	81	57.5%	70	66.7%

Table 2: Presence of ocular complication at initial examination (n = 141 eyes) and at final examination (n = 105 eyes) with a mean duration of follow-up of 1.8 years

	Juvenile Idiopathic Arthritis (n = 22)	Pars Planitis (n = 16)	Idiopathic Uveitis (n = 24)	All Etiology (n = 86)
Systemic corticosteroid	77.3%	75.0%	16.7%	43.0%
Methotrexate	77.3%	43.7%	8.3%	31.4%
Biological agent	40.9%	25.0%	8.3%	18.6%

Table 3: Percentage of children treated with corticosteroid therapy, methotrexate and biologic agent in the population during the follow-up.

Risk factor for final visual acuity of 20/40 or worse	Odds-Ratio	95% confidence interval	P
Band keratopathy	31.0	5.7-168.1	0.0001
Cataract	15.0	3.4-66.5	0.0001
Glaucoma	8.5	1.9-3.7	0.005
At least one complication	2.5	0.9-6.3	0.057

Table 4: Ocular complications associated with a significant risk factor for poor final visual acuity.

	Location	Sample size	Main causes of uveitis			Type of uveitis			
			Idiopathic	JRA	Infectious	Anterior	Intermediate	Posterior	Panuveitis
STUDY 2021	France	86	27,90%	25,60%	16,28%	41%	32%	12%	15%
Ben Ezra ³⁴ , 2005	Israel	276	25,40%	14,90%	33,30%	13,40%	41,70%	14,10%	30%
De Boer ⁹ , 2003	Netherlands	123	24 à 53,7%	20%	13,00%	36%	24%	19%	21%
Kadayifci lar ¹⁵ , 2003	Turkey	219	24,20%	13,20%	24,00%	43,40%	11,90%	31%	13,00%
Edelsten ⁸ , 2003	England	249	44%	47%	2,00%	70,00%	0,00%	30,00%	0,00%
Kump ¹⁶ , 2004	USA	269	52%	33%	5,20%	56,90%	20,80%	6,30%	16%
Smith ¹⁷ , 2009	USA	527	28,80%	20,90%	11,00%	44,60%	28%	14,40%	12,90%
Gautam ³⁸ , 2016	North India	369	34,15%	15,99%	26,83%	42,81%	9,21%	27,64%	20,32%
Kitano ¹⁹ , 2020	Japan	98	35,70%	3,10%	5%	52%	0,00%	10,20%	37,80%
Yalçındağ ²⁰ , 2019	Turkey	76	50%	25%	0,00%	32,80%	34,20%	2,60%	30,20%
Habot-Wilner ²¹ , 2018	Israel	107	53,30%	25,20%	6,50%	48%	25%	10%	17%
Rahimi ⁴² , 2016	Iran	54	63%	9,20%	18,50%	40,70%	33,30%	18,50%	7,50%
Takkar ²² , 2017	India	134	54%	16,40%	15%	40%	25%	17%	18%
Dajee ²³ , 2016	USA	46	74%	2%	9%	42%	33%	7%	20%
Keino ²⁴ , 2016	Japan	64	57,80%	17%	6%	56,30%	0%	15,60%	28,10%
Lonngi ²⁵ , 2016	Colombia	310	34,20%	1,90%	58,40%	14,20%	16,50%	58,70%	10,60%
Clarke ²⁶ , 2013	Switzerland	79	34,20%	22,80%	30,40%	39,20%	32,90%	22,80%	5,10%
Ganesh ²⁷ , 2016	India	190	37,40%	13%	23%	52%	26%	14%	7,90%
Stoffel ²⁸ , 2000	Switzerland	70	54%	34,20%	0,00%	57%	0,00%	14%	29%
Rosenberg ²⁹ , 2004	USA	148	26,50%	23%	24,30%	30,40%	27,70%	23,70%	18,20%
Paroli ³⁰ , 2009	Italy	257	12,80%	19,90%	31%	47,80%	19,40%	24,90%	7,80%
Ferrara ³¹ , 2019	USA	286	51,40%	34,96%	3,50%	61,90%	20,60%	3,20%	14,30%
Päivönsalo-Hietanen ³² , 2000	Finland	55	44,50%	36,30%	12,80%	90,90%	1,80%	5,50%	1,80%
Hamade ³³ , 2009	Saudi Arabia	163	11,00%	14,70%	12,00%	42,00%	20,00%	7,00%	31,00%
Azar ³⁴ , 2004	Australia	40	60,00%	17,50%	20,00%	66,00%	5,70%	13,20%	15,10%
Khairallah ³⁵ , 2006	Tunisia	64	50,00%	15,40%	25,00%	31,25%	31,25%	20,30%	17,20%
Frling ³⁶ , 2005	Israel	38	39,50%	23,70%	5,20%	39,50%	39,50%	2,60%	18,40%
Morelle ³⁷ , 2019	France	147	25,00%	56,00%	0,00%	93,00%	1,00%	0,00%	6,00%
Al-Haddad ³⁷ , 2019	Lebanon	49	51,00%	12,20%	20,40%	40,80%	12,30%	20,40%	26,50%
Abd El Latif ³⁸ , 2018	Egypt	413	28,60%	6,50%	36,30%	27,10%	30%	18,60%	24,20%
Ozdal ³⁹ , 2012	Turkey	121	16,50%	6,60%	21,50%	31,40%	25,60%	24,80%	18,20%
Chebil ⁴⁰ , 2012	Tunisia	49	57,20%	6,20%	14,10%	44,90%	14,3	8,10%	32,70%
Narayana ⁴¹ , 2003	India	31	29,03%	29,03%	29,03%	12,91%	22,60%	12,90%	25,80%
Osswald ⁴² , 2018	France	90	44,40%	15,50%	16,70%	48,90%	3,30%	17,80%	30,00%

Treatments			Initial VA		Final Visual Acuity		Main complications		
Systemic Corticotherapy	Methotrexate	Biological Agent	< 20/200	> 20/40	< 20/200	> 20/40	Cataract	Glaucoma	Synechia
43%	31%	19%	8%	81%	3%	91%	18%	7,60%	27,60%
/	/	/	/	/	/	/	/	/	/
32%	9%	/	/	/	19,00%	63,00%	35	19	/
/	/	/	/	/	/	/	/	/	/
21%	/	/	/	/	/	/	/	/	/
/	/	/	9,00%	71%	6%	77%	40%	15%	35%
/	26,80%	5,90%	9,23%	80,19%	7,70%	69,20%	19,90%	/	33,80%
/	/	/	/	/	/	/	/	/	/
36,70%	25,50%	5,10%	3,00%	85,00%	6,20%	90,00%	25,50%	33,70%	26,50%
28,90%	44,70%	30,30%	/	/	5,70%	82,90%	5,70%	7,70%	/
67%	51%	15%	1%	74%	1%	93%	9,90%	1,60%	19,20%
/	/	/	/	/	/	/	18,80%	3,80%	20,70%
/	/	/	/	/	/	/	30,60%	4,40%	/
21%	52%	0%	24%	28%	30%	44%	26%	16%	24%
3,10%	12,50%	3,10%	1,00%	95,00%	1,00%	98,00%	14,10%	17,10%	18,70%
19,40%	13,90%	/	/	/	/	/	4,80%	5,20%	13,50%
56%	29%	24%	12%	/	6%	/	8%	8%	18%
28%	24%	/	/	/	/	/	44%	14%	/
/	/	/	/	/	/	/	/	/	/
26,3	23	8,1	47,30%	53%	62,60%	39,30%	52%	33%	55%
/	/	/	9,50%	/	7%	> 79,3%	16%	13%	29%
/	66,70%	/	8,65%	73,27%	7,69%	83,50%	43,84%	23,27%	19,60%
/	/	/	/	/	/	/	/	/	/
/	/	/	/	/	20%	64%	47,80%	49,70%	79,20%
22,50%	2,50%	0%	/	/	15%	67%	26,40%	7,50%	/
51,60%	/	/	/	/	/	/	17,90%	9,50%	28,40%
/	/	/	/	/	/	/	26,50%	14,70%	14,70%
42%	57,10%	41,00%	/	/	11,00%	70-84%	22%	39%	/
/	/	/	18,40%	57,90%	13,20%	68,40%	25%	22,50%	32,50%
39,20%	27,60%	2,90%	23,00%	30,40%	19,70%	49,60%	31,10%	29,40%	4,50%
19%	26,40%	/	20,70%	54,20%	17,90%	69,80%	21,20%	17,80%	1,80%
/	/	/	/	/	18,30%	/	24,50%	16,30%	/
/	/	/	42%	/	/	/	44,50%	22,20%	/
46,70%	6,70%	15,50%	/	/	/	/	7,20%	4,40%	32,80%

Table 5 : Review of pediatric uveitis studies since 2000