

# Long-term Follow-up of Intermediate Uveitis in Children

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- **PURPOSE:** To analyze the clinical manifestations, remissions, and visual prognosis of intermediate uveitis in children, and to identify the risk factors for poor visual outcome.
- **DESIGN:** Retrospective cohort study.
- **METHODS:** Institutional study of 32 consecutive patients examined at a tertiary referral center with intermediate uveitis and the onset of ocular disease before the age of 16 years. Numerous variables were assessed, including age and gender distribution, laboratory data, the presence of systemic diseases, onset and course of ocular inflammation, clinical features and complications, therapeutic strategies and their outcomes, remission and final visual acuity, and characteristics associated with poor visual outcome.
- **RESULTS:** Bilateral involvement was observed in 94% of the patients. Remission was observed in seven out of 15 patients (47%) with completed follow-up of five years. For our 32 subjects, we found a mean time to remission of 6.4 years (SE 0.7, CI 5.1 to 7.7). Visual outcome was favorable as only three patients developed unilateral acuity of less than 0.1 after five-year follow-up, and no additional blind eyes manifested. No associated systemic diseases were established. Optic disk edema was the most frequent complication observed (71%). Cystoid macular edema (CME) was observed in 44% of the patients and was the most common cause of visual loss.
- **CONCLUSIONS:** Intermediate uveitis of childhood might exhibit a self-limiting course after several years. Visual loss was limited despite the high rate of severe ocular complications. (Am J Ophthalmol 2006;141: 616–621. © 2006 by Elsevier Inc. All rights reserved.)

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INTERMEDIATE UVEITIS (IU) IS A CHRONIC INTRAOCULAR inflammation, mainly affecting the anterior vitreous and the pars plana. The disease predominantly affects patients under the age of 40 years and forms approximately 8% to 22%<sup>1</sup> of all uveitis in the general uveitic population.<sup>2</sup> The percentage of IU increases in the uveitis population aged less than 16 years (18% to 33%).<sup>3–6</sup> The visual prognosis in adults is usually favorable.<sup>1,2</sup> The visual outcome of IU in children is not known. The ocular inflammation in children is frequently discovered late in the disease process, and the child might already be presenting with advanced signs and complications.<sup>7–10</sup> The etiology of IU in adults is considered to be an idiopathic autoimmune disease, and was occasionally associated with sarcoidosis, multiple sclerosis (MS), or infectious diseases.<sup>2,4</sup> In the pediatric population, the causes and prognosis of IU have not yet been systematically studied. Remission of the disease has been reported, but the incidence of remissions reported was low.<sup>11,7</sup> Data concerning the resolution of IU in children and the possible activity changes in adolescence and adulthood are lacking. In this study, we investigate the clinical manifestations of intermediate uveitis in children and pay specific attention to the associated systemic diseases, the complication rate, therapy, the remission rate, and the visual outcome.

## METHODS

THE STUDY INCLUDED 32 CONSECUTIVE PATIENTS WITH onset of IU at less than 16 years of age from the tertiary referral center between 1994 and 2003, who presented with IU according to the diagnostic criteria of the International Uveitis Study Group.<sup>12</sup> Briefly, the ocular inflammation had to involve the anterior vitreous, the peripheral retina, and the ciliary body, with or without anterior segment and without chorioretinal inflammatory signs, except snow banking.<sup>12</sup> Anterior segment inflammation in IU is more common in children than in adults.<sup>2,7</sup> Legal blindness was defined as the best-corrected visual acuity of the affected eye equal to or less than 20/200.<sup>13</sup> Visual outcome was determined as the optimal visual acuity at

TABLE 1. Complications, Treatment, Visual Outcome, and Remission of Intermediate Uveitis in Children

Patient Number	Complications	Periocular Injections	Systemic Treatment	Visual Acuity						Uveitis in Remission	Interval Till Remission (Years)	Follow-up After Remission (Years)
				Disease Onset		5-Years Follow-up		8-Years Follow-up				
				OD	OS	OD	OS	OD	OS			
1	Optic disk edema, CME, cataract	Yes	—	10/20	20/20	16/20	20/20	16/20	24/20	Yes	7	1
2	Optic disk edema, CME, cataract	Yes	Corticosteroids, acetazolamide	16/20	16/20	12/20	20/20	16/20	16/20	Yes	7	2
3	Optic disk edema, cataract, glaucoma, endophthalmitis	Yes	Corticosteroids	6/20	12/20	20/20	16/20	20/20	20/20	Yes	8	4
4	Optic disk edema, CME	Yes	—	20/20	10/20	20/20	24/20			Yes	2.5	2.5
5	Optic disk edema, glaucoma, endophthalmitis	—	—	20/20	16/20	24/20	24/20			Yes	2.5	2.5
6	Optic disk edema	Yes	—	5/20	20/20	20/20	20/20	20/20	20/20	Yes	3	5
7	Optic disk edema, CME, endophthalmitis	Yes	—	1/20	20/20	1/20	24/20	2/20	24/20	Yes	4	4
8	Optic disk edema	—	—	No uveitis	10/20	No uveitis	20/20			Yes	4	4
9	Optic disk edema	Yes	—	18/20	14/20	18/20	20/20	18/20	18/20	Yes	5	3
10	Retinal detachment	—	—	1/20	4/20	Lp-	12/20	Lp-	16/20	Yes	5	3
11	Optic disk edema, CME, cataract, glaucoma	Yes	Corticosteroids, acetazolamide	3/20	3/20	16/20	16/20			Low grade activity		
12	Optic disk edema	Yes	—	4/20	10/20	18/20	16/20	20/20	20/20	Low grade activity		
13	Optic disk edema, CME, cataract	Yes	Corticosteroids	1/200	20/20	1/20	10/20	1/20	20/20	No		
14	Optic disk edema, CME	Yes	Corticosteroids	6/20	12/20	12/20	20/20	12/20	20/20	No		
15	Optic disk edema, CME	Yes	—	8/20	20/20	12/20	24/20	16/20	20/20	No		
16	Optic disk edema, CME	Yes	Corticosteroids, methotrexate	8/20	1/20	—	—	—	—	—		
17	Optic disk edema, CME, cataract	Yes	Corticosteroids, methotrexate	4/20	12/20	—	—	—	—	—		
18	Vitreous hemorrhage, bandkeratopathy	—	Corticosteroids, cyclosporin	2/200	16/20	—	—	—	—	—		
19	Optic disk edema, CME	Yes	Corticosteroids, NSAID	1/20	8/20	—	—	—	—	—		
20	Optic disk edema, CME, serous retinal detachment	—	Corticosteroids	4/20	1/20	—	—	—	—	—		
21	—	—	Corticosteroid <sup>†</sup>	14/20	18/20	—	—	—	—	—		
22	Pucker, cataract	Yes	—	16/20	6/20	—	—	—	—	—		
23	Optic disk edema	Yes	NSAID	5/20	8/20	—	—	—	—	—		
24	Optic disk edema, CME	Yes	—	6/20	10/20	—	—	—	—	—		

**TABLE 1. Complications, Treatment, Visual Outcome, and Remission of Intermediate Uveitis in Children (Continued)**

Patient Number	Complications	Periocular Injections	Systemic Treatment	Visual Acuity						Uveitis in Remission	Interval Till Remission (Years)	Follow-up After Remission (Years)
				Disease Onset		5-Years Follow-up		8-Years Follow-up				
				OD	OS	OD	OS	OD	OS			
25	CME, cataract	Yes	—	20/20	2/200	—	—	—	—	—	—	—
26	Optic disk edema, CME, glaucoma	Yes	—	No uveitis	3/20	—	—	—	—	—	—	—
27	Optic disk edema	—	NSAID	16/20	12/60	—	—	—	—	—	—	—
28	Optic disk edema	—	—	6/20	18/20	—	—	—	—	—	—	—
29	Optic disk edema	—	—	20/20	20/20	—	—	—	—	—	—	—
30	—	—	—	5/20**	5/20**	—	—	—	—	—	—	—
31	—	—	—	20/20	12/20	—	—	—	—	—	—	—
32	—	—	—	20/20	20/20	—	—	—	—	—	—	—

CME = cystoid macular edema.  
 \*LP = no light perception.  
 \*\*Visual acuity influenced by young age of the patient (3 years old).  
 †Treatment with systemic steroids was already started at the first visit at our clinic.

five-year and eight-year follow-up (not the worst visual acuity at any visit or at a nonstandardized follow-up point).

Remission of uveitis was defined as absence of inflammatory cells in aqueous humor or vitreous and/or signs of snowballs or snow banking without medication for at least one year. Only fibrotic remaining scars over the pars plana were allowed.

Indications for treatment were CME, retinal neovascularizations, or severe vitreous opacities causing visual acuity less than 20/40. Cystoid macular edema was treated with periocular corticosteroid injections or systemic corticosteroids. Immunosuppressive medication was, if necessary, added as corticosteroid sparing drug. Optic disk edema in the absence of CME was not an indication for treatment. Raised intraocular pressure was managed with topical medication and, if necessary, acetazolamide was supplemented.

We conducted a retrospective analysis of the medical records of all our patients. Special attention was paid to the relevance of clinical and angiographic features, the presence of systemic diseases, the necessity for treatment with systemic immunosuppressive drugs and corticosteroids, the ocular complication rate, and visual outcome.

Patients underwent a standard uveitis screening protocol, which encompassed the erythrocyte sedimentation rate (n = 25), a complete blood count, leukocytes, and differentiation (n = 27), serum angiotensin-converting enzyme level (n = 23), and an antinuclear antibody test (n = 22). If infectious uveitis was suspected, serological tests were performed for *Borrelia burgdorferi* (n = 23) and *Bartonella henselae* (n = 16) since both infections are endemic in The Netherlands. Fluorescein angiography (n = 20), visual fields examination (n = 6), visual evoked potentials (n = 4), and magnetic resonance imaging (MRI) scan of the brain (n = 3) were performed in selected cases (“tailored approach”). Depending on the medical history, clinical presentation, and results of the uveitis screening, a subsequent referral to the specialist followed.

## RESULTS

OUR SERIES INCLUDED 14 GIRLS (44%) AND 18 BOYS (56%). The uveitis was unilateral in two patients (6%) and bilateral in 30 patients (94%), resulting in 62 affected eyes. The mean follow-up was 4.5 years (range from six months to twelve years; 15 patients were followed for at least five years and 11 patients for at least eight years).

The mean age at onset of uveitis was 8.5 years (range three to fifteen years). The uveitis had a chronic course in all cases (disease duration of minimal 2.5 years). Nine out of 32 patients (28%) showed white areas of snow banking at the pars plana. At the onset of IU, three patients (9%) exhibited linear precipitates on the peripheral corneal endothelium (Khododaust-like lines).<sup>14</sup>

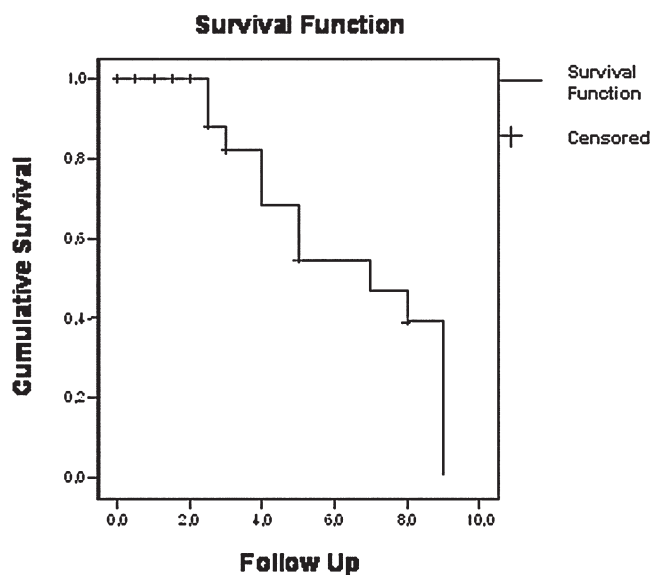


FIGURE. Kaplan-Meier analysis of 32 patients with intermediate uveitis showing at the time to remission of the disease. A mean time to remission was observed of 6.4 years for the total population of 32 patients (SE 0.7, CI 5.1 to 7.7).

After a follow-up of three years, three of the 16 patients showed a complete remission. Complete remission of IU was noted in seven out of 15 patients (47%) with completed follow-up of five years. Three additional patients demonstrated remission at eight-year follow-up. Additionally, inflammatory activity decreased in two other patients. The mean follow-up after remission was three years (range one to five years) and no recurrences were observed during this period (Table 1). No difference in remission rate was observed between the patients with and without the systemic treatment. We performed a Kaplan-Meier analysis looking at the time to remission of the disease. For our 32 subjects, we found a mean time to remission of 6.4 years (SE 0.7, CI 5.1 to 7.7) (Figure).

Ocular complications, therapy, and visual outcome after five years of follow-up are shown in Table 1. The most frequent complication was edema of the optic disk (24 of 32, 75%). At onset, 15 patients were found to have optic disk edema (47%) on funduscopy and additional nine patients (28%) were found to have fluorescein leakage of the optic disk on fluorescein angiography in the absence of evident clinical edema. CME was observed in 14 of 32 (44%), and all of those affected by CME also had edema of the optic disk. Fifteen patients had optic disk edema in the absence of CME, but four of them developed CME during the follow-up period. Visual acuity in patients with optic disk edema in the absence of CME (n = 9) was 0.5 or better during two-years follow-up. Five of them were followed for five years and none of them developed CME. Two of them had not been treated with periocular injections or systemic corticosteroids.

There were no differences between patients with the age of onset before (n = 19) or after (n = 13) the age of eight years concerning baseline visual acuity (mean VA 20/40 and 12/20, respectively), optic disk edema (68% and 84%, respectively), and CME (42% and 46%, respectively).

Other complications included cataract (eight of 32, 25%), glaucoma (four of 32, 13%), high intraocular pressure response to corticosteroid administration (four of 32, 13%; of which two developed glaucoma), band kerathopathy (two of 32, 6%), retinal detachment after vitrectomy (one of 32, 3%), epiretinal membranes (n = 2 of 32, 6%; one with tractional retinal detachment), and bilateral vitreous hemorrhage (one of 32, 3%). All eight patients with cataract had been treated with periocular corticosteroid injections compared with 12 of 24 patients without cataract (P = .01  $\chi^2$  test), and five of eight received additional systemic corticosteroids compared with six of 24 without cataract (P = .05;  $\chi^2$  test). One patient presented with lens opacities at first ophthalmologic examination that progressed during the subsequent treatment with periocular and systemic corticosteroids.

The majority of the patients (19 of 25; 76%) had a BSE <10 mm. No major abnormalities were observed in leukocyte count, differentiation (n = 27), antinuclear antibodies (n = 22), and ACE. *Borrelia burgdorferi* antibodies IgM (n = 14) and IgG (n = 24) and *Bartonella Henselae* IgM (n = 17) were negative in all the cases tested.

In none of the 32 children with IU, an overt systemic disease was diagnosed. An 11-year-old girl was suspected of having MS, since demyelization plaques were noted on the MRI scan of the brain. Her visual-evoked responses showed a prolonged latency with normal amplitude of one eye. No neurologic symptoms or cerebrospinal fluid abnormalities had so far been detected. Skin lesions were observed in four cases, including granuloma annulare (n = 2) and alopecia (n = 1).

Twenty out of 32 patients (63%) were treated with periocular corticosteroid injections, and the visual acuity improved in the majority of these eyes three to six months after injection. Lack of response occurred in two eyes with longstanding CME. In eight of the 20 patients treated with injections, systemic corticosteroid treatment was required because of high IOP (n = 4) or insufficient response to periocular injections (n = 4). Three other patients were already on systemic corticosteroid treatment when they were first seen at our clinic. Immunosuppressive medication (methotrexate [n = 2] or cyclosporine [n = 1]) was added in three patients for corticosteroid-sparing purposes. The methotrexate was stopped in one of them due to lack of response at a dose of 25 mg/wk subcutaneously. None of the patients had been treated with only one immunosuppressive drug. Seven patients (14 eyes) were only treated with topical corticosteroids and two remissions were observed in this group. Systemic treatment with nonsteroidal anti-inflammatory drug (NSAID) was attempted in three patients with a slight progression of vitritis considered not

**TABLE 2.** Visual Acuity in Intermediate Uveitis of Childhood

Visual Acuity Number of Eyes	Follow-up			
	Initial Presentation	1 Year	5 Years	8 Years
Legal blindness (visual acuity less than or equal to 2/20)	8*	4	3	3
Visual impairment (visual acuity between 2/20 and 6/20)	12	1	0	0
Visual acuity better than or equal to 6/20	42	33	27	19
Total number of eyes	62	38	30	22

\*In the first year of follow-up, the visual acuity improved in two eyes.  
No additional blind eyes developed during eight-years follow-up.

severe enough to initiate the corticosteroid treatment. Indications for acetazolamide were CME (n = 4) and glaucoma (n = 1).

Surgical intervention for complications of IU was performed in seven patients (22%): cryotherapy (four patients, seven eyes; 13%), cataract surgery with IOL in three patients (9%), vitrectomy (n = 3), and trabeculectomy (n = 2). The indications for cryotherapy and laser coagulation were reducing the need of systemic treatment or periocular injections (four patients) or peripheral neovascularizations (one patient). The indication for vitrectomy was persistent or recurrent vitreous hemorrhage (n = 2). One patient had undergone vitrectomy for vitreous opacities elsewhere. Trabeculectomy was performed when topical treatment for glaucoma had failed.

At initial presentation, eight patients (25%) suffered from unilateral legal blindness (visual acuity less than or equal to 2/20), but cases of bilateral legal blindness were not observed. The causes of visual loss in the eyes with visual acuity less than or equal to 2/20 were CME (n = 5), epiretinal membrane with serous detachment (n = 1), recurrent vitreous hemorrhage (n = 1), and retinal detachment after vitrectomy (n = 1). Within the first year of follow-up, the visual acuity had improved in two initially legally blind eyes. In two remaining patients the long-term follow-up was not yet available. No additional legally blind eyes developed in the course of the follow-up (Table 2).

At initial presentation, visual impairment (visual acuity between 2/20 and 6/20) was observed in 10 patients (28%) and in two of them bilaterally (12 eyes). The causes of visual impairment were CME (n = 8), macular pucker (n = 1), and vitreous opacities (n = 2). Within the first year of follow-up, the visual acuity had improved in eight eyes. None of the affected eyes developed visual impairment during the course of the study (Table 2).

## DISCUSSION

THIS STUDY DEMONSTRATES THAT SPONTANEOUS REMISSION OF IU MIGHT OCCUR IN PEDIATRIC PATIENTS WITH IU. In our population, we observed remission in seven out of 15 patients after five-year follow-up. Patients and parents are frequently informed that ocular inflammation might resolve during adolescence, but no exact data were available concerning remission rates in children. Since our follow-up was restricted to only a portion of our patients and our patient population was relatively small, the exact remission rate in childhood IU cannot be calculated from the present series. Although most of the patients with remissions were followed for several years after the onset of remission, the possibility that IU might recur in some of them at a later time can not be excluded. Future studies addressing the follow-up until adulthood might provide information on the long-term remission rates of IU in childhood.

Further, severe visual loss was limited despite the high rate of severe ocular complications. Unilateral visual loss was already manifest in the initial phase of the disease and long-term follow-up revealed no increase in the number of legally blind or visually impaired eyes.

During active inflammation, ocular complications were frequently observed. The most common complication was optic disk edema. The incidence of optic disk edema in IU in children in previous studies was very variable and ranged from 2% to 20%,<sup>1,5,8</sup> and it was suggested that optic disk edema is more frequently seen in children than in adults with intraocular inflammation.<sup>2</sup> However, the previous data concerning optic disk edema were probably underestimated, because low-grade edema can only be detected by fluorescein angiography,<sup>15,16</sup> which was not systematically performed in our series and earlier studies. The long-term risks of optic disk edema in IU have not yet been elucidated, but it has been suggested that prolonged axoplasmic stasis might lead to optic atrophy and subsequent visual loss.<sup>4</sup> Several studies reported that optic atrophy is one of the causes of visual loss in IU in adults.<sup>17,18</sup> However, the risk of prolonged optic disk edema in children with IU needs further investigation. Other complications, such as cataract and glaucoma were less frequently observed in IU compared with other uveitis entities in childhood such as juvenile idiopathic arthritis (JIA).<sup>19</sup> In the present series, all the cataract and half of the glaucoma cases seemed to be associated with corticosteroid medication either in periocular and/or systemic administration. However, from our data, it is not possible to discriminate between secondary cataract induced by inflammation and corticosteroid medication.

The etiology of intermediate uveitis has not yet been elucidated. Overt systemic diseases were not established in our series, which is in accordance with other studies.<sup>5,20</sup> IU in adults has been reported to be associated with sarcoidosis, multiple sclerosis, or infectious diseases, such as tuberculosis, Lyme disease, cat scratch disease, or infec-

tions with EBV or HTLV-1.<sup>21,22</sup> These diseases were absent in our pediatric IU population although the majority of them were encountered in other uveitis entities.<sup>6</sup> An autoimmune pathogenesis of IU has also been suggested and, furthermore, a familial predisposition has also been reported.<sup>23–25</sup> Malinowsky and associates reported that 15% of the patients with pars planitis developed MS after five years of follow-up.<sup>26</sup> Our patient with MRI abnormalities already present might develop MS in the future.

Since the etiology of IU remains elusive in most cases, the therapy is mainly symptomatic. Several studies reported that the prognosis for IU starting at an early age might be poor,<sup>7,10,20</sup> but others reported that the visual outcome of IU was not age-related.<sup>26</sup> However, in the previous studies, the very young patients were less frequently systemically treated than adults.<sup>20</sup> In our series, no differences between patients with disease onset before or after the age of eight years were noted in initial presentation, complications, and visual prognosis. Kaplan and associates recommended treatment in IU when the visual acuity dropped below 20/40.<sup>27</sup> In our institution, we consider the presence of CME (even in association with full visual acuity) as an indication for treatment. We tend to start the treatment with periocular corticosteroid injections because they are frequently very effective; sometimes we initiate the treatment with a short-term course of systemic corticosteroids. Since CME is the major cause of visual loss or impairment of IU in children, early detection and treatment of CME are crucial for the prevention of visual loss. Our study indicates that optic disk edema accompanied CME in all cases and preceded it in several cases. Whether optic disk edema might indicate which children are at risk of developing CME and visual loss needs further investigation. Some of the children with optic disk edema, however, never developed CME.

Our study indicates that IU in children might resolve after several years and, despite a high ocular complication rate, severe visual loss is uncommon.

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### **Biosketch**

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