

# The spectrum of paediatric uveitis in New Zealand

Priya D Samalia, Hannah Ng, Sarah Hull, Justin Mora, Joanne L Sims, Rachael L Niederer

## ABSTRACT

**AIMS:** To describe the aetiology, complications, treatment and outcomes of paediatric uveitis.

**METHODS:** This was a retrospective chart review including all paediatric participants presenting with uveitis to a tertiary referral hospital in Auckland, New Zealand between January 1997 and March 2020.

**RESULTS:** Two hundred and twenty-four eyes of 143 participants were included. One hundred and three (46.0%) eyes were found to have uveitis without the child reporting any symptoms. Non-infectious uveitis occurred in 97 (67.8%) participants and infectious aetiology occurred in 46 (32.2%) participants. One hundred and twenty-six (56.3%) eyes developed complications by final follow-up, including ocular hypertension (60 eyes, 26.8%), cataract (55 eyes, 24.6%) and glaucoma (21 eyes, 9.4%). Conventional disease modifying anti-rheumatic drugs (DMARDs) were required in 58 (59.8%) participants, and biologic disease modifying anti-rheumatic drugs in 31 (32.0%) participants with non-infectious uveitis. Participants who were younger at presentation were more likely to require a DMARD (OR 0.896  $p=0.032$ ). Vision loss of 6/15 or worse occurred in 38 (17.0%) eyes.

**CONCLUSIONS:** Infections are an important cause of uveitis in this age group. Asymptomatic presentation and complications commonly occur. A large proportion of children with non-infectious uveitis will require steroid sparing immunosuppression.

Paediatric uveitis is uncommon, constituting around 5–10% of all cases of uveitis.<sup>1</sup> It represents a significant challenge, however, to ophthalmologists, as children may present late due to difficulty reporting symptoms, may be asymptomatic in the early stages (especially juvenile idiopathic arthritis [JIA]) and can be difficult to examine.

There appears to be geographic variation in the identifiable causes of paediatric uveitis. Additionally genetic, ethnic and environmental factors contribute to disease patterns.<sup>2</sup> In American, European, Australian and Indian cohorts, JIA is the most common associated systemic disease,<sup>2–5</sup> while in Japan the most common systemic association is Behçet's disease.<sup>6</sup> Behçet's disease is also more common in the Middle East<sup>7</sup> and Turkey,<sup>8</sup> while Vogt–Koyanagi–Harada disease is more common in Saudi Arabia.<sup>9</sup> Of infective causes, toxoplasmosis is a common cause of infectious uveitis in Europe,<sup>4</sup> while in India tuberculosis was the most common cause of infectious paediatric uveitis.<sup>2</sup>

Uveitis is a heterogeneous group of entities causing intraocular inflammation. When assessing patients with uveitis, a focussed history and examination is necessary, and a variety of investigations contribute to establishing a diagnosis. It is vital that these investigations are tailored to the history, examination findings and clinical suspicion. For

this, an awareness of local disease patterns and prevalence rates is necessary.<sup>10</sup>

Therapies can also be challenging to administer in this age group, with some therapies requiring general anaesthetic and corticosteroid increasing the risk of cataract, glaucoma<sup>1</sup> and growth retardation.<sup>1,11,12</sup> Disease occurring during the amblyogenic period can lead to guarded visual outcomes. Vision impairment in the paediatric population leads to lifelong visual disability,<sup>2</sup> hindering a child's ability to learn.

The primary objective of this study was to describe the causes of uveitis in the paediatric population in a tertiary referral centre at Auckland, New Zealand. The secondary objectives included visual outcomes, complications and treatment modalities.

## Methods

### Subject selection

This study received ethics approval from the Auckland District Health Board Review Committee (AH1339) and adhered to the tenets of the Declaration of Helsinki. Subjects were identified from the Auckland Inflammatory Eye Disease Registry between January 1997 to March 2020, and paediatric participants were taken as subjects 16 years of age or younger at first presentation.

## Data collection

A retrospective chart review was performed for all participants, with relevant case details transcribed onto a standardised proforma, including demographics, anatomic location of uveitis, cause of uveitis, ocular and systemic treatment, complications and surgical interventions. Post surgical and post trauma uveitis were only included if the uveitis persisted three months or more. Location of uveitis was graded according to the Standardization of Uveitis Nomenclature (SUN) classification.<sup>13</sup> Complications of band keratopathy, posterior synechiae, ocular hypertension, glaucoma, hypotony, cataract, cystoid macular oedema (CMO), retinal detachment, epiretinal membrane (ERM), macular hole, macular scar, vitreous hemorrhage, optic neuropathy, choroidal neovascular membrane (CNVM), phthisis, visual impairment and death were recorded. Hypotony was defined as an intraocular pressure (IOP) of 6mmHg or less on two consecutive occasions, and ocular hypertension was defined as an IOP of 24mmHg or greater.<sup>13</sup>

Presenting and final visual acuity were typically noted using Snellen acuity; these were converted to LogMAR for the purpose of analysis. For visual acuity of counting fingers or worse, the following conversion was used: counting fingers, 2.0 LogMAR; hand movements, 2.3 LogMAR; light perception, 2.6 LogMAR; no light perception 2.9 LogMAR.<sup>14</sup> Severe vision loss (SVL) was defined according to the SUN criteria as a permanent reduction in best corrected visual acuity (BCVA) of 6/60 or worse and moderate vision loss (MVL) as a BCVA of 6/15 or worse.<sup>13</sup>

## Analysis and statistics

Data were entered into an Excel spreadsheet (Microsoft Corp., Redmond, WA) and analysed in STATA version 15.0 (Stata Corporation, College Station, TX). Values were reported as n (%) or median (interquartile range [IQR]). Logistic regression and Cox proportional hazards were used to analyse risk of complications of uveitis. A p-value of  $\leq 0.05$  was considered significant.

## Results

### Demographics

During the study period from January 1997 to March 2020, 2,751 people were reviewed with uveitis, of which 143 (5.2%) were aged  $\leq 16$  at presentation. Disease was bilateral in 81 (56.6%) participants, with a total of 224 eyes included in

the study. Median presenting visual acuity was 6/7.5 (IQR 6/6–6/15). Participant demographics and diagnoses are listed in Table 1. Age distribution is shown in Figure 1.

### Causes

Non-infectious uveitis was the most common cause, occurring in 97 (67.8%) participants. Causes of uveitis are shown in Table 1 and Table 2. Idiopathic uveitis (29.4%) was the most common non-infectious aetiology.

Twenty-five (17.5%) participants had JIA related uveitis. The median age of diagnosis was 5.0 years (mean 6.0, range 1.6–14.4) and 17 (68.0%) subjects were female. Twenty-one (84.0%) subjects were antinuclear antibody (ANA) positive.

Forty-six (32.2%) participants had an infectious aetiology. Seven (4.9%) subjects had varicella uveitis, of which four had anterior uveitis due to primary varicella infection (chickenpox) and the remaining three subjects due to herpes zoster.

### Presenting symptoms

Presenting symptoms are shown in Table 3. Self-reported symptoms were documented for 121 (54.0%) eyes.

One hundred and three (46.0%) eyes were found to have uveitis without the child reporting any symptoms. This included 12 children who presented with symptoms in one eye but were found to have bilateral uveitis. Uveitis was detected in 18 (17.5%) eyes following referral based on parental concern, 32 (31.1%) eyes based on other referrer concern (including the child's general physician, optometrist, teacher or nurse). Six (5.8%) eyes were found to have uveitis following a failed B4 School Check, a New Zealand nationwide health initiative designed to screen a child's health and development that is conducted at four years of age.

Of the asymptomatic children, four (3.9%) eyes were referred for assessment of possible squint and two (1.9%) eyes were referred regarding concerns for leukocoria.

Twenty-five participants had JIA associated uveitis, of which 19 (76.0%) subjects were asymptomatic, with uveitis diagnosed on screening alone.

### Complications

Complications occurring at initial presentation and final follow-up are shown in Table 4. There was no significant association between complications present at initial presentation and vision loss (OR 1.249,  $p=0.163$ ).

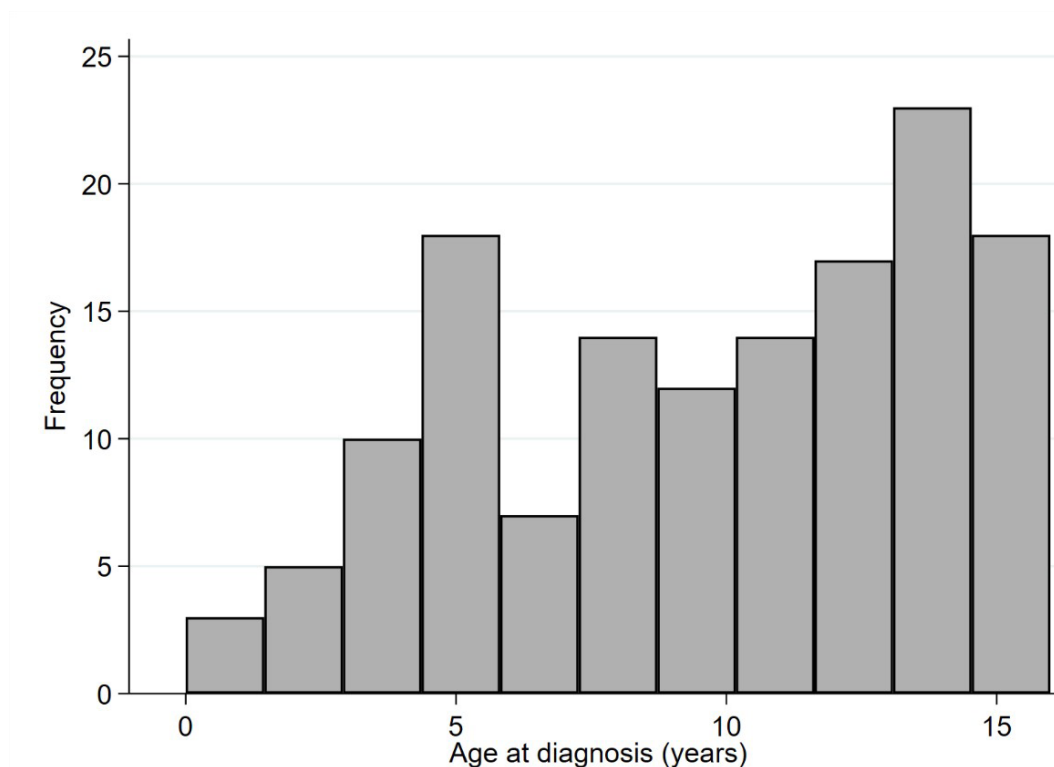
**Table 1:** Demographics and diagnosis of paediatric uveitis.

<b>n=143</b>	
<b>Age</b>	Median 10.3 (IQR 5.8–13.9)
<b>Female</b>	86 (60.1%)
<b>Ethnicity</b>	
Caucasian	74 (51.7%)
Indian	13 (9.1%)
Other Asian	12 (8.4%)
Māori	20 (14.0%)
Pacific Islander	20 (14.0%)
Other	4 (2.8%)
<b>Anatomical classification of uveitis*</b>	
Anterior	88 (61.5%)
Intermediate	18 (12.6%)
Panuveitis	19 (13.3%)
Posterior	23 (16.1%)
Scleritis	4 (2.8%)
Peripheral ulcerative keratitis	1 (0.7%)
<b>Uveitis diagnosis</b>	
<b>Non infectious</b>	<b>97 (67.8%)</b>
• Idiopathic	42 (29.4%)
• Juvenile idiopathic arthritis	25 (17.5%)
• HLA-B27 positive uveitis	9 (6.3%)
• Tubulointerstitial nephritis	5 (3.5%)
• Post-surgical	4 (2.8%)
• Psoriatic arthritis	1 (0.7%)
• Vogt–Koyanagi–Harada syndrome	1 (0.7%)
• Behçet’s disease	1 (0.7%)
• Granulomatosis with polyangiitis	1 (0.7%)
• Sympathetic ophthalmitis	1 (0.7%)
• Crohn’s disease	1 (0.7%)

**Table 1 (continued):** Demographics and diagnosis of paediatric uveitis.

<b>Uveitis diagnosis</b>	<b>n=143</b>
• Granuloma annulare	1 (0.7%)
• Sarcoidosis	1 (0.7%)
• Small vessel vasculitis	1 (0.7%)
• Post-trauma	1 (0.7%)
• Unspecified neurological disease	1 (0.7%)
• Multifocal choroiditis	1 (0.7%)
<b>Infectious</b>	<b>46 (32.2%)</b>
• Toxoplasmosis	15 (10.5%)
• Bartonella	5 (3.5%)
• Varicella zoster	7 (4.9%)
• Cytomegalovirus	3 (2.1%)
• Herpes simplex	3 (2.1%)
• Acute retinal necrosis	2 (1.4%)
• Post-streptococcal	3 (2.1%)
• Post-viral	3 (2.1%)
• Toxocara	3 (2.1%)
• Tuberculosis	1 (0.7%)
• Unspecified infection	1 (0.7%)

\*Note some participants had more than one anatomical classification.

**Figure 1:** Age distribution of paediatric participants.**Table 2:** Diagnosis based on age subcategories.

	Age (years)		
	0-6	7-11	12-16
<b>Uveitis diagnosis (n=143)</b>			
<b>Non infectious</b>	<b>28 (19.5%)</b>	<b>25 (17.5%)</b>	<b>44 (30.8%)</b>
• Idiopathic	7 (4.9%)	13 (9.1%)	22 (15.4%)
• Juvenile idiopathic arthritis	18 (12.6%)	4 (2.8%)	3 (2.1%)
• HLA-B27 positive uveitis	0 (0.0%)	1 (0.7%)	8 (5.6%)
• Tubulointerstitial nephritis	0 (0.0%)	1 (0.7%)	4 (2.8%)
• Other	3 (2.1%)	6 (4.2%)	7 (4.9%)
<b>Infectious</b>	<b>12 (8.4%)</b>	<b>22 (15.4%)</b>	<b>12 (8.4%)</b>
• Toxoplasmosis	4 (2.8%)	4 (2.8%)	7 (4.9%)
• Bartonella	0 (0.0%)	4 (2.8%)	1 (0.7%)
• Varicella zoster	2 (1.4%)	4 (2.8%)	1 (0.7%)
• Toxocara	2 (1.4%)	1 (0.7%)	0 (0.0%)
• Other	4 (2.8%)	9 (6.3%)	3 (2.1%)

**Table 3:** Symptoms of uveitis.

Symptoms	n eyes (%)
<b>Self-reported</b>	121 (54.0%)
• Redness	67 (55.4%)
• Pain	64 (52.9%)
• Reduced vision	51 (42.1%)
• Photophobia	33 (27.3%)
• Watering	11 (9.1%)
• Floaters	10 (8.3%)
<b>Asymptomatic</b>	103 (46.0%)
• JIA screening programme	35 (34.0%)
• Other referrer concern	32 (31.1%)
• Parental concern	18 (17.5%)
• Asymptomatic but symptomatic in contralateral eye	12 (11.7%)
• B4 School Check	6 (5.8%)

† Some subjects had more than one self-reported symptom

‡ Other referrer, including General Physician, Optometrist, Teacher, Nurse

**Table 4:** Complications of paediatric uveitis.

Complication	Initial n=224 eyes	Final n=224 eyes
Any complication	48 (21.4%)	126 (56.3%)
Band keratopathy	7 (3.1%)	22 (9.8%)
Posterior synechiae	14 (6.3%)	33 (14.7%)
Ocular hypertension	3 (1.3%)	60 (26.8%)
Glaucomatous optic neuropathy	1 (0.4%)	21 (9.4%)
Hypotony	3 (1.7%)	8 (3.6%)
Cataract	8 (3.6%)	55 (24.6%)
Cystoid macular oedema	6 (2.7%)	19 (8.5%)
Retinal detachment	5 (2.2%)	12 (5.4%)
Epiretinal membrane	1 (0.4%)	6 (2.7%)
Macular hole	0 (0.0%)	1 (0.5%)

**Table 4 (continued):** Complications of paediatric uveitis.

Complication	Initial n=224 eyes	Final n=224 eyes
Macular scar	6 (2.7%)	11 (4.9%)
Vitreous haemorrhage	2 (0.9%)	3 (1.3%)
Optic neuropathy	2 (0.9%)	3 (1.3%)
Choroidal neovascular membrane	1 (0.4%)	5 (2.2%)
Phthisis	0 (0%)	2 (0.9%)
Moderate visual loss (6/15–6/60)	5 (2.2%)	12 (5.4%)
Severe visual loss ( $\leq$ 6/60)	15 (6.7%)	26 (11.6%)

† Some eyes had more than one complication

‡ NA=not applicable

At one-year, median visual acuity had improved to 6/6 (IQR 6/6–6/9, n=167), and this remained fairly stable at five years (median 6/7.5, IQR 6/6–6/12, n=78) and at 10 years (median 6/7.5, IQR 6/6–6/9, n=37). Final visual acuity was 6/6 (IQR 6/6–6/9); with a mean, follow-up was  $5.2 \pm 5.4$  years (median 3.0 years).

Despite the good median visual acuity, MVL occurred in 12 (5.4%) eyes and SVL occurred in 26 (11.6%) eyes at final follow-up. Six (50.0%) eyes with MVL were due to infectious causes—three (50%) from toxoplasmosis, one (16.7%) from herpetic acute retinal necrosis and one (16.7%) from Bartonella, one (16.7%) from Herpes simplex anterior uveitis. Twelve (46.2%) eyes with infectious uveitic aetiology developed SVL—six (50.0%) toxoplasmosis, three (25.0%) eyes from toxocara, one (8.3%) cytomegalovirus, one (8.3%) Herpes zoster anterior uveitis, one (8.3%) Bartonella.

By the final follow-up, eight (5.6%) participants were bilaterally vision impaired or blind. Four (2.8%) participants developed SVL in both eyes, and four participants (2.8%) developed SVL in one eye and MVL in the fellow eye at final follow-up.

One (0.7%) subject died during follow-up due to an undifferentiated systemic small vessel vasculitis. This was a 10.5-year-old girl who initially presented with a bilateral simultaneous episcleritis, and subsequently developed a bilateral panuveitis just prior to death.

## Medical management

Topical steroid was used in 218 eyes (97.3%) and topical IOP lowering was required in 51 eyes (22.8%).

Periocular steroid was used in 15 eyes (6.7%) with a total of 31 injections, and intraocular steroid was used in three eyes (1.3%) with a total of six injections. All paediatric participants requiring periocular and intraocular steroid injections required a general anaesthetic for the procedure.

Conventional disease modifying anti-rheumatic drugs (cDMARDs) were required in 58 subjects (59.8%) with non-infectious uveitis, with methotrexate the most common choice, used in 53 participants. Azathioprine was used in six participants, mycophenolate mofetil in five participants, cyclosporine A in five participants, sulphasalazine in two participants and cyclophosphamide in two participants.

Biologic DMARDs (bDMARDs) were used in 31 (32.0%) participants with non-infectious uveitis: infliximab in 23 participants, adalimumab in 16 participants, tocilizumab in two participants and rituximab in two participants, golimumab in one participant and abatacept in one participant.

Some participants were treated with more than one DMARD. Participants who were younger at presentation were more likely to require a DMARD (OR 0.896 p=0.032).

Three (9.7%) participants were able to stop bDMARDs during follow-up without recurrence

of uveitis. Sixteen (27.6%) participants stopped cDMARDs, and 5 (31.3%) had recurrent uveitis once DMARD treatment had ceased.

### Surgical management

Twenty-six eyes (11.6%) required cataract surgery, 12 (46.2%) of which had a primary intraocular lens inserted at the time of cataract surgery. All cataract operations were performed with an anterior approach under general anaesthesia.

Twenty (8.9%) eyes required incisional glaucoma surgery with either trabeculectomy (5 eyes, 2.2%) or glaucoma drainage device (15 eyes, 6.7%). All trabeculectomy surgery was augmented with either mitomycin C or 5-fluorouracil. Three (60.0%) trabeculectomies failed; one eye underwent subsequent glaucoma drainage device and cyclodiode laser, and two underwent subsequent glaucoma drainage devices. Two eyes (40.0%) with mitomycin C enhanced trabeculectomies had complete success in managing intraocular pressure without needing further surgical or medical glaucoma intervention during the follow-up period. Two eyes (13.3%) treated with glaucoma drainage devices needed further intervention with cyclodiode laser.

Band keratopathy developed in 22 (9.8%) eyes and, of these, four (18.2%) required EDTA chelation.

Vitreotomy was performed in 11 (4.9%) eyes: one (9.1%) for a tractional retinal detachment secondary to toxoplasma panuveitis, two (18.2%) eyes with rhegmatogenous retinal detachments due to ARN, three (27.3%) eyes for toxocara posterior uveitis, one (9.1%) eye due to an unspecified infective panuveitis and four (36.4%) eyes with idiopathic uveitis.

### Discussion

Paediatric uveitis is an uncommon but important entity that can lead to lifelong visual disability. Moreover, children have higher rates of complications and vision loss compared to adult-onset uveitis.<sup>1</sup> We describe the causes, management, complications and outcomes of 224 eyes of 143 paediatric participants with uveitis seen at a tertiary referral centre (Auckland, New Zealand). There was a high rate of infectious aetiologies (46 subjects, 32.2%). Asymptomatic presentation was common, occurring in 103 (46.0%) eyes. Steroid sparing immunosuppression was frequently required, with cDMARD used in 58 (59.8%) participants and bDMARDs in 31 (32.0%)

participants with non-infectious uveitis.

There tends to be disproportionately more infectious uveitis in the paediatric population.<sup>15</sup> In this study 46 (32.2%) subjects had an infective cause, with toxoplasmosis being most prevalent (15 subjects, 10.5%). Toxoplasmosis can be acquired in utero or as a primary infection during childhood. There is a high rate of seropositivity for *Toxoplasma gondii* in healthy individuals in New Zealand<sup>16</sup> but, as yet, toxoplasmosis is not routinely tested for during pregnancy. Congenitally acquired toxoplasmosis ocular lesions can develop as late as 12 years after birth; lesions occurring at a younger age tend to be located at the macular, while those that develop later in childhood are more peripheral.<sup>17</sup> In this study, as well as being the most common cause of infectious uveitis, toxoplasmosis was also an important cause of MVL and SVL.

Varicella virus uveitis occurred in 7 (4.9%) participants. Varicella infection can occur as either primary varicella infection (chickenpox) or reactivation of latent infection (herpes zoster).<sup>18</sup> Children with eye pain, floaters, redness or reduced vision in the setting of chickenpox should have an ophthalmic assessment, especially if these symptoms persist for more than a week after onset of rash.<sup>18</sup>

Herpes zoster infection is most prevalent in the fifth to seventh decade of life and is uncommon in those younger than 40 years.<sup>19</sup> Infection in younger individuals has historically prompted investigation for underlying immunosuppression, including HIV and malignancy, as a cause of reduced cellular immunity. Rising rates of childhood herpes zoster in immunocompetent children in recent years may be attributed to acquiring primary varicella infection in utero or early infancy when immunity is not fully developed.<sup>20</sup> Clinical manifestations of herpes zoster infection may give clues as to which affected children should be screened for underlying immunosuppression. Gupta et al.<sup>21</sup> characterised the spectrum of disease in young patients based on immune status. Young immunocompetent subjects presented with localised, less severe disease with better response to medical therapy, while HIV positive subjects had greater severity and prolonged course of disease, poorer visual outcomes, superimposed bacterial infections and post herpetic neuralgia.<sup>21</sup> HIV testing may therefore be considered in children who present with herpes zoster infection if they present with poor vision and severe disease.

It is important to consider and rule out

infective causes for uveitis in any child presenting with uveitis. This includes less recognised entities such as post-streptococcal uveitis syndrome (PSUS). PSUS occurred in three (2.1%) participants; however, it is not commonly considered or tested for. It is usually seen one to four weeks after streptococcal infection.<sup>22</sup> Diagnosis requires a high degree of clinical suspicion, particularly given the temporal association with infection, and also the subclinical nature of infection in some affected individuals. Anti-streptolysin O (ASO) titers are high in almost all cases described in the literature and is considered the most useful test.<sup>22</sup> Increasing awareness is necessary and testing with ASO titers in the paediatric population is recommended.

JIA associated uveitis occurred in only 25 (17.5%) participants. The incidence of JIA uveitis has decreased over recent years, attributed to the improved availability and earlier institution of immunomodulatory therapies for arthritis.<sup>23,24</sup> Additionally, this serves as a reminder that JIA is not the only cause of uveitis in children. Other conditions such as HLA-B27, sarcoidosis and Behçet's disease can also be associated with arthropathy and should be considered.

Treatment of uveitis in the paediatric population has a unique set of challenges. Systemic corticosteroids are known to induce growth retardation in prepubescence,<sup>1,11,12</sup> due to premature closure of the epiphyseal plates.<sup>25</sup> Treatment can also increase the risk of ocular hypertension and cataract.<sup>1</sup> Topical corticosteroid increases the risk of cataract independent of active uveitis; a dosing of three times daily or less is associated with an 87% lower risk of cataract formation compared to eyes treated with greater than three drops daily (relative risk=0.13, 95% confidence interval: 0.21, 0.69,  $p=0.02$ ).<sup>26</sup> If children require frequent corticosteroid dosing for control, it is imperative to consider DMARD treatment to reduce the risk. Local steroid injections also carry increased risk of cataract and glaucoma, and can even rarely cause severe ocular adverse effects, including retinal and choroidal emboli,<sup>27</sup> and in the paediatric population they tend to require general anaesthesia to be administered, posing a further procedural risk.<sup>12</sup> Eighteen eyes (8.0%) required local steroid injections, and all required general anaesthesia for administration.

In more recent years, early use of steroid sparing immunomodulatory therapy such as methotrexate has been advocated to obviate steroid side effects and improve visual outcomes

by controlling inflammation.<sup>28,29</sup> cDMARDs like methotrexate have also been associated with delayed development of cataract requiring surgery.<sup>24</sup> Fifty-eight (59.8%) participants with non-infectious uveitis required cDMARDs and 31 (32.0%) participants with non-infectious uveitis required bDMARDs. Additionally, younger age at first presentation was associated with greater likelihood of requiring a DMARD (OR 0.896,  $p=0.032$ ). Steroid sparing immunosuppression should be considered early in the management of paediatric uveitis in children with difficulty tapering steroid, and in JIA.<sup>28</sup> DMARD screening should be considered at first presentation in the paediatric population, given the high number requiring these medications. Once disease remission has been achieved, limited data exists to guide cessation of these medications. The PRINTO study<sup>31</sup> showed that relapse-free survival following methotrexate withdrawal for JIA was more likely in those treated for greater than three years ( $P=0.009$ ), aged over eight years at time of withdrawal ( $P=0.003$ ) and with a period of disease quiescence of at least two years ( $P=0.003$ ). The Australian and New Zealand JIA-Uveitis Working Group recommend trial cessation of systemic immunosuppression once JIA associated uveitis has been inactive for 24 months.<sup>30</sup> Further study into the indications for successfully discontinuing second line immunosuppression is required.

Children develop uveitic complications more readily than adults.<sup>1</sup> One hundred and twenty-six (56.3%) eyes developed any complication at final follow-up. Twelve (5.4%) eyes developed MVL and 26 (11.6%) had SVL at final follow-up. Nine eyes (23.7%) had vision loss from toxoplasma. Additionally, younger age at onset and longer duration of disease have been shown to be associated with poorer outcomes.<sup>32</sup> Risk factors for poor visual outcome include male sex, posterior and panuveitis, infectious uveitis, severe disease and complications at presentation.<sup>33-35</sup>

Lifelong visual disability impacts on education, employment prospects and social development.<sup>36</sup> Health economic studies are required to examine the cost of childhood blindness to enable better calculations for future medications. Paediatric uveitis is an uncommon but important disease. Vision loss at a young age leads to many years of disability, which can impact on the overall development of the child. Results of this study highlight the need to consider infectious aetiology for paediatric uveitis and early institution of DMARDs where necessary.

**COMPETING INTERESTS**

No conflicts of interest to declare.

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