Survey of Ophthalmology 69 (2024) 483–494

Contents lists available at ScienceDirect

Survey of Ophthalmology

journal homepage: www.elsevier.com/locate/survophthal

Review article

Causes of infectious pediatric uveitis: A review

Yaninsiri Ngathaweesuk [a,b], Jytte Hendrikse [a,*], Jolanda Dorothea Francisca de Groot-Mijnes [a,c], Joke Helena de Boer [a], Ymkje Marije Hettinga [d]

[a] Department of Ophthalmology, University Medical Centre Utrecht, Utrecht, the Netherlands
[b] Department of Ophthalmology, Phramongkutklao Hospital, Phramongkutklao College of Medicine, Bangkok, Thailand
[c] Department of Medical Microbiology, University Medical Centre Utrecht, Utrecht, the Netherlands
[d] Bartiméus Diagnostic Center for Complex Visual Disorders, Zeist, the Netherlands

ARTICLE INFO

Keywords:
Infectious uveitis
Childhood uveitis
Paediatric uveitis
Congenital infection
Virus
Bacteria
Parasite
Fungi
Serology
Goldmann witmer coefficient
Polymerase chain reaction

ABSTRACT

Infectious pediatric uveitis is a rare disease that can cause severe ocular damage if not detected rapidly and treated properly. Additionally, early identification of an infection can protect the child from life-threatening systemic infection. Infectious uveitis can be congenital or acquired and may manifest as a primary ocular infection or as a reactivation. Nevertheless, publications on infectious paediatric uveitis are usually limited to a small number of patients or a case report. So far, most studies on uveitis in children have focused primarily on noninfectious uveitis, and a systematic study on infectious uveitis is lacking. In this review, we summarize the literature on infectious uveitis in pediatric populations and report on the epidemiology, pathophysiology, clinical signs, diagnostic tests, and treatment. We will describe the different possible pathogens causing uveitis in childhood by microbiological group (i.e. parasites, viruses, bacteria, and fungi). We aim to contribute to early diagnosis and management of infectious pediatric uveitis, which in turn might improve not only visual outcome, but also the general health outcome.

1. Introduction

Uveitis is a group of inflammatory disorders affecting the uveal tissue of the eye that may lead to visual impairment causing a significant impact on quality of life. While uveitis in children comprises a small proportion (5–10%) of all uveitis cases, it is an important cause of ocular morbidity in this age group, responsible for 5–25% of blindness.[21,39] Infectious uveitis approximately accounts for 20–35% of all pediatric uveitis cases.[2,21,54,83,155,171,182,220] The wide variation in incidence is caused by geographic distribution, with the highest percentage of infectious causes in developing countries.[182] On the contrary, noninfectious uveitis is the most common entity in the developed western world.[39,58,83,107,152,155,182] An overview of pathogens, location of uveitis, endemic area, diagnosis, and treatment of childhood infectious uveitis is provided in Table 1. In this review, we included parasites, viruses, bacteria, and fungi. We also include the clinical diagnosis of diffuse unilateral subretinal neuroretinitis, as this is a unique ocular presentation strongly related to nematodes.

2. Epidemiology of infectious uveitis

Widely varied incidences are reported depending on the geographic area, ranging from 3.5 to 24% in the United States, 9% to 31% in Europe, 15% to 36% in Asia, and up to 58% in a single study from South America.[2,54,58,83,107,115,155,171,182,220] *Toxoplasma gondii* has been identified as the most common infectious cause of pediatric uveitis, with reported numbers ranging from 22% to 76% of all infectious entities worldwide.[84,115,152,154,182] The percentages of viral and bacterial

Abbreviations: AH, aqueous humour; PCR, polymerase chain reaction; GWC, Goldmann-Witmer coefficient; NGS, next-generation sequencing; CMV, cytomegalovirus; HSV, Herpes Simplex virus; LCMV, lymphocytic choriomeningitis virus; WNV, West Nile virus; ZIKV, Zika virus; OT, ocular toxoplasmosis; DUSN, diffuse unilateral subretinal neuroretinitis; VZV, Varicella Zoster virus; ARN, Acute retinal necrosis; CNS, Central nervous system; CMVR, cytomegalovirus retinitis; AIDS, acquired immunodeficiency syndrome; EBV, Epstein-Barr virus; FHS, Fuchs heterochromic uveitis; CRS, Congenital rubella syndrome; MIS-C, Multisystemic inflammatory syndrome in children; APMPPE, Acute posterior multifocal placoid pigment epitheliopathy; JIA, Juvenile idiopathic arthritis; TB, Tuberculosis; COTS, The Collaborative Ocular Tuberculosis Study; CSD, Cat-scratch disease; mNGS, Metagenomic next-generation sequencing; MAT, microscopic agglutination test; ELISA, Enzyme-linked immunosorbent assay: FE, fungal endophthalmitis.

* Correspondence to: Department of Ophthalmology, University Medical Center Utrecht, Heidelberglaan 100, P.O. Box 85500, 3508 CX Utrecht, the Netherlands.
E-mail address: j.hendrikse-14@umcutrecht.nl (J. Hendrikse).

https://doi.org/10.1016/j.survophthal.2023.12.003
Received 7 August 2023; Received in revised form 11 December 2023; Accepted 29 December 2023
Available online 3 January 2024

Table 1
Overview of pathogen, location of uveitis, endemic area, diagnosis, and treatment of childhood infectious uveitis.

Pathogen type	Pathogen name	Common location of uveitis	Endemic	Diagnosis				Treatment	References
				Serology in blood	Intraocular fluid		Other		
					GWC	PCR			
Parasite	*Toxoplasma gondii*	PU	worldwide	+	+	+	-	pyrimethamine plus sulfadiazine	24,90,97,108,130,139,153,155,158,179,203,212,221
	Toxocara canis, Toxocara cati	PU, panuveitis	worldwide	+	+	+	-	steroid + /-[1] albendazole	7,15,23,33,67,118,128,142,169,175,218
	Onchocerca volvulus	AU	Africa, South America	+	-	-	skin biopsy	ivermectin[2]	4,28,52,113,147,149,199
	Baylisascaris procyonis and Ancylostoma caninum (neuroretinits)	PU, DUSN	Americas, Europe, India, Chaina	+[3]	-	+	visualization of worm	photocoagulation, albendazole	1,13,35,65,77,133,160,164,193
Virus	Herpes Simplex virus	AU, ARN	worldwide	+	+	+	-	aciclovir, valaciclovir	86,111,125,157,202,204,223
	Varicella Zoster virus	AU, ARN	worldwide	+	+	+	-	aciclovir, valaciclovir	46,64,93,94,112,125,159
	Cytomegalovirus	AU, PU	worldwide	+	+	+	-	ganciclovir, valganciclovir, foscarnet, cidofovir	16,25,85,95,100,101,136,146,180,197,216,219,227
	Epstein-Barr virus	AU, PU, ARN	worldwide	+	+	+	-	supportive + /-aciclovir, valaciclovir	41,63,68,185,191
	Rubella virus	PU>AU	worldwide	+	+	+	-	supportive	20,59,70,72,99,110,162,188,217
	Chikungunya virus	AU	Africa, Asia, Europe, Indian, Pacific	+	-	-	-	supportive	109,114,122,163,187,210
	SARS-CoV 2	All forms	worlwide	+	-	-	nasopharynx	supportive	11,30,45,57,120,156
	Dengue virus	PU	Africa, Americas, East Mediterranean, South-East Asia West Pacific, Asia	+	-	-	-	supportive	74,98,148,151,166,198,225
	Ebola virus	AU>PU, panuvetis	west Africa	+	-	+	-	supportive	132,161,211
	Lymphocytic choriomeningitis virus	PU	Europe, Americas, Australia, Japan	+	-	-	-	supportive	14,137,228,232
	West Nile virus	PU	worldwide	+	-	-	-	supportive	12,80,104,174,229
	Zika virus	PU	worldwide	+	-	-	urine	supportive	5,6,82,186,208,213,214,224,231
Bacteria	*Mycobacterium tuberculosis*	choroiditis, all forms	worldwide, developing country	+	-	+	TST IGRA	Isoniazid plus rifampicin plus pyrazinamide and ethambutol	36,47,73,123,124,167,201,205,206,226
	Beta-hemolytic *Streptococcus*	AU, PU	worldwide	+	-	-	Anti-DNase, ASOT	supportive, immunosuppressive drug	3,8,43,62,76,173,209
	Bartonella henselae	neuroretinitis, PU	worldwide	+	-	-	Lymph node, skin	azithromycin, clarithromycin, doxycycline	40,42,60,66,75,92,121,183,200
	Borrelia burgdorferi	all forms	worldwide	+	-	-	skin	ceftriaxone, doxycycline	19,140,184
	Brucella	all forms	worldwide	+	-	-	-	ceftriaxone, doxycycline, rifampicin	117,143
	Leptospira	all forms	worldwide, heavy rain fall, flooding	+	-	-	urine, MAT	ceftriaxone, doxycycline	31,53,91,189,190,195
	Rickettsia	PU	Mediterranean countries	+	-	-	-	doxycycline	126,144
	Spiroplasma	AU	Europe	-	-	-	Lens aspiration, TEM	supportive	55,116,129

(*continued on next page*)

Table 1 (*continued*)

Pathogen type	Pathogen name	Common location of uveitis	Endemic	Diagnosis				Treatment	References
				Serology in blood	Intraocular fluid		Other		
					GWC	PCR			
	Treponema pallidum	all forms	worldwide	+	-	+[4]	-	penicillin G	50,61,103,135
	Tropheryma whipplei	all forms	Europe, North America	-	-	+		TMP-SMX, doxycycline	49,88,207
Fungi	*Candida*	chorioretinitis, endophthalitis	worldwide	-	-	+	blood culture	fluconazole, liposomal amphoteracin B	44,79,102,181, 230
	Aspergillus	chorioretinitis, endophthalmitis	worldwide	-	-	+	blood culture, serum galactomannan	voriconazole	48,79,194,222
	Coccidioides immitis, *Coccidioides posadasii*	granulomatous AU, PU, endophthalmitis	United States, Mexico, South America	+	-	-	direct microscope, culture, microbiology	fluconazole, ketoconazole, itraconazole	32,106,134, 168
Possible associated pathogen	Parvovirus B19	panuveitis	worldwide	+	-	-	-	supportive	34,69,81,87,89
	Salmonella	AU	worldwide	+	-	-	stool	supportive	9
	Yersinia enterocolitica, *Yersinia pseudotuberculosis*	AU	worldwide	+	-	-	-	Supportive	121

PCR polymerase chain reaction; *GWC* Goldmann-Witmer coefficient; *AU* anterior uveitis; *PU* posterior uveitis; DUSN diffuse unilateral subretinal neuroretinitis; AC anterior chamber; *TST* tuberculin skin test; *IGRA* interferon gamma release assay; *Anti-DNase* anti-deoxyribonuclease, *ASOT* anti-streptolysin O; *MAT* Microscopic agglutination test; *TMP-SMX* trimethoprim-sulfamethoxazole; *TEM* transmission electron microscopy

[1] trimethroprim and sulfamethoxazole is used for prophylaxis of recurrent

[2] doxycycline has been reported to be effective

[3] serology test and PCR can be done with limited value

[4] we experienced a positive PCR of *Treponema* from intraocular fluid in adult patients

causes, among infectious uveitis cases, varied among different studies, with herpes viruses as the main cause in developed countries, responsible for 20% to 43% of cases.[83,152] In high-endemic areas for tuberculosis, mostly developing countries, tuberculosis is a significant and important cause of infectious uveitis, accounting for 9%− 25% of infectious childhood cases.[171,182,201]

3. Diagnosis

Fast identification of infectious uveitis entities is crucial importance since treatment regimens are entirely different from those for noninfectious disorders. Infectious uveitis is generally suspected based on history and clinical characteristics. Unilateral posterior uveitis is the most common presentation of infectious uveitis.[83,172,182,192] In clinical practice, the diagnosis of infectious uveitis is mainly based on a combination of specific clinical features, serological data, and aqueous humour (AH) analysis by polymerase chain reaction (PCR) and Goldmann-Witmer coefficient (GWC).[56,141] Next-generation sequencing (NGS) testing is a new method for molecular diagnosis that can detect all DNA-based lifeforms and provide information on drug resistance; however, it is not widely available today for diagnostic purposes because it is expensive and can detect nonpathogenic organisms that might lead to misinterpretations.[51,119] Therefore, the value of this method for detecting intraocular pathogens is currently still limited.

4. Congenital infections

Infections can be congenitally obtained from an infected mother by transplacental transmission or during birth. TORCH (*Toxoplasma*, rubella virus, cytomegalovirus (CMV), herpes simplex virus (HSV), and *Treponema pallidum* (syphilis)) are the most common causes of congenital infections causing ocular morbidity.[138] In endemic areas, lymphocytic choriomeningitis virus (LCMV), West Nile virus (WNV), and Zika virus (ZIKV) are also associated with congenital infection as posterior uveitis.[14,17,215,231,2712] In contrast, *Spiroplasma* is reported to present as granulomatous anterior uveitis.[55,116,129]

If a congenital infection is suspected, the presence of specific IgG/IgM in the peripheral blood of both the mother and child can be tested. PCR on umbilical cord blood is also a beneficial diagnostic tool. Analysis of the Guthrie card can be employed in neonates and older children suspected of congenital infection.[37,78,196] The congenital infections with their clinical signs are summarized in Table 2.

Table 2
Reported ocular manifestations of congenital infection.

Pathogen name	Ocular manifestations	References
Toxoplasma	Chorioretinal scars (macula or periphery)	108,138,139, 221
Varicella zoster virus and Herpes simplex virus	Retinitis (retinal lesions), acute retinal necrosis	138
Cytomegalovirus	Retinitis (retinal lesions)	78,138
Rubella virus	Nuclear cataract, micropthalmos, iris hypoplasia, cloudy cornea, glaucoma, salt and pepper retina, nystagmus, strabismus, primary optic atrophy	72,138,188
Lymphocytic choriomeningitis virus	Chorioretinal scars (resembling toxoplasmosis)	14,27,138
West Nile virus	Macular and peripheral chorioretinal scar, macular granularity	12,138
Zika virus	Retinal (macular) lesions, optic atrophy	17,213,214, 231
Spiroplasma	Granulomatous anterior uveitis, cataract	55,116,129
Treponema pallidum	Bilateral cataract and granulomatous uveitis, salt and pepper retina, interstitial keratitis	138

5. Pediatric uveitis categorized by group of pathogens

5.1. Parasites

5.1.1. Toxoplasmosis

Toxoplasmic retinochoroiditis is the most common cause of posterior uveitis in children and may be a part of a congenital infection or acquired after birth.[139] It has been shown that the frequency of ocular toxoplasmosis increases with age from 13% between the ages of 6 and 10 years to 23% between the ages of 11 till 16 years.[155,221] Congenital toxoplasmosis is frequently observed as an atrophic hyperpigmented scar at the macula, described as a "wagon wheel". A study from Brazil in 2020 showed that, if the lesions occurred during the first year of life, they were usually in the central area, whereas if they presented later in life, new lesions predominately were found in the peripheral retina.[108]

The presentation of acquired ocular toxoplasmos (OT) in children is focal retinitis, sometimes with overlying severe vitreous inflammation described as "headlight in the fog", and is frequently closely located to hyperpigmented scarring similar as in adults. OT is also a rare cause of high intraocular pressure in uveitis.[203]

The diagnosis of OT is generally based on the characteristics of the chorioretinal scar and serological testing.[24,130] Seroprevalence to *T gondii* rises with increasing age, reaching 60% positivity in the general adult population (IgG).[153,212] In the first 3 weeks, immunoblotting of aqueous humor has been shown to have a more significant sensitivity than GWC (64.7% vs. 23.5%).[130] PCR has been found positive in only 35.9% of cases and even lower, 24.3%, in immunocompetent patients.[24] Prenatal screening and information campaigns on congenital toxoplasmosis can be beneficial in terms of reducing the risk of infection during pregnancy and developing severe neurological and ocular morbidity.[158,179]

In children the indications for treatment are similar to those in adults (optic nerve head involvement, posterior pole involvement, immunocompromised patients, dense vitreous opacities, or lesions larger than 3 disc diameters). Neonates with congenital OT require long term therapy, regardless of specific findings, to prevent neurological and ocular recurrences.[97,139,158] Parents should be informed that, despite complete treatment, recurrence or relapse can still occur later in life.[108] A long term intermittent regimen with trimethroprim and sulfamethoxazole (co-trimoxazole) could reduce the rate of recurrent infection.[90] Consultation with a pediatrician for diagnosing systemic infection and treatment is mandatory.

5.1.2. Toxocara canis and Toxocara cati

Ocular toxocariasis has a prevalence of approximately 5% of the world's population, with remarkable differences between regions, with the highest prevalence in Africa.[15] Children aged between 5 and 10 years of age are affected most often, and 80% of patients are diagnosed before the age of 16.[15,33,118] Humans are predominantly infected by ingesting infective eggs from soil or contact with affected animals. Clinical manifestations range from mostly asymptomatic to severe organ injury and are categorized into 4 types: visceral larva migrans, ocular toxocariasis, covert toxocariasis, and neurotoxocariasis.[23,33]

The most common ocular symptoms in children are unilateral decreased vision, strabismus, leukocoria, and red eye.[128] The clinical ophthalmological presentation has 3 major forms comprised of diffuse nematode endophthalmitis, peripheral inflammatory mass, and posterior pole granuloma.[33,128]

The diagnosis is based on the clinical presentation in combination with positive serology for *Toxocara*; however, *Toxocara* serology in the blood may be low or even seronegative in ocular toxocariasis.[175,218] Therefore, the GWC and PCR analysis can be of value for a definitive diagnosis of Toxocara.[142,218] Eosinophilia was found in only 52% of ocular toxocariasis patients.[128] Ultrasonography can assist in differentiating between granuloma and calcification to make the important distinction from retinoblastoma.[169] The mainstays of treatment are anthelmintic drugs and corticosteroids (systemic and regional); however, due to massive death of the larvae, the treatment may cause severe inflammation in the eye.[7] Other ocular treatment modalities include laser photocoagulation if the larvae are visible in the retina.[7,67]

5.1.3. Onchocerca volvulus

Onchocerciasis, also known as river blindness, is a zoonotic disease caused by the *Onchocerca volvulus* parasite.[4] Infected blackflies introduce the parasites by biting humans and infecting them with the larvae, which typically occurs during the wet season.[28] The larvae grow into adult worms and produce a large quantity of microfilariae, which are the major cause of the disease.[149] Clinical symptoms in affected children are photophobia, conjunctival nodules, limbal sclerokeratitis, anterior chamber microfilarias (70.3%) and anterior uveitis (3,7%).[147] Diagnosis is based on the presence of microfilariae, mostly from skin snips, or PCR.[113] Microfilariae may be found in the anterior chamber during slit lamp examination in 70.3% of infected children.[147] Ivermectin is administered in order to decrease the number of intraocular microfilariae and reduce inflammatory activity.[52,199]

5.1.4. Diffuse unilateral subacute neuroretinitis caused by nematodes

Diffuse unilateral subacute neuroretinitis (DUSN) is an ocular presentation caused by various mobile nematodes; the most common are *Baylisascaris procyonis* and *Ancylostoma caninum*.[133,160] DUSN affects mainly healthy children and young adults.[13,35,165] Unilateral disease with a single or unidentified nematode is common; however, bilateral eye disease with 2 worms has been reported.[38,77] Ocular presentations in the early stage include mild to moderate vitritis, papillitis, retinal vasculitis, retinal edema, recurrent yellow-white or grey-white lesions, and macular star. The worm may or may not be visualized.[1,13,35] In the late stage, ocular manifestations are mainly subretinal tracks, RPE alteration, white spots, vitritis, disc atrophy, and vascular attenuation.[1,13,35,133,164] A diagnosis of DUSN is made by identification of a subretinal worm or clinical suspicion from ocular presentation. The serology test can be done, but its utility is limited if the nematodes are not identified by fundus examination because there are various causative nematodes and antibodies may wane over time.[133,160,218] Laser photocoagulation of the worm is the gold standard treatment. Antihelminthic therapy is effective, and steroids may be administered.[13,35,133,164,193] In general, the prognosis in the late stage is poor.[13,35,65,193]

5.2. Viruses

5.2.1. Herpes simplex virus and varicella zoster virus (VZV)

Herpetic infections are the most common infectious cause of anterior uveitis in children in developed countries.[96,154] In general, as in adults, clinical differentiation between VZV and HSV infections is difficult, since both can present with similar clinical features. HSV and VZV can cause a broad spectrum of ocular inflammation in children, but most commonly they present as unilateral anterior uveitis.

Herpetic anterior uveitis is usually accompanied by stromal or endothelial keratitis, high intraocular pressure, and the characteristic iris atrophy in a later stage.[111,223] Anterior uveitis rarely develops during primary chickenpox but has been described in primary infection if the eyelids are affected and usually has a good visual prognosis.[93,94] PCR and GWC are helpful for the diagnosis. Oral antiviral medications are used for the treatment of HSV and VZV anterior uveitis.[46,112] Topical steroids should be administered to reduce inflammation.[46]

The most severe ocular manifestation of both HSV and VZV is acute retinal necrosis (ARN), which can also occur in children. ARN can affect healthy as well as immunocompromised children of all ages, even neonates.[64,86,125,159,202,204] Over 50% of ARN-infected children had red eye, and 30% of patients had a history of herpesvirus infection, including central nervous system (CNS) involvement.[125,157] The diagnosis of ARN is based on a clinical presentation with rapid progressive circumferential peripheral retinal necrosis, occlusive vasculopathy, and marked anterior

and vitreous inflammation.[125] PCR for herpesviruses and serological testing with GWC in intraocular fluid is also necessary to confirm the diagnosis. Intravenous and intravitreal antiviral medication and systemic steroids in severe inflammatory cases are the mainstays of treatment.[125]

5.2.2. Cytomegalovirus

Cytomegalovirus retinitis (CMVR) in children can be congenital or postnatally acquired in immunocompromised patients. In rare cases, CMV can cause hypertensive anterior uveitis (Posner Schlossman-like anterior uveitis) in immunocompetent children.[25] The incidence of cytomegalovirus retinitis in acquired immunodeficiency syndrome (AIDS) patients appears to be much lower in the pediatric population than in the adult population.[136,146] Pediatric patients with secondary immunodeficiency, such as solid organ transplantation or, hematologic malignancy, are also at risk of developing CMV infection. While the recommendation for CMVR screening in secondary immunodeficiency patients is not yet established, it is generally considered beneficial for those in high-risk groups.[85,101] For congenital CMV, apart from retinal involvement clinical manifestations also include sensorineural deafness, thrombocytopenia purpura, microcephaly, and hepatosplenomegaly.[138] Clinical features of acquired CMV retinitis do not differ from those in adults with retinal necrosis with granular white opacification of the retina, hard exudates, and hemorrhages, but they are more likely to be bilateral and located in the central area.[16,227]

The diagnosis is based on clinical characteristics and the immune status of the patient. Aqueous humor analysis by PCR can confirm the diagnosis of ocular CMV in anterior uveitis and CMV-related retinitis in immunocompromised patients.[25,100] The GWC may be less sensitive in immunocompromised patients due to disturbed B cell function, but it can contribute to the diagnosis of CMV anterior uveitis.[25,180,216] There are no guidelines for the treatment of CMV anterior uveitis, topical 2% ganciclovir has been reported to be beneficial for treatment in adults.[197] In congenital active CMVR, systemic and/or intraocular antiviral treatment is recommended as it is likely to improve the visual outcome.[95] The visual prognosis depends on the patient's systemic immunocompetence and on the rapid institution of effective antiviral therapy.[16,219]

5.2.3. Epstein-Barr virus

Epstein-Barr virus (EBV) or human herpes virus-4, a double-stranded DNA virus, is a common infectious agent worldwide. It is transmitted via saliva or aerosol and tends to be asymptomatic in children, but can lead to infectious mononucleosis with clinical manifestations of fever, lymphadenopathy, and pharyngitis.[22,41] Although a link between EBV infection and ocular manifestations including hypertensive anterior uveitis, ARN, and frosted branch angiitis has been suggested, the role of EBV in the causation of uveitis remains controversial.[10,41,63,105,127,145] EBV is also associated with post-transplantation lymphoproliferative disorder in organ transplant patients which can have ocular manifestations such as iris nodules, granulomatous anterior uveitis, and papillitis.[41,150,170,176] The diagnosis of active EBV infection is based on serology, while aqueous humor analysis is of limited value since positive PCR for EBV has been found in patients without ocular inflammation.[41,68,145,191] Whether systemic antiviral therapy in EBV associated uveitis is of benefit is unclear, but some authors reported a clinical improvement.[105,145,185]

5.2.4. Rubella virus

Ocular involvement of rubella virus infections in children consists of congenital rubella syndrome, rubella virus-associated anterior uveitis, and/or Fuchs heterochromic uveitis (FHU). Vaccination against rubella virus has resulted in less congenital rubella syndrome as well as less rubella virus-associated uveitis.[20,110] Congenital rubella syndrome (CRS) is often a devastating disorder causing a significant lifetime burden, with a classic triad of cataract, cardiac abnormalities, and deafness.[72,110,188] The ocular involvement is often bilateral with nuclear cataract being the most common finding. Other findings are microphthalmos, iris hypoplasia, cloudy cornea, glaucoma, salt and pepper retinopathy, nystagmus, concomitant strabismus, and primary optic atrophy (Table 2).[99,110,217] Rubella virus-associated anterior uveitis, as reported in non-vaccinated children, is comparable to that in adults, characterized by mild unilateral chronic anterior uveitis, iris heterochromia, and vitritis.[59,70]

GWC is the preferred test for diagnosing FHU, with a positive rate of 93–100%, whereas the reported PCR sensitivity for rubella virus RNA is only 10–20%.[70,162] Topical corticosteroids are administered briefly in symptomatic FHU. In general, the visual outcome of Rubella-associated uveitis, or FHU, is favorable but it depends on the presence of complications, such as glaucoma.

5.2.5. Chikungunya virus

Chikungunya virus is an alphavirus spreading globally through *Aedes* mosquitoes and has since recently been reported regularly in Africa, Asia, Europe, and in the Indian and Pacific ocean countries.[210] Infection can give rise to various ocular manifestations, including conjunctivitis, episcleritis, anterior uveitis, retinitis, neuritis, choroiditis, or exudative retinal detachment.[109,122,163,210] In general, Chikungunya virus infections have a benign and self-limiting disease course in adults. In children, Chikungunya virus infection often leads to more severe clinical manifestations with neurological complications, including rarely lethal meningoencephalitis or blindness from retrobulbar neuritis.[114,187]

5.2.6. SARS-CoV-2 (COVID-19)

COVID-19 related ocular manifestations in pediatric patients occur in 2 phases: in the acute phase as conjunctivitis and in the late phase as uveitis, part of the multisystemic inflammatory syndrome in children.[11,30,45,57,120] Ocular presentations of uveitis are anterior uveitis, retinitis, retinal vein occlusion, and optic neuritis.[11,156] In general, the majority of cases of COVID-19 with ocular involvement resolved without treatment.[120]

5.2.7. Dengue virus

Dengue is a viral disease caused by one of the 4 dengue virus serotypes (DENV 1–4), which are transmitted by *Aedes* mosquitoes.[74] Ocular involvement in dengue fever in children is comparable to that in adults and can be divided into 2 main mechanisms: inflammation and thrombocytopenia. Subconjunctival hemorrhage is the most common ocular manifestation.[98] The acute phase of Dengue virus infections, mainly presents as posterior uveitis, including maculopathy, macular edema, choroidal vasculopathy, retinal vasculitis, hemorrhages and yellow spots.[148,166,198] Anterior uveitis has been reported several months after the initial infection.[151,198] The detection of anti-dengue-virus IgM in serum, which reveals a recent infection, is the most widely used diagnostic test. At present, there is no effective drug treatment for dengue. The prognosis is favorable in most patients.[151]

5.2.8. Ebola virus

Ebola virus disease is a zoonotic virus causing hemorrhagic fever associated with high mortality. The virus is endemic in West Africa. Following the 2014–2016 outbreak, uveitis (mainly anterior) was reported in 18% of the survivors of the Ebola virus disease, 20% of which were under the age of 20 years.[211] Although Ebola virus is rapidly cleared from body fluids after resolution of the acute phase, high concentrations were isolated from the aqueous humor of a patient with sight-threatening uveitis after surviving acute Ebola virus disease.[132,161,211] A recently published longitudinal study of the survivors showed there were no significant differences in visual acuity between the survival and control groups.[161]

5.2.9. Lymphocytic choriomeningitis virus (LCMV)

LCMV is an enveloped RNA virus, and infection may occur through

aerosols, ingestion, or bites from rodents. Congenital infection of humans with LCMV can lead to severe neurological disease, with hydrocephalus, macro-or microcephaly, and chorioretinitis resembling toxoplasma chorioretinitis.[14,232] Several cases of severely retarded children with chorioretinal scars related to an intrauterine infection with LCMV mimicking ocular toxoplasmosis are reported (Table 2).[27,137,228] Currently, there is no proven or established treatment for LCMV.

5.2.10. West Nile virus

West Nile virus (WNV) is a single-stranded flavivirus transmitted by a mosquito vector (type Culex), with wild birds serving as its reservoir.[80] A typical bilateral multifocal chorioretinitis, frequently asymptomatic, is the most common ocular manifestation of WNV infection (80%).[104,174] Congenital infections with chorioretinal scarring have also been described (Table 2).[12,229] There is no proven treatment for WNV.[174] The ocular disease itself usually has a self-limiting course, but foveal chorioretinal scarring, severe ischemic maculopathy, or optic atrophy might occur.

5.2.11. Zika

Zika virus is a flavivirus transmitted by daytime active *Aedes* mosquitoes, transplacentally, or through sexual contact. Congenital ZIKV infection can cause severe brain anomalies, microcephaly, and posterior uveitis. Brain and eye anomalies include optic nerve hypoplasia, optic nerve pallor, loss of foveal reflex, retinal pigment mottling, chorioretinal scar, and retinal vascular abnormalities.[82,186,213,214,231] A recent study in adult patients found bilateral hypertensive non-granulomatous anterior uveitis in nearly 50% of patients with ZIKV infection and red eye; however, this has not been reported in children.[208] The diagnosis can be confirmed by detecting viral RNA in the blood or IgM combined with a serum plaque reduction neutralization test.[5,6,224]

5.3. Bacteria

5.3.1. Mycobacterium tuberculosis

Mycobacterium tuberculosis is mostly transmitted through aerosolized droplets and can cause latent or active tuberculosis (TB). It is endemic in developing countries.[182,201,206] All parts in the eye can be affected in children with tuberculosis.[36,123,205] According to the Collaborative Ocular Tuberculosis Study (COTS), posterior uveitis with choroidal involvement was the most common finding and among this group of patients, a serpiginous-like phenotype was most frequently observed.[205] Optic disc edema was more often observed, whereas retinal vasculitis tended to be less frequent in children compared to adults.[205] A positive result for the tuberculin skin test without BCG vaccination or the Quantiferon-TB test is indicative of prior exposure, but the test cannot distinguish between active systemic infection and latent TB. PCR for TB in ocular fluid is not very sensitive.[73] For children, anti-tuberculosis treatment is given according to standard treatment regimens.[47,124,226] Rarely, paradoxical worsening due to a severe inflammatory response can be observed in children after the initiation of anti-tuberculosis treatment.[167]

5.3.2. Streptococcus

Beta-hemolytic streptococci are commonly responsible for respiratory tract and skin infections in children.[43] Post-streptococcal syndrome is believed to be caused by an autoimmune response, typically observed 7–35 days following the infection, and is diagnosed through serological tests.[43,62,209] Post-streptococcal syndrome-related uveitis can manifest within the broad spectrum of ocular inflammation, but anterior uveitis is most commonly described in children.[3,8,43,62,76,173,209]

5.3.3. Bartonella henselae

Cat-scratch disease (CSD) is a systemic disease caused by the gram-negative rod *Bartonella henselae*. Ocular involvement occurs in 5–10% of patients, both children and adults, and typically develops after the resolution of symptoms such as fever and malaise.[121] Ocular manifestations of CSD are mainly in the posterior segment, including neuroretinitis and optic disc anomalies.[40,42,60,66,75,121,183,200] The diagnosis of CSD is based on a history of contact with cats, along with positive serology in the blood, PCR from tissue or skin biopsy.[92] Treatment with systemic antibiotics, possibly in combination with steroids, has been shown to improve visual acuity.[42,60,66,75]

5.3.4. Borrelia burgdorferi

Lyme borreliosis is a tick-borne disease caused by the spirochete *Borrelia burgdorferi* that affects multiple systems. A diagnosis is typically established based on a history of a tick bite followed by erythema migrans, a positive serology, and confirmation by immunoblot.[19,140] Ocular involvement in Lyme disease is rare, develops mainly during the late stages, and can manifest as all forms of uveitis.[19,140,184]

5.3.5. Brucella

Brucellosis is a zoonotic disease caused by bacteria of the *Brucella* genus. Infection may occur by ingestion of infected raw milk, raw meat, or dairy products from sheep, goats, or cattle. The ocular presentations of *Brucella*- associated uveitis are anterior uveitis, posterior uveitis, and optic neuropathy.[117,143] The diagnosis is based on a positive blood culture or PCR, a serologic test; vitreous sampling for metagenomic next-generation sequencing (mNGS), may be helpful. Treatment involves prompt antimicrobial therapy.[117]

5.3.6. Leptospira

Leptospirosis is a zoonotic infection caused by *Leptospira* bacteria. This disease can be acquired by humans through contact with contaminated urine or tissue or swimming in open water.[91,195] Uveitis occurs between 2 weeks and 1 year after infection, with an average of 6 months, and may manifest in all forms.[31,53,189,190] The diagnosis of leptospirosis is based on detecting spirochetes by dark field microscopy or PCR in the blood or urine.[31,91] Other diagnostic techniques include the microscopic agglutination test (MAT) or the enzyme-linked immunosorbent assay (ELISA).[31,91]

5.3.7. Rickettsia

Rickettsia conorii is a small coccobacillary intracellular bacterium transmitted to humans by the dog tick *Rhipicephalus sangineus*. Children in endemic areas (Mediterranean countries) present with a triad of posterior segment changes in the eye (retinitis, retinal vasculitis, optic disc abnormalities), fever, and skin rash.[126,144] A positive result on serology tests is helpful in reaching a diagnosis.[126] Prompt antibiotic treatment can prevent complications and visual impairment.

5.3.8. Spiroplasma

Spiroplasma is an intracellular bacterium without a cell wall that was generally considered non-pathogenic in humans;[129] however, this organism has been reported to cause congenital spiroplasmosis presenting with ocular manifestations such as granulomatous anterior uveitis, iris synechiae, and cataract. Only 5 patients were reported in France and Germany.[55,116,129] These babies were born to healthy mothers, except in one case where the mother had a history of *Mycoplasma* infection during pregnancy. From these babies, crystalline lens aspiration and anterior vitreous were obtained during cataract surgery. A positive PCR for *Spiroplasma* or visualization of this bacteria on the lens with transmission electron microscopy confirmed the diagnosis. There is no specific treatment, but all the cases respond well to steroids (Table 2).

5.3.9. Treponema pallidum

Syphilis, a sexually transmitted disease, is caused by the spirochete *Treponema pallidum*. In children syphilis is mostly a congenital infection, but clinicians should also be aware that sexual abuse forms a risk factor. In congenital syphilis, choroiditis with a salt and pepper fundus,

bilateral cataract and granulomatous uveitis are described.[103,135] Also, chorioretinitis is mostly an early finding, whereas interstitial keratitis is usually seen later in the disease.[103,135] The diagnosis is made clinically with confirmation by serological tests, such as the *Treponema pallidum* haem- or particle agglutination test, which remains positive for life even after treatment, and the Venereal Disease Research Laboratory (VDRL) test or its substitute, the rapid plasma reagin test (RPR), which is only positive during the active stages of disease.[50,61,135] In both children and adults, treatment with intravenous penicillin is essential.[135]

5.3.10. *Tropheryma whipplei*

Whipple disease is a rare entity caused by the *Tropheryma whipplei* bacterium that occurs mainly in Caucasians, with a strong predominance for males. Gastrointestinal symptoms and weight loss are the main clinical manifestations; however, in rare cases, uveitis occurs.[88,207] So far, one case was reported of a 3-year-old girl with unilateral, anterior, granulomatous uveitis, possibly as a result of Whipple disease.[49] Long-term antibiotic therapy is obligatory in cases of *Tropheryma whipplei* infection.[207]

5.4. *Fungi*

Most of the patients infected with fungal uveitis are immunosuppressed or have a severe illness. The most common endogenous intraocular fungal infection is *Candida* and *Aspergillus* endophthalmitis; additionally, coccidioidomycosis should be considered in endemic regions.

Regarding childhood uveitis, only endophthalmitis and chorioretinis have been described for the endogenous route. Risk factors for developing disseminated fungus in children are prematurity, neutropenia, immunosuppressants, persistence of candidemia for more than three days from a centre vein catheter, and bone marrow transplants.[48,181,230] The prevalence of fungal endophthalmitis (FE) in fungemia cases is rare, approximately 0–2.5% in the prophylactic antifungal and early treatment eras.[48,102] Neonatal endophthalmitis from candidemia was reported in approximately 3%.[18] Screening for FE in fungemia is recommended when patients report floaters or are unresponsive to antifungal treatment.[26,48]

The diagnosis of FE can made with microbiological culture or direct microscopy of vitreous fluid; however, culture requires time, up to 2 weeks, and has a low sensitivity. Therefore, PCR from intraocular fluid is a very useful method for the diagnosis.[44,177] Serum galactomannan is also useful for the diagnosis of aspergillosis.[194] Systemic anti-fungal therapy is the mainstay treatment. Intravitreal anti-fungal therapy and early vitrectomy may be needed.[79,194]

5.4.1. *Candida*

Pediatric patients have similar signs and symptoms as adult patients and similar clinical findings, both in the endogenous and exogenous routes. Patients usually experience subacute onset of floaters, blurred vision, and eye discomfort. Ocular manifestations are localized fluffy creamy white retinal or subretinal nodules, string of pearls appearance, puff ball abscess, and vitreous lesions with snowball and snowbank.[102,178] Systemic antifungal therapy is the mainstay of fungal chorioretinitis and endogenous endophthalmitis. Vitrectomy and intravitreal antifungal may also be warranted in endophthalmitis cases.[79]

5.4.2. *Aspergillus*

Aspergillus FE is usually more severe compared to *Candida,* with a shorter onset and worse prognosis.[71,79] Ocular manifestations are hypopyon, fluffy white preretinal lesions with creamy white deep retinal lesions located in the macula, focal retinal hemorrhage, and retinal necrosis.[79,102,194,222]

5.4.3. *Coccidioides*

Coccidioides immitis, or *Coccidioides posadasii*, is fungus-caused coccidioidomycosis, also known as Valley fever, acquired by inhalation of arthroconidia.[29,106,168] Generally, it is an asymptomatic to mild disease self-limited in a healthy patient, but it may cause disseminated disease in immunocompromised patients. Ocular involvement associated with the systemic coccidioidomycosis is rare.[106,168] The ocular manifestations are granulomatous iridocyclitis, choroiditis, chorioretinitis, and endophthalmitis.[32,168] The diagnosis is based on a history of visits to or living in an endemic area and evidence of systemic infection. Serology testing, culture, and histopathology from biopsy are helpful.[134] Systemic antifungal treatment should be initiated after diagnosis.[32,168]

5.4.4. *Other infectious agents associated with uveitis in adults*

Other infectious agents associated with uveitis in adults are parechovirus, Human T-lymphotropic virus, HIV-infection associated uveitis, *Coxiella burnetti, Mycobacterium leprae*, *Chlamydia trachomatis, Histoplasma capsulatum, and Cryptococcus neoformans*. These pathogens have been described as a cause of uveitis in adults. We found no clinical reports of pediatric uveitis.

5.5. *Pathogens which might be associated with pediatric uveitis*

Several pathogens have been associated with uveitis, but it is unclear whether the pathogen itself directly causes the eye inflammation.

5.5.1. *Parvovirus B19*

Parvovirus B19 infection, known as erythema infectiosum or 'fifth disease', is a common childhood disease, with a seroprevalence of 60–80% in young adults.[34,81] It has been associated with pediatric uveitis in a few cases.[34,69,87,89] Interestingly, our group found local antibody production against parvo B19 in aqueous humour in a cohort of childhood uveitis. We reported that 7 of 13 children with juvenile idiopathic arthritis (JIA)-associated uveitis and 3 out of 45 children with idiopathic chronic anterior uveitis had a positive GWC for parvovirus B19.[69] The relevance of this finding for the pathogenesis of (JIA-associated or idiopathic) uveitis remains to be established.

5.5.2. *Salmonella*

Salmonellosis is caused by several *Salmonella* species that are divided into the typhoid group, comprising of *S. typhi* and *S. paratyphi,* which cause a generalized infection with bacteremia, and the nontyphoid Salmonellae, which cause gastroenteritis. The bacteria are usually contracted from contaminated food. One case report describes an 11-year-old girl with acute anterior uveitis in both eyes after a culture-confirmed *Salmonella* enteritis.[9] In this patient a transient serum antinuclear antibody positivity was found. Whether ocular manifestation was caused directly by the Salmonella bacterial infection or through a post-infection immunological phenomenon remains to be determined.

5.5.3. *Yersinia*

Yersinia bacteria cause enteral infections. It is widely recognized as a triggering factor for reactive arthritis. One study reported 4 cases of HLA-B27 positive children with acute nongranulomatous anterior uveitis and one case of fibrinous exudate after a systemic *Yersinia* infection. Three (sub)species were reported to be associated with reactive arthritis: *Y. enterocolitica* serotype 3 and 9, and *Y. pseudotuberculosis* serotype 1A.[131] Visual acuity of all children was restored to baseline levels after anti-inflammatory treatment.[131]

6. Conclusion

We have conducted a literature review on infectious uveitis in the pediatric population and reported on the epidemiology, pathophysiology, clinical signs, diagnosis, and treatment. Although some of the infectious causes of uveitis are very rare, they can cause serious ocular and systemic disease if not recognized in time. In the severely ill patients, fungal infections should be considered as causative pathogen.

Congenital infections generally present with more severe systemic, neurological, and ocular complications. Most congenital infections are diagnosed early after birth due to their associated systemic involvement. The Guthrie card test and TORCH antibody screening are useful tools for confirming a congenital infection. In cases where prenatal diagnosis is possible, especially for congenital toxoplasmosis, they should be considered.

Regarding acquired infectious uveitis in children, unilateral posterior uveitis is the most common characteristic, and ocular toxoplasmosis is the most common cause worldwide. Since most ocular infections are associated with systemic infections, it is important to gather relevant medical histories and refer the patient to a paediatrician for systemic manifestations. Early diagnosis and treatment are crucial to preventing ocular complications and preserving good visual function in many cases; however, some infections are self-limiting and only need careful monitoring. Multidisciplinary care with a pediatrician, microbiologist, and/or virologist is essential for the optimal management of affected patients.

6.1. Method of literature search

A literature search of published data was performed using the PubMed search engine in the MEDLINE database. The last literature search was performed until August 2023. The following search terms were used: “pediatric/paediatric”, “childhood”, “congenital infection”, “TORCH”, ”diffuse unilateral subacute neuroretinitis”, “fungul endophthalmitis”, “uveitis”, “ocular”, and “eye” with similar terms were used in combination with each infectious agent known to cause uveitis. Search terms of “polymerase chain reaction”, “serology”, “intraocular fluid”, "aqueous humor”, “Goldmann Witmer coefficient”, “next-generation sequencing”, and “guthrie card" were used for the diagnosis section.

The retrieved articles were only in English and reviewed by their title and abstract. We included papers on infectious uveitis in children (age below 18 years) and significant non-peer-reviewed publications such as guidelines. Case reports were included only if they contributed new information about the characteristics, diagnosis, or treatment of the disease, or rare diseases. Additional publications were identified from a search of studies cited within the publications identified in the literature search.

The majority of studies included in this review were performed in paediatric populations. However, general information that did not involve ocular manifestations, such as endemic area, basic knowledge of disease, diagnosis technique, other studies from adult populations, and a report from the WHO, were also considered.

CRediT authorship contribution statement

de Groot-Mijnes Jolanda Dorothea Francisca: Writing – review & editing. **Hendrikse Jytte:** Writing – review & editing. **Ngathaweesuk Yaninsiri:** Writing – original draft. **Hettinga Ymkje Marije:** Writing – review & editing, Writing – original draft. **de Boer Joke Helena:** Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

None.

Financial supports

None.

Disclosure

Authors have nothing to disclose.

References

1. de A, Garcia CA, Gomes AHB, de A, Garcia Filho CA, Vianna RNG. Early-stage diffuse unilateral subacute neuroretinitis: Improvement of vision after photocoagulation of the worm. *Eye*. 2004;18(6):624–627. https://doi.org/10.1038/sj.eye.6700742.
2. Abd El Latif E, Fayez Goubran W, El Gemai EEDM, et al. Pattern of childhood uveitis in Egypt. *Ocul Immunol Inflamm*. 2019;27(6):883–889. https://doi.org/10.1080/09273948.2018.1502325.
3. Abderrahim K, Chebil A, Falfoul Y, Bouladi M, Matri LEl. Granulomatous uveitis and reactive arthritis as manifestations of post-streptococcal syndrome. *Int Ophthalmol*. 2015;35(5):641–643. https://doi.org/10.1007/s10792-012-9626-1.
4. Abegunde AT, Ahuja RM, Okafor NJ. Doxycycline plus ivermectin versus ivermectin alone for treatment of patients with onchocerciasis. *Cochrane Database Syst Rev*. 2016;2016(1). https://doi.org/10.1002/14651858.CD011146.pub2.
5. Adebanjo T., Godfred-Cato S., Viens L., et al. Update: Interim Guidance for the Diagnosis, Evaluation, and Management of Infants with Possible Congenital Zika Virus Infection — United States, October 2017.; 2017. https://www.cdc.gov/mmwr/cme/conted_info.html#weekly.
6. Agrawal R, Oo HH, Balne PK, Ng L, Tong L, Leo YS. Zika Virus and the Eye. *Ocul Immunol Inflamm*. 2018;26(5):654–659. https://doi.org/10.1080/09273948.2017.1294184.
7. Ahmad A Othman. Therapeutic battle against larval toxocariasis: Are we still far behind. *Acta Trop*. 2012;124(3):171–178. https://doi.org/10.1016/j.actatropica.2012.08.003.
8. Ahmad N, Natarajan V, Rathaur V, Chacham S. A rare association of post-streptococcal uveitis and post-streptococcal glomerulonephritis in a child. *Indian J Nephrol*. 2022;32(5):516–518. https://doi.org/10.4103/ijn.IJN_426_20.
9. Aihara Y, Shimizu C, Fujiwara Y, Yokota S. Acute anterior uveitis in a child with HLA-B60 after Salmonella enteritis associated with the transient appearance of auto-antibody. *Pediatr Int*. 1996;38(3):286–287. https://doi.org/10.1111/j.1442-200X.1996.tb03489.x.
10. Alba-Linero C, Rocha-de-Lossada C, Rachwani-Anil R, et al. Anterior segment involvement in Epstein–Barr virus: a review. *Acta Ophthalmol*. 2022;100(5):e1052–e1060. https://doi.org/10.1111/aos.15061.
11. Alnahdi MA, Alkharashi M. Ocular manifestations of COVID-19 in the pediatric age group. *Eur J Ophthalmol*. 2023;33(1):21–28. https://doi.org/10.1177/11206721221116210.
12. Alpert SG, Fergerson J, Noël LP. Intrauterine West Nile Virus: Ocular and Systemic Findings. *Am J Ophthalmol*. 2003;136(4):733–735.
13. De Amorim Garcia Filho CA, Gomes AHB, Ana Claudia ACM, De Amorim Garcia CA. Clinical features of 121 patients with diffuse unilateral subacute neuroretinitis. *Am J Ophthalmol*. 2012;153(4):743–749. https://doi.org/10.1016/j.ajo.2011.09.015.
14. Ansari N, Demmler-Harrison G, Coats DK, Paysse EA. Severe congenital chorioretinitis caused by congenital lymphocytic choriomeningitis virus infection. *Am J Ophthalmol Case Rep*. 2021:22. https://doi.org/10.1016/j.ajoc.2021.101094.
15. Badri M, Eslahi AV, Olfatifar M, et al. Keys to Unlock the Enigma of Ocular Toxocariasis: A Systematic Review and Meta-analysis. *Ocul Immunol Inflamm*. 2021;29(7-8):1265–1276. https://doi.org/10.1080/09273948.2021.1875007.
16. Baumal CR, Levin AV, Read SE. Cytomegalovirus Retinitis in Immunosuppressed Children. *Am J Ophthalmol*. 1999;127(5):550–558.
17. Benavides-Lara A, MDLP Barboza-Arguello, González-Elizondo. M, et al. Zika virus-associated birth defects, Costa Rica, 2016-2018. *Emerg Infect Dis*. 2021;27(2):360–371. https://doi.org/10.3201/EID2702.202047.
18. Benjamin daniel K, et al. Neonatal candidemia and end-organ damage: a critical appraisal of the literature using meta-analytic technique. *Pediatrics*. 2003;112:3.
19. Bernard A, Kodjikian L, Abukhashabh A, et al. Diagnosis of Lyme-associated uveitis: Value of serological testing in a tertiary centre. *Br J Ophthalmol*. 2018;102(3):369–372. https://doi.org/10.1136/bjophthalmol-2017-310251.
20. Birnbaum AD, Tessler HH, Schultz KL, et al. Epidemiologic Relationship Between Fuchs Heterochromic Iridocyclitis and the United States Rubella Vaccination Program. *Am J Ophthalmol*. 2007;144(3):424–428. https://doi.org/10.1016/j.ajo.2007.05.026.
21. de Boer J, Wulffraat N, Rothova Br AJ. Visual loss in uveitis of childhood. *Br J Ophthalmol*. 2003;87(7):879–884. ⟨www.bjophthalmol.com⟩.
22. Bolis V, Karadedos C, Chiotis I, Chaliasos N, Tsabouri S. Atypical manifestations of Epstein-Barr virus in children: A diagnostic challenge. *J Pedia (Rio J)*. 2016;92(2):113–121. https://doi.org/10.1016/j.jped.2015.06.007.
23. Borecka A, Kłapeć T. Epidemiology of human toxocariasis in Poland – A review of cases 1978–2009. *Ann Agric Environ Med*. 2015;22(1):28–31. https://doi.org/10.5604/12321966.1141364.
24. Bourdin C, Busse A, Kouamou E, et al. PCR-based detection of Toxoplasma gondii DNA in blood and ocular samples for diagnosis of ocular toxoplasmosis. *J Clin Microbiol*. 2014;52(11):3987–3991. https://doi.org/10.1128/JCM.01793-14.

25. van Boxtel LAA, van der Lelij A, van der Meer J, Los LI. Cytomegalovirus as a Cause of Anterior Uveitis in Immunocompetent Patients. *Ophthalmology*. 2007;114(7):1358–1362. https://doi.org/10.1016/j.ophtha.2006.09.035.
26. Breazzano MP, Bond JB, Bearelly S, et al. American Academy of Ophthalmology Recommendations on Screening for Endogenous Candida Endophthalmitis. *Ophthalmology*. 2022;129(1):73–76. https://doi.org/10.1016/j.ophtha.2021.07.015.
27. Brézin AP, Thulliez P, Cisneros B, Mets MB, Saron MF. Lymphocytic choriomeningitis virus chorioretinitis mimicking ocular toxoplasmosis in two otherwise normal children. *Am J Ophthalmol*. 2000;130(2):245–247.
28. Busari LO, Adeleke MA, Surakat OA, Akindele AA, Fasasi KA, Ojurongbe O. Black flies and Onchocerciasis: Knowledge, attitude and practices among inhabitants of Alabameta, Osun State, Southwestern, Nigeria. *PLoS Negl Trop Dis*. 2022;16(4). https://doi.org/10.1371/journal.pntd.0010320.
29. Campbell AP, Qiu L, Dillman JR, et al. Endemic mycoses in children in North America: a review of radiologic findings. *Pedia Radio*. 2023;53(5):984–1004. https://doi.org/10.1007/s00247-023-05636-3.
30. Ceran BB, Ozates S. Ocular manifestations of coronavirus disease 2019. *Graefes Arch Clin Exp Ophthalmol*. 2020;258:1959–1963. https://doi.org/10.1007/s00417-020-04777-7/Published.
31. Cesar Elias Arrieta-Bechara Angie Yesenia Carrascal-Maldonado. Ocular leptospirosis: a review of current state of art of a neglected disease. *Rom J Ophthalmol*. 2022;66(4):282–288. https://doi.org/10.22336/rjo.2022.53.
32. Char DH, Crawford JB, Bertolucci G, Cole T. Intraocular coccidioidomycosis simulating a neoplasm. *Br J Ophthalmol*. 2012;96(2):218–219. https://doi.org/10.1136/bjo.2011.202515.
33. Chen J, Liu Q, Liu GH, et al. Toxocariasis: A silent threat with a progressive public health impact. *Infect Dis Poverty*. 2018;7(1). https://doi.org/10.1186/s40249-018-0437-0.
34. Cohen WBJ, Buckley MM. The prevalence of antibody to human parvovirus B I 9 in England and Wales. *J Med Microbiol*. 1988;25:151–153.
35. Cortez R, Denny JP, Muci-Mendoza R, Ramirez G, Fuenmayor D, Jaffe GJ. Diffuse unilateral subacute neuroretinitis in Venezuela. *Ophthalmology*. 2005;112(12):2110–2114. https://doi.org/10.1016/j.ophtha.2005.05.029.
36. Cromb D, Mahroo OA. Pediatric Ocular Tuberculosis - Choroidal Tubercles. *J Pediatr*. 2016;169:323. https://doi.org/10.1016/j.jpeds.2015.10.082.
37. Cruickshank MN, Pitt J, Craig JM. Going back to the future with Guthrie-powered epigenome-wide association studies. *Genome Med*. 2012;4(10). https://doi.org/10.1186/gm384.
38. Cunha De Souza E, Abujamra S, Nakashima Y, Donald, Gass M J. *Diffus Bilater Subacute Neuroretinitis First Patient Doc Nematodes Both Eyes*. 1999;Vol 117.
39. Cunningham ET. Uveitis in children. *Ocul Immonol Inflamm*. 2000;8(4):251–261.
40. Cunningham ET, Koehler JE. Ocular Bartonellosis. *Am J Ophthalmol*. 2000;130:340–349.
41. Cunningham ET, Zierhut M. Epstein-Barr Virus and the Eye. *Ocul Immunol Inflamm*. 2020;28(4):533–537. https://doi.org/10.1080/09273948.2020.1760549.
42. Curi ALL, MacHado D, Heringer G, et al. Cat-scratch disease: Ocular manifestations and visual outcome. *Int Ophthalmol*. 2010;30(5):553–558. https://doi.org/10.1007/s10792-010-9389-5.
43. Curragh DS, McAvoy CE, Rooney M, McLoone E. Post-streptococcal uveitis syndrome in a Caucasian population: a case series. *Eye (Basingstoke)*. 2019;33(3):380–384. https://doi.org/10.1038/s41433-018-0214-0.
44. Danielescu C, Stanca HT, Iorga RE, Darabus DM, Potop V. The Diagnosis and Treatment of Fungal Endophthalmitis: An Update. *Diagnostics*. 2022;12(3). https://doi.org/10.3390/diagnostics12030679.
45. Danthuluri V, Grant MB. Update and Recommendations for Ocular Manifestations of COVID-19 in Adults and Children: A Narrative Review. *Ophthalmol Ther*. 2020;9(4):853–875. https://doi.org/10.1007/s40123-020-00310-5.
46. Del M, Preciado-Delgadillo C, Lorenzo-Mejía A, Hitos-Fajer A, Arellanes-García L. Herpetic Keratouveitis in Children. *Int Ophthalmol Clin*. 2008;48(3):39–49.
47. Donald PR, Maher D, Maritz JS, Qazi S. Ethambutol dosage for the treatment of children: literature review and recommendations. *INT J TUBERC LUNG DIS*. 2006;10(12):1318–1330. ⟨www.iuatld.org⟩.
48. Dozier CC, Tarantola RM, Jiramongkolchai K, Donahue SP. Fungal eye disease at a tertiary care center: The utility of routine inpatient consultation. *Ophthalmology*. 2011;118(8):1671–1676. https://doi.org/10.1016/j.ophtha.2011.01.038.
49. Drancourt M, Berger P, Terrada C, et al. High prevalence of fastidious bacteria in 1520 cases of uveitis of unknown etiology. *Medicine*. 2008;87(3):167–176. https://doi.org/10.1097/MD.0b013e31817b0747.
50. Dutta Majumder P, Chen EJ, Shah J, et al. Ocular Syphilis: An Update. *Ocul Immunol Inflamm*. 2019;27(1):117–125. https://doi.org/10.1080/09273948.2017.1371765.
51. Dutta Majumder P, Mochizuki M, González-López JJ, et al. Laboratory Investigations in Infectious Uveitis. *Ocul Immunol Inflamm Publ Online*. 2023. https://doi.org/10.1080/09273948.2022.2164728.
52. Enk CD. Onchocerciasis-river blindness. *Clin Dermatol*. 2006;24(3):176–180. https://doi.org/10.1016/j.clindermatol.2005.11.008.
53. Erica Mancel FMLPDSGAPP. Clinical aspects of ocular leptospirosis in New Caledonia (South Pacific). *Aust N Z J Ophthalmol*. 1999;27:380–386.
54. Eser-Ozturk H, Sullu Y. Pediatric Uveitis in a Referral Center in North Part of Turkey. *Ocul Immunol Inflamm*. 2021;29(7-8):1299–1303. https://doi.org/10.1080/09273948.2020.1758158.
55. Farassat N, Reich M, Serr A, et al. Spiroplasma species as a rare cause of congenital cataract and uveitis: a case series. *BMC Ophthalmol*. 2021;21(1). https://doi.org/10.1186/s12886-021-02201-0.
56. Fekri S, Barzanouni E, Samiee S, Soheilian M. Polymerase chain reaction test for diagnosis of infectious uveitis. *Int J Retin Vitr*. 2023;9(1). https://doi.org/10.1186/s40942-023-00465-w.
57. Fernández Alcalde C, Granados Fernández M, Nieves Moreno M, Calvo Rey C, Falces Romero I, Noval Martín S. COVID-19 ocular findings in children: a case series. *World J Pediatr*. 2021;17(3):329–334. https://doi.org/10.1007/s12519-021-00418-z.
58. Ferrara M, Eggenschwiler L, Stephenson A, et al. The Challenge of Pediatric Uveitis: Tertiary Referral Center Experience in the United States. *Ocul Immunol Inflamm*. 2019;27(3):410–417. https://doi.org/10.1080/09273948.2017.1420202.
59. Ferrini W, Aubert V, Balmer A, Munier FL, Abouzeid H. Anterior uveitis and cataract after rubella vaccination: A case report of a 12-month-old girl. *Pediatrics*. 2013;132(4):e1035–e1038. https://doi.org/10.1542/peds.2012-2930.
60. Font RL, Valle MDel, Mitchell BM, Boniuk M. Cat-scratch Uveitis Confirmed by Histological, Serological, and Molecular Diagnoses. *Cornea*. 2011;30:468–471. ⟨www.corneajrnl.com⟩.
61. Furtado JM, Simões M, Vasconcelos-Santos D, et al. Ocular syphilis. *Surv Ophthalmol*. 2022;67(2):440–462. https://doi.org/10.1016/j.survophthal.2021.06.003.
62. Gallagher MJ, Muqit MMK, Jones D, Gavin M. Post-streptococcal uveitis. *Acta Ophthalmol Scand*. 2006;84(3):424–428. https://doi.org/10.1111/j.1600-0420.2005.00594.x.
63. Gallego-Pinazo R, Harto M, Garcia-Medina JJ, Serra I, España E, Pinazo-Duran MD. Epstein-Barr virus and acute retinal necrosis in a 5-year-old immunocompetent child. *Clin Ophthalmol*. 2008;2(2):451–455.
64. Ganatra JB, Chandler D, Santos C, Margolis TP. Viral Causes of the Acute Retinal Necrosis Syndrome. *Am J Ophthalmol*. 2000;129(2):166–172.
65. Garcia CAA, Gomes AHB, Vianna RNG, Filho JPS, Filho CAAG, Oréfice F. Late-stage diffuse unilateral subacute neuroretinitis: Photocoagulation of the worm does not improve the visual acuity of affected patients. *Int Ophthalmol*. 2005;26(1-2):39–42. https://doi.org/10.1007/s10792-005-0078-8.
66. Ghazi NG, Sams WA. A case of cat-scratch disease with unusual ophthalmic manifestations. *Middle East Afr J Ophthalmol*. 2012;19(2):243–246. https://doi.org/10.4103/0974-9233.95263.
67. Giuliari GP, Ramirez G, Cortez RT. Surgical treatment of ocular toxocariasis: Anatomic and functional results in 45 patients. *Eur J Ophthalmol*. 2011;21(4):490–494. https://doi.org/10.5301/EJO.2010.6118.
68. Groen-Hakan F, Van Der Eijk AA, Rothova A. The Usefulness of Aqueous Fluid Analysis for Epstein–Barr Virus in Patients with Uveitis. *Ocul Immunol Inflamm*. 2020;28(1):126–132. https://doi.org/10.1080/09273948.2018.1543709.
69. De Groot-Mijnes JDF, Dekkers J, De Visser L, Rothova A, Van Loon AM, De Boer JH. Antibody production against b19 virus in ocular fluid of JIA-associated uveitis patients. e1 *Ophthalmology*. 2015;122(6):1270–1272. https://doi.org/10.1016/j.ophtha.2015.01.006.
70. De Groot-Mijnes JDF, et al. Rubella Virus Is Associated With Fuchs Heterochromic Iridocyclitis. *Am J Ophthalmol*. 2006;141:212–214.
71. Guerriero S, Dammacco R, Albano V, et al. A 10-year-old immunocompetent girl with endogenous fungal endophthalmitis: Report of a case and review of the literature. *Eur J Ophthalmol*. 2022;32(1):89–94. https://doi.org/10.1177/11206721211037825.
72. Gupta PC, Kumar-M P, Ram J, et al. Prediction of probability of rubella based on eye outcomes (PORBEO Nomogram)—a cross-sectional sentinel surveillance of 1134 infants. *Graefe's Arch Clin Exp Ophthalmol*. 2021;259(5):1333–1342. https://doi.org/10.1007/s00417-020-04973-5.
73. Gupta V, Gupta A, Rao NA. Intraocular Tuberculosis-An Update. *Surv Ophthalmol*. 2007;52(6):561–587. https://doi.org/10.1016/j.survophthal.2007.08.015.
74. Guzman MG, Harris E. Dengue. *Lancet*. 2015;385(9966):453–465. https://doi.org/10.1016/S0140-6736(14)60572-9.
75. Habot-Wilner Z, Trivizki O, Goldstein M, et al. Cat-scratch disease: ocular manifestations and treatment outcome. *Acta Ophthalmol*. 2018;96(4):e524–e532. https://doi.org/10.1111/aos.13684.
76. Han J, Lee SC, Song WK. Recurrent Bilateral Retinal Vasculitis as a Manifestation of Post-streptococcal Uveitis Syndrome. *Korean J Ophthalmol*. 2012;26:309–311.
77. Harto, et al. Diffuse unilateral subacute neuroretinitis in europe. *Eur J Ophthalmol*. 1999;9(1):58–62.
78. Hasanabad MH, Noorbakhsh S, Farhadi M, Haghighi F, Minaeian S. Neonatal screening for congenital cytomegalovirus infection in Tehran, Iran, using Guthrie cards. *Iran J Microbiol*. 2020;12(3):198–203. ⟨http://ijm.tums.ac.ir⟩.
79. Haseeb AA, Elhusseiny AM, Siddiqui MZ, Ahmad KT, Sallam AB. Fungal endophthalmitis: A comprehensive review. *J Fungi*. 2021;7(11). https://doi.org/10.3390/jof7110996.
80. Hayes EB, Gubler DJ. West Nile virus: Epidemiology and clinical features of an emerging epidemic in the United States. *Annu Rev Med*. 2006;57:181–194. https://doi.org/10.1146/annurev.med.57.121304.131418.
81. Heinz C, Plentz A, Bauer D, Heiligenhaus A, Modrow S. Prevalence of parvovirus B19-specific antibodies and of viral DNA in patients with endogenous uveitis. *Graefe's Arch Clin Exp Ophthalmol*. 2005;243(10):999–1004. https://doi.org/10.1007/s00417-005-1178-x.
82. Hendrixson DT, Newland JG. Zika Virus Infection in Children. *Infect Dis Clin North Am*. 2018;32(1):215–224. https://doi.org/10.1016/j.idc.2017.10.003.
83. Hettinga YM, De Groot-Mijnes JDF, Rothova A, De Boer JH. Infectious involvement in a tertiary center pediatric uveitis cohort. *Br J Ophthalmol*. 2015;99(1):103–107. https://doi.org/10.1136/bjophthalmol-2014-305367.

84. Hettinga YM, De Groot-Mijnes JDF, Rothova A, De Boer JH. Infectious involvement in a tertiary center pediatric uveitis cohort. *Br J Ophthalmol*. 2015;99(1):103–107. https://doi.org/10.1136/bjophthalmol-2014-305367.
85. Hiwarkar P, Gajdosova E, Qasim W, et al. Frequent occurrence of cytomegalovirus retinitis during immune reconstitution warrants regular ophthalmic screening in high-risk pediatric allogeneic hematopoietic stem cell transplant recipients. *Clin Infect Dis*. 2014;58(12):1700–1706. https://doi.org/10.1093/cid/ciu201.
86. Hsu C, Moinfar N, Lipman B, Capone A, Trese M. Acute retinal necrosis in a neonate. *Retin Cases Brief Ref*. 2013;7:406–408.
87. Hsu D. SC& HJS. Frontal Lobe Seizures and Uveitis Associated With Acute Human Parvovirus B19 Infection. *J Child Neurol*. 2004;19:304–306.
88. Hujoel IA, Johnson DH, Lebwohl B, et al. Tropheryma whipplei Infection (Whipple Disease) in the USA. *Dig Dis Sci*. 2019;64(1):213–223. https://doi.org/10.1007/s10620-018-5033-4.
89. Ito T, Hoshina T, Mizuki K, Fukuda T, Ishibashi S, Kusuhara K. A pediatric case with parvovirus B19-associated uveitis without autoantibody formation. *Nagoya J Med Sci*. 2018;80(4):611–614. https://doi.org/10.18999/nagjms.80.4.611.
90. Montoya JG, Toxoplasmosis OLiesenfeld. *Lancet*. 2004;363(9425):1965–1976.
91. Jahan A, Bhargava P, Kalyan RK, et al. Serological and molecular study of Leptospira in pediatric patients at a tertiary care centre of northern India. *Indian J Med Microbiol*. 2021;39(2):245–248. https://doi.org/10.1016/j.ijmmb.2021.03.010.
92. Johnson A. Ocular complications of cat scratch disease. *Br J Ophthalmol*. 2020;104(12):1640–1646. https://doi.org/10.1136/bjophthalmol-2019-315239.
93. Johnston NR. Red eye in chickenpox: Varicella-related acute anterior uveitis in a child. *BMJ Case Rep*. 2010. https://doi.org/10.1136/bcr.01.2010.2678.
94. Jordan DR. Noel on P, Clarke WN, Noel LP. Ocular Involvement in Varicella. *Clin Pedia (Philos)*. 1984;23(8):434–436.
95. Kadambari S, Williams EJ, Luck S, Griffiths PD, Sharland M. Evidence based management guidelines for the detection and treatment of congenital CMV. *Early Hum Dev*. 2011;87(11):723–728. https://doi.org/10.1016/j.earlhumdev.2011.08.021.
96. Kalogeropoulos D, Asproudis I, Stefaniotou M, et al. The large Hellenic Study of Uveitis: epidemiology, etiologic factors and classification. *Int Ophthalmol*. 2023. https://doi.org/10.1007/s10792-023-02772-5.
97. Kalogeropoulos D, Sakkas H, Mohammed B, et al. Ocular toxoplasmosis: a review of the current diagnostic and therapeutic approaches. *Int Ophthalmol*. 2022;42(1):295–321. https://doi.org/10.1007/s10792-021-01994-9.
98. Kapoor HK, Bhai S, John M, Xavier J. Ocular manifestations of dengue fever in an East Indian epidemic. *Can J Ophthalmol*. 2006;41:741–746.
99. Kaushik S, Choudhary S, Dhingra D, et al. *Newborn Glaucoma: A Neglected Manifestation of Congenital Rubella Syndrome*. In: *Ophthalmology Glaucoma*. Vol 5. American Academy of Ophthalmology,; 2022:428–435. https://doi.org/10.1016/j.ogla.2021.12.005.
100. Kaushik S, Singh R, Gupta A, et al. Unilateral recalcitrant glaucoma associated with cytomegalovirus in an immunocompromised child with Wiskott-Aldrich syndrome. *J AAPOS*. 2013;17(6):646–647. https://doi.org/10.1016/j.jaapos.2013.08.007.
101. Kenneson A, Cannon MJ. Review and meta-analysis of the epidemiology of congenital cytomegalovirus (CMV) infection. *Rev Med Virol*. 2007;17(4):253–276. https://doi.org/10.1002/rmv.535.
102. Kernt M, Kampik A, Kernt M. Clinical Ophthalmology Endophthalmitis: Pathogenesis, clinical presentation, management, and perspectives. *Clin Ophthalmol Publ Online*; 2010:4–121. ⟨www.dovepress.com⟩.
103. Keuning MW, Kamp GA, Schonenberg-Meinema D, Dorigo-Zetsma JW, van Zuiden JM, Pajkrt D. Congenital syphilis, the great imitator—case report and review. *Lancet Infect Dis*. 2020;20(7):e173–e179. https://doi.org/10.1016/S1473-3099(20)30268-1.
104. Khairallah M, Ben Yahia S, Ladjimi A, et al. Chorioretinal involvement in patients with West Nile virus infection. *Ophthalmology*. 2004;111(11):2065–2070. https://doi.org/10.1016/j.ophtha.2004.03.032.
105. Khanna R, Devishanmani CS, Pradeep S, Biswas J. Multimodal Imaging of a Case of Bilateral Frosted Branch Angiitis in a 5-Year-Old Boy Secondary to Epstein Barr Virus (EBV) Infection. *Ocul Immunol Inflamm Publ Online*. 2023. https://doi.org/10.1080/09273948.2023.2194412.
106. Krase IZ, Garabedian E, Fuleihan R, Sacco K. Prevalence of coccidioidomycosis in primary immunodeficiency: Data from the USIDNET registry. *Clin Immunol*. 2022:245. https://doi.org/10.1016/j.clim.2022.109135.
107. Kump LI, Cervantes-Castañeda RA, Androudi SN, Foster CS. Analysis of pediatric uveitis cases at a tertiary referral center. *Ophthalmology*. 2005;112(7):1287–1292. https://doi.org/10.1016/j.ophtha.2005.01.044.
108. Lago EG, Endres MM, Scheeren MFDC, Fiori HH. Ocular Outcome of Brazilian Patients with Congenital Toxoplasmosis. *Pediatr Infect Dis J*. 2021;40:e21–e27. https://doi.org/10.1097/INF.0000000000002931.
109. Lalitha P, Rathinam S, Banushree K, Maheshkumar S, Vijayakumar R, Sathe P. Ocular Involvement Associated With an Epidemic Outbreak of Chikungunya Virus Infection. *Am J Ophthalmol*. 2007;144(4):552–556. https://doi.org/10.1016/j.ajo.2007.06.002.
110. Lambert N, Strebel P, Orenstein W, Icenogle J, Poland GA. Rubella. *Lancet*. 2015;385(9984):2297–2307. https://doi.org/10.1016/S0140-6736(14)60539-0.
111. Van Der Lelij A, Ooijman FM, Kijlstra A, Rothova A. Anterior Uveitis with Sectoral Iris Atrophy in the Absence of Keratitis A Distinct Clinical Entity among Herpetic Eye Diseases. *Ophthalmology*. 2000;107:1164–1170.
112. Lin P, Yoon MK, Chiu CS. Herpes zoster keratouveitis and inflammatory ocular hypertension 8 years after varicella vaccination. *Ocul Immunol Inflamm*. 2009;17(1):33–35. https://doi.org/10.1080/09273940802491892.
113. Lloyd MM, Gilbert R, Taha NT, et al. Conventional parasitology and DNA-based diagnostic methods for onchocerciasis elimination programmes. *Acta Trop*. 2015;146:114–118. https://doi.org/10.1016/j.actatropica.2015.03.019.
114. Lodha R, Sebastian MR, Kabra SK. Chikungunya Infection in Children. *Indian J Peadiatr*. 2009;76:185–189.
115. Lonngi M, Aguilar MC, Ríos HA, Aristizábal-Duque CH, Rodríguez FJ, de-la-Torre A. Pediatric Uveitis: Experience in Colombia. *Ocul Immunol Inflamm*. 2016;24(4):410–414. https://doi.org/10.3109/09273948.2016.1160129.
116. Lorenz B, Schroeder J, Reischl U. First evidence of an endogenous Spiroplasma sp. infection in humans manifesting as unilateral cataract associated with anterior uveitis in a premature baby. *Graefe's Arch Clin Exp Ophthalmol*. 2002;240(5):348–353. https://doi.org/10.1007/s00417-002-0453-3.
117. Ma C, Li H, Lu S, Li X, Wang S, Wang W. Ocular Lesions in Brucella Infection: A Review of the Literature. *Infect Drug Resist*. 2022;15:7601–7617. https://doi.org/10.2147/IDR.S394497.
118. Ma G, Holland CV, Wang T, et al. Human toxocariasis. *Lancet Infect Dis*. 2018;18(1):e14–e24. https://doi.org/10.1016/S1473-3099(17)30331-6.
119. Ma L, Jakobiec FA, Dryja TP. A Review of Next-Generation Sequencing (NGS): Applications to the Diagnosis of Ocular Infectious Diseases. *Semin Ophthalmol*. 2019;34(4):223–231. https://doi.org/10.1080/08820538.2019.1620800.
120. Ma N, Li P, Wang X, et al. Ocular Manifestations and Clinical Characteristics of Children with Laboratory-Confirmed COVID-19 in Wuhan, China. *JAMA Ophthalmol*. 2020;138(10):1079–1086. https://doi.org/10.1001/jamaophthalmol.2020.3690.
121. Mabra D, Yeh S, Shantha JG. Ocular manifestations of bartonellosis. *Curr Opin Ophthalmol*. 2018;29(6):582–587. https://doi.org/10.1097/ICU.0000000000000522.
122. Mahendradas P, Avadhani K, Shetty R. Chikungunya and the eye: A review. *J Ophthalmic Inflamm Infect*. 2013;3(1):1–9. https://doi.org/10.1186/1869-5760-3-35.
123. Majumder PD, Ali S, George A, Ganesh S, Biswas J. Clinical Profile of Scleritis in Children. *Ocul Immunol Inflamm*. 2019;27(4):535–539. https://doi.org/10.1080/09273948.2017.1423333.
124. Mane SS, Mandal A, Pustake M, Ali MK, Yadav N. Ocular Toxicity of Ethambutol During Both Intensive and Continuation Phases of Anti-Tubercular Therapy in Children. *Indian Pedia*. 2022;59(11):863–866.
125. Mapelli C, Milella P, Donà C, et al. Acute Retinal Necrosis: Clinical Features, Diagnostic Pitfalls, Treatment, and Outcome of an Insidious Disease in Children. Case Report and Review of the Literature. *Front Pedia*. 2022:10. https://doi.org/10.3389/fped.2022.854325.
126. Marques SHDM Guerra MG, Almeida C, Ribeiro M. Ocular manifestations of rickettsia in children: Common but frequently overlooked. *BMJ Case Rep*. 2018:2018. https://doi.org/10.1136/bcr-2017-222809.
127. Marrani E, Venturini E, Danti G, et al. A case of unilateral acute hypertensive uveitis in a child. *Eur J Ophthalmol*. 2022;32(1):NP223–NP225. https://doi.org/10.1177/1120672120954050.
128. Martinez J, Ivankovich-Escoto G, Wu L. Pediatric Ocular Toxocariasis in Costa Rica: 1998-2018 Experience. *Ocul Immunol Inflamm*. 2021;29(7-8):1246–1251. https://doi.org/10.1080/09273948.2020.1792513.
129. Matet A, Le Flèche-Matéos A, Doz F, Dureau P, Cassoux N. Ocular spiroplasma ixodetis in Newborns, France. *Emerg Infect Dis*. 2020;26(2):340–344. https://doi.org/10.3201/eid2602.191097.
130. Mathis T, Beccat S, Sève P, Peyron F, Wallon M, Kodjikian L. Comparison of immunoblotting (IgA and IgG) and the Goldmann-witmer coefficient for diagnosis of ocular toxoplasmosis in immunocompetent patients. *Br J Ophthalmol*. 2018;102(10):1454–1458. https://doi.org/10.1136/bjophthalmol-2017-311528.
131. Matti Saari K, Mfiki M, Pfiiv T, Leino R, Toivanen Tampere A. Acute anterior uveitis and conjunctivitis following yersinia infection in children. *Int Ophthalmol*. 1986;9:237–241.
132. Mattia JG, Vandy MJ, Chang JC, et al. Early clinical sequelae of Ebola virus disease in Sierra Leone: A cross-sectional study. *Lancet Infect Dis*. 2016;16(3):331–338. https://doi.org/10.1016/S1473-3099(15)00489-2.
133. Mazzeo TJMM, dos Santos Motta MM, Curi ALL. Diffuse unilateral subacute neuroretinitis: review article. *J Ophthalmic Inflamm Infect*. 2019;9(1). https://doi.org/10.1186/s12348-019-0191-x.
134. McHardy IH, Barker B, Thompson GR. Review of Clinical and Laboratory Diagnostics for Coccidioidomycosis. *J Clin Microbiol*. 2023;61(5). https://doi.org/10.1128/jcm.01581-22.
135. Medoro AK, Sánchez PJ. Syphilis in Neonates and Infants. *Clin Perinatol*. 2021;48(2):293–309. https://doi.org/10.1016/j.clp.2021.03.005.
136. Mercado CL, Froines CP, Gaier ED, et al. Prevalence and Characteristics of Cytomegalovirus Ocular Disease in Children: A Multi-Center Study. *Clin Ophthalmol*. 2022;16:2209–2217. https://doi.org/10.2147/OPTH.S364741.
137. Mets MB, Barton LL, Khan AS, Ksiazek TG. Lymphocytic Choriomeningitis Virus: An Underdiagnosed Cause of Congenital Chorioretinitis. *Am J Ophthalmol*. 2000;130:209–215.
138. Mets MB, Chhabra MS. Eye Manifestations of Intrauterine Infections and Their Impact on Childhood Blindness. *Surv Ophthalmol*. 2008;53(2):95–111. https://doi.org/10.1016/j.survophthal.2007.12.003.
139. Mets MB, Holfels E, Boyer KM, et al. Eye Manifestations of Congenital Toxoplasmosis. *Am J Ophthalmol*. 1996;123:309–324.
140. Mikkilä HO, Seppälä IJT, Viljanen MK, Peltomaa MP, Karma A. The expanding clinical spectrum of ocular lyme borreliosis. *Ophthalmology*. 2000;107(3):581–587. https://doi.org/10.1016/S0161-6420(99)00128-1.

141. Mochizuki M, Sugita S, Kamoi K, Takase H. A new era of uveitis: impact of polymerase chain reaction in intraocular inflammatory diseases. *Jpn J Ophthalmol*. 2017;61(1). https://doi.org/10.1007/s10384-016-0474-9.
142. Mohamad S, Azmi NC, Noordin R. Development and evaluation of a sensitive and specific assay for diagnosis of human toxocariasis by use of three recombinant antigens (TES-26, TES-30USM, and TES-120. *J Clin Microbiol*. 2009;47(6): 1712–1717. https://doi.org/10.1128/JCM.00001-09.
143. Mohammadi Z, Dehghani A, Ghanbari O, Akhlaghi MR, Nasrollahi K, Salam H. Ocular manifestations in a child with systemic brucellosis. *J Res Med Sci*. 2013;19: 677–679. ⟨http://www.uptodate⟩.
144. Moore SM, McAllister MA, Thomas TO. Rickettsia rickettsii infection as an unusual cause of pediatric retinitis: A case report. *Am J Ophthalmol Case Rep*. 2022:26. https://doi.org/10.1016/j.ajoc.2022.101566.
145. Morishima N, Miyakawa S, Akazawa Y, Takagi S. A Case of Uveitis Associated with Chronic Active Epstein-Barr Virus Infection. *Ophthalmologica*. 2010;210(3): 186–188. https://doi.org/10.1159/000310705.
146. Mota A, Breda J, Silva R, Magalhães A, Falcão-Reis F. Cytomegalovirus Retinitis in an Immunocompromised Infant:A Case Report and Review of the Literature. *Case Rep Ophthalmol*. 2011;2(2):238–242. https://doi.org/10.1159/000330550.
147. Neto GH, Jaegger K, Marchon-Silva V, et al. Eye disease related to onchocerciasis: A clinical study in the Aratha-ú, Yanomami Tribe, Roraima State, Brazil. *Acta Trop*. 2009;112(2):115–119. https://doi.org/10.1016/j.actatropica.2009.07.006.
148. Ng AWW, Mi HF, Ho SL, Teoh SCB, Agrawal R. Ocular Autoimmune Systemic Inflammatory Infectious Study (OASIS)–Report 6: Dengue Uveitis at a Tertiary Eye Institution in Singapore. *Ocul Immunol Inflamm Publ Online*. 2023. https://doi.org/10.1080/09273948.2022.2159840.
149. Nmorsi O, Oladokun I, Egwunyenga OA, Oseha E. Eye lesions and onchocerciasis in a rural farm settlement in Delta state, Nigeria. *Southeast Asian J Trop Med Public Health*. 2002;33(1):28–32.
150. O'Hara M, Lloyd WC, Scribbick FW, Gulley ML. Latent intracellular Epstein-Barr virus DNA demonstrated in ocular posttransplant lymphoproliferative disorder mimicking granulomatous uveitis with iris nodules in a child. *J AAPOS*. 2001;5(1): 62–63. https://doi.org/10.1067/mpa.2001.112444.
151. Oliver GF, Carr JM, Smith JR. Emerging infectious uveitis: Chikungunya, dengue, Zika and Ebola: A review. *Clin Exp Ophthalmol*. 2019;47(3):372–380. https://doi.org/10.1111/ceo.13450.
152. Päivönsalo-Hietanen T, Tuominen J, Saari KM. Uveitis in children: Population-based study in Finland. *Acta Ophthalmol Scand*. 2000;78(1):84–88. https://doi.org/10.1034/j.1600-0420.2000.078001084.x.
153. Pappas G, Roussos N, Falagas ME. Toxoplasmosis snapshots: Global status of Toxoplasma gondii seroprevalence and implications for pregnancy and congenital toxoplasmosis. *Int J Parasitol*. 2009;39(12):1385–1394. https://doi.org/10.1016/j.ijpara.2009.04.003.
154. Paroli MP, Restivo L, Ottaviani E, et al. Clinical Features of Infectious Uveitis in Children Referred to a Hospital-Based Eye Clinic in Italy. *Med (Kaunas)*. 2022;(11): 58. https://doi.org/10.3390/medicina58111673.
155. Paroli MP, Spinucci G, Liverani M, Monte R, Pezzi PP. Uveitis in childhood: An Italian clinical and epidemiological study. *Ocul Immunol Inflamm*. 2009;17(4): 238–242. https://doi.org/10.1080/09273940802702561.
156. Parvez Y, AlZarooni F, Khan F. Optic Neuritis in a Child With COVID-19: A Rare Association. *Cureus*. 2021. https://doi.org/10.7759/cureus.14094.
157. Perhiar BA, Siddiqui MAR, Ibrahim S. Acute retinal necrosis with exudative retinal detachment in a child. *BMJ Case Rep*. 2021;14(12). https://doi.org/10.1136/bcr-2021-245984.
158. Peyron F, L'ollivier C, Mandelbrot L, et al. Maternal and congenital toxoplasmosis: Diagnosis and treatment recommendations of a French multidisciplinary working group. *Pathogens*. 2019;8(1). https://doi.org/10.3390/pathogens8010024.
159. Pikkel YY, Pikkel J. Acute retinal necrosis in childhood. *Case Rep Ophthalmol*. 2014; 5(2):138–143. https://doi.org/10.1159/000363130.
160. Poppert S, Heideking M, Agostini H, et al. Diffuse unilateral subacute neuroretinitis caused by ancylostoma hookworm. *Emerg Infect Dis*. 2017;23(2):343–344. https://doi.org/10.3201/eid2302.142064.
161. PREVAIL III Study Group. Sneller MC RCBMBREAMSJKGDDHLHENATKVJJKDKBNJLHFMP. A Longitudinal Study of Ebola Sequelae in Liberia. *N Engl J Med*. 2019;380(10):924–934. https://doi.org/10.1056/NEJMoa1805435.
162. Quentin CD, Reiber H. Fuchs heterochromic cyclitis: Rubella virus antibodies and genome in aqueous humor. *Am J Ophthalmol*. 2004;138(1):46–54. https://doi.org/10.1016/j.ajo.2004.02.055.
163. Radosavljevic A, Agarwal M, Chee SP, Zierhut M. Epidemiology of Viral Induced Anterior Uveitis. *Ocul Immunol Inflamm*. 2022;30(2):297–309. https://doi.org/10.1080/09273948.2020.1853177.
164. Rasquin F, Waterschoot MP, Termote H, Carlier Y. Diffuse unilateral subacute neuroretinitis in Africa. *Ocul Immunol Inflamm*. 2006;14(1):59–62. https://doi.org/10.1080/09273940500224629.
165. Relhan N, Pathengay A, Raval V, Nayak S, Choudhury H, Flynn HW. Clinical experience in treatment of diffuse unilateral subretinal neuroretinitis. *Clin Ophthalmol*. 2015;9:1799–1805. https://doi.org/10.2147/OPTH.S86989.
166. Richards AL, Bagus R, Baso SM, et al. The first reported outbreak of dengue hemorrhagic fever in Irian Jaya, Indonesia. *Am J Trop Med Hyg*. 1997;57(1):49–55.
167. Van Rie A, Sawry S, Link-Gelles R, et al. Paradoxical tuberculosis-associated immune reconstitution inflammatory syndrome in children. *Pedia Pulmonol*. 2016; 51(2):157–164. https://doi.org/10.1002/ppul.23221.
168. Rodenbiker HT, Ganley BS. JP. Ocular Coccidioidomycosis. *Surv Ophthalmol*. 1980; 24(5):263–290.
169. Rodman J, Pizzimenti J. In vivo diagnostic imaging of ocular toxocariasis. *Clin Exp Optom*. 2009;92(2):146–149. https://doi.org/10.1111/j.1444-0938.2008.00337.x.
170. Rohrbach JM, Kröber SM, Teufel T, Kortmann RD, Zierhut M. EBV-induced polymorphic lymphoproliferative disorder of the iris after heart transplantation. *Graefe's Arch Clin Exp Ophthalmol*. 2004;242(1):44–50. https://doi.org/10.1007/s00417-003-0751-4.
171. Rosenberg KD, Feuer WJ, Davis JL. Ocular complications of pediatric uveitis. *Ophthalmology*. 2004;111(12):2299–2306. https://doi.org/10.1016/j.ophtha.2004.06.014.
172. Rosenberg KD, Feuer WJ, Davis JL. Ocular complications of pediatric uveitis. *Ophthalmology*. 2004;111(12):2299–2306. https://doi.org/10.1016/j.ophtha.2004.06.014.
173. Rossi DC, Sadeghi Y, Di Lucca J, Maitre S, Hofer M, Guex-Crosier Y. Post-Streptococcal Uveitis: a Rare Entity. *Klin Monbl Augenheilkd*. 2017;234(4):561–563. https://doi.org/10.1055/s-0042-119688.
174. Rousseau A, Haigh O, Ksiaa I, Khairallah M, Labetoulle M. Ocular manifestations of west nile virus. *Vaccin (Basel)*. 2020;8(4):1–9. https://doi.org/10.3390/vaccines8040641.
175. Rubinsky-Elefant G, Hirata CE, Yamamoto JH, Ferreira MU. Human toxocariasis: Diagnosis, worldwide seroprevalences and clinical expression of the systemic and ocular forms. *Ann Trop Med Parasitol*. 2010;104(1):3–23. https://doi.org/10.1179/136485910X12607012373957.
176. Rubinstein J, Toner K, Gross T, Wistinghausen B. Diagnosis and management of post-transplant lymphoproliferative disease following solid organ transplantation in children, adolescents, and young adults. *Best Pr Res Clin Haematol*. 2023;36(1). https://doi.org/10.1016/j.beha.2023.101446.
177. Salman AG, Mansour DE, Radwan AA, Mansour LE. Polymerase chain reaction in pediatric post-traumatic fungal endophthalmitis among egyptian children. *Ocul Immunol Inflamm*. 2010;18(2):127–132. https://doi.org/10.3109/09273940903395302.
178. Santiagu F, Ong L, Ariffin WA, Tajunisah I. A case of multifocal choroiditis secondary to Candida albicans infection in a leukemic child. *Ocul Immunol Inflamm*. 2013;21(4):317–320. https://doi.org/10.3109/09273948.2013.780083.
179. Sawers L, Wallon M, Mandelbrot L, Villena I, Stillwaggon E, Kieffer F. Prevention of congenital toxoplasmosis in France using prenatal screening: A decision-analytic economic model. *PLoS One*. 2022;17(11), e0273781. https://doi.org/10.1371/journal.pone.0273781.
180. De Schryver Rozenberg F, Cassoux N, et al. Diagnosis and treatment of cytomegalovirus iridocyclitis without retinal necrosis. *Br J Ophthalmol*. 2006;90(7): 852–855. https://doi.org/10.1136/bjo.2005.086546.
181. Sean PDonahue, Eric Hein, Robbin BSinatra. Ocular Involvement in Children With Candidemia. *Am J Opthalmol*. 2003;135(6):886–887.
182. Seepongphun U, Sittivarakul W, Dangboon W, Chotipanvithayakul R. The Pattern of Uveitis in a Pediatric Population at a Tertiary Center in Thailand. *Ocul Immunol Inflamm Publ Online*. 2021. https://doi.org/10.1080/09273948.2021.1980814.
183. Shariffudin N, Min T, Adnan A, Hashim H, Teo K. A child with a rare presentation of ocular bartonellosis. *Taiwan J Ophthalmol*. 2021;11(3):292–295. https://doi.org/10.4103/tjo.tjo_29_20.
184. Sibony P, Halperin J, Coyle PK, Patel K. Reactive Lyme Serology in Optic Neuritis. *J Neuroophthalmol*. 2005;25:71–82.
185. Silpa-archa S, Sriyuttagrai W, Foster CS. Treatment for Epstein-Barr Virus-associated uveitis confirmed by polymerase chain reaction: Efficacy of Anti-Viral Agents and a literature review. *J Clin Virol*. 2022:147. https://doi.org/10.1016/j.jcv.2022.105079.
186. da Silva Pone MV, Moura Pone S, Araujo Zin A, et al. Zika virus infection in children: epidemiology and clinical manifestations. *Child's Nerv Syst*. 2018;34(1): 63–71. https://doi.org/10.1007/s00381-017-3635-3.
187. Simon F, Javelle E, Oliver M, Leparc-Goffart I, Marimoutou C. Chikungunya virus infection. *Curr Infect Dis Rep*. 2011;13(3):218–228. https://doi.org/10.1007/s11908-011-0180-1.
188. Simons EA, Reef SE, Cooper LZ, Zimmerman L, Thompson KM. Systematic Review of the Manifestations of Congenital Rubella Syndrome in Infants and Characterization of Disability-Adjusted Life Years (DALYs). *Risk Anal*. 2016;36(7): 1332–1356. https://doi.org/10.1111/risa.12263.
189. Sivakumar R, Balakrishnan V, Gowri P, Visalakshi J. Leptospiral Uveitis: Usefulness of Clinical Signs as Diagnostic Predictors. *Ocul Immunol Inflamm*. 2018;26(4): 569–576. https://doi.org/10.1080/09273948.2016.1217341.
190. Sivakumar RR. Ocular leptospirosis: lack of awareness among ophthalmologists and challenges in diagnosis. *Curr Opin Ophthalmol*. 2022;33(6):532–542. https://doi.org/10.1097/ICU.0000000000000896.
191. Smit D, Meyer D, Maritz J, de Groot-Mijnes JDF. Polymerase Chain Reaction and Goldmann-Witmer Coefficient to Examine the Role of Epstein-Barr Virus in Uveitis. *Ocul Immunol Inflamm*. 2019;27(1):108–113. https://doi.org/10.1080/09273948.2017.1370653.
192. Smith JA, Mackensen F, Sen HN, et al. Epidemiology and Course of Disease in Childhood Uveitis. *Ophthalmology*. 2009;116(8). https://doi.org/10.1016/j.ophtha.2009.05.002.
193. Souza EC, Casella AMB, Nakashima Y, Monteiro MLR. Clinical features and outcomes of patients with diffuse unilateral subacute neuroretinitis treated with oral albendazole, 437.e1-437.e11 *Am J Ophthalmol*. 2005;140(3). https://doi.org/10.1016/j.ajo.2005.03.065.
194. Spadea L, Giannico MI. Diagnostic and management strategies of aspergillus endophthalmitis: Current insights. *Clin Ophthalmol*. 2019;13:2573–2582. https://doi.org/10.2147/OPTH.S219264.

195. Spichler A, Athanazio DA, Vilaça P, Seguro A, Vinetz J, Leake JAD. Comparative analysis of severe pediatric and adult leptospirosis in São Paulo, Brazil. *Am J Trop Med Hyg*. 2012;86(2):306–308. https://doi.org/10.4269/ajtmh.2012.11-0308.
196. Storchilo HR, Rezende HHA, Gomes TC, et al. Basic heel prick test: Inclusion of screening, diagnosis and criteria for early confirmation of congenital infection by Toxoplasma gondii. *Rev Inst Med Trop Sao Paulo*. 2019:61. https://doi.org/10.1590/s1678-9946201961030.
197. Su CC, Hu FR, Wang TH, et al. Clinical outcomes in cytomegalovirus-positive posner-schlossman syndrome patients treated with topical ganciclovir therapy. e2 *Am J Ophthalmol*. 2014;158(5):1024–1031. https://doi.org/10.1016/j.ajo.2014.08.007.
198. Su DHW, Bacsal K, Chee SP, et al. Prevalence of Dengue Maculopathy in Patients Hospitalized for Dengue Fever. *Ophthalmology*. 2007;114(9):1743–1747. https://doi.org/10.1016/j.ophtha.2007.03.054.
199. Sulaiman WAW, Kamtchum-Tatuene J, Mohamed MH, et al. Anti-Wolbachia therapy for onchocerciasis & lymphatic filariasis: Current perspectives. *Indian J Med Res*. 2019;149(6):706–714. https://doi.org/10.4103/ijmr.IJMR_454_17.
200. Sykes DAW, Joseph SL, Williams SP, Das SU. A 13-Year-Old Girl With Unilateral Visual Changes. *J Invest Med High Impact Case Rep*. 2023:11. https://doi.org/10.1177/23247096221150635.
201. Takkar B, Venkatesh P, Gaur N, Garg SP, Vohra R, Ghose S. Patterns of uveitis in children at the apex institute for eye care in India: analysis and review of literature. *Int Ophthalmol*. 2018;38(5):2061–2068. https://doi.org/10.1007/s10792-017-0700-6.
202. Tan JCH, Byles D, Stanford MR, Frith PA, Graham EM. Acute retinal necrosis in children caused by herpes simplex virus. *Retina*. 2001;21:344–347.
203. Tan SZ, Yau K, Steeples LR, Ashworth J, Fenerty C, Jones N. Incidence, management and outcome of raised intraocular pressure in childhood-onset uveitis at a tertiary referral centre. *Br J Ophthalmol*. 2019;103(6):748–752. https://doi.org/10.1136/bjophthalmol-2018-312498.
204. Tanaka-Kitajima N, Iwata N, Ando Y, et al. Acute retinal necrosis caused by herpes simplex virus type 2 in a 3-year-old Japanese boy. *Eur J Pedia*. 2009;168(9):1125–1128. https://doi.org/10.1007/s00431-008-0878-8.
205. Testi I, Agrawal R, Mahajan S, et al. The Collaborative Ocular Tuberculosis Study (COTS)-1: A Multinational Descriptive Review of Tubercular Uveitis in Paediatric Population. *Ocul Immunol Inflamm*. 2020;28(sup1):58–64. https://doi.org/10.1080/09273948.2020.1781197.
206. Testi I, Agrawal R, Mehta S, et al. Ocular tuberculosis: Where are we today. *Indian J Ophthalmol*. 2020;68(9):1808–1817. https://doi.org/10.4103/ijo.IJO_1451_20.
207. Touitou V, Fenollar F, Cassoux N, et al. Ocular Whipple's disease: Therapeutic strategy and long-term follow-up. *Ophthalmology*. 2012;119(7):1465–1469. https://doi.org/10.1016/j.ophtha.2012.01.024.
208. Troumani Y, Touhami S, Jackson TL, et al. Association of Anterior Uveitis with Acute Zika Virus Infection in Adults. *JAMA Ophthalmol*. 2021;139(1):95–102. https://doi.org/10.1001/jamaophthalmol.2020.5131.
209. Ur Rehman S, Anand S, Reddy A, et al. Poststreptococcal Syndrome Uveitis. *A Descr Case Ser Lit Rev Ophthalmol*. 2006;113(4):701–706. https://doi.org/10.1016/j.ophtha.2005.12.024.
210. Vairo F, Haider N, Kock R, Ntoumi F, Ippolito G, Zumla A. Chikungunya: Epidemiology, Pathogenesis, Clinical Features, Management, and Prevention. *Infect Dis Clin North Am*. 2019;33(4):1003–1025. https://doi.org/10.1016/j.idc.2019.08.006.
211. Varkey JB, Shantha JG, Crozier I, et al. Persistence of Ebola Virus in Ocular Fluid during Convalescence. *N Engl J Med*. 2015;372(25):2423–2427. https://doi.org/10.1056/nejmoa1500306.
212. Van Der Veen J, Polak MF. Prevalence of toxoplasma antibodies according to age with comments on the risk of prenatal infection. *J Hyg, Camb*. 1980;85:165–174.
213. Ventura CV, Maia M, Travassos SB, et al. Risk factors associated with the ophthalmoscopic findings identified in infants with presumed zika virus congenital infection. *JAMA Ophthalmol*. 2016;134(8):912–918. https://doi.org/10.1001/jamaophthalmol.2016.1784.
214. Ventura CV, Zin A, Paula Freitas B de, et al. Ophthalmological manifestations in congenital Zika syndrome in 469 Brazilian children, 158.e1-158.e8 *J AAPOS*. 2021;25(3). https://doi.org/10.1016/j.jaapos.2021.01.009.
215. Ventura LO, Ventura CV, Lawrence L, et al. Visual impairment in children with congenital Zika syndrome. e2 *J AAPOS*. 2017;21(4):295–299. https://doi.org/10.1016/j.jaapos.2017.04.003.
216. Verbraak FD, et al. Cytomegalovirus (CMV) strain differences between the eye and blood in AIDS patients with CMV retinitis. *AIDS*. 1998;12:713–718.
217. Vijayalakshmi P, Kakkar G, Samprathi A, Banushree R, Vijayalakshmi. B: P. Ocular manifestations of congenital rubella syndrome in a developing country. *Indian J Ophthalmol*. 2002;50(4):307–311.
218. de Visser L, Rothova A, de Boer JH, et al. Diagnosis of Ocular Toxocariasis by Establishing Intraocular Antibody Production. *Am J Ophthalmol*. 2008;145(2):369–374. https://doi.org/10.1016/j.ajo.2007.09.020.
219. Vora SB, Englund JA. Cytomegalovirus in immunocompromised children. *Curr Opin Infect Dis*. 2015;28(4):323–329. https://doi.org/10.1097/QCO.0000000000000174.
220. Waduthantri S, Chee SP. Pediatric Uveitis and Scleritis in a Multi-Ethnic Asian Population. *Ocul Immunol Inflamm*. 2021;29(7-8):1304–1311. https://doi.org/10.1080/09273948.2020.1766083.
221. Wallon M, Kodjikian L, Binquet C, et al. Long-Term Ocular Prognosis in 327 Children With Congenital Toxoplasmosis. *Pediatrics*. 2004;113(6):1567–1572. ⟨http://publications.aap.org/pediatrics/article-pdf/113/6/1567/1004024/zpe00604001567.pdf⟩.
222. Weishaar PD, Flynn HW, Murray TG, et al. Endogenous Aspergillus Endophthalmitis Clinical Features and Treatment Outcomes. *Ophthalmology*. 1998;105(1):57–65.
223. Wensing B, Relvas LM, Caspers LE, et al. *Comp Rubella Virus- herpes Virus-Assoc anterior uveitis: Clin Manif Vis Progn Ophthalmol*. 2011;118(10):1905–1910. https://doi.org/10.1016/j.ophtha.2011.03.033.
224. Wongsawat J, Vivong N, Suttha P, et al. Zika virus disease comparing children and adults in a dengue-endemic setting. *Am J Trop Med Hyg*. 2021;104(2):557–563. https://doi.org/10.4269/ajtmh.20-0795.
225. World Health Organization. Dengue and severe dengue. Published March 17, 2023. Accessed September 13, 2023. https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue.
226. World Health Organization. WHO operational handbook on tuberculosis. Module 5: management of tuberculosis in children and adolescents. In:; 2022.
227. Wren SME, Fielder AR, Bethell D, et al. Cytomegalovirus retinitis in infancy. *Eye*. 2004;18(4):389–392. https://doi.org/10.1038/sj.eye.6700696.
228. Wright R, Johnson D, Neumann M, et al. Congenital Lymphocytic Choriomeningitis Virus Syndrome: A Disease That Mimics Congenital Toxoplasmosis or Cytomegalovirus Infection. *Pediatrics*; 1997:100. ⟨http://publications.aap.org/pediatrics/article-pdf/100/1/e9/890117/e9.pdf⟩.
229. Yim R, PBKM ND. FG& WER. Spectrum of clinical manifestations of West Nile virus infection in children. *Pediatrics*. 2004;114:1673–1675.
230. Zaoutis TE, Greves HM, Lautenbach E, Bilker WB, Coffin SE. Risk factors for disseminated candidiasis in children with candidemia. *Pediatr Infect Dis J*. 2004;23(7):635–641. https://doi.org/10.1097/01.inf.0000128781.77600.6f.
231. Zin AA, Tsui I, Rossetto J, et al. Screening criteria for ophthalmic manifestations of congenital zika virus infection. *JAMA Pedia*. 2017;171(9):847–854. https://doi.org/10.1001/jamapediatrics.2017.1474.
232. Zinkernagel MS, Bolinger B, Krebs P, Onder L, Miller S, Ludewig B. Immunopathological basis of lymphocytic choriomeningitis virus-induced chorioretinitis and keratitis. *J Virol*. 2009;83(1):159–166. https://doi.org/10.1128/jvi.01211-08.