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The red eye in childhood

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Diagnosis and treatment of red eyes in children can be extremely challenging for the primary care physician. The anatomic structures involved are small, often requiring microscopic examination. Diagnostic failure can, in the worst cases, result in loss of vision. Nevertheless, if the primary physician cautiously refers to specialists cases involving ocular pain, loss of vision, or opacity of the cornea itself, most common causes of red eye in childhood can be safely managed.

One key to accurate treatment of a red eye is delineation of the specific ocular structures involved. A pair of binocular magnifying loupes with a power of 2.5 or greater, although not necessary, can be helpful. The ocular structures of consideration include the upper and lower eyelids, with the eyelid margins considered separately. The eyelid margins contain the lashes and oil glands that give rise to distinct causes of red eyes. The outside of the eyelids is covered with the thinnest skin in the human body.

The inside of the eyelids is covered by the palpebral (eyelid) conjunctiva. The bulbar conjunctiva is a thin mucous membrane that folds back to cover the eyeball itself. The sclera is the tough, white shell of the eye. Although the sclera does contain blood vessels, it is the dilated conjunctival blood vessels that usually make an eyeball look red.

The cornea is the clear tissue bubble at the front of the eye, where a contact lens may rest. The iris is the brown- or blue-colored tissue inside the eye, with the pupil being the hole in the center of the iris. The anterior chamber is the space between the cornea and iris and is filled with watery aqueous humor. The lens of the eye rests behind the iris. The lens may rarely move forward, pushing the iris against the cornea, blocking the aqueous flow and causing a great rise in intraocular pressure, or acute glaucoma.

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Red eyes may be caused by infections, inflammations, tumors, and trauma. Identifying the specific ocular structures involved helps with diagnosis. Initially, one must decide whether the eyelid or the eyeball itself is the truly red area.

Eyelids

The entire extent of the eyelids may become red and swollen in orbital cellulitis, a condition involving deep infection of the eyelids and the orbital fat and tissues surrounding the eye. The eyeball itself may also be red, but with only minimal discharge. Bulbar conjunctival injection is more prominent than palpebral conjunctival injection. The eyeball may be pushed forward (proptosis), and it may have decreased motions (Fig. 1).

In children, sinus infection spreading into the orbit is by far the most common cause of orbital cellulitis. Recent studies have shown that such infections in children younger than 8 years of age are typically caused by single-organism Staphylococcus or Streptococcus species. With increasing age, multiple bacterial strains become involved, including both aerobes and anaerobes. The treatment involves intravenous antibiotics, which must include anaerobic coverage for children more than 8 years of age. Because of the differences in the causative organisms, even subperiosteal orbital abscesses in children younger than 8 of age may be treated medically, whereas those of older children and adults often require surgery [1–3]. Additionally, orbital cellulitis from ethmoid sinus infections are usually amenable to medical treatment, whereas orbital infections secondary to frontal sinusitis may be more dangerous, in part because of the proximity to the intracranial cavity.

Children with orbital cellulitis should have orbital computed tomographic (CT) scanning; if sinusitis is not present, a search for an alternate cause must be made. Ascending dental infections, orbital trauma, and hematogenous spread of organisms are other, less common causes.

Fig. 1. Orbital cellulitis.

Orbital tumors, such as rhabdomyosarcomas, lymphangiomas, and even neuroblastomas, may masquerade as orbital cellulitis. Orbital pseudotumor, an autoimmune inflammation of the orbital tissues, presents with eyelid swelling, red eye, pain, and decreased ocular motility. It can be distinguished from orbital cellulitis by the absence of significant fever, by the lack of response to antibiotics, and by prompt response to systemic steroid treatment. Computed tomographic scan with contrast may show a characteristic enhancement around the sclera. This condition usually requires high-dose systemic steroid treatment and slow taper to avoid rebound. Recurrences are not uncommon [4].

Superficial eyelid trauma, eyelid impetigo, infected comedones, or infections of the oil glands or hair follicles on the eyelid margin may spread to cause preseptal orbital cellulitis (Fig. 2). The eyelids may be diffusely red and swollen but without orbit or eyeball involvement. Frequently, a point of maximal swelling and tenderness can be found at the source of infection. These infections of the eyelid tissues are anterior to the orbital septum, a tough connective tissue extending from the orbital rim to the eyelids that serves as a protective barrier against posterior spread of infection. Thus, preseptal cellulitis with an identifiable point source may frequently be managed with oral or intramuscular broad-spectrum antibiotics, on a closely monitored outpatient basis.

Preseptal cellulitis may also be caused secondary to acute dacryocystitis, which is infection of the tear sac. The sac lies nasally in the inferior orbital rim, and edema from infection can close off both the inflow and outflow ducts. A red, tender mass becomes apparent in the nasal portion of the lower eyelid, always inferior to a line drawn between the eyelids (Fig. 3). Masses above this line can represent encephaloceles, dermoid cysts, or other lesions.

In the newborn, acute dacryocystitis is related to congenital nasolacrimal duct obstruction (Fig. 4), and simple probing of the tear ducts is usually curative.

Fig. 2. Preseptal cellulitis.

Fig. 3. Acute dacryocystitis. Note maximal swelling nasally, inferior to medial canthal tendon.

Some newborns and all older children with acute dacryocystitis should be treated with intravenous antibiotics. Many of these require subsequent tear duct surgery to prevent recurrence [5].

Preseptal orbital cellulitis without an obvious source should be managed more like true orbital cellulitis, with CT imaging to rule out sinusitis-associated disease. Classically, the encapsulated bacteria Streptococcus and Hemophilus have caused preseptal cellulitis, and treatment with intravenous antibiotics is warranted to prevent possible meningitis and to resolve any causative sinus infection completely.

Occasionally, an angioneurotic (type I) allergic response (eg, reaction to poison ivy or poison oak, fish, or another allergen) presents with a cellulitis-like swollen eyelid. Insect bites or stings can also present with a preseptal allergic

Fig. 4. Acute neonatal dacryocystitis.

Fig. 5. Bee sting with angioneurotic response. (See also Color Plate 5.)

response (Fig. 5). These conditions may appear similar to infectious preseptal cellulitis but can be distinguished by the more purplish skin color with a peau d'orange texture, the boggy rather than tense edema (Fig. 6), and the presence of significant itch accompanying any pain. The treatment for allergic eyelid reactions is systemic oral steroids or antihistamines, although antibiotics may be used additionally in cases of bites and stings to prevent concurrent infection.

Eyelid tumors, especially capillary hemangiomas, and nevus flammeus hemangiomas of Sturge-Weber syndrome can cause redness and sometimes swelling of the eyelids and should be evaluated by a specialist because of risk of visual complications.

Fig. 6. Angioneurotic allergic eyelid and conjunctival response.

Chalazia and hordeola are common, noninfectious, inflammatory reactions to the products of eyelid-margin oil glands and eyelash-associated oil glands, respectively. Swelling occurs focally, close to the eyelid margin, and may be either acute or chronic.

Acute lesions generally respond to hot compresses and steroid or antibiotic ointments. Swelling and redness spreading along or away from the focal lesion can indicate secondary infection and may require oral, and occasionally intravenous, antibiotics. Only rarely is surgical drainage necessary.

Chronic chalazia may persist for many months but usually resolve spontaneously or with the help of hot compresses or steroid-antibiotic ointments. Lesions persisting more than 3 to 6 months may require surgical removal or drainage. Young children with recurring and multiple chalazia on several eyelids frequently benefit from long-term oral erythromycin, which may prevent new lesions. Doxycycline may be used for older children.

Blunt trauma to the eyelids frequently leads to ecchymoses and eyelid edema, sometimes even requiring eyelid speculae to expose the eye. The eyelids can almost always be opened, however, and examination of the eyeball is essential. Care should be taken not to exert pressure on the eyeball itself until one is sure the globe is structurally intact.

In sharp trauma to the eyelids, one must rule out laceration of the tear ducts, which lie in the far medial eyelid region (Fig. 7), and laceration of the eyelid margin. Failure to repair these injuries surgically can result in permanent damage.

Eyelids and conjunctiva

Inflammation of eyelid that spreads on to the mucous membranes lining the eyelid or eyeball is known as blepharoconjunctivitis. The most common

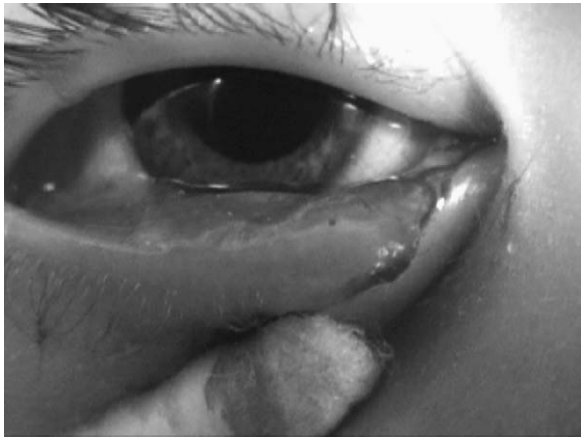

Fig. 7. Lower tear duct laceration. Note laceration nasal to tear duct punctual opening.

Fig. 8. Herpes simplex blepharoconjunctivitis. (See also Color Plate 6.)

infectious cause is herpes simplex virus (HSV), in which the eyelid skin is affected by the typical grouped, pinpoint vesicles, which later scab (Fig. 8). Crops of vesicles mature at the same rate, unlike impetigo, in which the lesions in different stages of development occur simultaneously [6].

Both the palpebral and bulbar conjunctiva may be injected, although HSV may occur as an isolated eyelid infection. Although HSV may cause scarring with visual loss when the cornea is involved, cases of blepharoconjunctivitis frequently, but not always, remain confined to the eyelids and conjunctiva.

Treatment involves ophthalmic topical antibiotic ointment to prevent superinfection of the skin lesions and, most importantly, oral acyclovir, which is most effective when treatment is started as early as possible. Because acyclovir has an excellent safety profile, patients with recurrent episodes may be given refill prescriptions to begin treatment at home at the first sign of recurrence [7]. Topical antiviral eye drops are not used in ocular HSV not involving the cornea [8].

Herpes zoster virus (HZV) may also cause blepharoconjunctivitis in children, with eyelid skin involvement up to the midline, as part of the typical dermatomal distribution. Bulbar and palpebral conjunctiva may be red, and there can be tremendous eyelid and conjunctiva edema, often simulating an orbital cellulitis. High fever and prostration lasting a week or more is typical. Herpes zoster virus is less sensitive to acyclovir than HSV, and high-dose oral or intravenous treatment is thus used. Although treatment with intravenous acyclovir and fluids is all that really is indicated, most children are also given antibiotics because of the orbital cellulitis-like picture and the acuity of the illness.

Allergic eyelid reactions may also involve conjunctiva. In those cases, addition of topical ophthalmic steroid eye drops may be helpful to control itching and redness.

Molluscum contagiosum virus may involve the eyelid skin, with the typical umbilicated nodular lesions. Viral particles shed from the lesions produce a

Fig. 9. Molluscum contagiosum lesions of the central and nasal lower eyelid margin. Note secondary scaling dermatitis and conjunctivitis.

scaling dermatitis of the eyelid skin. When the lesions are close to the eyelid margin, the shed viral particles cause a toxic, chronic follicular conjunctivitis. Along with redness of the palpebral and bulbar conjunctiva, there is swelling of the lymphoid follicles in the lower conjunctival fornix, creating a bumpy appearance in this area. In cases of chronic red eye, it is worth searching for tiny molluscum lesions among the eyelashes, because this condition is not rare and is frequently missed (Fig. 9).

Phthirus pubis, or pubic louse, may cling to the eyelashes as it does to the pubic hairs (the similar diameter of the two kinds of hairs fits into the claws of these lice). Lice organisms and eggs can be found along the eyelash shafts, and the waste products can produce an itchy dermatitis of the eyelid skin as well as conjunctivitis. Treatment is with petroleum jelly or greasy ointment to suffocate the organisms, and eyelashes may be cut to hasten organism removal. Cases should be reported, because organisms are transmitted sexually.

Conjunctiva (diffuse involvement)

Conjunctivitis can be infectious, allergic, or chemical. Although eyelid swelling may be prominent, especially in young children, the maximal redness lies in the mucous membrane tissue. For the physician to recognize true swelling and injection of the lower conjunctival fornix, it is useful to become familiar with the normal appearance of this area, which is vascular, causing a normal amount of redness, and contains noninflamed, bumpy lymphoid follicles. Inflammation of this tissue causes thickening of the membranes, with additional redness and swelling of the lymphoid follicles, frequently accompanied by watery or mucous discharge.

Viral conjunctivitis, most frequently related to adenoviruses, is by far the most common cause of conjunctivitis. These infections are spread from eye to hand to eye, and may be quite contagious. Severity is variable, depending on the strain as well as the host. It may range from mild redness and irritation to intense bulbar and palpebral conjunctival injection, with heavy discharge. Occasionally, the cornea may show a painful immune reaction. Extreme eyelid swelling may simulate orbital cellulitis, especially in toddlers. Duration may vary from several days to 3 weeks or more. Infection is frequently bilateral, with the first eye more severely affected, and the second eye more mildly involved at a later time. A swollen preauricular lymph node can often be found, especially on the more involved side. Fever and signs of upper respiratory infection often accompany viral conjunctivitis [9].

Other viruses may cause conjunctivitis, including coxsackieviruses and echoviruses, which also may cause subconjunctival hemorrhages. Herpes simplex infection may occasionally present as a pure viral conjunctivitis without skin lesions and can be clinically indistinguishable from the other viral causes of conjunctivitis [8,9].

Viral conjunctivitis is usually self limited and may not require treatment, especially in mild cases. More severe cases may be treated with steroid eye drops, usually given as combination steroid/antibiotic drops. Some physicians refrain from such treatment, however, because steroid eye drops may worsen corneal bacterial ulcers or herpetic disease. One must thus be absolutely certain of the diagnosis by typical clinical picture or by history of other close contacts with similar conjunctivitis. Because HSV conjunctivitis may not be distinguishable, patients treated with steroids should be instructed to return if any skin lesion should appear, and indeed, for any worsening, because topical steroid treatment results in rapid improvement in most viral conjunctivitis.

Bacterial conjunctivitis is less common, although the incidence of true bacterial conjunctivitis is difficult to determine. Normal conjunctiva may harbor common skin flora, as well as Pseudomonas, Moraxella, and other bacteria. Additionally, viral conjunctivitis may have a bacterial superinfectious component. In any case, bacterial conjunctivitis classically shows a more purulent discharge, less follicular reaction in the fornix, and less frequent preauricular lymphadenopathy. Topical antibiotic treatment is usually successful [9].

In teenagers it is important to rule out sexually transmitted bacterial conjunctivitis. *Neisseria gonorrheae* infection produces a hyperacute conjunctivitis, with a particularly heavy purulent ocular discharge, as well as possible genital symptoms. A Gram's stain for intracellular gram-negative Diplococci can quickly identify the need to treat for gonorrhea, and culture samples should be taken using special media. Treatment is with intramuscular ceftriaxone or oral penicillin. *Chlamydia trachomatis* causes a chronic conjunctivitis that may fail to respond to multiple eye-drop treatments. The conjunctiva is classically beefy red with scant discharge, and genital symptoms may or may not be present. For confirmation of diagnosis, a rapid fluorescent antibody test is quicker than either culture or Giemsa stain for intracytoplasmic inclusion bodies; however, each method may suffer from false negatives [10]. Treatment is with oral doxycycline.

One must rule out bacterial causes in neonatal conjunctivitis, especially sexually transmitted diseases (STDs) such as gonorrhea or chlamydia. *Neisseria gonorrheae* may penetrate cornea tissue, potentially leading to visual loss, and *Chlamydia trachomatis* may spread to cause pneumonia in the newborn. Treatment for neonatal gonorrhea includes intravenous or intramuscular ceftriaxone. Cases positive for gonorrhea are treated for chlamydia as well, because the rate of coexisting infection is high. Treatment for neonatal chlamydia conjunctivitis is oral erythromycin for 2 weeks.

Conjunctivitis in neonates may be sometimes be caused by a chemical irritation from silver nitrate or antibiotic eye drops used as prophylaxis against these bacteria. More commonly, Staphylococci or Streptococci cause bacterial conjunctivitis in the newborn and respond to topical antibiotics.

The most common condition to differentiate from neonatal conjunctivitis is **c**ongenital nasolacrimal duct obstruction, which is much more common in infants than true conjunctival infection. The nasolacrimal duct normally drains tears from the eye into the nasal cavity. Some authors estimate that up to half of all nasolacrimal ducts are not fully open at birth. Most open spontaneously in the first few weeks to months after birth.

In general, nasolacrimal duct obstruction causes tearing and discharge accumulation without significant conjunctival redness (Fig. 10). The eyelid skin may show redness from secondary dermatitis, but the eyeball itself is white. Nasolacrimal duct obstruction is probably the only condition that produces ocular discharge with a white eye and thus can be distinguished from conjunctivitis at a glance.

The exception is in newborns, in whom mild conjunctival injection is often seen with the nasolacrimal discharge. Of course, it is these children in whom differentiation from conjunctivitis is so important, because of the potential need for STD workup. In these cases, a small finger or cotton swab may be used to

Fig. 10. Congenital nasolacrimal duct obstruction. Note tearing and discharge in a white eye. (See also Color Plate 7.)

exert pressure on the nasolacrimal sac, just inside the inferomedial orbital rim. Discharge from the lacrimal puncta, at the far medial eyelid margin, is diagnostic for nasolacrimal duct obstruction, and workup for conjunctivitis is then not necessary.

Spontaneous resolution of blocked nasolacrimal ducts occurs before the age of 6 months in most cases. Persistent congenital nasolacrimal duct obstruction is treated by probing the duct with a narrow metal rod to pop through any obstruction. Some pediatric ophthalmologists prefer to probe the ducts in the office during the first few months of life. Others wait until 9 months, 12 months, or even later, to allow spontaneous resolution, which often occurs. The children with ducts blocked at this age, however, require anesthesia to allow probing.

Occasionally, the conjunctiva may be diffusely involved in cat-scratch disease. In the ocular form of this condition, infection with the *Bartonella henselae* bacteria can cause a chronic, granulomatous conjunctivitis with diffuse redness of the bulbar and palpebral conjunctiva. A confluence of 1- to 2-mm palpebral and fornix nodules, some of which may be white-centered, is observed. Patients develop large to very large preauricular and occasionally submandibular adenopathy on the involved side (Fig. 11). A multitude of antibiotics have been recommended; oral sulfamethoxazole or doxycycline is commonly used, and even ciprofloxacin may used for children with cat-scratch disease [11].

The bulbar and palpebral conjunctiva may be diffusely red and inflamed in Stevens-Johnson syndrome. Unfortunately, there is no effective treatment for the acute ocular condition, which may result in scarring of the eyelids, conjunctiva, and their lubrication-producing structures. This process can cause severe and life-long irritation, degeneration, and scarring of the corneas with permanent visual loss.

Fig. 11. Ocular cat-scratch disease. Note granulomatous conjunctival reaction and large preauricular lymphadenopathy.

Moderate to severe bulbar and palpebral conjunctival injection may occur with Kawasaki disease. Unlike most forms of conjunctivitis, there is minimal swelling of the conjunctiva and no follicular reaction in the fornix. This pattern of ocular redness is unusual, especially in the absence of corneal irritation or intraocular inflammation (iritis). Iritis may also be present in Kawasaki disease; however, association of iritis with both bulbar and palpebral conjunctival injection is, rarely seen in other causes. The presence of either of these unusual presentations in a febrile child is suggestive of Kawasaki disease and may be particularly useful in diagnosing incomplete cases. Such findings require slit-lamp microscopic examination by a specialist, and thus a timely request for consultation may provide the key to diagnosis of this potentially fatal condition [12].

Ocular conjunctival allergies may be acute or chronic in form. The hallmark of ocular allergy and the symptom to treat is itch. Giemsa stains of conjunctival scrapings show eosinophils; however, most ocular allergic conditions can be diagnosed on the basis of symptomatic itch. One should think twice about an allergy diagnosis in the absence of itch. In acute conjunctival allergy of the hay fever type, the conjunctiva becomes red with fluid-filled thickening of the bulbar conjunctiva, occasionally swelling so much as to appear as a bubble on the eye. Treatment with a short course of antihistamine or steroid eye drops is usually all that is necessary, although systemic treatment may be used if nasal or other symptoms are concurrent.

Chronic conjunctival allergies in children are usually environmental, although allergy to eye drops, and especially their preservatives, may develop with long-term use. A milky thickening of the palpebral conjunctiva may accompany diffuse bulbar redness. Pigmentation of the lower eyelid skin may occur, and pigmentation of the bulbar conjunctiva may yield a brownish or tawny tint to the redness. Long-term treatment with antihistamine or mast cell–stabilizing eye drops may be necessary. Steroid eye drops must be used for initial control in severe cases. Once again, systemic treatment is appropriate if concurrent, non-ocular allergic signs are present.

Limbal vernal conjunctivitis is a unique form of conjunctival allergy, readily diagnosed by the primary care practitioner. In this condition, a ring of swollen, gelatinous conjunctiva develops surrounding the edge of the cornea, which is known as the limbus. White to yellow dots are often seen in the gelatinous tissue (Fig. 12). Other signs of chronic ocular allergy, including fairly severe itch, are usually present. Young boys are more often affected, and the condition may flare up seasonally each year for many years. Symptoms begin when the weather becomes warm, hence the name vernal, or spring. Treatment is the same as for chronic allergic conjunctivitis. Patients often do well if they start using antihistamine/mast cell–stabilizing eye drops prophylactically, before the onset of warm weather [13].

Recently, several new classes of antiallergy eye drops have become available, greatly improving the success in treating ocular allergies. For mild allergic symptoms, ketorolac (Acular, Allergan, Irvine, CA) and other nonsteroidal

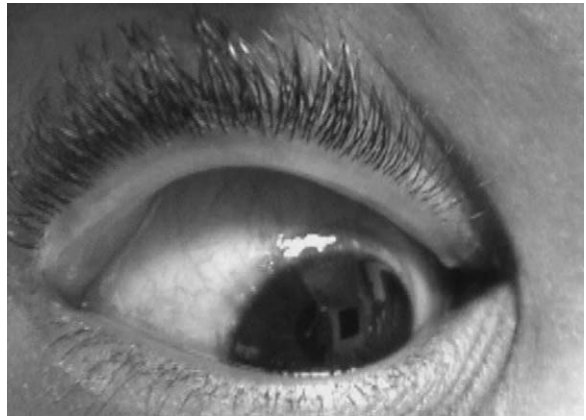

Fig. 12. Limbal vernal allergic conjunctivitis.

anti-inflammatory eye drops may be sufficient. Most of these drops cause a stinging sensation upon instillation, however, which may limit pediatric use.

Levocabastine (Livostin, Novartis Opthalmics, Duluth, GA) is a relatively new antihistamine eye drop. Lodoxamide (Alomide, Alcon, Fort Worth, TX) and cromolyn sodium (Opticrom, Allergan, Irvine, CA) are pure mast cell stabilizers. Olopatadine (Patanol, Alcon, Fort Worth, TX) has antihistamine and mast cell–stabilizing effects. Nedocromil (Alocril, Allergan, Irvine, CA) and pemirolast (Alamast, Santen, Napa, CA) are mast cell stabilizers that also inhibit eosinophil activation and chemotaxis. Ketotifen (Zaditor, Novartis Opthalmics, Duluth, GA) and azelastine (Optivar, Muro, Tewksbury, MA) have antihistamine, mast cell–stabilizing, and eosinophil chemotaxis–inhibiting effects. These eye drops can control many moderate to severe allergic conditions for which formerly only steroids would do. Additionally, the medications with mast cell–stabilizing effects are well suited to springtime prophylactic use [14].

Lastly, Loteprednol (Alrex, Bausch and Lomb, Tampa, FL) is a true steroid formulation which reportedly does not cause cataract or glaucoma, which are potential risks for long-term use of other steroid eye drops. The local immunosuppressive effects, however, still warrant judicial use of this formulation, as well as all steroid eye drops [14].

Many ocular irritations are misdiagnosed as allergy. These conditions may cause some itch; however, scratching, burning, or foreign-body sensation are the more prominent symptoms. Chlorine from swimming pools may cause chronic red eye in student athletes and recreational swimmers. Nonsteroidal anti-inflammatory eye drops may provide some comfort, but swim goggles are the best solution.

Blepharitis is an inflammation of the eyelid margins secondary to plugging of the eyelid oil glands. Thickening and redness of the eyelid margins are signs, along with crusting or flaking scurf at the base of the eyelashes. Multiple and recurrent chalazia, or inflammatory eyelid oil cysts, may be one result.

Plugging of the oil glands that lubricate the ocular surface can also lead to a change in the conjunctival microenvironment, including the normal flora. This alteration may lead to a conjunctival surface inflammatory reaction, usually to Staphylococcus antigens, which may cause diffuse conjunctival redness and moderate to severe irritation. Occasionally phlyctenules, or vascular inflammatory nodules, may form on the conjunctiva or cornea [15].

Mild blepharitis may be treated with daily warm soaks to open the oil glands and with baby shampoo eyelash scrubs to clear the scurf. Ocular surface inflammatory reactions and phlyctenules usually require combination steroid/antibiotic eye drops under specialist supervision for control. Recurrent episodes in older children demand long-term (6 months or more) prophylactic treatment with doxycycline, which works in much the same way as when used to control oil gland inflammation in acne. Younger children can be treated with oral erythromycin in the same way.

Children may be seen for ocular redness and irritation associated with watching television, or, more frequently, with computer use or playing video games. Although parents fear adverse effects on the eyes from these technologic gadgets, the common culprit is a decreased blink rate causing ocular surface drying and subsequent ocular irritation.

Ocular redness and irritation worse in the mornings can be caused by nocturnal lagophthalmos, or eye opening during sleep, which leads to exposure and drying of the ocular surface. Children with normal daytime eyelid function may show this behavior, and frequently this condition is familial. Usually symptoms are mild and require no treatment, although recognition of this cause is important, because many patients are unnecessarily treated with various eye drops for presumed infectious or allergic red eye. More severe cases may be treated with bedtime ocular lubricants.

Conjunctiva (focal involvement)

Some conditions may cause redness focally, in just a portion of the conjunctiva. Episcleritis is an inflammation of the tissue layer below the conjunctiva. This condition is common and tends to produce a brick-colored redness in a wedge or sector of the bulbar conjunctiva (Fig. 13). Thought to be viral or autoimmune in nature, episcleritis causes minimal discomfort despite the redness and is usually self resolving in 3 to 6 weeks. Steroid or nonsteroidal anti-inflammatory eye drops may hasten resolution. Episcleritis may be recurrent in the same place, in a different place, or even in the other eye.

Occasionally an eyelash may rotate toward the ocular surface, creating a red section of the conjunctiva wherever the eyelash contacts the moving eye. This rotation occurs most commonly at the far lateral upper lashes and can be hidden where the eyelids come together. Usually, the lash can be moved off the ocular surface, although it should be removed if the rotation recurs. Rarely, the lash follicle must be cauterized permanently.

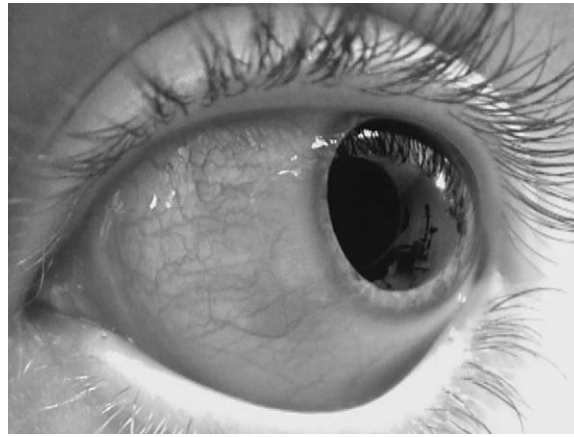

Fig. 13. Episcleritis. Note sector of conjunctival injection with clear area inferiorly. (See also Color Plate 8.)

Ocular myositis is a rare autoimmune condition in which a single extraocular eye muscle becomes inflamed. The redness of the conjunctiva is well demarcated in a strip area overlying the muscle. Pain is common, as is a face turn, because the patient avoids using the sore eye muscle. Moderately high-dose oral steroids are necessary for treatment, and recurrence is common if the medication is tapered too rapidly [16].

Focal lesions of the conjunctiva may also cause local redness. The virus that produces the common wart, verruca vulgaris, may infect the conjunctiva, producing a fleshy, dome-shaped nodule filled with a characteristic umbrellalike vascular pattern (Fig. 14). Lesions may become multiple spontaneously, although

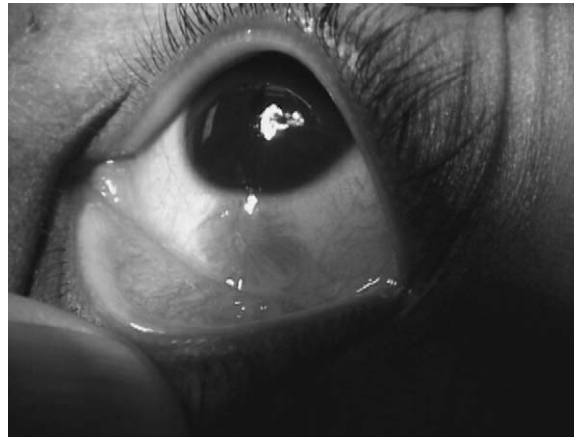

Fig. 14. Conjunctival papilloma. Note characteristic umbrella-shaped raised lesion.

treatment by excision without adequate cryotherapy can also result in recurrence of multiple lesions.

Conjunctival nevi may develop as amelanotic nodules with one or several feeder blood vessels, which give the lesions a red appearance. Treatment is by excision, if growth is noted.

Occasionally, a patient with chicken pox develop a round, red conjunctival nodule, just as the disease can affect other mucous membranes. Chicken pox lesions of the conjunctiva do not require treatment.

Patients with Louis Barr syndrome, or ataxia-telangiectasias, may develop focal knots of telangiectatic blood vessels on the bulbar conjunctiva (Fig. 15). They require no ocular treatment but serve as a diagnostic sign for this rare neurodegenerative condition.

Foreign bodies lodged in the conjunctiva should be removed with forceps or a cotton swab after topical anesthetic. Technique is not as critical as with cornea foreign bodies, because the conjunctiva heals well, and scarring does not affect the vision. Ophthalmic antibiotic drops or ointment should be used after removal of a foreign body or for isolated conjunctival lacerations. One to 2 weeks may pass before the redness resolves completely, especially if subconjunctival hemorrhage is present.

Sectoral or complete subconjunctival hemorrhages may occur after Valsalva's maneuvers, such as with vomiting, coughing, or weight lifting, or may occur spontaneously. Newborns may show subconjunctival blood after normal vaginal delivery. Although subconjunctival hemorrhage can appear very striking, the amount of blood is quite small, causes no ocular effects, and requires no treatment. Resolution may take 2 to 3 weeks, with blood turning from red to brown to yellow before fading away. Work up is unnecessary unless hemor-

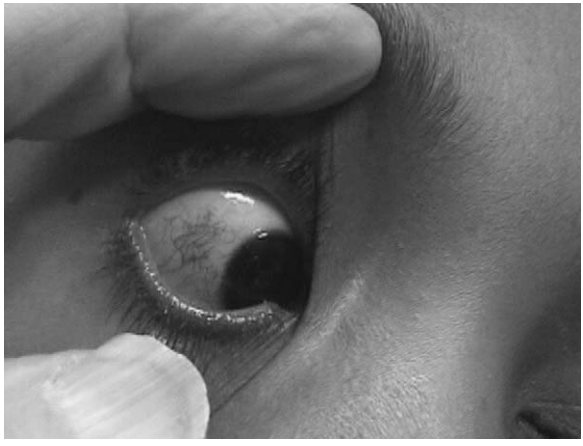

Fig. 15. Ataxia-telangiectasia.

rhage becomes recurrent, in which blood dyscrasias and hypocoagulable states must be ruled out. Rarely, hardware from orbital surgery can cause recurrent conjunctival hemorrhages.

Cornea

A specialist should treat most corneal conditions causing ocular redness. The cornea is the clear window on the world, and any scarring can cause permanent decreased vision. Ocular pain, decreased vision, and any corneal opacity are criteria for referral, and corneal disorders often qualify with all three.

In addition, a specialist should also evaluate ocular redness in children wearing contact lenses. The primary care physician cannot evaluate parameters such as lens fit, and the risk of permanent scarring from infectious conditions is significantly increased, especially among wearers of soft, disposable contact lenses, especially if they sleep in their lenses.

The exception, however, is the simple corneal abrasion, which is probably the most common corneal cause of red eye. Simple corneal abrasion can be treated well in the primary care setting. The corneal epithelium is loosely adherent and easily abraded. The underlying stroma is remarkably tough and difficult to scratch, although it may be cut by lacerating-type trauma. Corneal abrasions are usually painful, with tearing, photophobia, ocular redness, and even eyelid swelling. Diagnosis is by fluorescein stain, which accumulates in areas where the epithelium has been removed and fluoresces bright green when blue light is applied. Magnifying loupes can help to diagnose small or thin abrasions.

Treatment is by pressure patch with antibiotic ointment. It is essential that the patch be tight enough to keep the eye closed and adherent enough so the child cannot remove it. One good method is to use two eye pads, with tincture of benzoin used on the skin around the patch for stickiness. Then, 10 to 20 pieces of paper tape are applied firmly and with no holes for the child to find a finger hold. Removal of the patch can be uncomfortable, and even a 2-year-old almost never pulls this patch off at home.

The patch should be removed 24 to 36 hours after placement. Most simple abrasions will have healed; the patient will be comfortable, and the eye will be white. A residual abrasion of decreased size may be patched a second day. Any failure to improve significantly should be referred to a specialist.

A clear history of trauma should be present for the primary care physician to patch an abrasion. Herpes simplex virus epithelial keratitis presents with an abrasion-like corneal stain with fluorescein, usually in a characteristic branching, dendritic form (Fig. 16). Sometimes the dendritic pattern enlarges to form a geographic stain, which can mimic the appearance of a traumatic abrasion, except that the borders of the HSV geographic stain undulate much more than those of an abrasion caused by trauma. Prompt treatment with trifluridine antiviral eye drops is the rule, because corneal herpetic infections frequently leave a scar. Oral

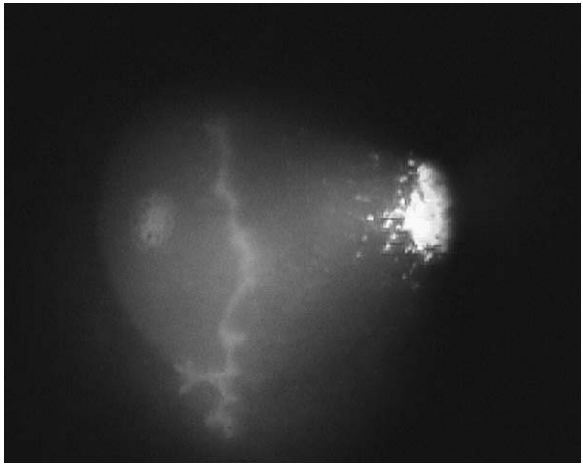

Fig. 16 Herpes simplex cornea epithelial infection with dendrite fluorescein stain pattern.

acyclovir is also useful, both for treatment and for prevention of recurrent episodes [7,8].

Anterior chamber

Intraocular inflammation (uveitis) in the front part of the eye is known as iritis. Such inflammation can be from traumatic, infectious, or autoimmune causes. Except for intraocular inflammation associated with juvenile arthritis, iritis typically presents with bulbar redness, photophobia, and pain or discomfort. A violet hue to the redness is often present, and the redness is concentrated in the

Fig. 17. Acute iritis. Note maximal conjunctival injection surrounding cornea and white blood cells layered at bottom of anterior chamber (hypopyon).

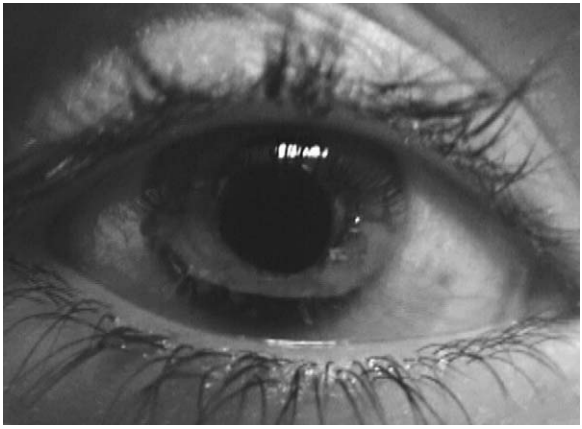

Fig. 18. Hyphema. Note red blood cells layered at bottom of anterior chamber.

area surrounding the cornea (the limbus). With a slit lamp microscope white blood cells may be seen floating in the anterior chamber and may layer inferiorly (Fig. 17). Definitive diagnosis requires a specialist.

Frank red blood layered in the anterior chamber is called a hyphema (Fig. 18). Although usually the result of trauma, blood in a child's anterior chamber may rarely be caused by tumors or coagulopathies. Vision is usually reduced. Nausea and vomiting are frequent and should prompt a close search for hyphema in any child suffering blunt eye trauma. Traumatic hyphema carries a long-term risk of glaucoma, may be associated with other ocular structural injuries, and thus should be evaluated by a specialist.

Summary

Overall, the primary care physician can diagnose most cases of red eyes in children, if specific attention is paid to which ocular structures are involved. Accurate diagnosis allows appropriate primary care treatment for most disorders and can aid in determining which cases need referral.

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