

Author: Jonathan Trobe, MD, 2009

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THE RED EYE

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A red eye is an eye that has dilated conjunctival vessels. The process need not originate in the conjunctiva—it could be in the eyelids, the eye, or the orbital tissues around the behind the eye. The cause need not be infection!

Most red eyes are benign. But there are seven conditions that could lead to blindness or death: keratitis, bacterial conjunctivitis, uveitis, angle closure glaucoma, endophthalmitis, orbital cellulitis, and orbital tumor. Learn to distinguish these dangerous red eyes and how to handle them.

We will review many causes of red eye, starting with the tissues around the eye (“ocular adnexae”).

Causes of Red Eye: Ocular Adnexal Tissues

1. Contact dermatitis
2. Chronic blepharitis
3. Stye
4. Dacryocystitis*
5. Orbital cellulitis*
6. Orbital tumor*

*Dangerous conditions

There are six major causes of red eye that originate in the ocular adnexae: contact dermatitis, chronic blepharitis, stye, dacryocystitis, orbital cellulitis, and orbital tumor. The last three are dangerous (asterisk).

Contact dermatitis



Contact dermatitis: Delayed hypersensitivity to agents that come into contact with skin (eyedrops, cosmetics, material on fingers). Eczema of eyelid skin, very little conjunctival hyperemia. Resolves spontaneously, faster with cortisone cream.



Chronic blepharitis: A chronic infection of the lid margin causing burning discomfort and red lids. Hard to diagnose without slit lamp. Hard to eliminate with treatment. Never serious.

Treated with warm soaks and dilute shampoo. If refractory, use broad spectrum oral antibiotic.

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A second example of chronic blepharitis to show hyperemic, thickened eyelid margins.

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Another example of chronic blepharitis, showing keratin debris on lid margins. Notice that conjunctiva is not hyperemic.

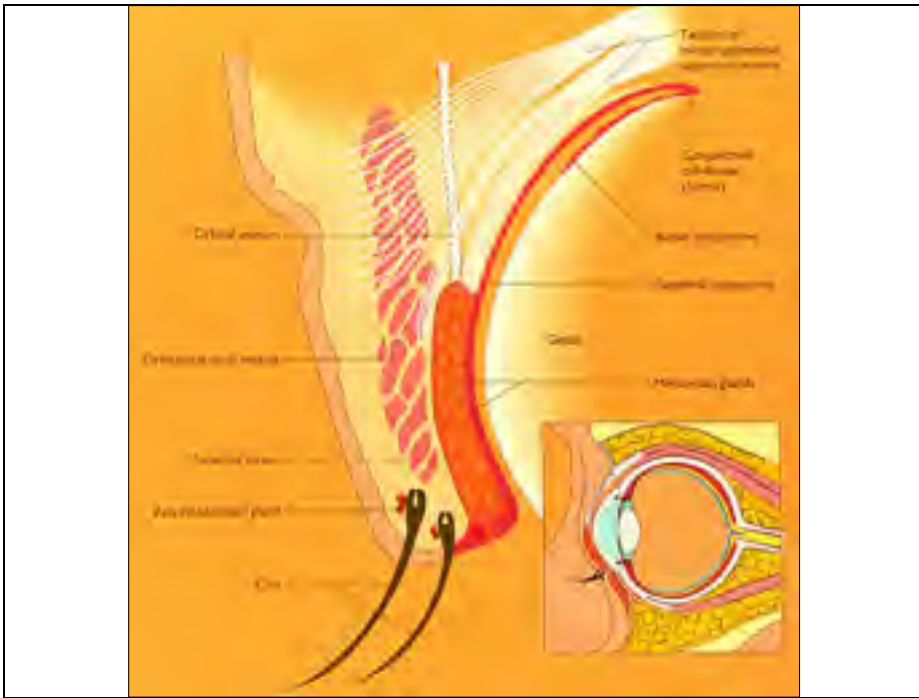
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Stye (Hordeolum)

Stye (hordeolum): acute, usually sterile, inflammation of plugged sebaceous glands of the lid margin. Causes acute focal swelling, tenderness, redness, and pain. Lasts about 3-4 days with or without treatment (warm soaks). No reason to treat with medications.

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Schematic cross section of eyelid shows its layers. Styes may originate in hair follicle sebaceous glands or meibomian glands.

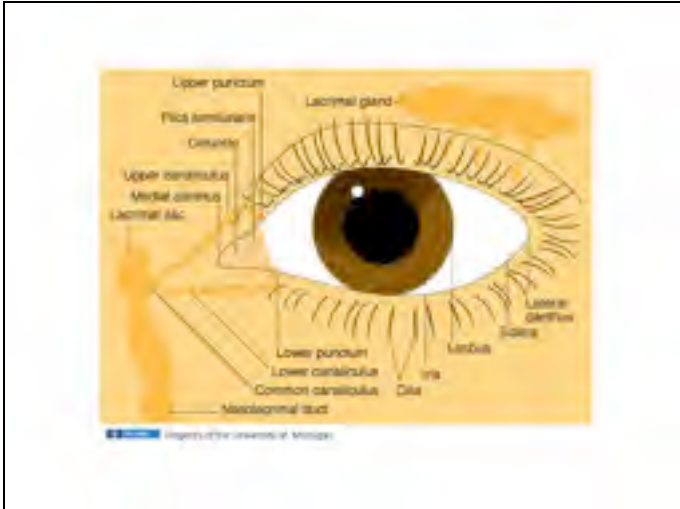
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Dacryocystitis

Dacryocystitis: infected lacrimal sac. Most common in infants because of delayed opening of nasolacrimal passage. Often resolves with massage, but anti-infectives and incision may be necessary. In adults, occurs when nasal passage is obstructed by trauma, inflammation, or neoplasm.

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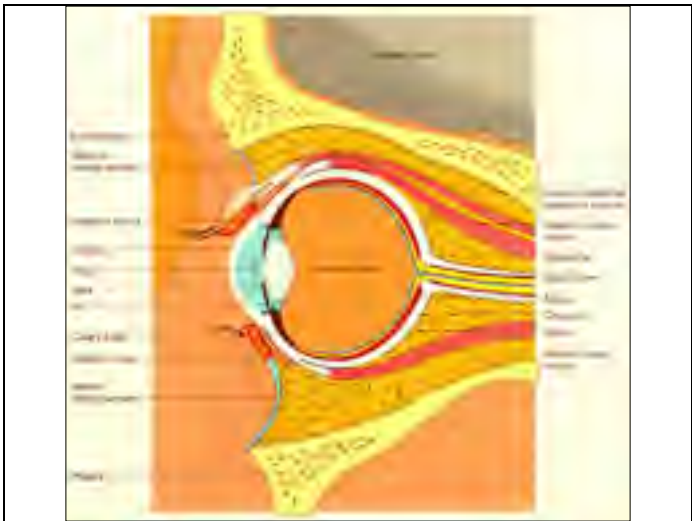
The lacrimal system: a gland that produces aqueous tears, upper and lower puncta opening into canaliculi which, in turn, empty into the lacrimal sac. The sac drains via the nasolacrimal duct into the nose.

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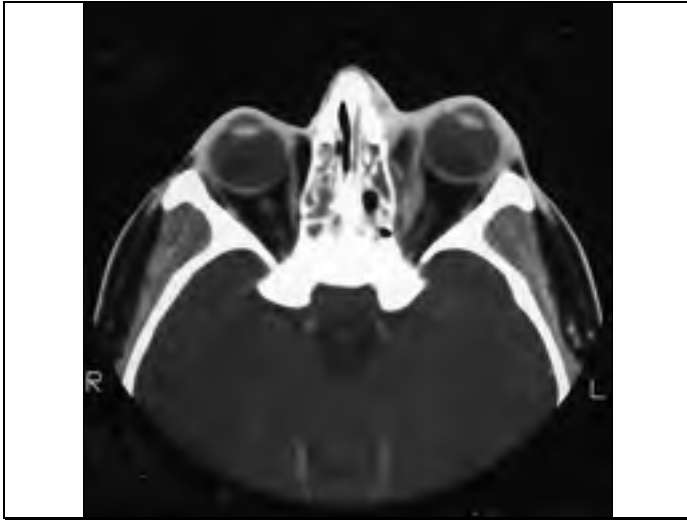
Orbital cellulitis: infection of orbital soft tissues. Presents with diffuse lid swelling, redness, tenderness. Caused by spread of sinus infection. Worry if eye movement is impaired or there is much proptosis. Requires urgent CT imaging and high dose (usually intravenous) antibiotic treatment.

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The eye in the orbit. Orbital cellulitis typically spreads via veins from the ethmoid sinus or facial skin into the preseptal and subperiosteal spaces. From there, it may enter the orbit. The greatest danger is damage to the optic nerve and spread via orbital veins to the intracranial space.

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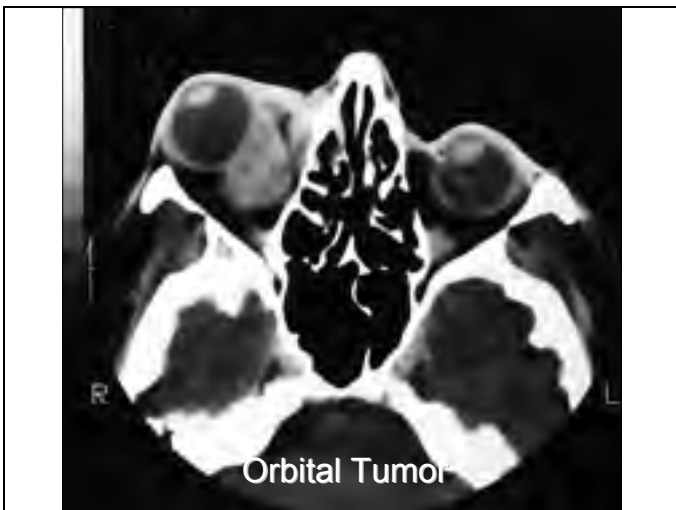
Subperiosteal abscess of the left orbit.

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Orbital tumor: benign and malignant tumors occur at any age and may be primary to the orbit or metastatic. Presents with proptosis and often signs of congestion. Needs urgent imaging. Treatment depends on the findings.

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CT shows a rhabdomyosarcoma of the left orbit. The diagnosis was made by biopsy. The earlier the diagnosis is made, the better the chance to preserve life (and vision).

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Causes of Red Eye: Conjunctiva/Sclera

1. Conjunctivitis**
2. Episcleritis
3. Scleritis*
4. Pinguecula
5. Pterygium
6. Squamous carcinoma*
7. Subconjunctival hemorrhage

*Dangerous conditions

**Dangerous only if bacterial

There are seven conjunctival and scleral causes of red eye: conjunctivitis, episcleritis, scleritis, pingueculum, pterygium, squamous cell carcinoma, and subconjunctival hemorrhage.



Bacterial conjunctivitis: the extreme swelling, redness, and pus suggest bacterial infection. Consider skin organisms but also *Neisseria*. Swab and culture are performed, and fortified antibiotic eye drops and sometimes systemic antibiotics are used to treat. Delayed treatment may result in blindness.



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Neisseria gonorrhoeae conjunctivitis acquired in the birth canal. Red eye occurs from day 2 to 4 of life. Treat with ceftriaxone 50 mg/kg iv OR im single dose.



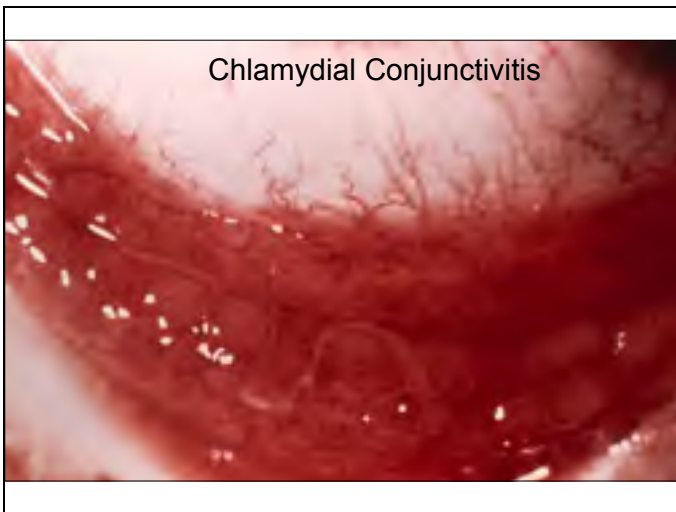
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Viral conjunctivitis: watery or mucoid discharge, discomfort but no pain. Usually diffuse hyperemia. Often has enlarged, tender pre-auricular node. Adenovirus common cause. Self-limited, should resolve without treatment within 7-10 days. Do not treat. Because may be contagious, quarantine until discharge stops. Frequent hand washing; avoid touching infected eye and sharing tools, utensils.



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Chlamydial conjunctivitis: acquired neonatally from infected birth canal or later through sexual contact. Produces lid follicles, minimal discharge. Definitive diagnosis by finding elementary bodies on stain of conjunctival scrapings. Treat babies with oral erythromycin azithromycin and adults with oral azithromycin or doxycycline. Full recovery always occurs without damage.



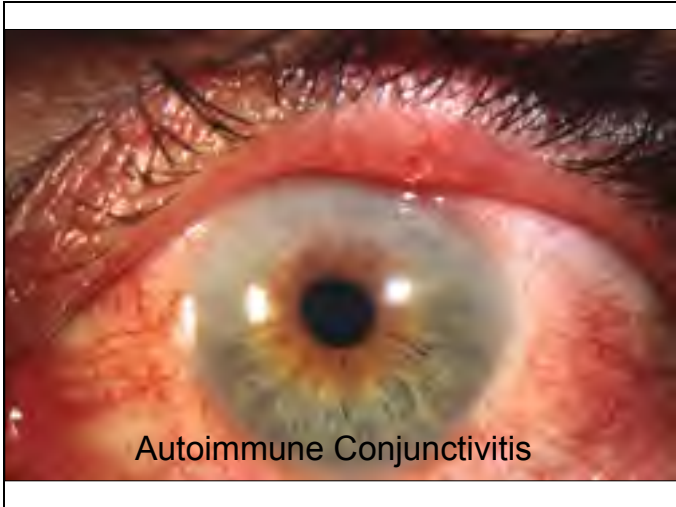
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Allergic conjunctivitis: most common form is seasonal (plant allergens); can be perennial (animal dander). Always causes itching! Also conjunctival swelling (chemosis), tearing, and mild redness. Use systemic agents if there is a respiratory component, otherwise topical anti-histaminic drops (many brands) and/or mast cell stabilizers.



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Autoimmune conjunctivitis: associated with systemic autoimmune disorders such as connective tissue diseases, vasculitides, Graves' disease, sarcoidosis. Minimal discharge; diffuse conjunctival redness. Often accompanied by orbitopathy or uveitis.



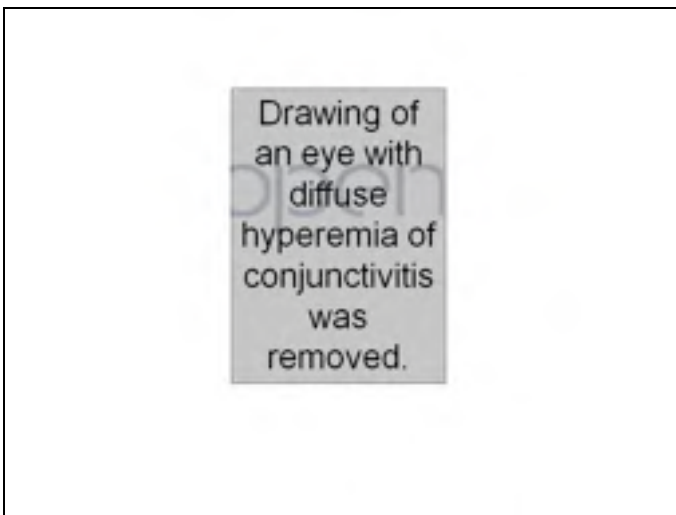
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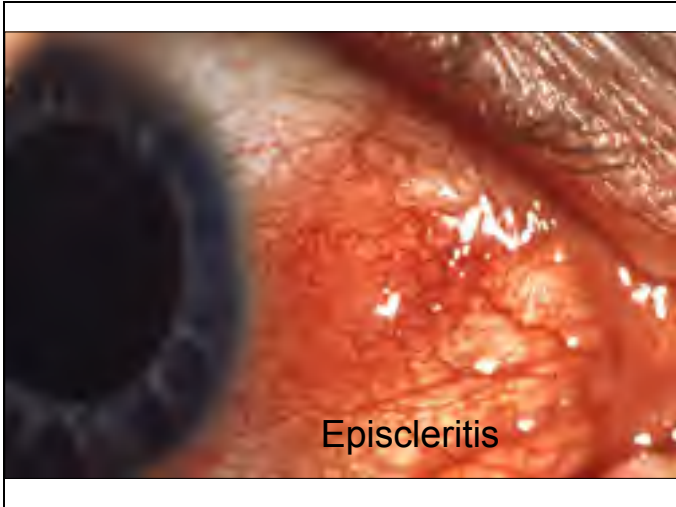
Graves' disease: the most distinctive form of autoimmune red eye because of lid retraction and/or proptosis. All ocular adnexal tissues are inflamed. Treated with decongestants. Correcting coexisting thyroid dysfunction has no effect on eye signs.



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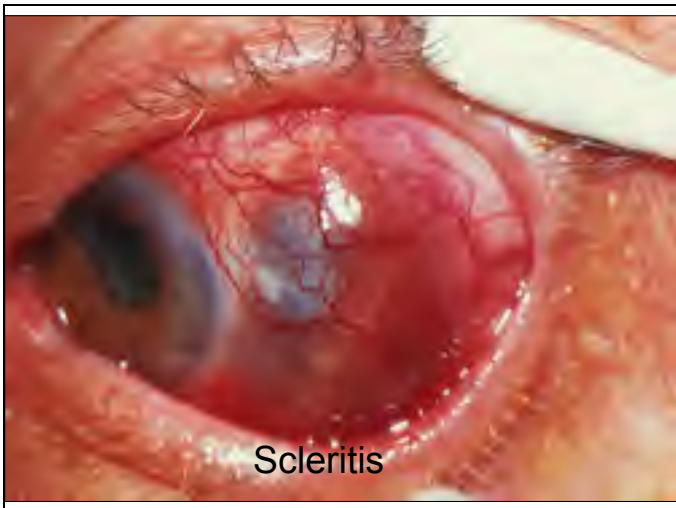


Diffuse hyperemia is typical of viral, allergic, autoimmune conjunctivitis but not of keratitis, uveitis, or acute glaucoma, which show a "ciliary flush" pattern (see below).



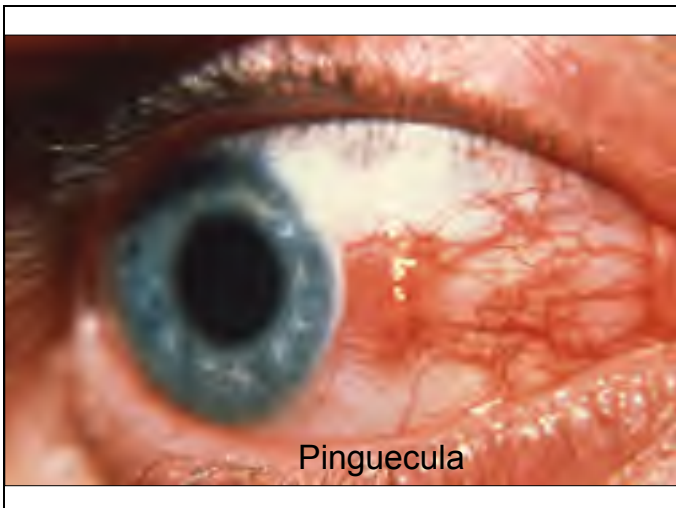
Episcleritis: autoimmune inflammation of the vascular layer between conjunctiva and sclera. Often causes focal tenderness, redness and swelling. Pain is mild. Usually an isolated condition. Can be readily treated with oral or topical NSAIDs. Often recurs but does not cause damage.

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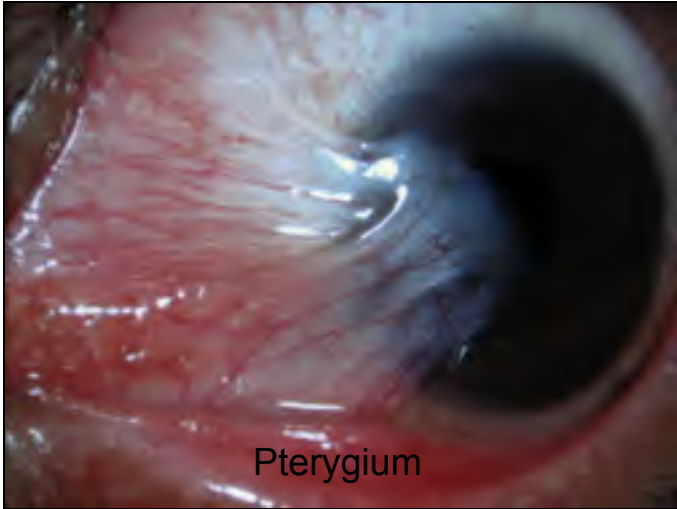
Scleritis: focal or diffuse inflammation of the sclera. Usually associated with a systemic connective tissue disease like rheumatoid arthritis, Wegener's granulomatosis, relapsing polychondritis. Systemic anti-inflammatory agents (corticosteroids, cytotoxic agents) are used in treatment.

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Pinguecula: dysplastic conjunctiva usually on the nasal border of the cornea. Suddenly becomes inflamed and produces stinging irritation. Mound of yellowish tissue surrounded by dilated conjunctival vessels. Often regresses spontaneously, but faster with vasoconstrictor or low-strength topical steroid.

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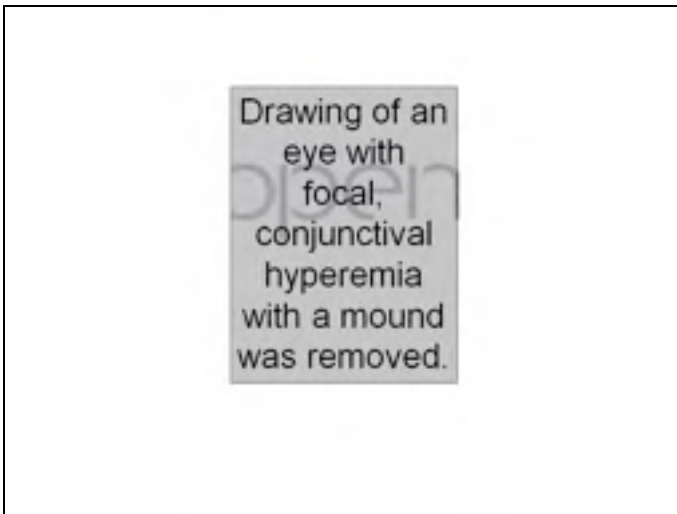
Pterygium: dysplastic conjunctiva (probably an extension of pinguecula) that grows from the canthus toward the cornea (and even onto its surface). Probably caused by excess exposure to sun and wind. Treat with surgical excision if growing onto cornea. Often recurs in spite of excision.

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Subconjunctival hemorrhage: the only cause of red eye in which the blood is outside the blood vessels. Patients worry about this, but it is usually just the result of sneezing, blowing nose. Should check for systemic hypertension or blood dyscrasias, particularly if found in youth, recurrently, or with other evidence of bleeding.

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Focal conjunctival hyperemia: a pattern common in pinguecula, pterygium, episcleritis, scleritis, and squamous cell carcinoma.

Causes of Red Eye: Cornea

1. Abrasion
2. Non-traumatic keratopathy* (infection, drying, corneal endothelial dysfunction)

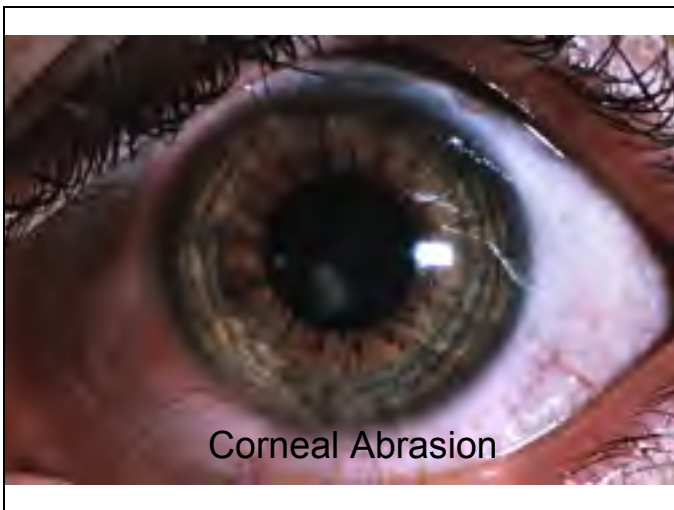
*Dangerous conditions

Corneal causes of red eye include traumatic abrasion, infection, drying, and corneal endothelial dysfunction.



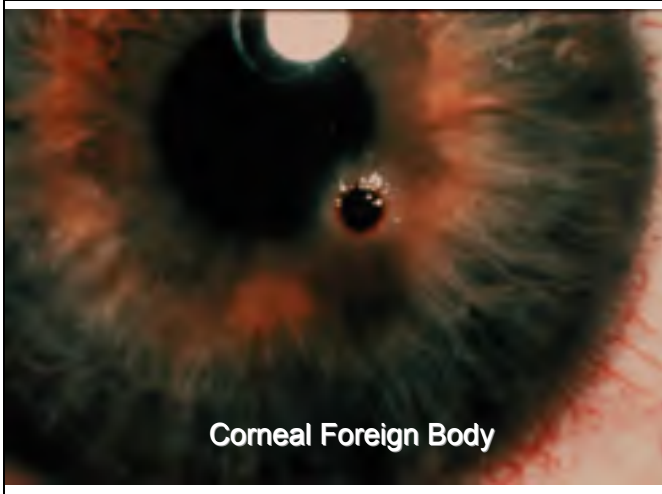
Fluorescein dye stains corneal basement membrane exposed by epithelial defects.

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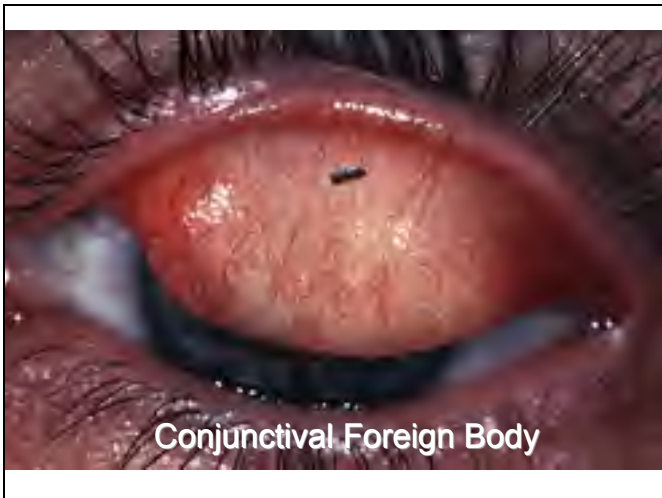
Corneal abrasion: sudden foreign body sensation because of exposure of trigeminal nerve endings as corneal epithelium is denuded. Can be caused by direct trauma or by foreign body striking cornea or lodged in pre-tarsal sulcus that rubs on the cornea. Usually heals spontaneously if foreign body removed.

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Corneal foreign body: it has lodged on the corneal surface. After applying topical anesthetic to the corneal surface, try to remove with wet cotton tip applicator. If it will not budge, refer to ophthalmologist who will remove with needle or burr.

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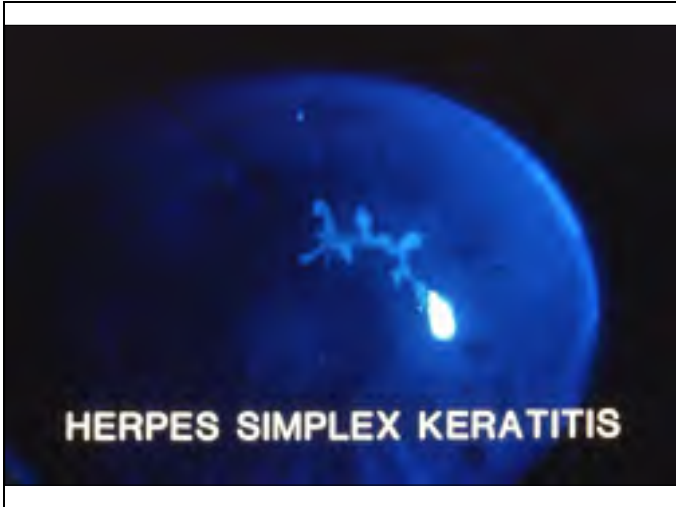
Corneal foreign body: it has lodged in the superior tarsal sulcus, a favorite resting place. Access this by everting the lid over an applicator. The foreign body should slide out with a rolling motion of a wet cotton tip applicator.

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Non-traumatic keratopathy: principal causes are infection with herpes simplex type 1 (shown here), other viruses, bacteria, or fungi; drying from lack of tears, or exposure or poor lid closure; and corneal endothelium dysfunction. Always a serious condition because can lead to scarring and permanent sight loss. Should be managed by an ophthalmologist.

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The typical “dendrite” of herpes simplex type 1 keratitis. This appearance can hardly be mimicked by any other condition. Even so, herpes simplex keratitis does not always produce such a classic picture. Treatment is with oral acyclovir or its congeners.

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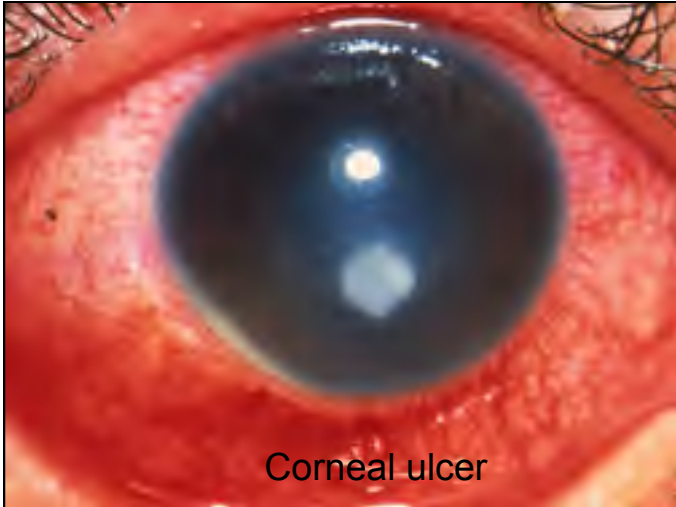
Another classic appearance of typical herpes simplex keratitis.

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Keratitis sicca: punctuate corneal surface staining (by fluorescein dye) of a cornea made dry by inadequate tear production. Usual cause is autoimmune damage to lacrimal gland in Sjogren syndrome or idiopathic conditions.

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Corneal ulcer: the white patch is dead corneal tissue resulting, in this case, from bacterial infection. Fungi and protozoa can also cause this. Intensive medical (and sometimes surgical) treatment is necessary to preserve vision.

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Causes of Red Eye: Anterior Chamber


1. Uveitis*
2. Angle Closure Glaucoma*
3. Infection (Endophthalmitis)*

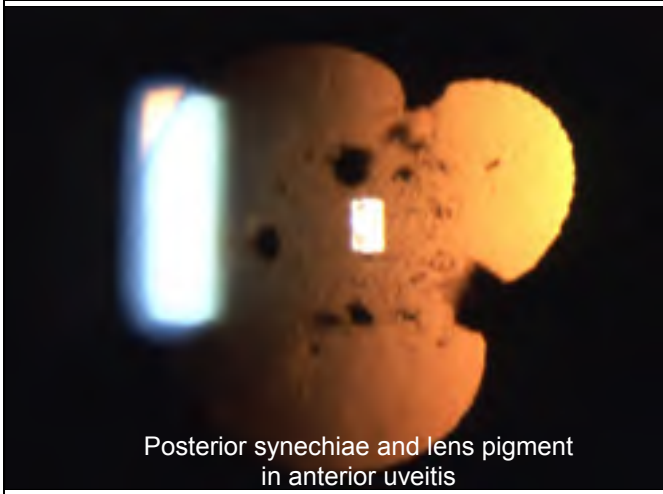
*Dangerous Conditions

There are three major causes of red eye that come from conditions within the eye: uveitis, angle closure glaucoma, and endophthalmitis. All are potentially blinding if not treated promptly.



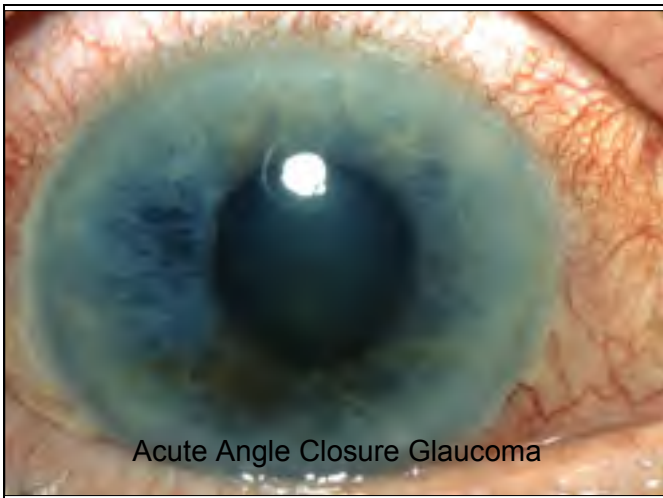
Anterior uveitis: inflammation of the iris and ciliary body. Usually an auto-immune condition, often isolated, but sometimes part of connective tissue state. Should be managed by an ophthalmologist.

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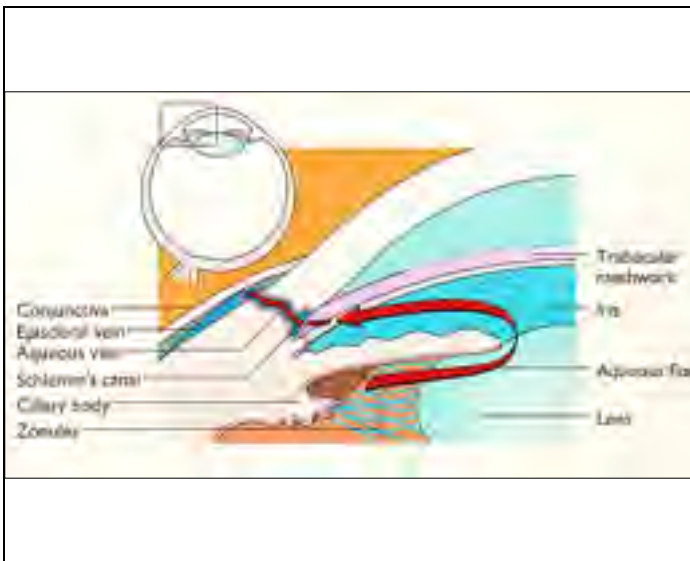
In this view, you see pigment blotches on the anterior lens surface and adhesions of the iris margin to the lens (“posterior synechiae”). These are signs of chronic anterior uveitis.

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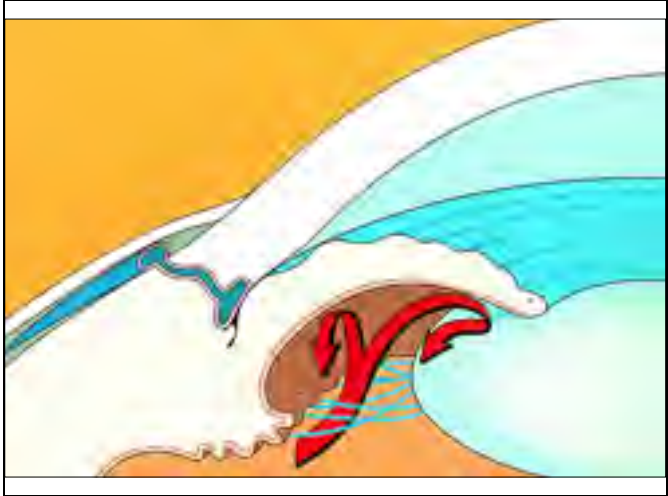
Acute angle closure glaucoma: a rare condition in which the intraocular pressure suddenly climbs to very high levels because the iris plugs the Canal of Schlemm. It presents with acute (often severe) periocular pain, vision loss, red eye and cloudy cornea. Usually monocular. Needs emergent treatment aimed at lowering intraocular pressure. Very difficult to diagnose without special instruments.

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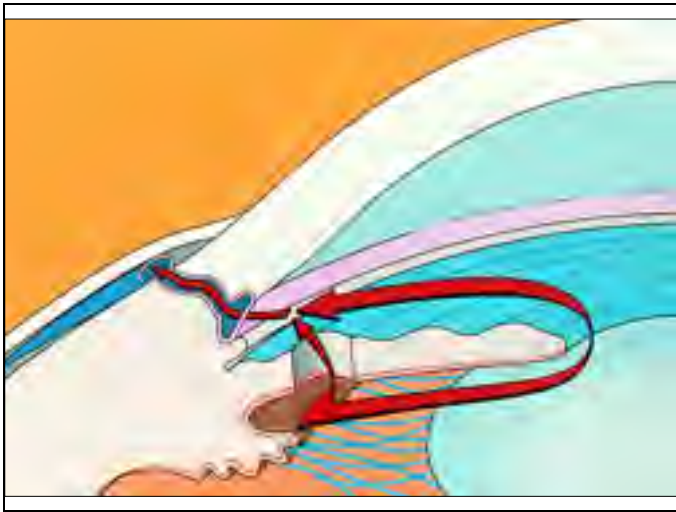
To illustrate angle closure glaucoma, here is how the aqueous humor normally drains out of the anterior chamber angle (Canal of Schlemm).

PD-INEL Source Undetermined



In angle closure glaucoma, crowding of the anterior ocular segment (small eyes, large lens, abnormal iris) leads to iris plugging of the angle. Aqueous cannot escape. Intraocular pressure goes sky high.

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Making a hole in the peripheral iris (usually with a laser) will cause the iris to drop away from the angle unless the iris is stuck, which happens if the procedure occurs too late. If the iris falls away, intraocular pressure will normalize unless the angle exit has been damaged. In that case, filtering eye surgery may be necessary to allow aqueous to drain properly.

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Endophthalmitis: infection within the eye. This usually results from an entry wound in the eye after eye trauma or surgery ("exogenous"), but may rarely occur through spread of infection from another body source such as a heart valve, joint, lung, bowel, or bone ("endogenous"). Management is urgent, consisting of aspirating ocular fluids for culture and injecting anti-infectives directly into the vitreous cavity. What little hope there is of saving the eye is eliminated if treatment is not prompt.

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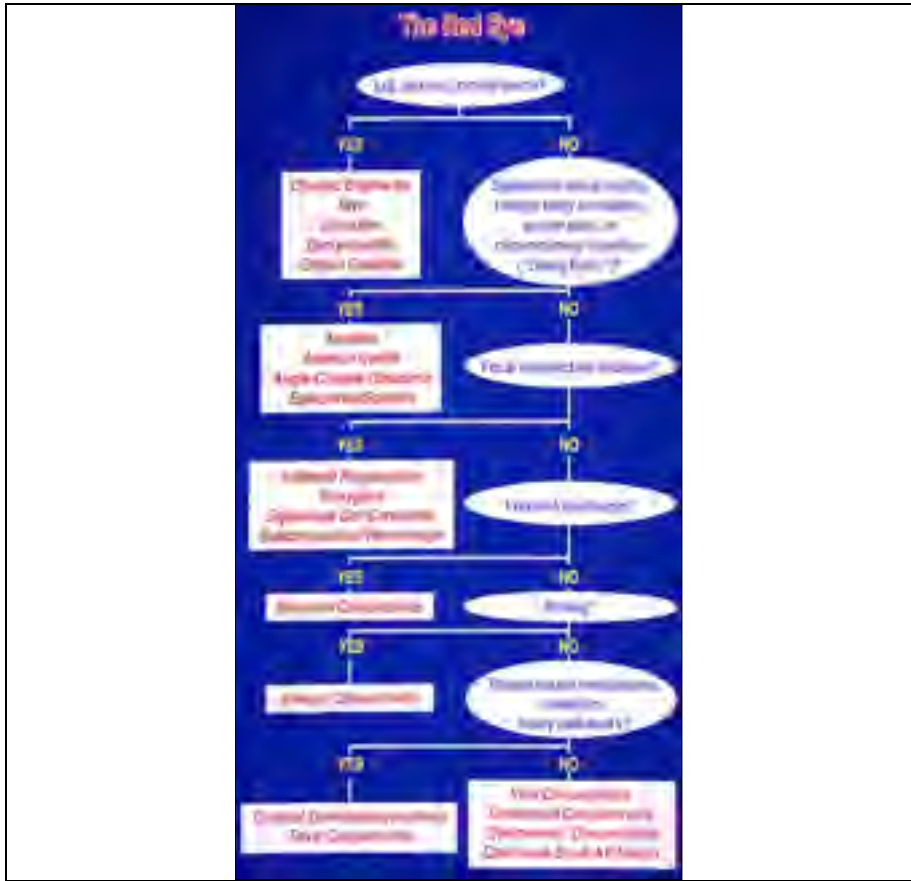
Drawing of an eye with ciliary flush of corneal/anterior chamber disorders was removed.

Ciliary flush (circumcorneal hyperemia): this pattern of hyperemia is common in patients with corneal or anterior chamber inflammations. Compare it to the other two common patterns: diffuse hyperemia and focal hyperemia shown earlier.

The Seven Dangerous Red Eyes

	Pain	Vision loss	Discharge	Ciliary flush	Corneal haze	Urgency of treatment
Keratitis	+	-	(+)	+	+	++
Uveitis	+	(+)	-	+	-	+
Acute angle closure glaucoma	++	-	-	+	+	+++
Endophthalmitis	++	++	(+)	(+)	(+)	+++
Orbital cellulitis	+	-	(+)	-	-	+
Orbital tumor	(+)	(+)	-	-	-	+
Bacterial conjunctivitis	(+)	-	++	-	-	++

The seven dangerous red eyes: use these indicators as a guide in differential diagnosis.



A decision-tree to guide you in assessing the red eye.

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- Page 5 (Middle Image) – “Cross-section of an eyelid” Regents of the University of Michigan (The Eyes Have It)
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- Page 6 (Top Image) – “External anatomy of the eye” Regents of the University of Michigan (The Eyes Have It)
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- Page 10 (Top Image) – “Autoimmune conjunctivitis” Regents of the University of Michigan (The Eyes Have It)
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