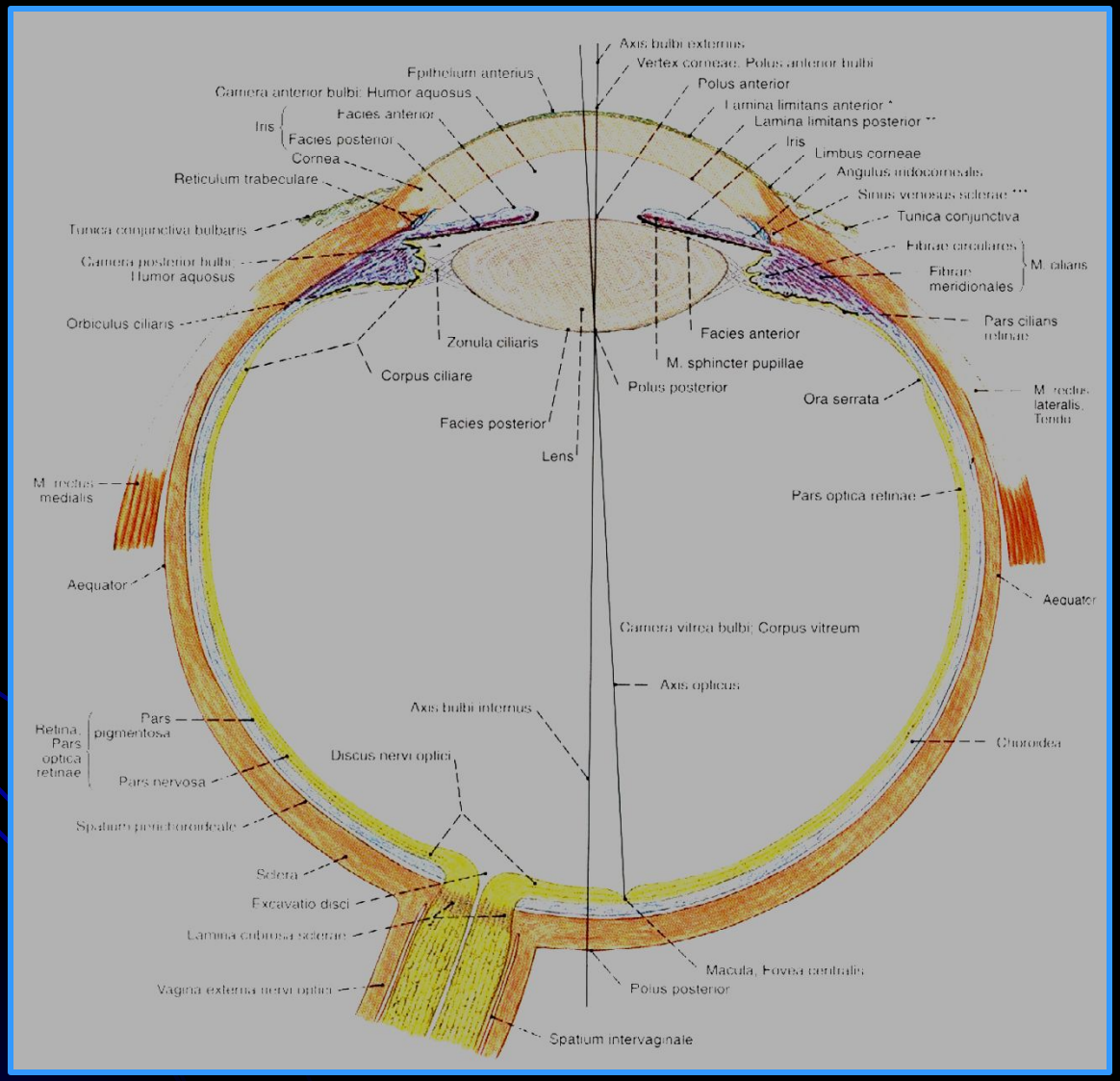
- Department of ophthalmology
- Head of department: Prof. N.V. Ivanova

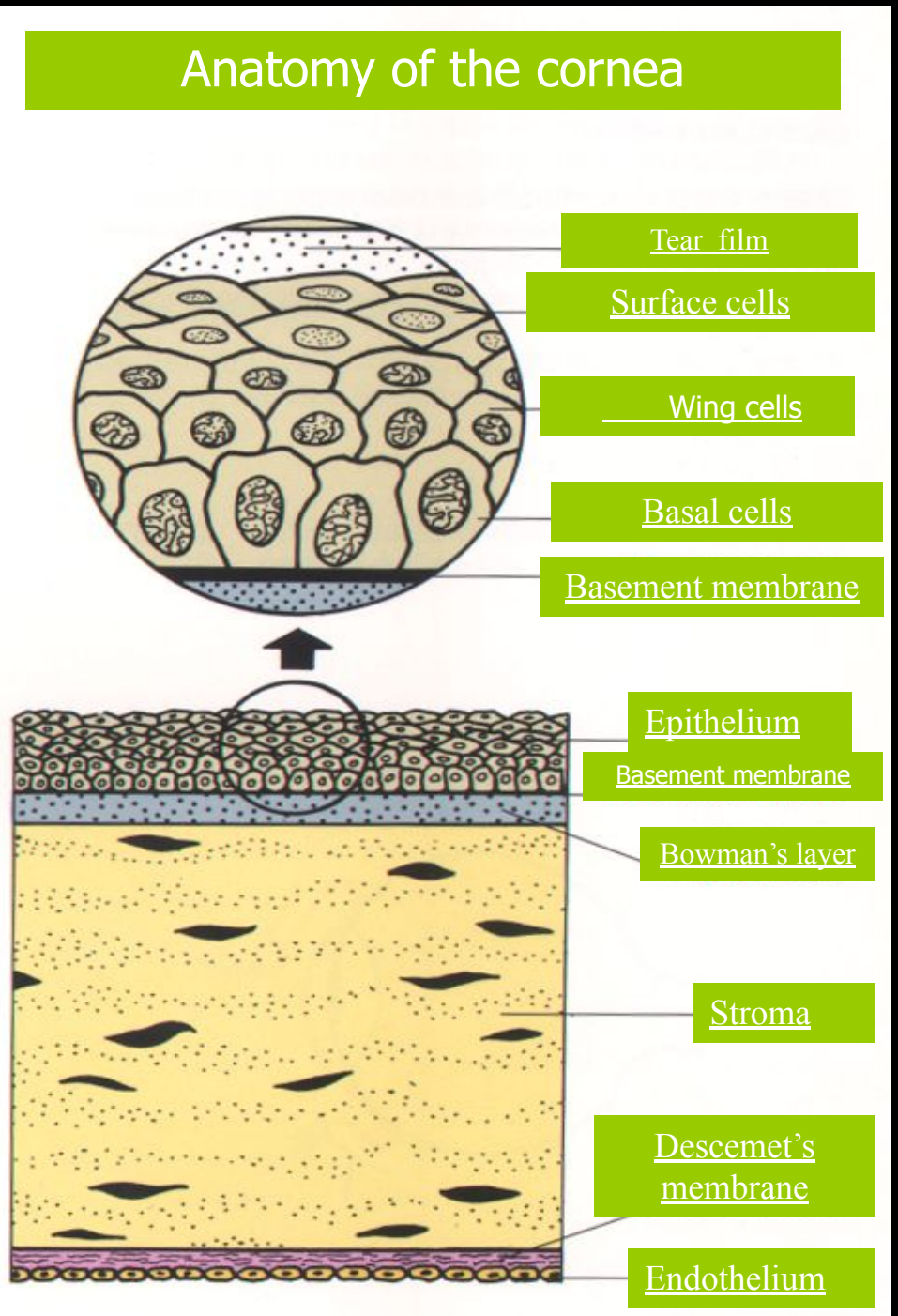

# Disorders of the Cornea, Sclera and Orbit

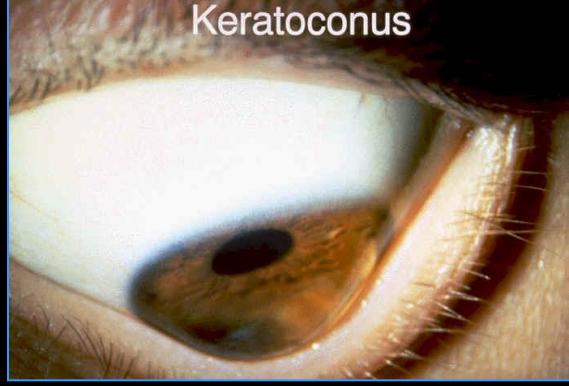
Cornea is anterior part of fibrous cover. Is a part of dioptric apparatus of the eye.



## In normal:

- avascular
- sensitive
- transparent
- smooth
- glassy
- spherical
- resplendent




Keratoconus

# Investigation of Corneal Disease

- Anamnesis
- Clinical examination
- Biomicroscopy
- Pachometry
- Keratometry
- Keratoscopy
- Laboratory investigations

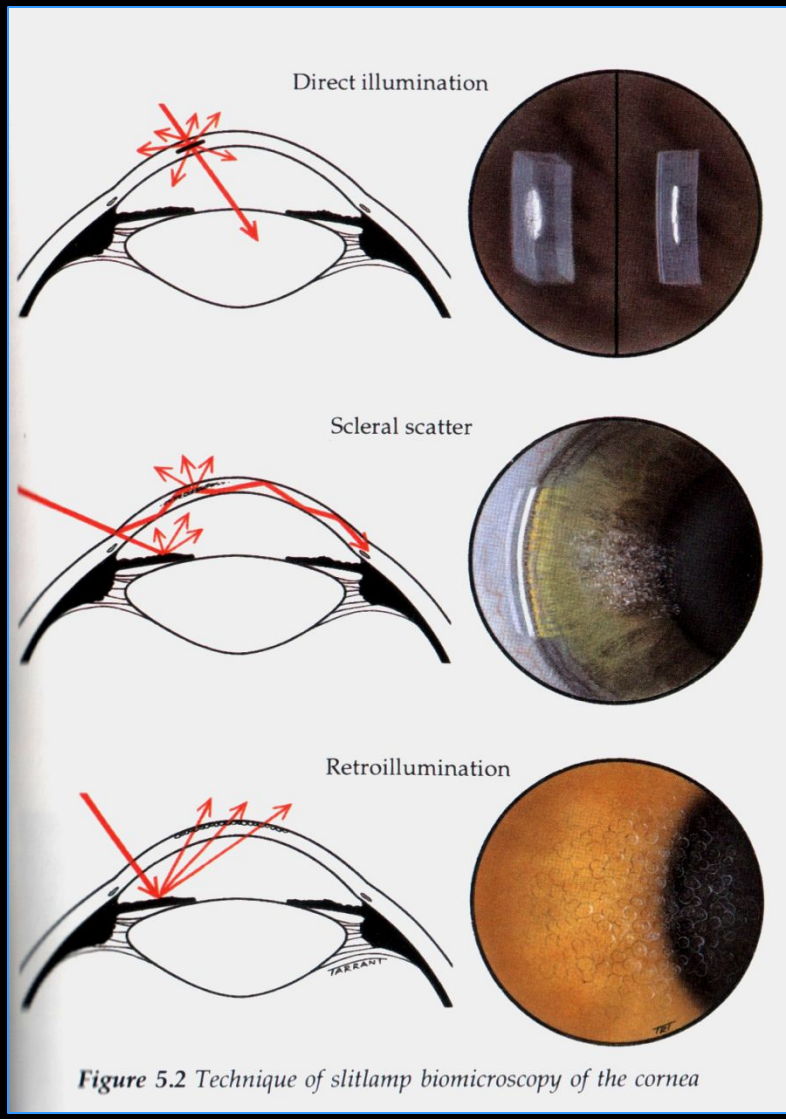



*Figure 5.2 Technique of slitlamp biomicroscopy of the cornea*

# Keratitis – inflammation of the cornea

Keratitis (objective signs)

=

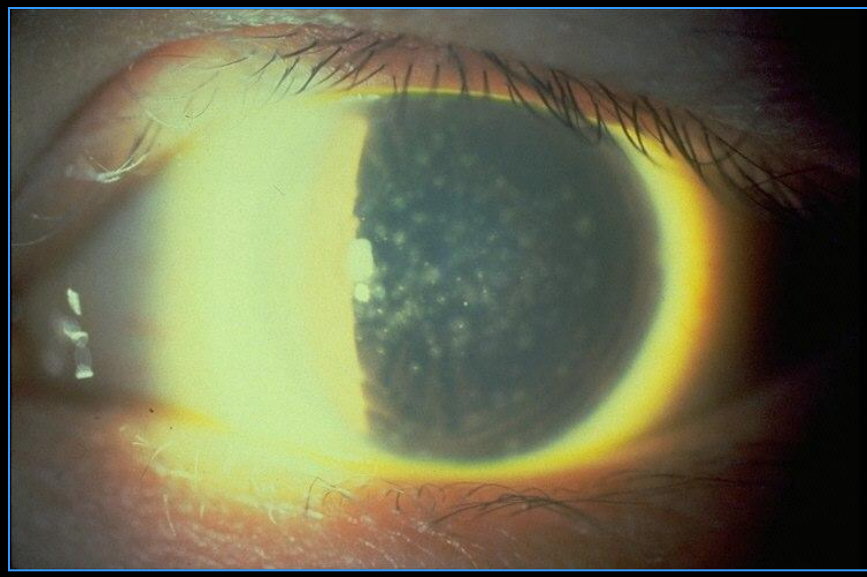
Corneal oedema

+

Cellular infiltration

+

Ciliary congestion



keratitis (adenovirus)

# Corneal syndrome

- photophobia
- lacrimation
- blepharospasm
- a sensation of a foreign body present behind the eyelids
- pain

# Classification

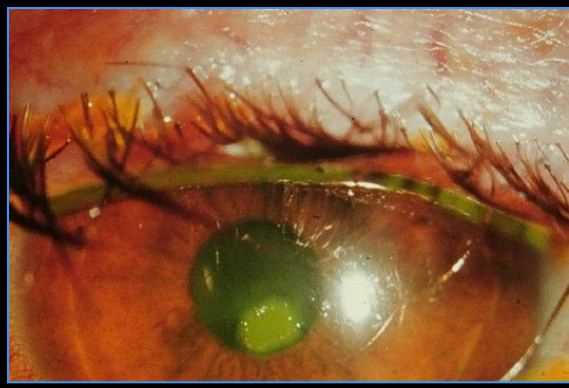
1. **Exogenous keratitis**
- **Corneal erosions**
- **Traumatic keratitis**
- **Bacterial keratitis**
- **Keratitis, caused by disease of conjunctiva, eyelids, meibomite glands.**
- **Fungal keratitis**
- **Corneal ulcer**

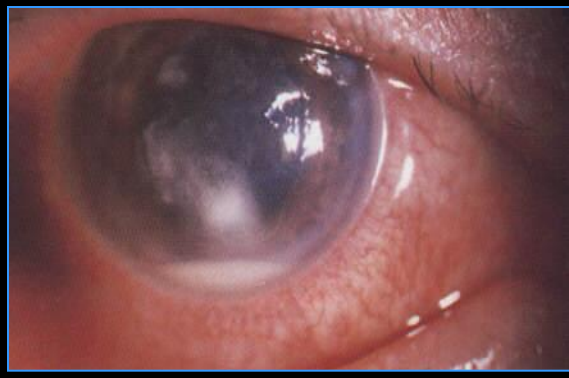
2. **Endogenous keratitis**
- **Infectious (tuberculous, viral, rheumatic, toxicoallergic and others)**
- **Neuroparalytic keratitis**
- **Keratitis because of avitaminosis**

3. **Keratitis of unclear etiology (recurrent erosion, rosacea keratitis and other)**

**Bacterial keratitis** – often develop in chronic inflammatory diseases of conjunctiva and lacrimal ducts, as well as in the trauma of the cornea.

## Predisposing Condition to Bacterial Keratitis:





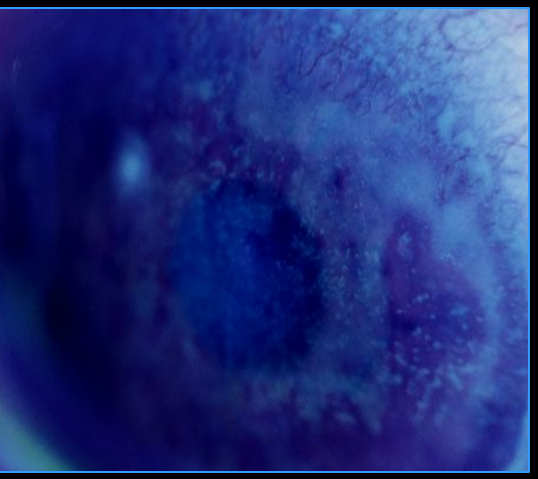
### 1/ Contact Lens Wear

### 2/ Nonsurgical Trauma
- Corneal abrasion or wound
- Corneal foreign body
- Toxic medications (e.g., anesthetic abuse, idoxuridine)

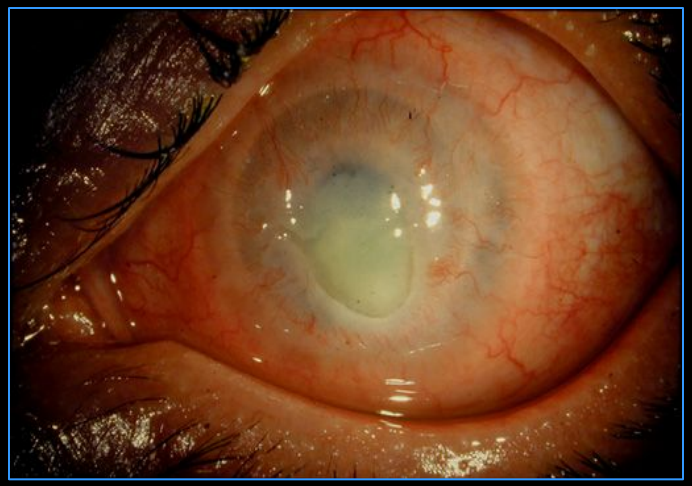
### 3/ Surgical Trauma

### 4/ Corneal Injury Caused by Lid Dysfunction
- Trichiasis
- Lagophthalmus

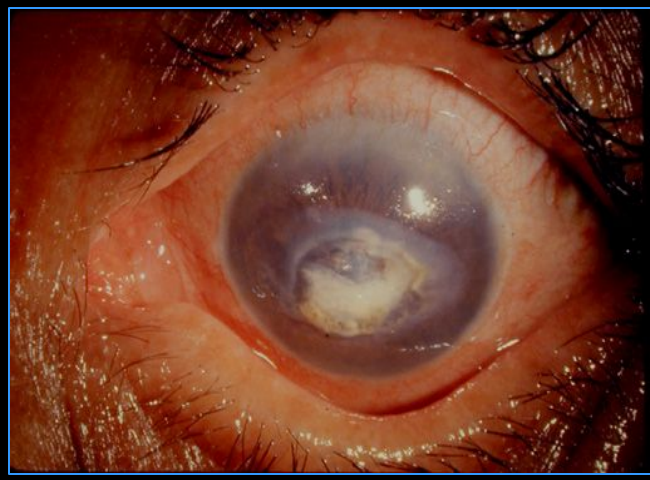
### 5/ Corneal, Conjunctival, or Lacrimal Dysfunction
- Bullous keratopathy
- Neurotrophic cornea
- Stevens-Johnson syndrome
- Tear insufficiency
- Mucin insufficiency



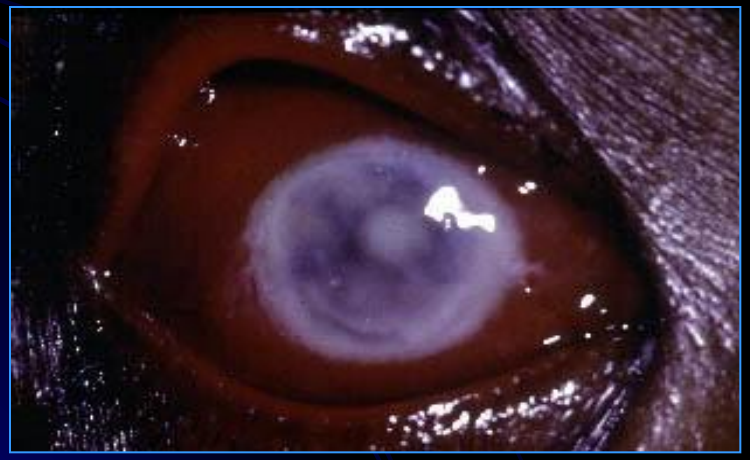
- Epithelial punctate keratitis

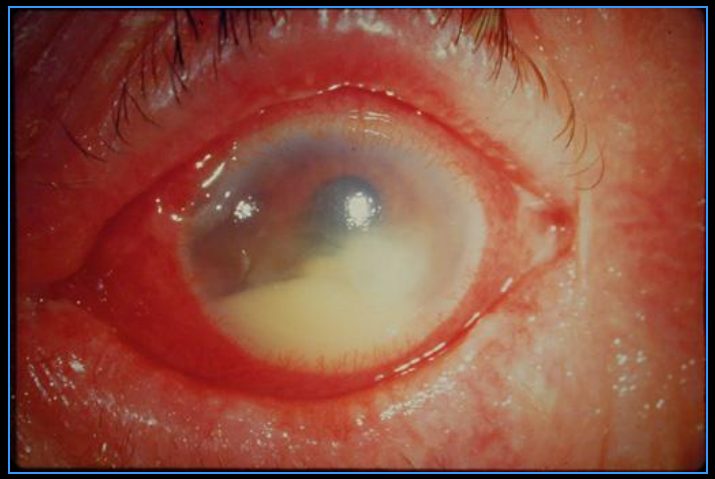


**Regressive keratitis**



**Keratitis with necrosis**

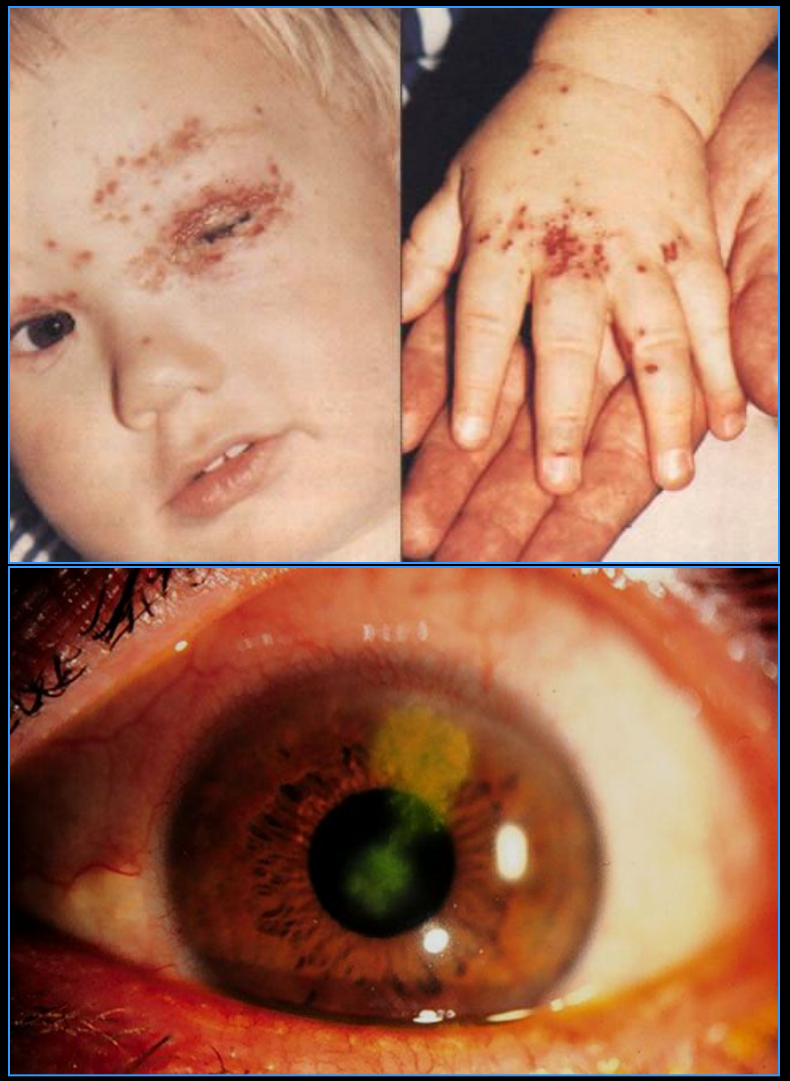




**corneal ulcer, iritis, hypolion in keratomycosis**

# Herpes Simplex Keratitis

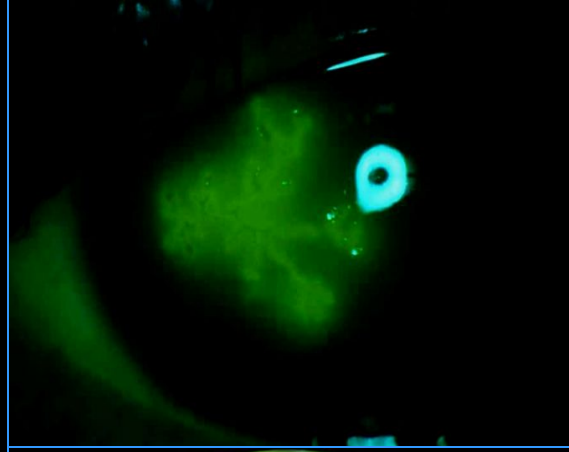
Primary ocular infection typically occurs in children between the ages of 6 months and 5 years. Is more frequently accompanied by anterior uveitis and keratic precipitates, early vascularization, hypoaesthesia, photophobia, blepharospasm, lacrimation.

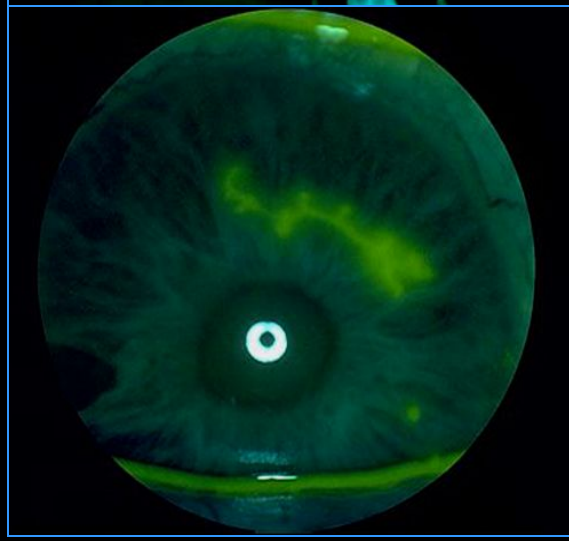


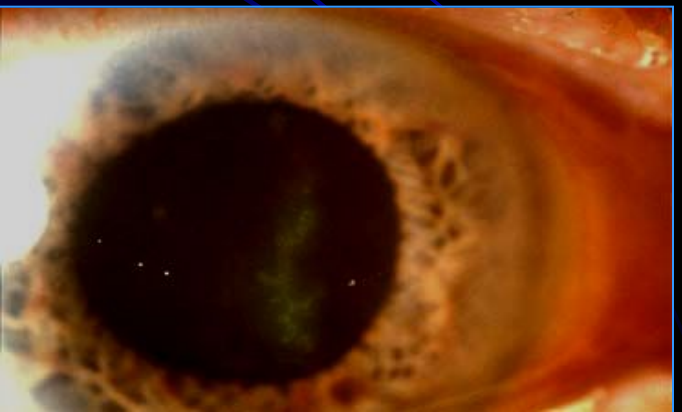
## Recurrent infection:

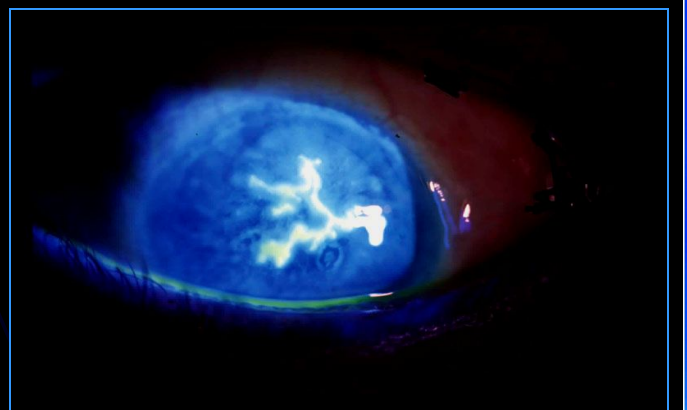
- Epithelial punctate keratitis
- Dendritic keratitis
- Metaherpetic keratitis
- Disciform keratitis

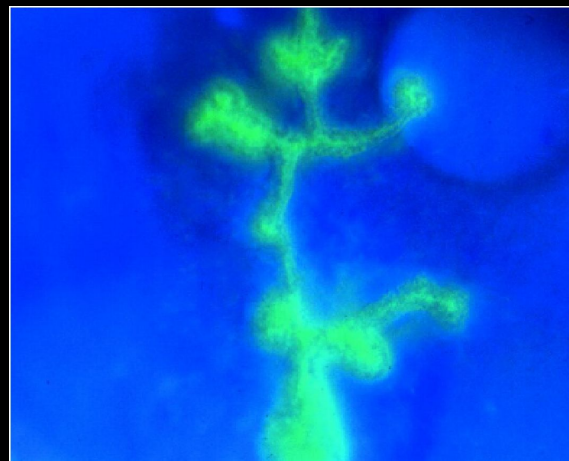
- Corneal syndrome, pericorneal hyperemia, hypoaesthesia.
- The lesion is composed of clear vesicles in the epithelium arranged in a dendritic or stellate pattern





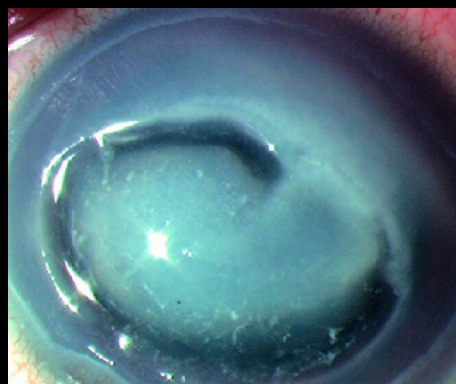






# additional investigations of patients with keratitis

- review roentgenography of the additional nasal sinus and organs of the chest
- consultations of the otorhinolaryngologist and stomatologist (sometimes of phthisiatrician and dermatovenerologist)
- results of additional methods of investigation: clinical and laboratory (detailed blood count, Wassermann reaction, Mantoux reactions, focal test with tuberculin, toxoplasmin and others).



# Laboratory diagnosis

## Bacterial

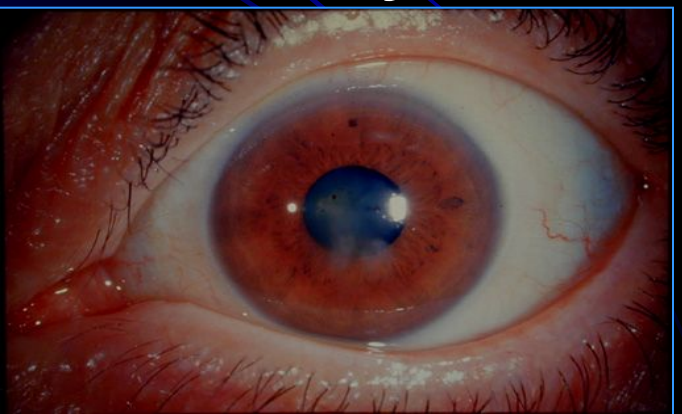
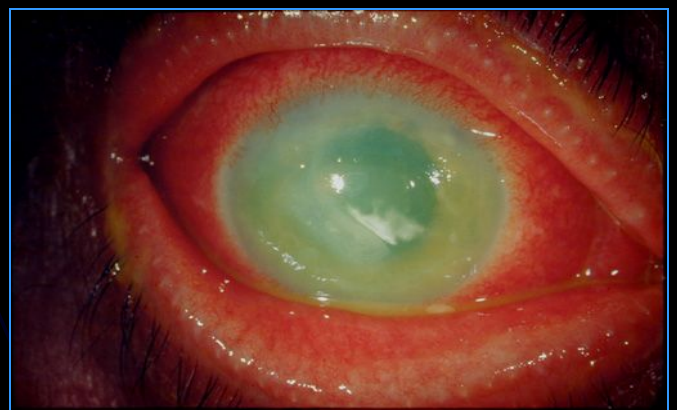
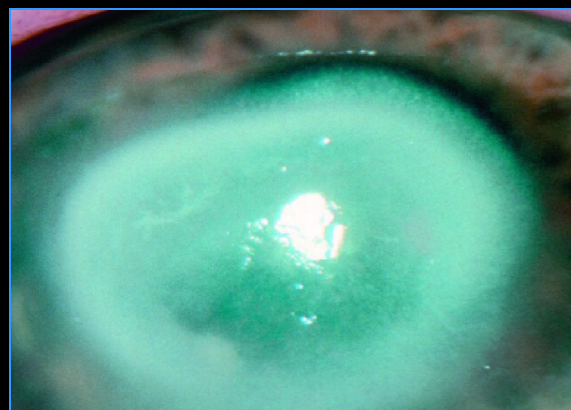
- Conjunctical smear in deep ulcers of the cornea - smear-print from the ulcer.
- Scrub from ulcerous surface and margins of ulcer
- Staining – with methylene blue and Gram's staining
- inoclulation of media with investigation of antibiotic sensitivity

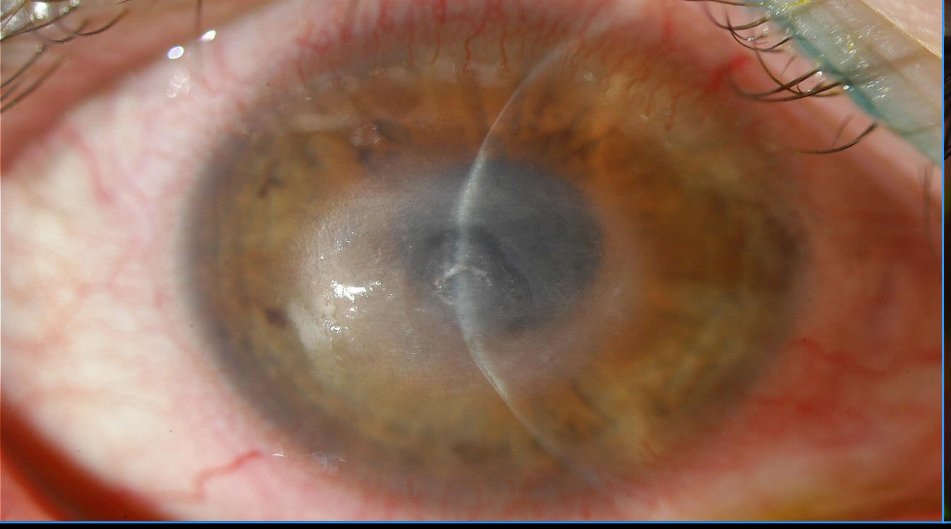
## Herpeviral

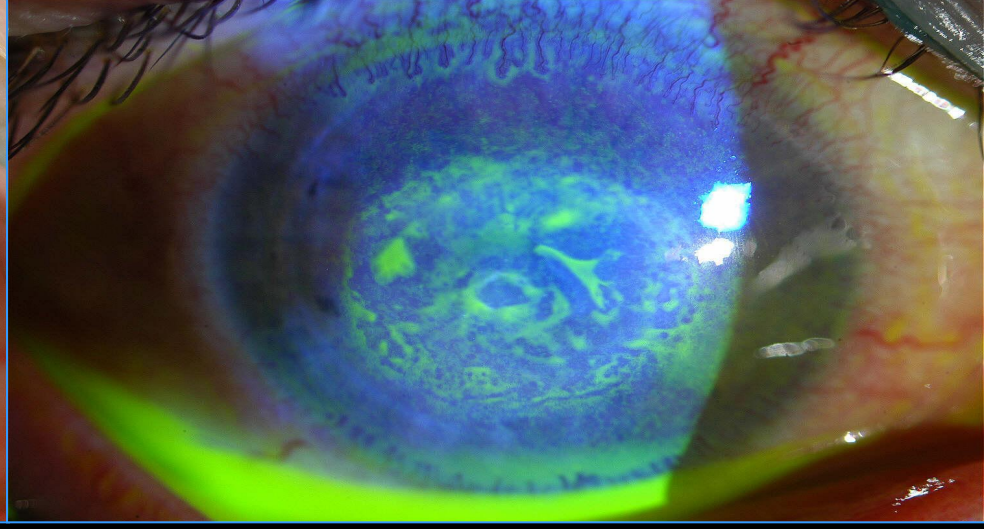
- Express-diagnosis-method of fluorescining antibodies – revealing of virus in the scrub of conjunctiva
- Monoclonal immunofermental test-system
- Finding of antiallergic antibodies in lacrimal fluid in the reaction of passive hemagglutination
- Finding of lymphocytes to herpes in the reaction of blasttansformation and inhibition of leucocytes migration
- Finding of IgA, IgG, IgM in

# The differential diagnosis of primary ocular infection includes:

1. Keratitis with lid lesions: zoster, chickenpox, molluscum contagiosum, and ulcerative blepharitis with keratitis due to staphylococcal infection
2. Keratitis without lid lesions: vaccinia, adenoviral infections (types 3, 7, and 8), chlamydial infections, and zoster

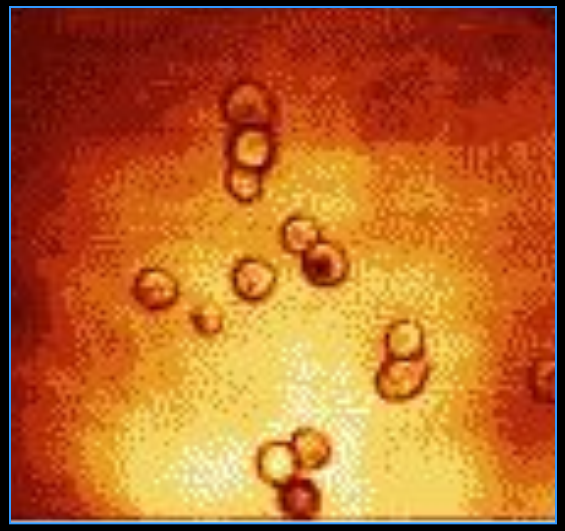








# Parasitic Keratitis - Acanthamoeba

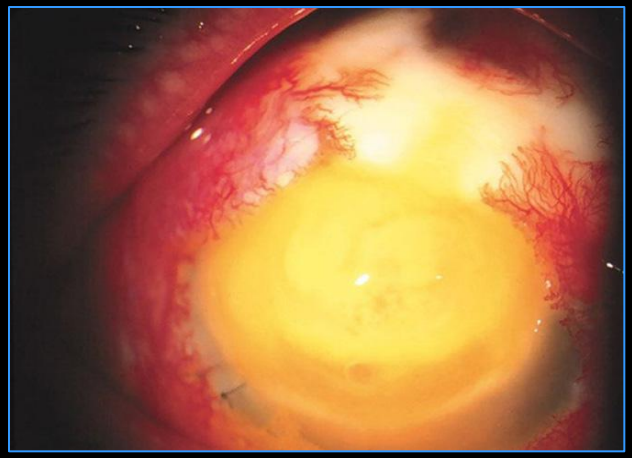
- Slit lamp photograph of a 42 year old female patient with unilateral, red, painful eye with epithelial defect; Corneal sensitivity decreased.
- Stromal ring infiltrate (1), fluorescein staining (2).
- Corneal scrapings and PCR for VZV negative.

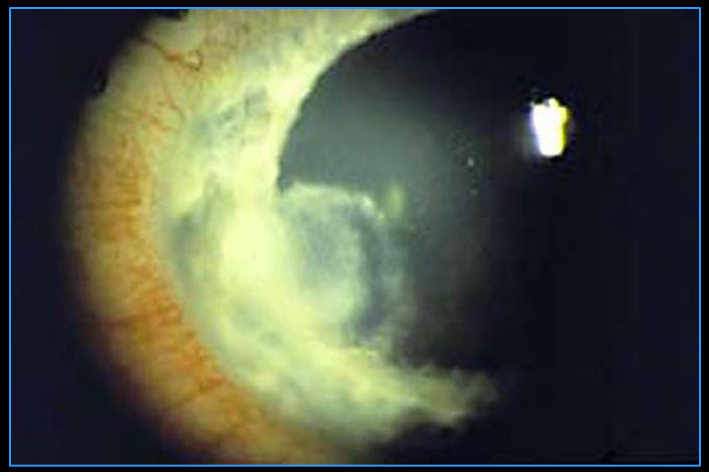


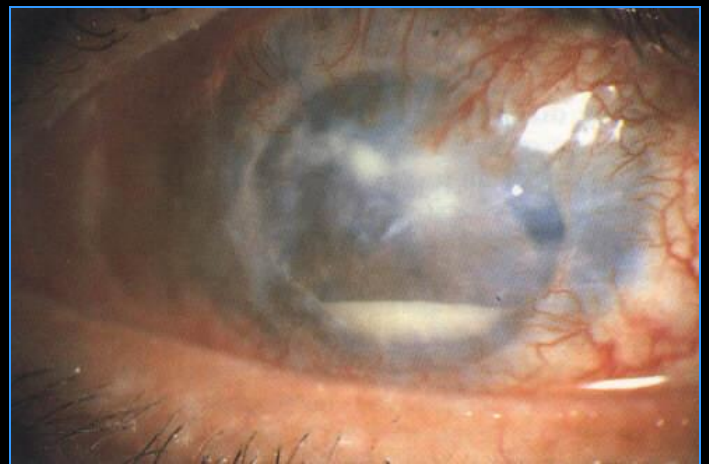
confocal microscopy *in vitro*

# Keratomycoses

- Risk factors: long treatment with antibiotics or coricosterois, microtraumas of the cornea, fungus skin diseases.
- Greyish-white infiltrate with crumb-like friable surface and yellowish border appears on the place of corneal erosion, presence of hypopion is typical. Vascularization is insignificant.





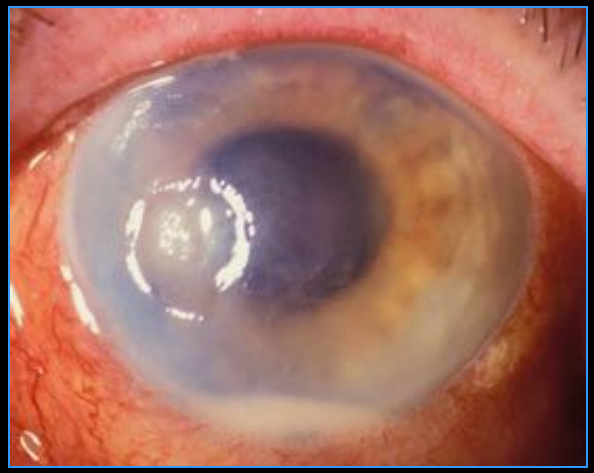


# Ulcer of cornea – inflammation of corneal membrane, accompanying with necrosis with formation of its tissue defect

- *Infectious* –*bacterial, herpeviral, fungal and parasitic infection of the eyes.*
- *Noninfectious* – *ulcer of immune genesis, corneal xerosis, in absolute glaucoma*

*Risk factors:*

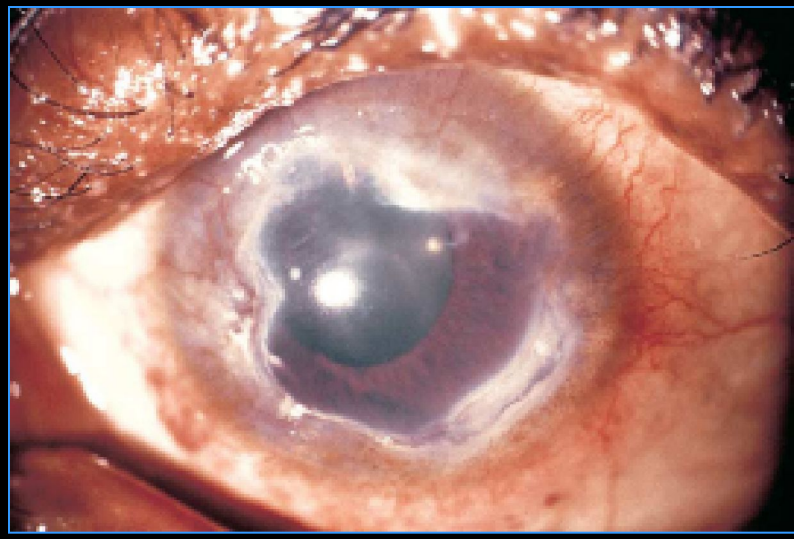
- *conjunctivites,*
- *dacriocystites,*
- *Corneal xerosis,*
- *traumas of the cornea,*
- *foreign bodies of the cornea,*
- *injuries by chemical, thermal, radiation, laser affection.*
- *long wearing of contact lenses,*
- *various operations on the cornea,*
- *bullous keratopathia.*



# Organisms Commonly Isolated From Corneal Ulcers

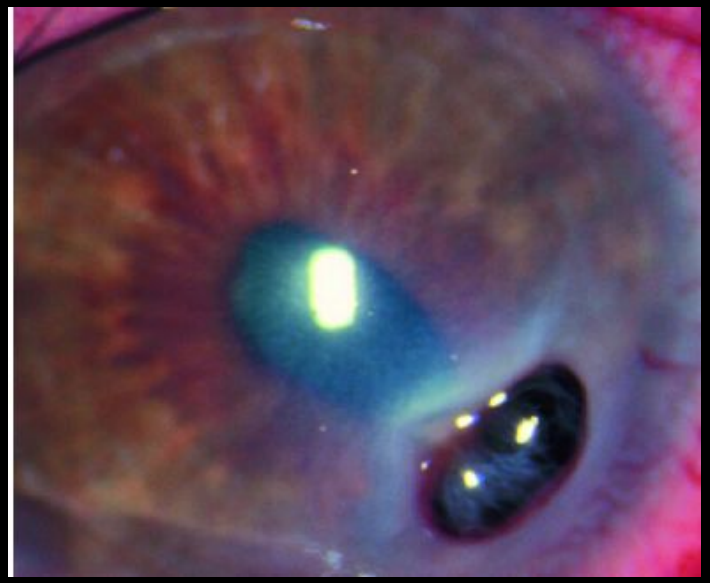
| Healthy Cornea | Compromised Cornea* | Pediatric |
|---|---|---|
| Staphylococcus | Staphylococcus aureus | Pseudomonas |
| Streptococcus | Staphylococcus epidermidis | Staphylococcus |
| Pseudomonas | a-Hemolytic Streptococcus | Fungi |
| Enterobacteriaceae | b-Hemolytic Streptococcus | |
| Moraxella | Pseudomonas | |
| Klebsiella | Proteus | |

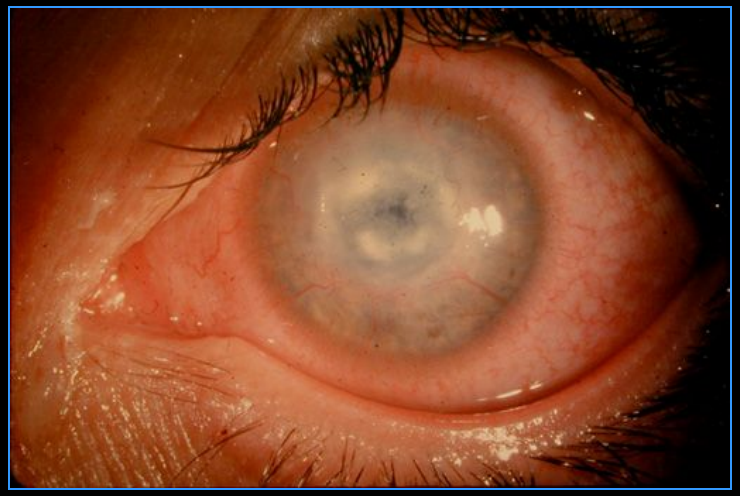
Corneal creeping ulcer with the thread of perforation

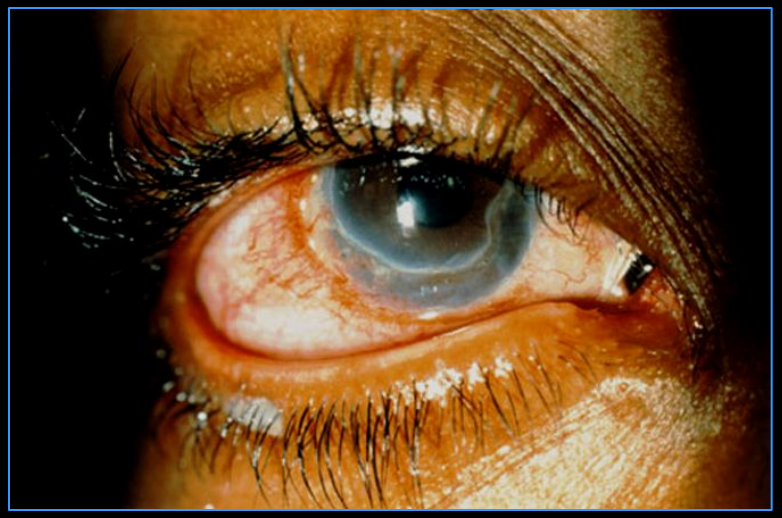


# Stages of ulcerous process:

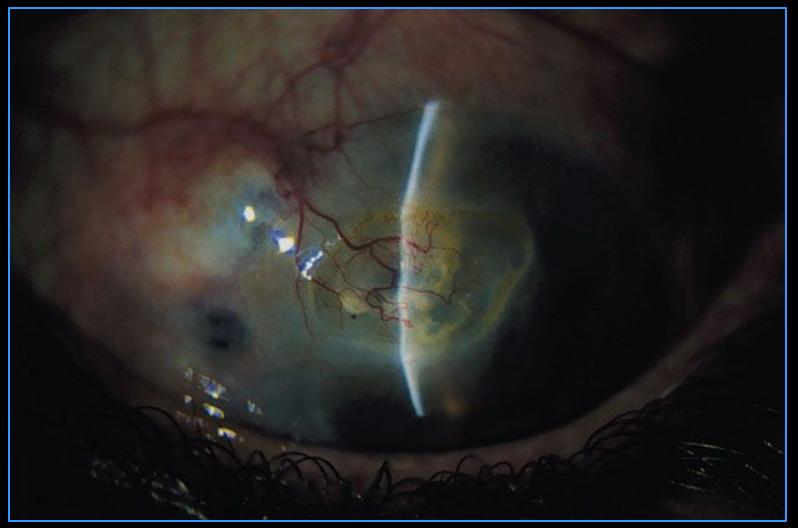
- **Stage of infiltration**
- **Stage of infiltrate decay and formation of ulcer**
- **Stage of facet – regression of ulcer, is characterized by clearance from necrotic residues of the fundus and margins of the ulcer and rapid growth of epithelium, that covers the fundus and margins of the cornea defects**
- **Stage of the scar formation**
- **Stage of outcome – maturation and thickness of connective-tissue scar**



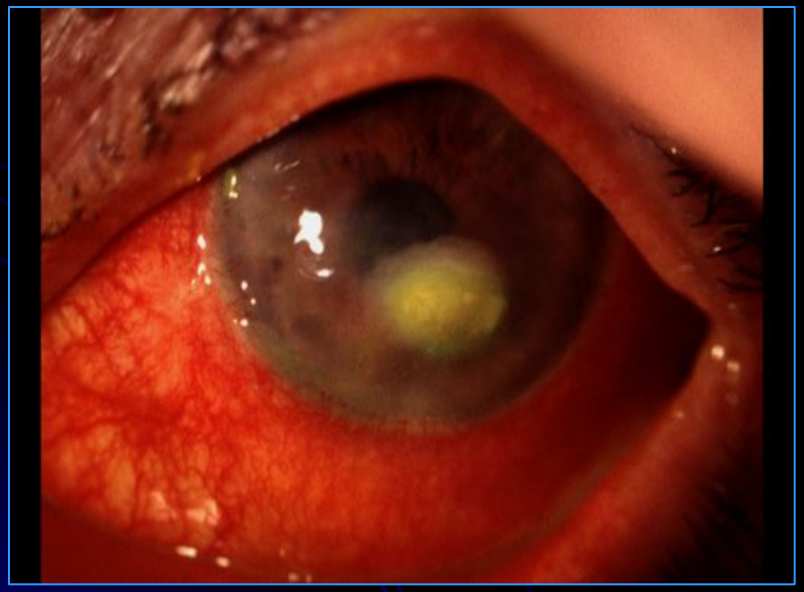




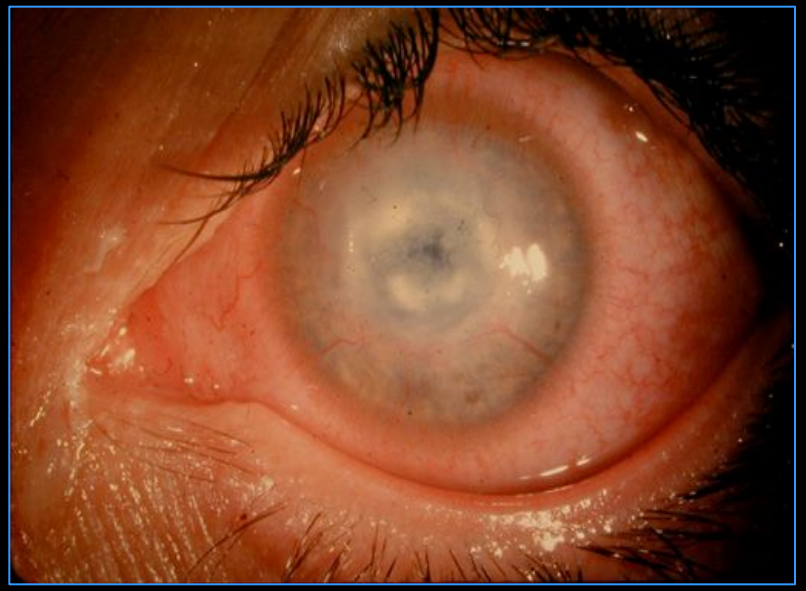
- Mooren’s Ulcer



**Corneal ulcer with neovascularization**



- Bacterial corneal ulcers



- **Perforation of corneal ulcer**

# Principles of Keratitis and Corneal Ulcers treatment

*1. Specific therapy:*

*a) Antiviral* (Zovirax, Aceclovir ointment 3% - 5 times a day or Lokferon 8000 ME/ml instillation 8 times a day for 5-7 days + systemic therapy)

*b) Antibacterial*

- Local – moxifloxacin, Cefazolin, Tobramycin, Gentamicin 4-8 times a day, Erythromycin, Tetracyclin ointment 1% 3-4 times a day
- Parabular – Tobramycin, Gentamicin, Cefazolin
- Systemically - Maxavin, Erythromycin, Doxicyclini, Ceftriaxone

*c) Antifungal* (local suspension of ketoconazole, miconazole ointment 4 times a day + Nizoral 200mg 2 times daily)

*d) Antiparasitic* (topical propamidine, neomysin, clotrimazole)

## 2. Pathogenetic therapy

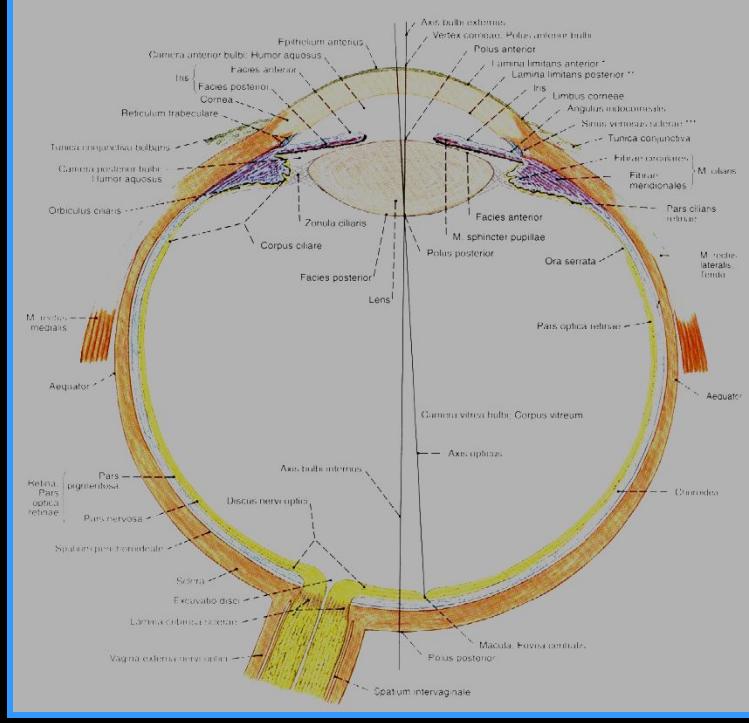
- *Antiinflammatory* (Eye drops – only non-steroidal antiinflammatory: Naclof. Parabular or intravenous injection of dexamethazon (in severe course)
- *Antiallergic*
- *Metabolic* – taufon, actovegin, solcoseril, corneregel, vitamins
- *Hypotensive* – in a case of the eye hypertesion or secondary glaucoma.
- *Mydriatic-cycloplegic drugs* – instillation of 1.0% mydriacyl, tropicamid.
- *Physiotherapy, Criotherapy*

- **Following arresting of inflammatory process a course of resolving therapy (fibrinolysin, lidase)**
- Penetrating keratoplasty indicated for visual rehabilitation in patients with sever corneal scarring. Lamellar keratoplasty has advantage over penetrating keratoplasty of reduced potential for corneal graft rejection.

# Complications of keratitis:

- *limbal and scleral extension*
- *corneal perforation*
- *iridocyclitis*
- *endophthalmitis*
- *Panophthalmitis*
- *Secondary glaucoma*
- *Corneal scarring: nebula, macula, leucoma, kerectasia, anterior staphyloma*

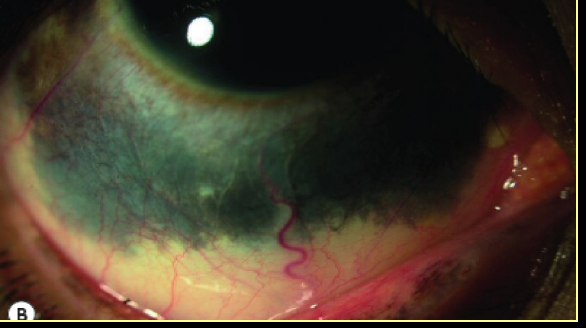
# Sclera – is a part of fibrous coat of the eyeball




**The sclera is composed of three layers:**

- the episclera
- the sclera proper
- the lamina fusca

- **The sclera is relatively poorly vascularized. Its blood supply is derived from the anterior and posterior ciliary arteries.**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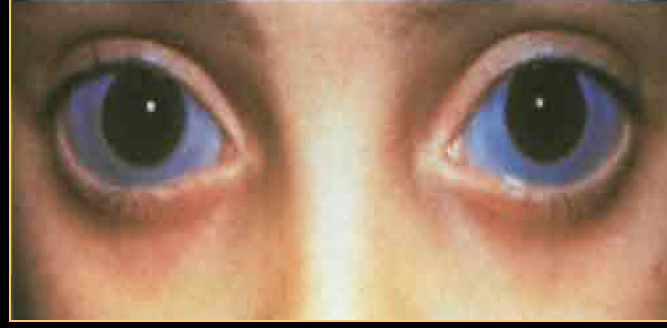
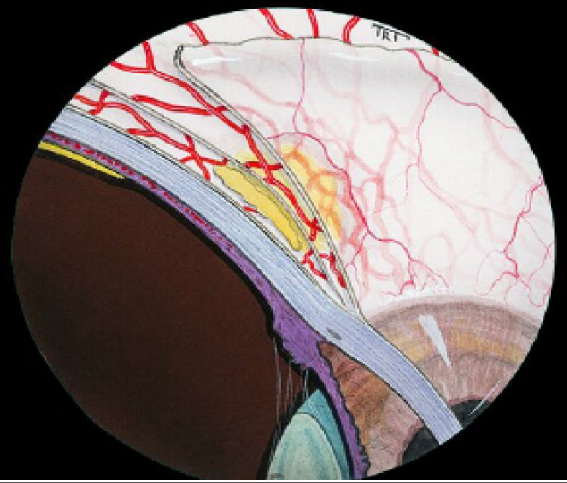
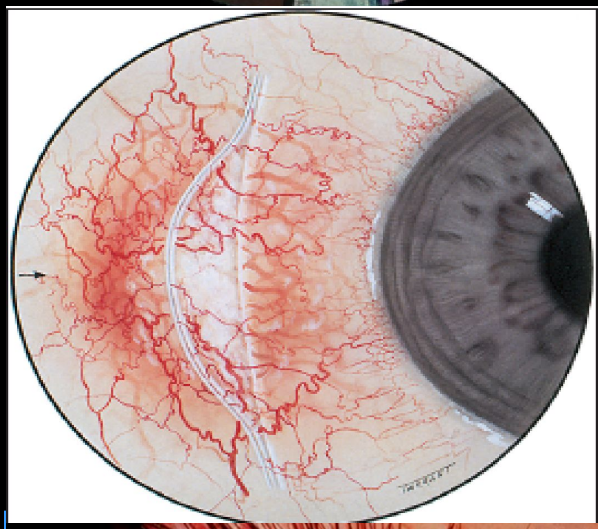
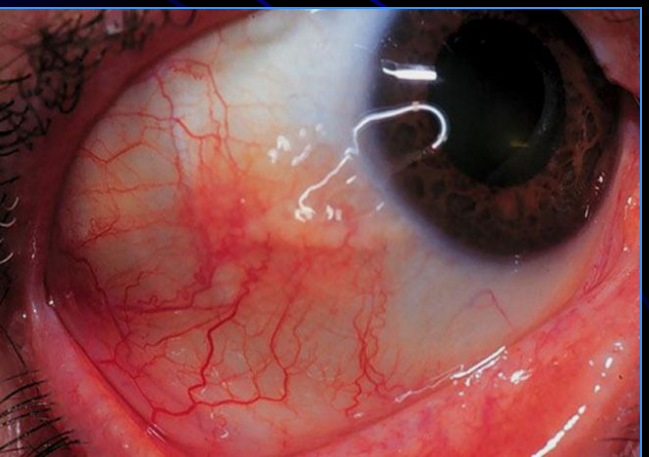


Episcleritis is a inflammatory disorder of the superficial layer of the sclera.

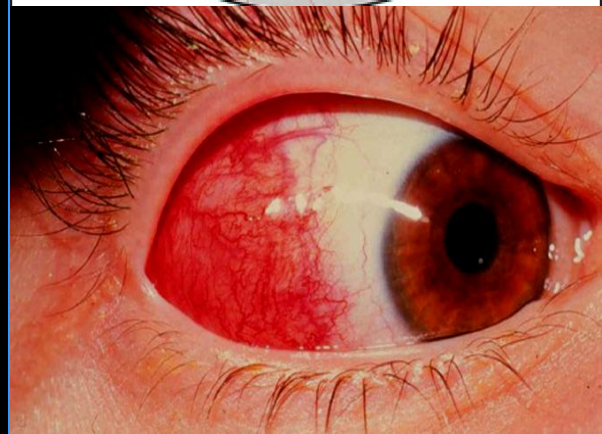
Is a common, benign, self-limiting and frequently recurrent disorder which typically affects young adults.





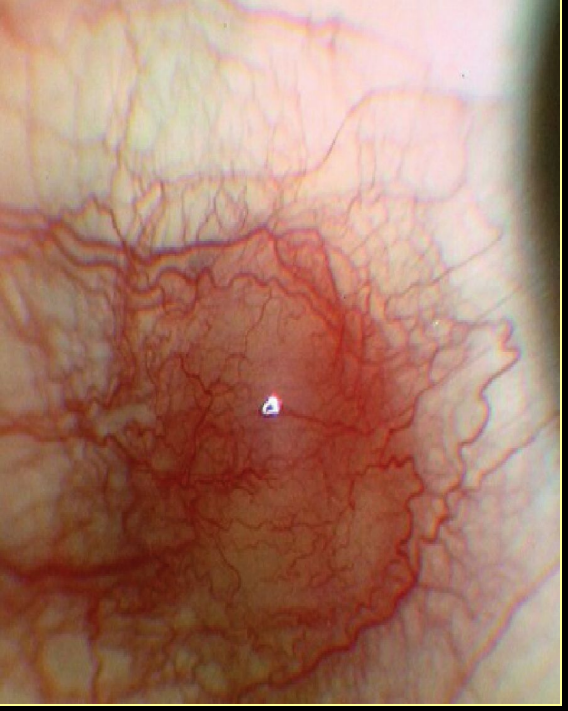


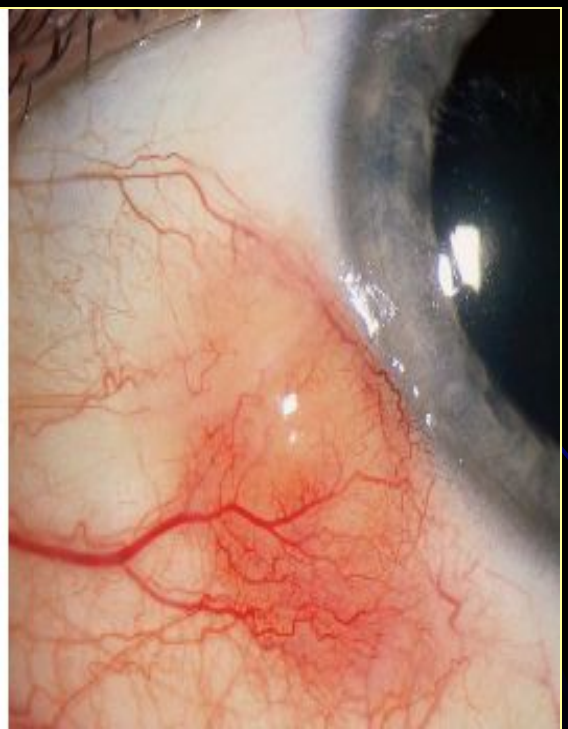
the episcleritis may be nodular or diffuse



# Systemic diseases with episcleritis

| | |
|---|---|
| Joints | Rheumatoid arthritis<br>Seronegative spondyloarthropathies |
| Connective tissue | Systemic lupus erythematosus<br>Recurrent polychondritis |
| Vasculitis | Behçet disease<br>Polyarteritis nodosa<br>Giant-cell arteritis<br>Wegener granulomatosis<br>Cogan syndrome II |
| Infectious/granulomatous | Syphilis<br>Tuberculosis<br>Herpes simplex<br>Sarcoidosis |
| Intestine | Ulcerative colitis<br>Crohn disease |
| Skin | Rosacea<br>Atopic dermatitis<br>Ophthalmic zoster |
| Metabolic | Gout |

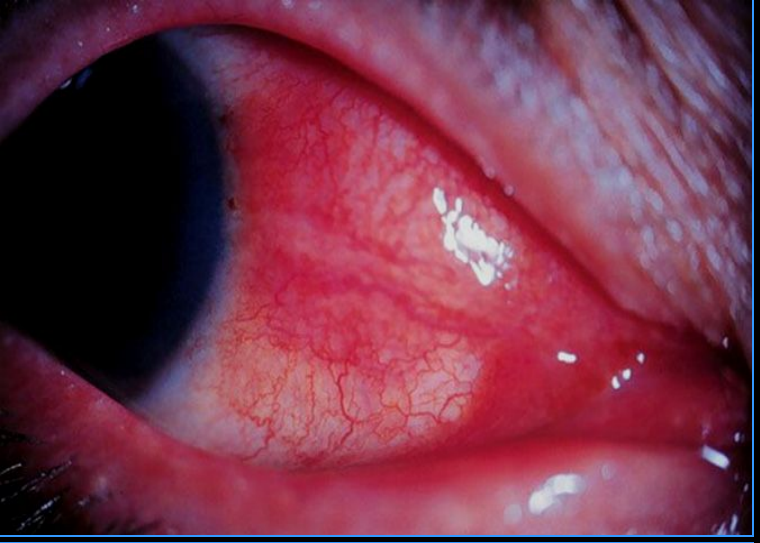


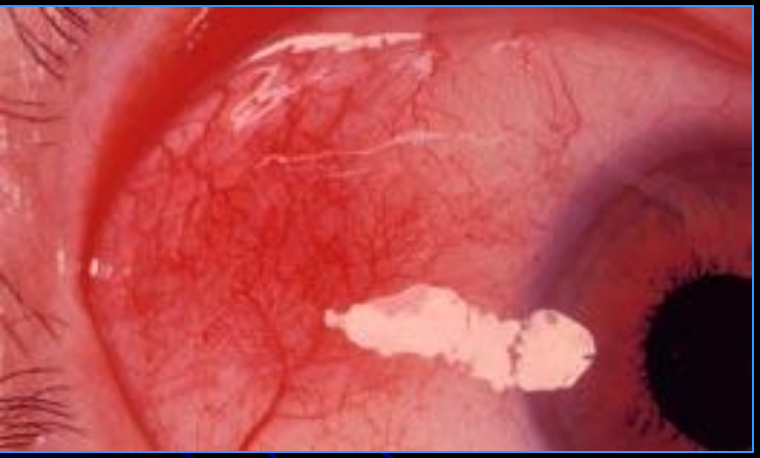


# Nodular Episcleritis

- Sudden onset of FB sensation, discomfort, tearing ± photophobia. It may be recurrent.
- Red nodule arising from the episclera; can be moved separately from the sclera and conjunctiva; blanches with topical vasoconstrictor (phenylephrine 10%); does not stain with fluorescein; globe nontender

Spontaneous resolution occurs in 5–6 weeks.



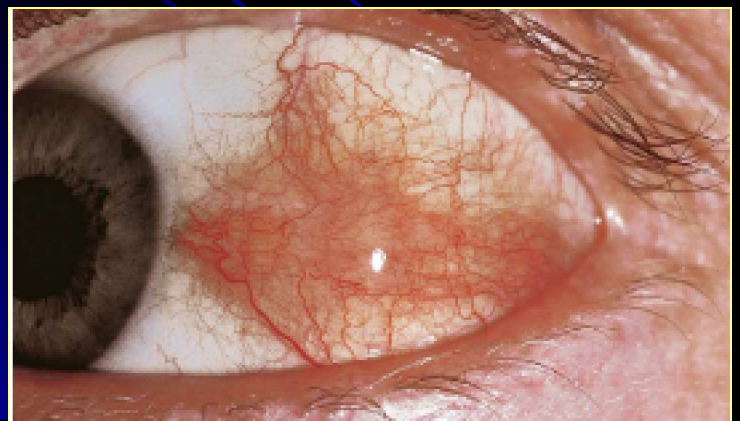


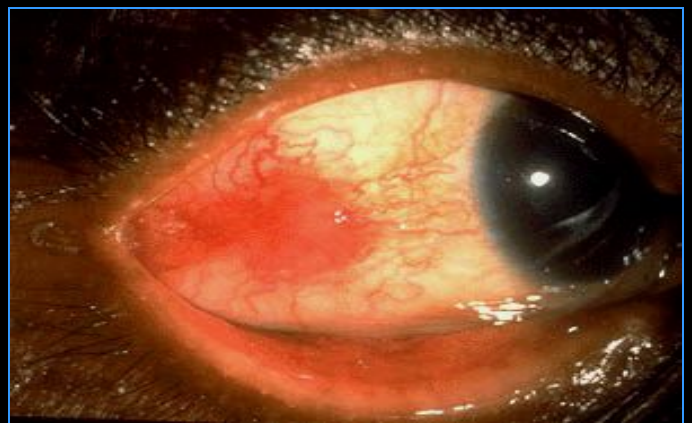
# Diffuse episcleritis

- Sudden onset of mild discomfort, tearing ± photophobia; may be recurrent.
- Sectoral redness that blanches with topical vasoconstrictor (phenylephrine 10%); globe nontender; spontaneous resolution 1–2 weeks.

# Episcleritis

- **Generally, the pain is not as severe as with scleritis.**
- **Hyperemia of the episcleral tissues most often is localized but may involve the entire anterior segment.**
- **The inflammatory process does not involve underlying sclera or intraocular tissue.**





# *Treatment*

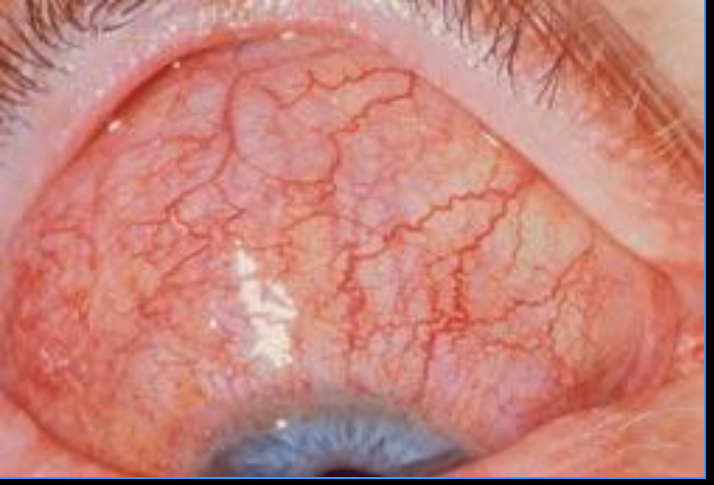
- If mild, no treatment is required.
- ***Supportive:*** reassurance ± cold compresses.
- ***Topical:*** consider lubricants ± NSAID (ketorolac 0.3% 3x/day). Although disease improves with topical steroids, there may be rebound inflammation on withdrawal.
- ***Systemic:*** if severe or recurrent disease, consider oral NSAID (flurbiprofen 100 mg 3x/day for acute disease).

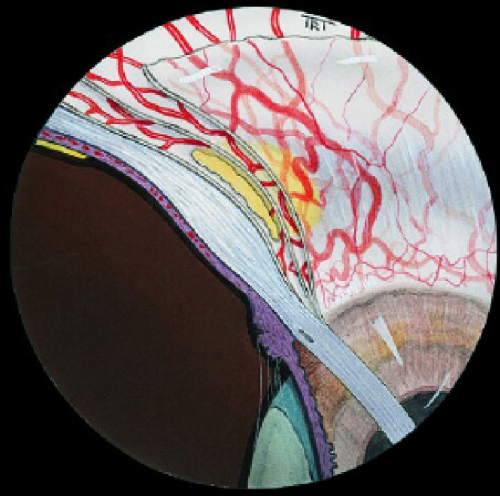
# COMPLICATIONS

- Involvement of other ocular structures is rare in patients with episcleritis.
- The peripheral cornea can be left thinned or vascularized. Recurrent attacks of episcleritis over many years can result in some mild scleral thinning, which is of no consequence to the integrity of the eye.
- The most frequent complications seen in patients with episcleritis are related to the use of long-term topical corticosteroids: Cataract, ocular hypertension, steroid-induced glaucoma, herpetic keratitis.

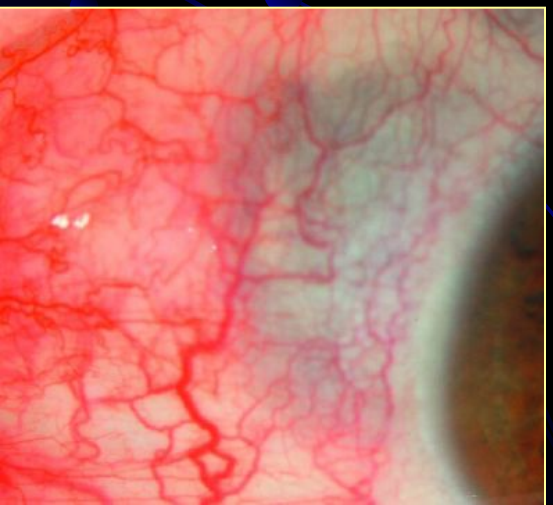
# COURSE AND PROGNOSIS

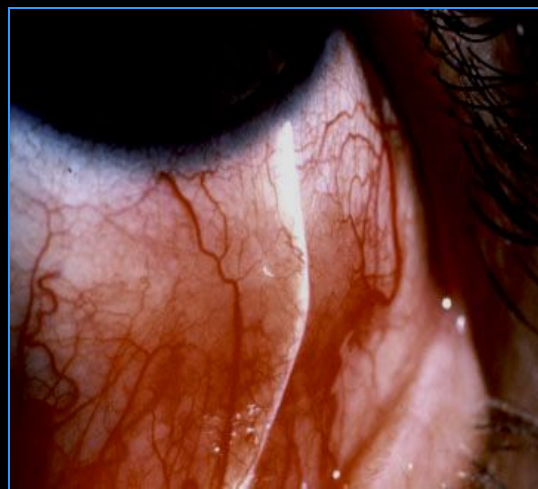
- Episcleritis is a mild, non-vision-threatening inflammation of the episclera that may recur over irregular intervals for many years.
- It is important to recognize its benign nature and not to induce vision-threatening complications by overtreating episodes of episcleritis.





Scleritis is a granulomatous inflammation of the scleral coat of the eye.



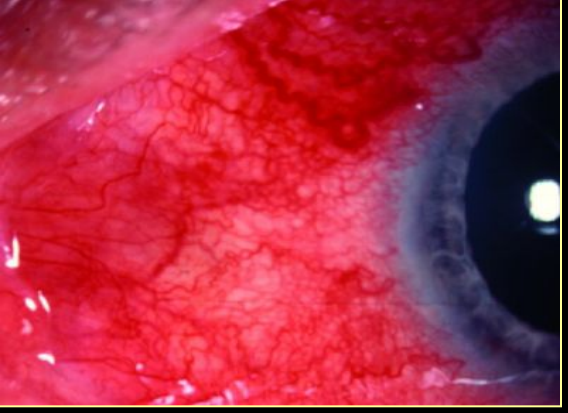


# Underlying systemic diseases

| | |
|---|---|
| Joints | – Rheumatoid arthritis<br>– Polyarticular juvenile idiopathic arthritis (seropositive)<br>– Seronegative spondyloarthropathies |
| Connective tissue | – Systemic lupus erythematosus<br>– Recurrent polychondritis<br>– IgA nephropathy |
| Vasculitis | – Behçet disease<br>– Polyarteritis nodosa<br>– Giant-cell arteritis<br>– Wegener granulomatosis<br>– Cogan syndrome II<br>– Takayasu disease |
| Infectious/ granulo-matous | – Syphilis<br>– Tuberculosis<br>– Borreliosis<br>– Sarcoidosis |
| Intestine | – Ulcerative colitis<br>– Crohn disease |
| Skin | – Ophthalmic zoster<br>– Porphyria<br>– Pyoderma gangrenosum |
| Metabolic | – Gout |

Other causes:

- infection (e.g., syphilis, tuberculosis, bacterial, fungal, and herpes zoster).
- trauma, surgery



# Scleritis

## Anterior scleritis

Non-necrotizing

- Diffuse
- Nodular

Necrotizing

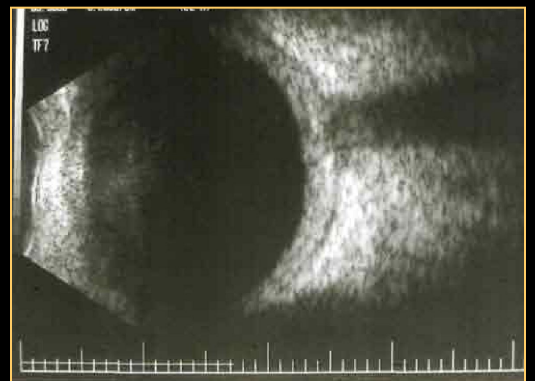
- With inflammation
- Without inflammation

## Posterior scleritis

Non-necrotizing

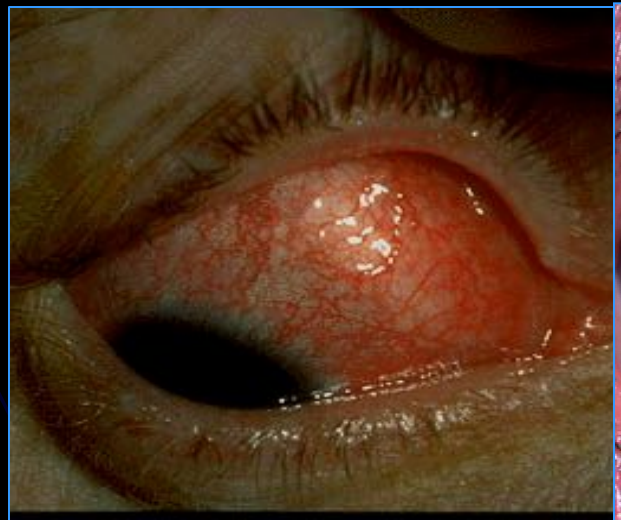
- Diffuse
- Nodular

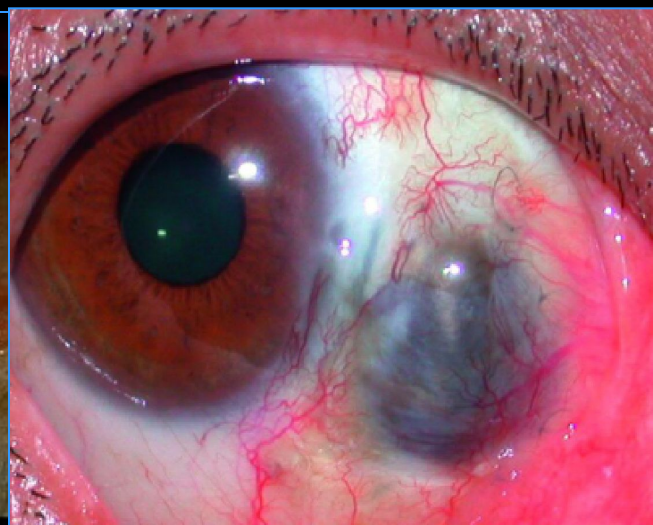
Necrotizing with inflammation



Scleritis presents in the fourth to sixth decade with the gradual onset of classic symptoms of severe, boring, ocular pain that occasionally radiates to the temple, jaw, or sinuses,

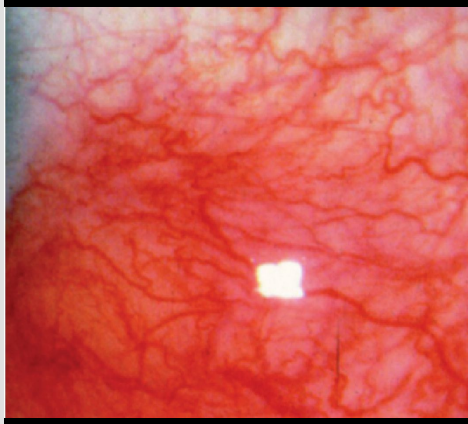
redness, tearing ± photophobia

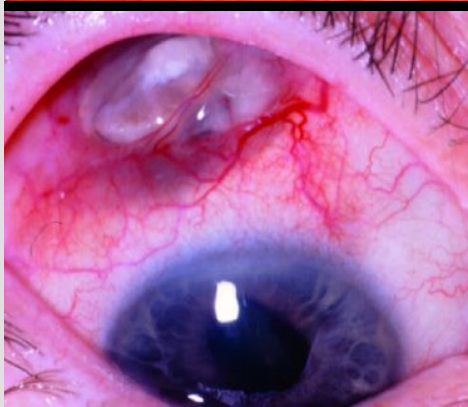


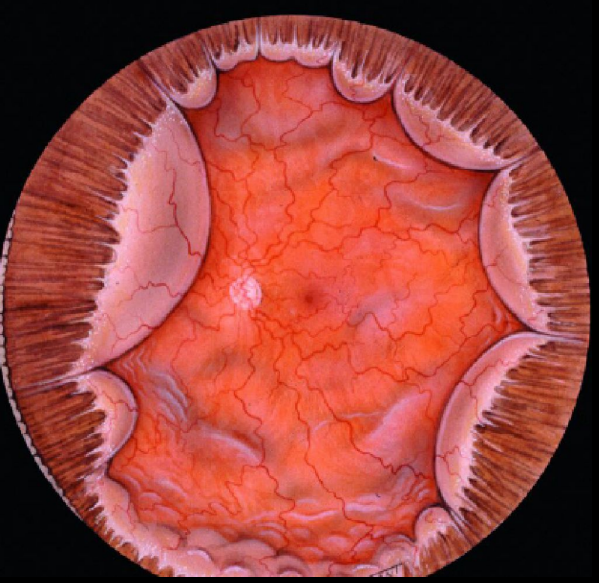


# Differentiation between episcleritis and scleritis

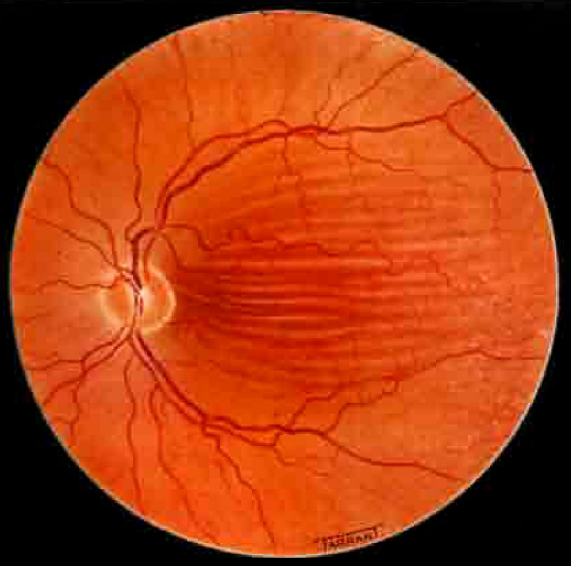
| Episcleritis | Scleritis |
| --- | --- |
| Discomfort rather than severe pain | Pain usually severe. May be severe enough to disturb or prevent sleep. May cause pain on moving the eye |
| Redness of the episclera tends to be mild. Superficial phenylephrine 2.5% will blanch superficial episcleral vessels within 10 minutes | Deep "brick-red" injection of vessels involving the sclera<br>Phenylephrine 2.5% blanches episcleral vessels within 10 minutes |
| Responds to topical treatment or nonsteroidal anti-inflammatory | May additionally require systemic immunosuppression |
| Will not cause necrotization/ scleral thinning | May cause a necrotizing process involving sclera and associated structures |







# Posterior scleritis



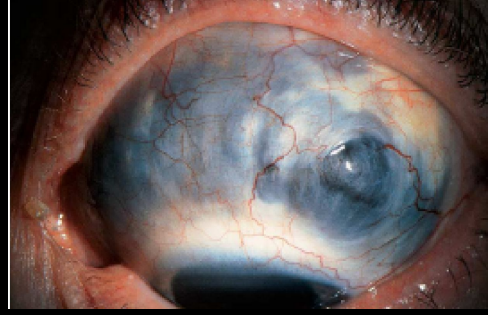
- Posterior scleritis is a serious, potentially blinding condition, which is often misdiagnosed and treated very late.
- *Clinical features*
- Mild–severe deep pain (may be referred to brow or jaw region), ↓VA, diplopia, photopsia, hypermetropic shift.
- White eye (unless anterior involvement), lid edema, proptosis, lid retraction, restricted motility; choroidal folds, annular choroidal detachment, exudative retinal detachments, macular edema, disc edema.

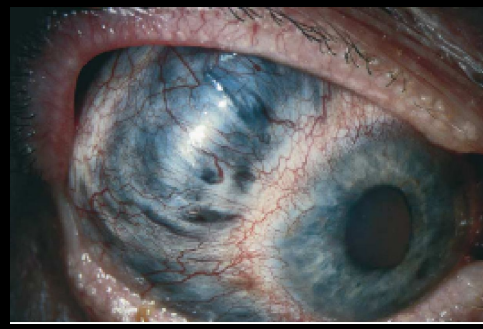
# Drugs commonly used in the treatment of scleritis

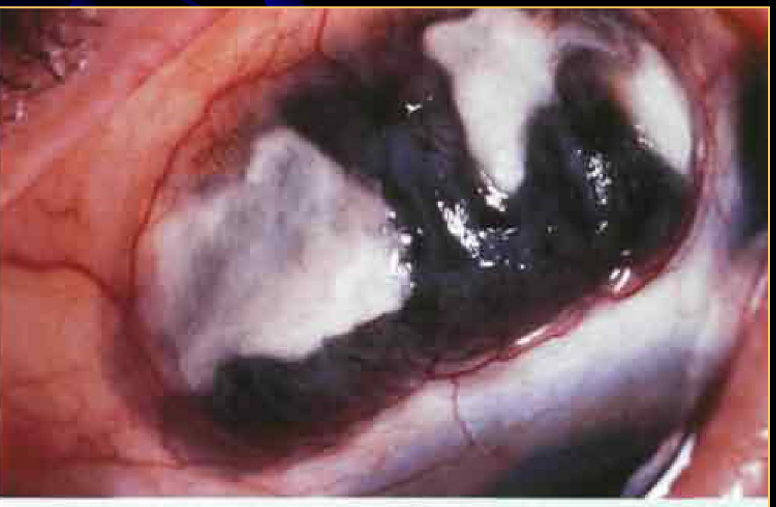
- Oral: NSAID (e.g., flurbiprofen 100 mg 3x/day; can be tapered down once disease is controlled).
- If not controlled, consider systemic immunosuppression: commonly corticosteroids (e.g., prednisone 1 mg/kg/day) ± other immunosuppressants (coordinate with rheumatologist).
- Topical corticosteroids are usually an adjunct to systemic therapy, lubrication
- Periocular corticosteroids (e.g., subtenons or transseptal triamcinolone acetonide) can be given in patients with no evidence of scleral thinning.
- If there is risk of perforation, protect globe (e.g., glasses by day, shield at night) and consider scleral patch graft.

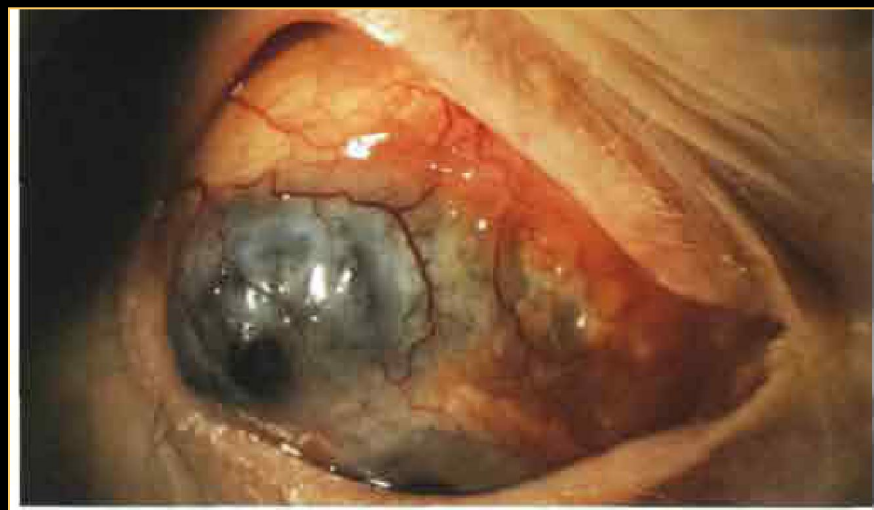
# *Complications*

- **Keratitis**
- **Uveitis**
- Staphyloma.
- **Perforation** of the sclera
- Exudative retinal detachment and choroidal detachment



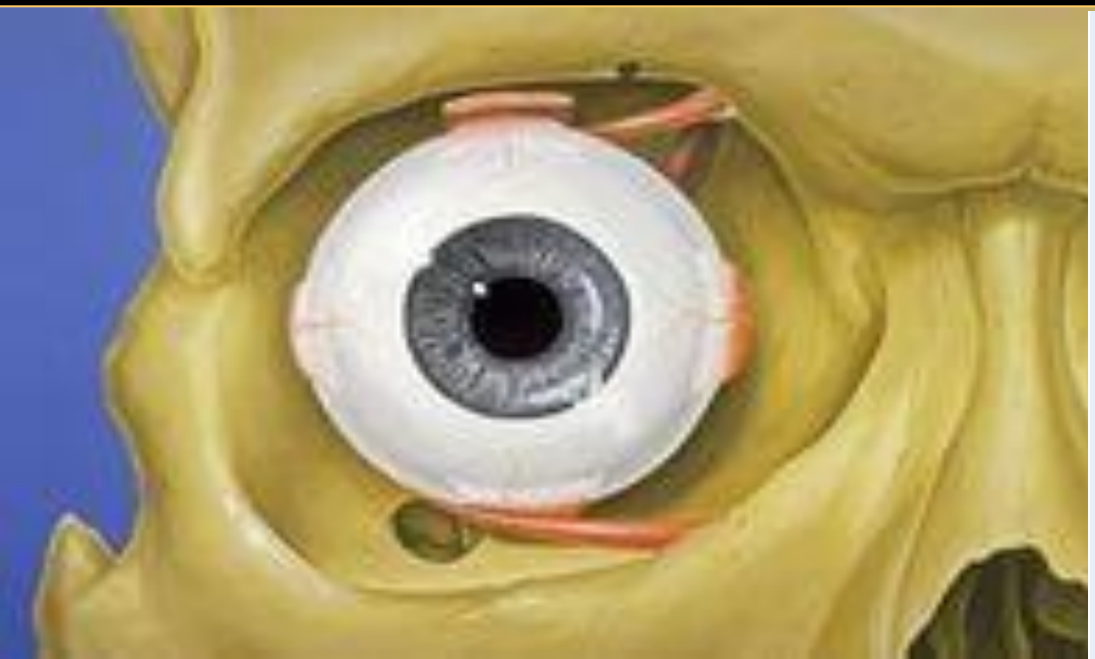






The orbit is a pear-shaped cavity in the skull

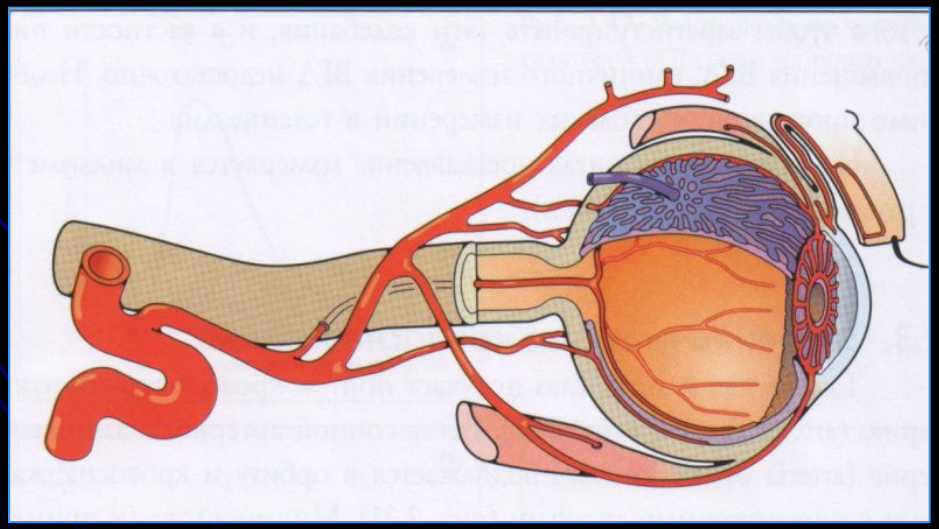
The orbit consist of the eyeball, external muscles, lacrimal gland, nerves, vessels, fat



| Wall | Bones |
|---|---|
| Roof | Frontal<br>Sphenoid (lesser wing) |
| Lateral | Sphenoid (greater wing)<br>Zygomatic |
| Floor | Zygomatic<br>Maxilla<br>Palatine |
| Medial | Maxilla<br>Lacrimal<br>Ethmoid<br>Sphenoid |

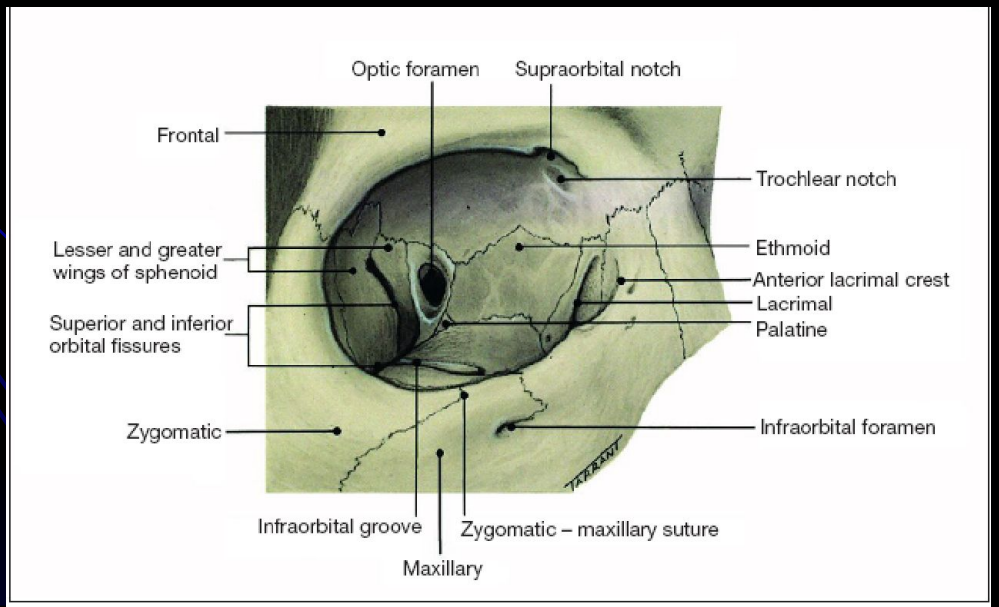
# Optic canal (orbital foramen):

- Within lesser wing of sphenoid
- **Transmits**: Optic nerve (CN 2), ophthalmic artery, and sympathetic nerves to ocular and orbital blood vessels



# The inferior orbital fissure

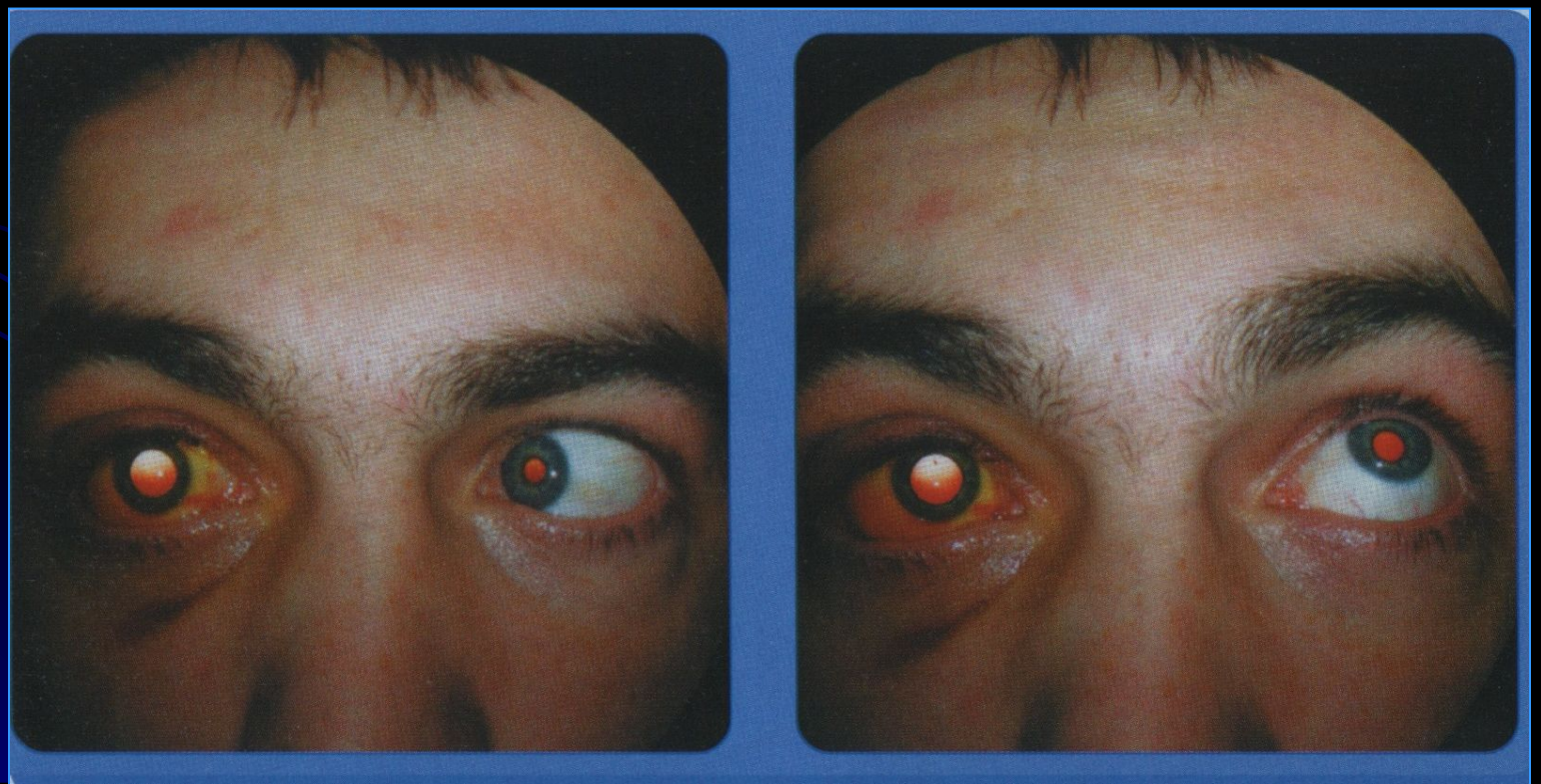
- Bordered medially by maxillary bone, anteriorly by zygomatic bone, and laterally by greater wing of sphenoid
- ***Transmits:*** CN $V_2$, zygomatic nerve, inferior ophthalmic vein



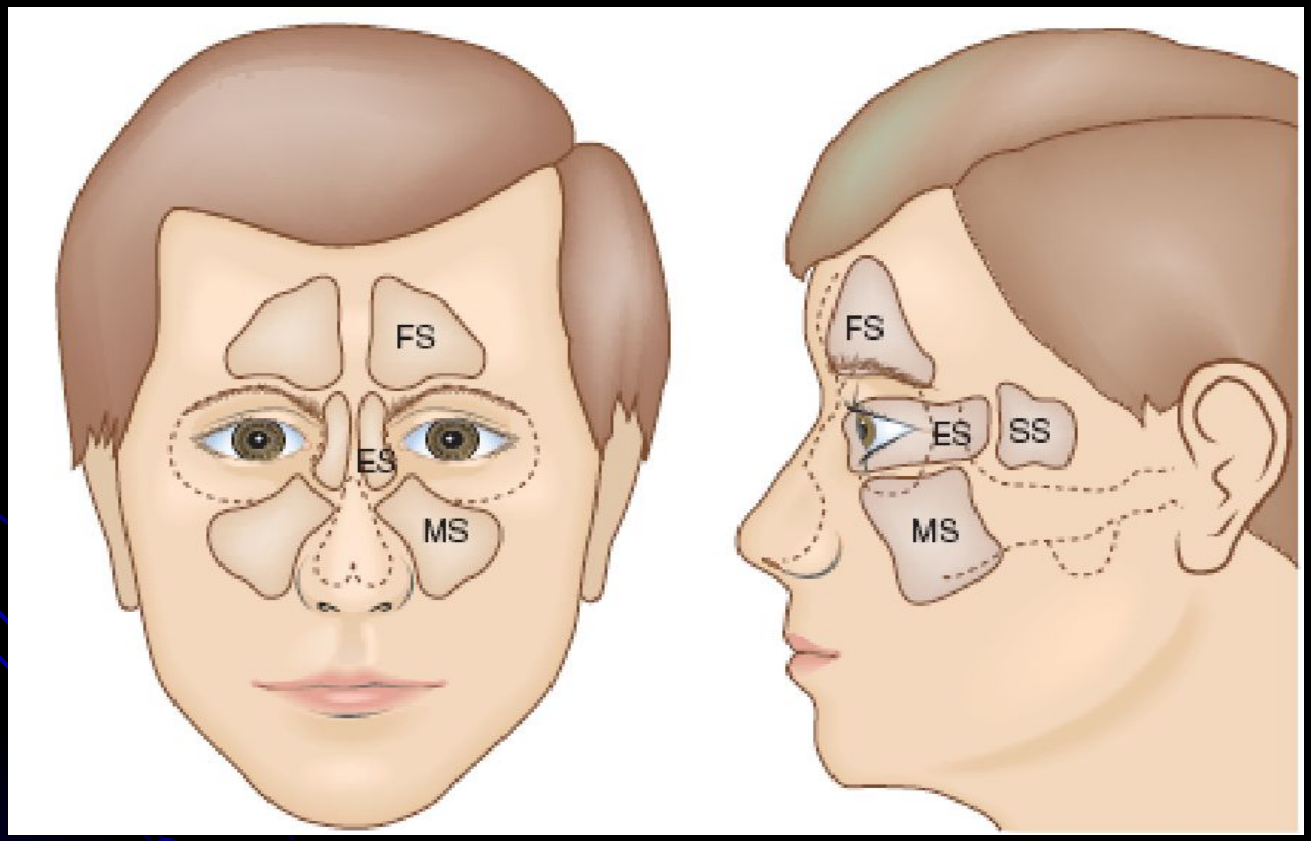
**The superior orbital fissure is a slit linking the cranium and the orbit, between the greater and lesserwings of the sphenoid bone.**

- ***Transmits***: CN III, IV, $V_1$, VI, superior ophthalmic vein,
- and sympathetic fibers

- Syndrome of superior orbital fissure – progressive diplopia, ptosis, complete right third, fourth, and sixth cranial nerve palsies, midriasis, sensory loss along the distribution of the first division of the trigeminal nerve

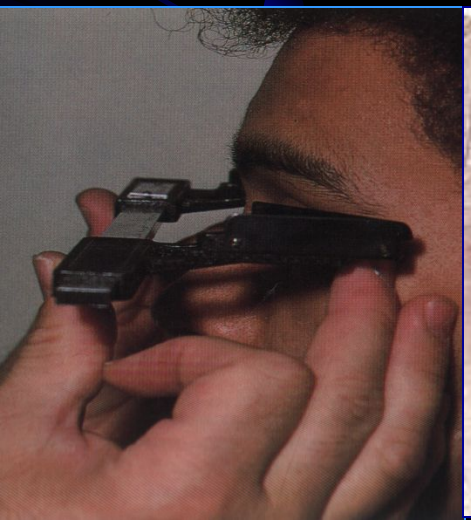


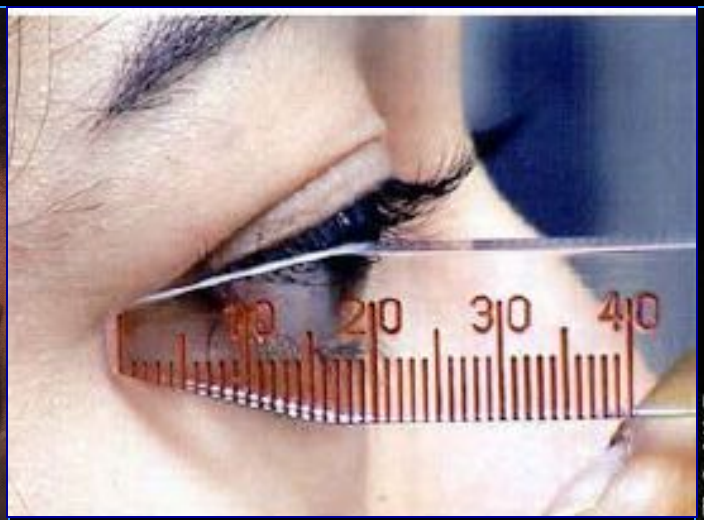
# Sinuses

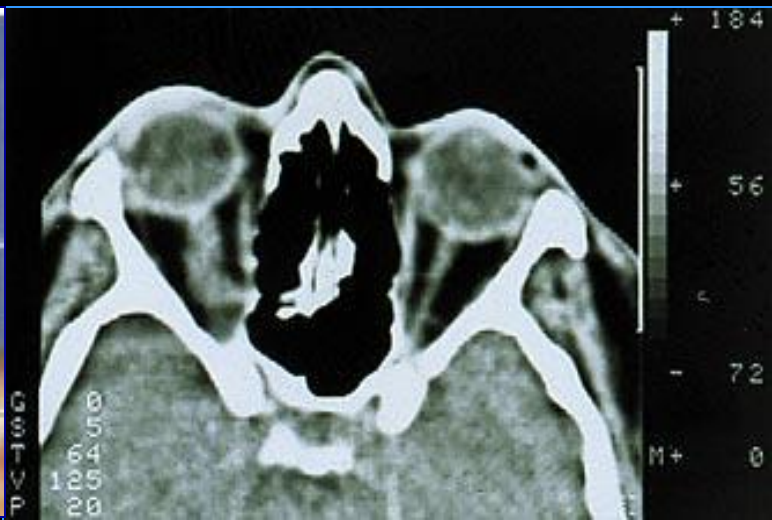


# Clinical and special investigations

- **Clinical examination, Palpation of anterior orbital tissues**
- **Orbitotonometry**
- **Exophthalmometry**
- **Ultrasonography**
- **Magnetic resonance imaging; fat-suppression techniques**
- **Arteriography**
- **Radionuclide scan**
- **Computed tomography, contrast-enhanced; bone-window (especially for fractures)**





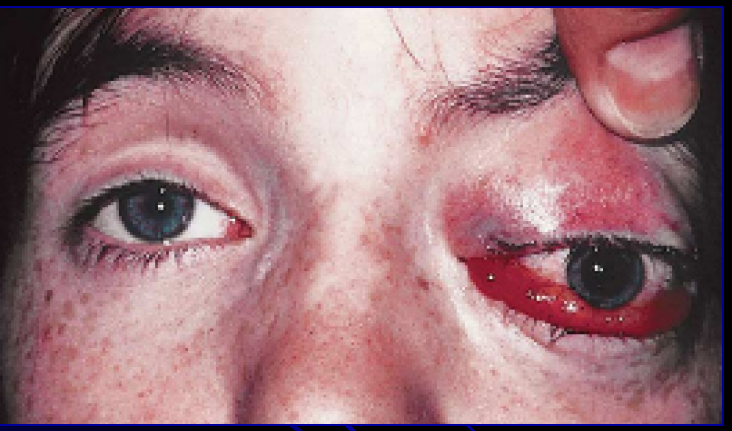


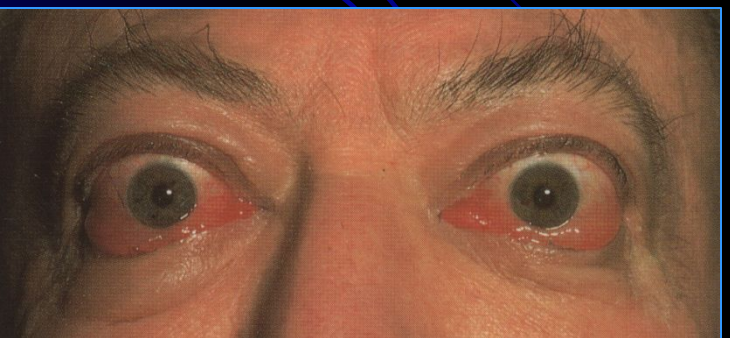
# ORBITAL DISORDERS

**Congenital** orbital malformations

**Acquired**

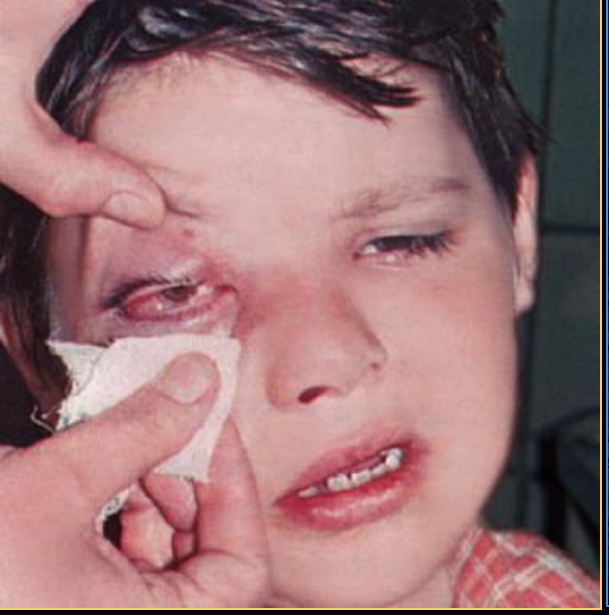
- **Infections**
  - **Orbital periostitis, Cellulitis, Cavernous Sinus Thrombosis**
- **Trauma**
- Thyroid-Related Ophthalmopathy
- **Tumors**
- **Vascular Abnormalities**

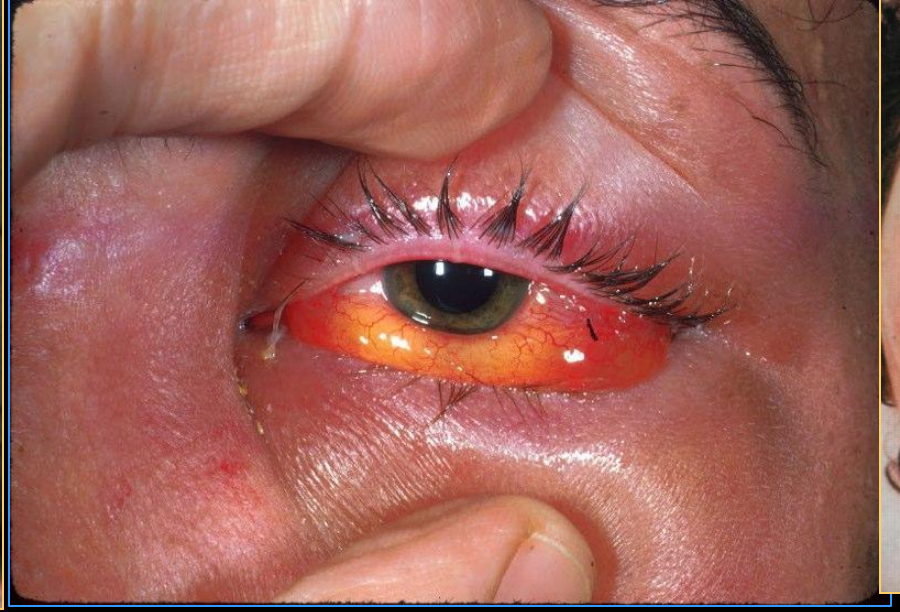


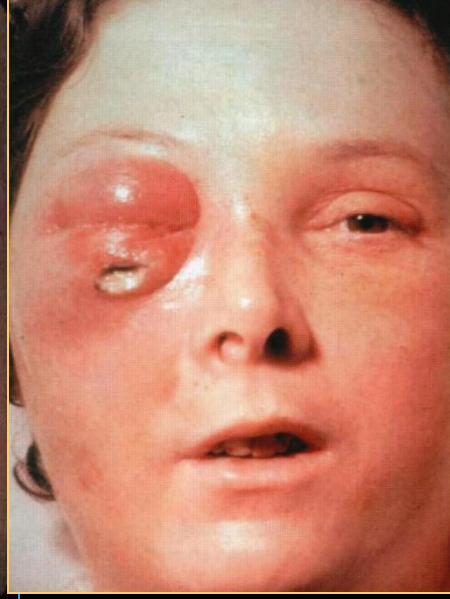


# Osteoperiostitis

- It may result from injuries or as an extension of infection from the surrounding structures
- *Clinical picture* may be in two forms.
- Anterior orbital periostitis – it involves the orbital margin and is characterized by severe pain, tenderness and swelling of the inflammed area. Subperiostal abscess when formed, frequently bursts on the skin surface.
- Posterior periostitis is characterized by deep seated orbital pain, exophthalmos, slight limitation of ocular movements. Sometimes there may be anaesthesia of the skin of eyelids and cornea.

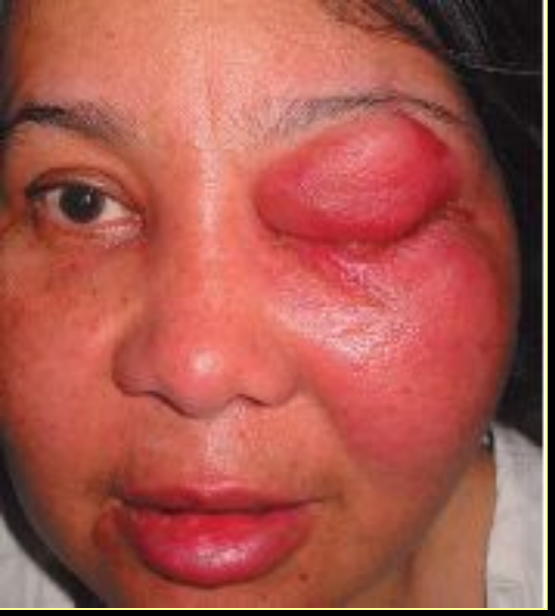


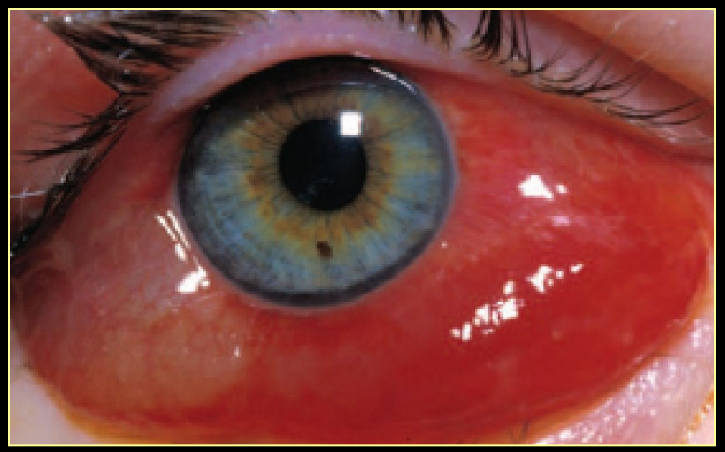


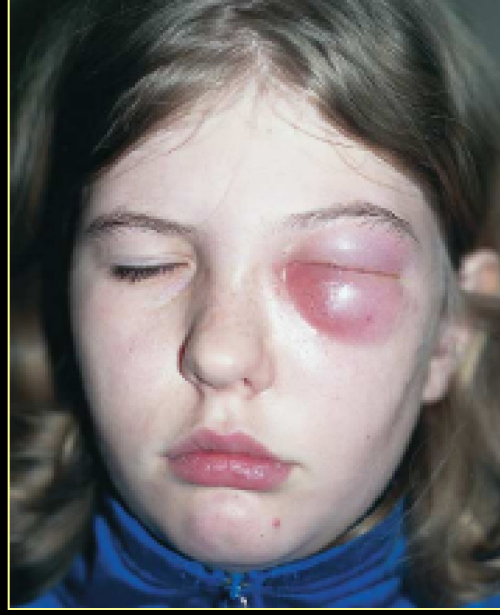


# Cellulitis
# - inflammation of the orbit

# Risk factors:







- ***Sinus disease:*** ethmoidal sinusitis (common), maxillary sinusitis.
- **Infection of other adjacent structures**: preseptal or facial infection, dacryocystitis, dental abscess.
- ***Trauma:*** septal perforation.
- ***Surgical:*** orbital, lacrimal, and vitreoretinal surgery.

- ***Symptoms*** include rapid onset of headache, fever, pain, nausea, in some cases – prostration.
- Eyelids are swollen, erythematous, warm and tender to palpation.
- A marked chemosis of conjunctiva.
- The eye is proptosed axially (the most frequently proptosis is lateral and downwards).
- Ocular movements are restricted and painful.
- In advanced cases visual acuity may be diminished.

# *Potential complications:*

- Intracranial complications include meningitis, brain abscess and cavernosus sinus thrombosis
- Subperiorbital abscess (it is relatively rare in sinus-related orbital cellulitis but may occur in post-traumatic and postoperative cases)
- Ocular complications (keratopathy, raised IOP, occlusion of the central retinal artery or vein, optic neuritis)

# Principles of treatment of inflammatory diseases of the orbit

- **It is an emergency requiring hospital admission.**
- **Intensive antibiotic therapy (topical (subconjunctival and retrobulbar injections). Admit for intravenous antibiotics (e.g., either floxacillin 500–1000 mg 4x/day or cefuroxime 750–1500 mg 3x/day with metronidazole 500 mg 3x/day).**
- **Analgetics and anti-inflammatory drugs if necessary**
- **Osmotherapy (40% glucosae solution)**
- **Surgical drainage. In most cases it is necessary to drain both the orbit and the infected paranasal sinuses.**
- **Physiotherapeutical treatment**

# Thank you for your attention!

- The lecture is composed by:
- prof. doctor of medical sciences Ivanova N.V.,
- Assistant Kondratiuk G.I.