UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
„NICOLAE TESTEMIȚANU” DIN REPUBLICA MOLDOVA

Ophthalmology Department

EYE TRAUMA

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Eye Trauma

- presents a medico-social problem, because they are one of the main causes that can lead to visual impairment, including severe, such as blindness, of one eye or both eyes, or even loss of the eyeball, in young people - especially men, able to work.

Present particularities

- Modification of the character of the traumas
- New mechanisms of trauma
- New possibilities for diagnosis and treatment

Eye Trauma

- Habitual (home)
- Industrial
- Agricultural
- School (infantile)
- Sport
- Travel
- Criminal
- Recreational
- Casual

Eye Trauma:

- Local
- Associational with:
  - head injury
  - face injury
  - multiple injury (polytrauma)

Action:

- mecanical - mecanical trauma
- chemical/thermal - burns
- physical – phototrauma, radiational trauma
- other

Eye Trauma:

- Mecanical
- NonMecanical
  - chemical
  - thermal
  - radiational
  - phototrauma
  - electrical
  - ultrasonic
  - barometric

Mecanical eye trauma:

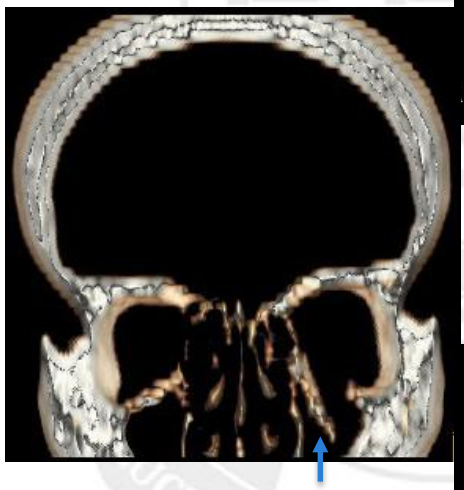
- Adnexal
  - orbital
  - palpebral
  - lacrimal
  - conjunctival
- Global:
  - closed
  - open
  - distructive

Mecanical eye trauma:

- Closed
  - contusion
  - lamelar laceration
  - EOFB, IMFB
  - dislocation
- Open:
  - rupture
  - penetration
  - perforation
  - IOFB
- Distructive :
  - traumatic evisceration
  - traumatic enucleation
  - full thickness laceration 1/3 globe circumference

Orbital trauma:

- Walls fractures:
  - *Most thin is medial – subcutaneous emphysema, the treatment in association with ORL*
  - *Most dangerous – of the superior– the treatment in association with neurosurgeon*
  - *inferior – enophthalmia – the treatment in association with OMF surgeon*
  - *Most resistant and "opened" – lateral – the treatment in association with OMF surgeon*



Orbital trauma:

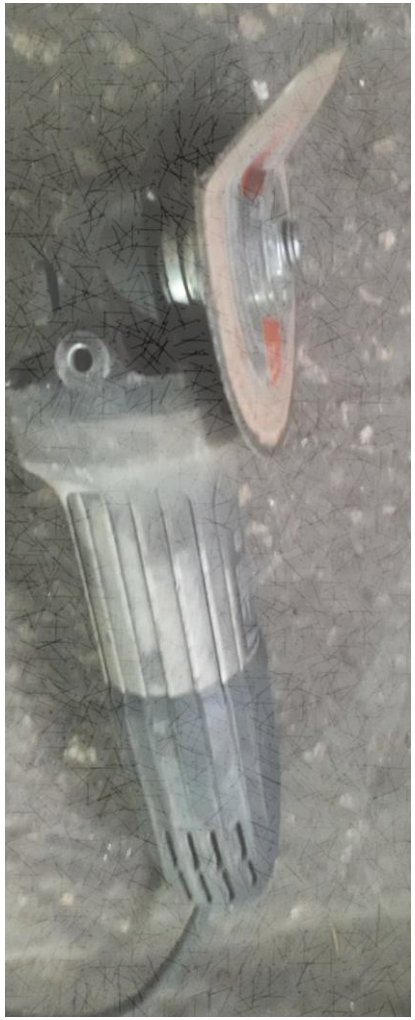
- Fractures in the region of the superior orbital fissure (sever retrobulbar hematoma) – the syndrome of superior orbital fissure :
  - *Exophthalmia*
  - *Ophthalmoplegia*
  - *Ptosis*
  - *Venous stasis*
  - *Mydriasis*
- Fractures of the optic nerve channel wall, retrobulbar hematoma.

Eyelids Trauma:

- edema, ecchymosis, hematomas
- excoriations, erosions, superficial lesions
- ruptures, wounds; most sever from them:
  - subtotal or total;
  - ruptures with loss of eyelid tissue
  - ruptures or wound in medial (nasal) part of the eyelid with lesion of the lacrimal canaliculus; in this case is necessary to do reconstruction of this duct

- outcomes/ complications:
  - ptosis
  - lagophthalmia
  - scar deformation with evolution in entropion / ectropion etc
  - lacrimal ways impermeability/ dysfunction

Eye, Eyelids and Face Trauma:



first day 1 week 1 month

Eyelid linear wounds:

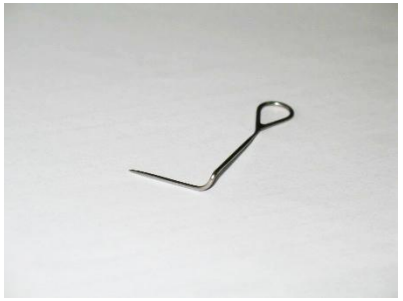
- horizontal (parallel to the palpebral margin) - usually they are adapted, because the direction of the wound coincides with the direction of the muscular fibers of the *m.orbicularis oculi, pars palpebralis*; their suturing is performed depending on the case;

- vertical (perpendicular to the palpebral margin) - they are usually dehiscent, as the direction of the wound is perpendicular to the direction of the muscle fibers of the *m.orbicularis oculi, pars palpebralis*; their suturing is usually necessary, especially when the lesion starts from the eyelid edge.

Ruptures/wounds in the Eyelid medial (nasal) region, which involve tear ducts:

- obliges the doctor not only to do the reposition of the wound and to suture it, but also to perform drainage and reconstruction of the damaged tear duct;

- drainage is obtained by passing through both segments of the broken duct of:
  - a metal probe
  - an elastic thread (ex. Nylon suture)
  - an elastic tube (silicone tube)



Conjunctival Trauma:

- Edema
- Redness (conjunctivitis)
- Hemorrhages (conjunctival, subconjunctival)
- Conjunctival foreign body
- Ruptures, wounds

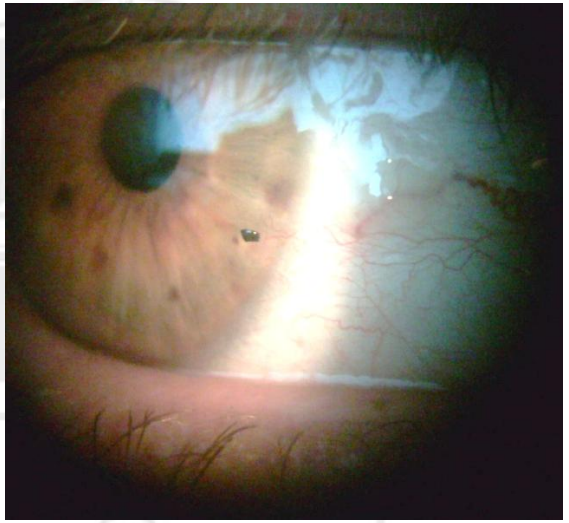
Conjunctival Trauma:

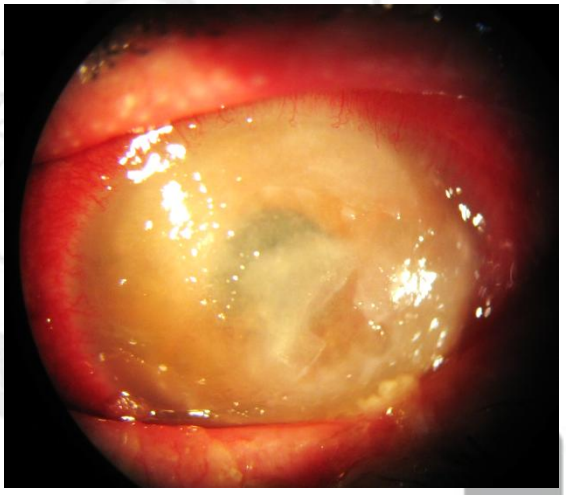
- Conjunctival foreign body:
  - foreign body sensation
  - tearing
  - blepharospasm
  - redness
  - it is removed by cotton (or by irrigation)
  - if it is necessary - with the upper eyelid eversion

- Conjunctival ruptures, wounds:
  - disconfort, pain sensation
  - tearing
  - wounds/ruptures of the conjunctiva
  - redness of the conjunctiva
  - they are usually repositioned and sutured; due to its elasticity in some cases (if it is necessary) a portion of damaged tissue can be excised without adverse consequences.

Superficial eyeball trauma:

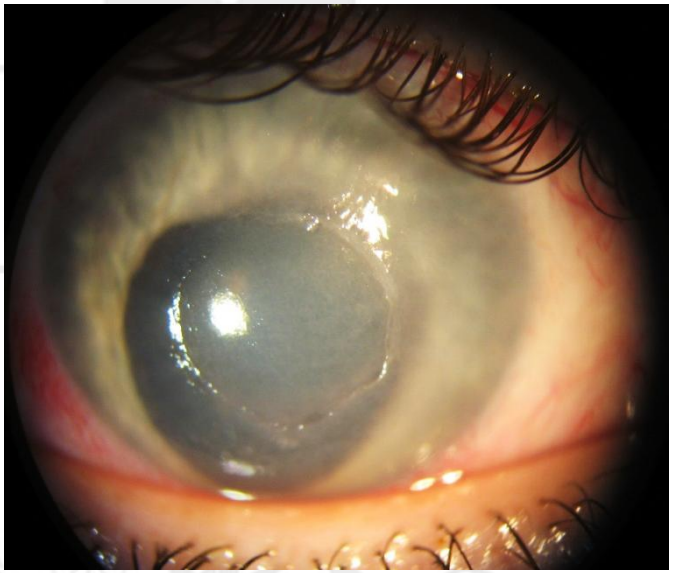
- Corneal erosion
- Corneal foreign body
- Keratitis
- Nonpenetrating injury (lamelar laceration)





Corneal erosion

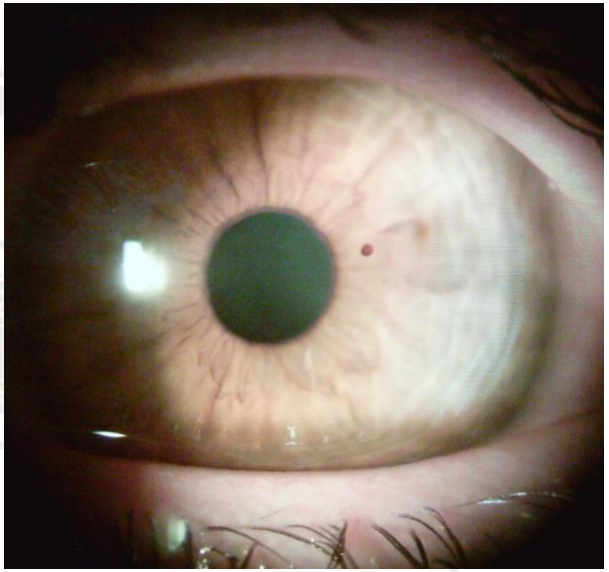
- Excoriation, deepithelisation of the cornea;
- Corneal syndrome (pain, photophobia, blepharospasm, tearing, redness);
- Epithelial defect is inspected by biomicroscopy (for better visualization Fluoresceini use);
- Treatment include: antibacterians (ophthalmic drops, ointment), contact lens/monocular punch, mydriatics, drugs for corneal regeneration/rehealing.

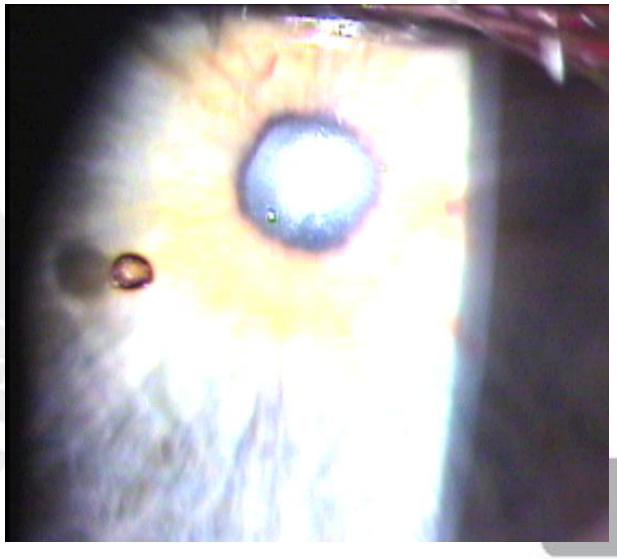


Corneal foreign body

- they are characteristics predominantly to the people, whose activity is related to the processing of metals;
- the appearance of the foreign body sensation is mentioned clinically; the presence of a corneal syndrome, usually, not pronounced;
- in the case of a central positioning, visual disturbances may occur;
- the foreign body is viewed biomicroscopically (or by examination with lateral illumination)
- to extract it is used a sharp instrument (ex. syringe needle) after local anesthesia by instillation of topical anesthetics
  - in case of late addressing to the doctor it is usually necessary to remove the foreign body with the adjacent modified corneal tissue, which will ensure a faster healing.
- after removal of the topical foreign body, antibacterials (eye drops, ointment) are administered, depending on the case - mydriatics, contact lens/monocular punch, drugs for corneal regeneration/rehealing.

Corneal foreign body





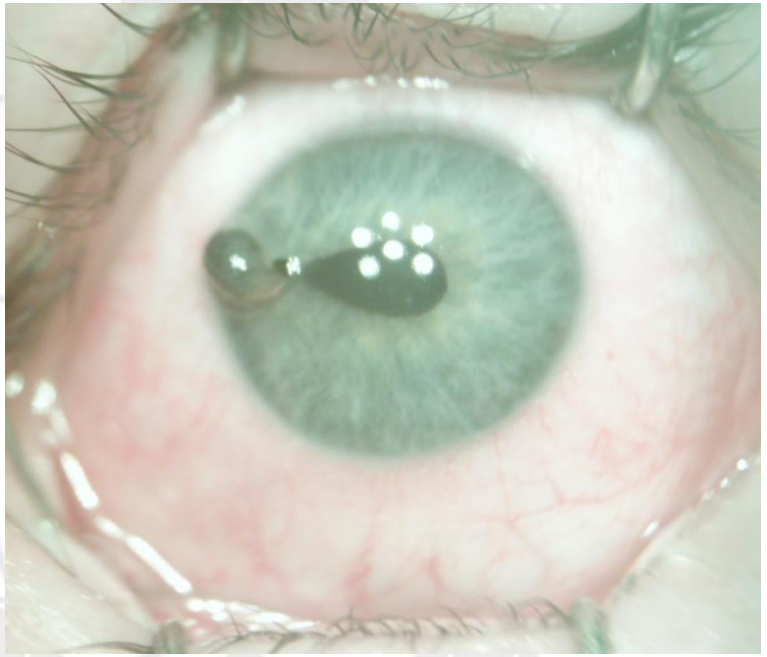
Eye penetrating injury:

- corneal;
- scleral;
- corneo-scleral

It is the result of the action of a sharp object (knife, glass, needle, etc.).

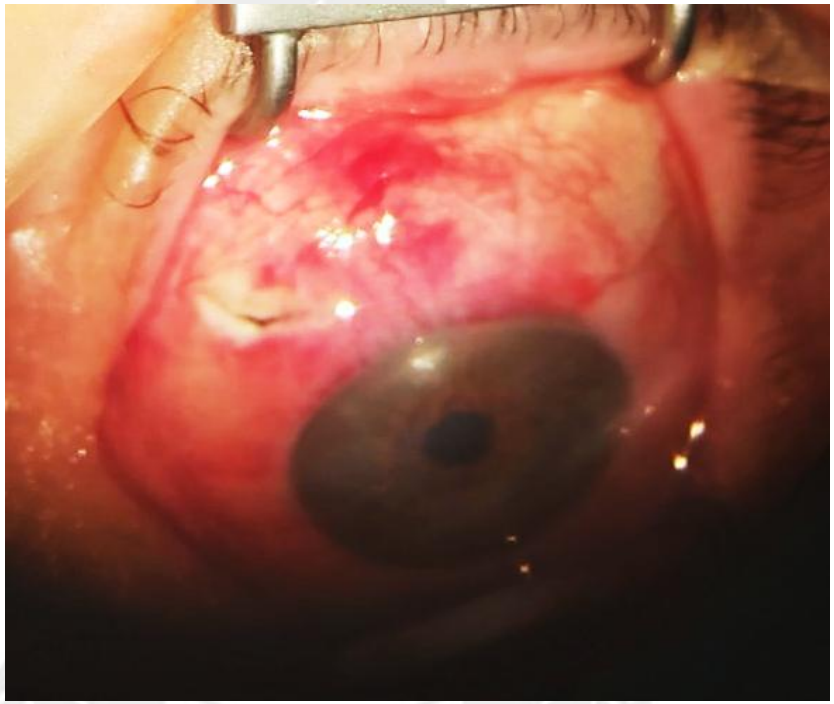
Corneal penetrating injury:

- Presence of the corneal wound
- Anterior chamber absence/shalow
- Wound insertion of the iris
- Deformation and deviation of pupil to wound,
- Iris wound (from case to case),
- Hyphaema (from case to case),
- Traumatic cataract (from case to case),
- Usually the disturbance of visual functions



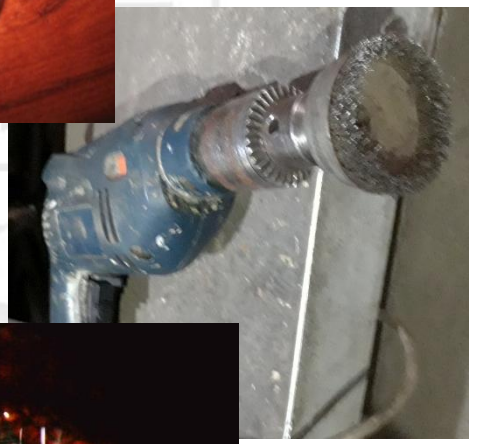
Scleral penetrating injury:

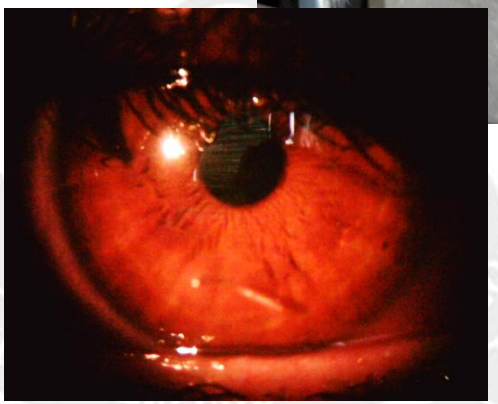
- Conjunctival and scleral wound
- Subconjunctival hemoragies,
- Insertion of the vitreous, choroid, retina in the wound,
- Anterior chamber may be deeper as a result of posterior displacement of the irido-crystalline diaphragm following loss of vitreous
- Hemophthalmus
- Usually the disturbance of visual functions



Special attention:

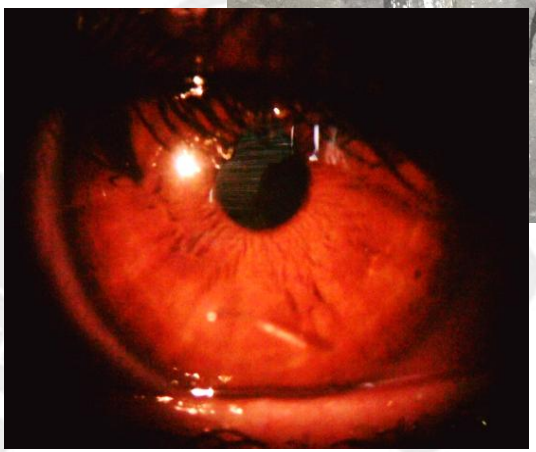
- in the case of corneal or scleral wounds of small size (1-2 mm) the detection of penetration is difficult, especially in the scleral wound with a late addressing of the patient.
- such wounds of this size can be caused by puncture (needle of a syringe, etc.) or by intraocular penetration of a foreign body, usually metal.





Trauma circumstances and provenience of intraocular foreign body (IOFB):

- Mechanical processing of same metal pieces, with metal tools (hammer hit over another metal, etc.)
- Fragment of copper wire (ex. from the wires whip)
- Car accidents (windscreen fragments)
- Explosions



In order to detect or exclude a intraocular foreign body:

in all cases of penetrating ocular wounds or in case of suspicion of penetrating wound, imaging methods are used to detect a possible EOFB (extraocular foreign body) or IOFB (intraocular foreign body):

- *radiological examination - radiography of the orbits in two projections (face / profile)*
- *ocular ultrasonography*
- *Computed Tomography*

ExtraOcular Foreign Body (EOFB):

Localization of intraocular foreign body:

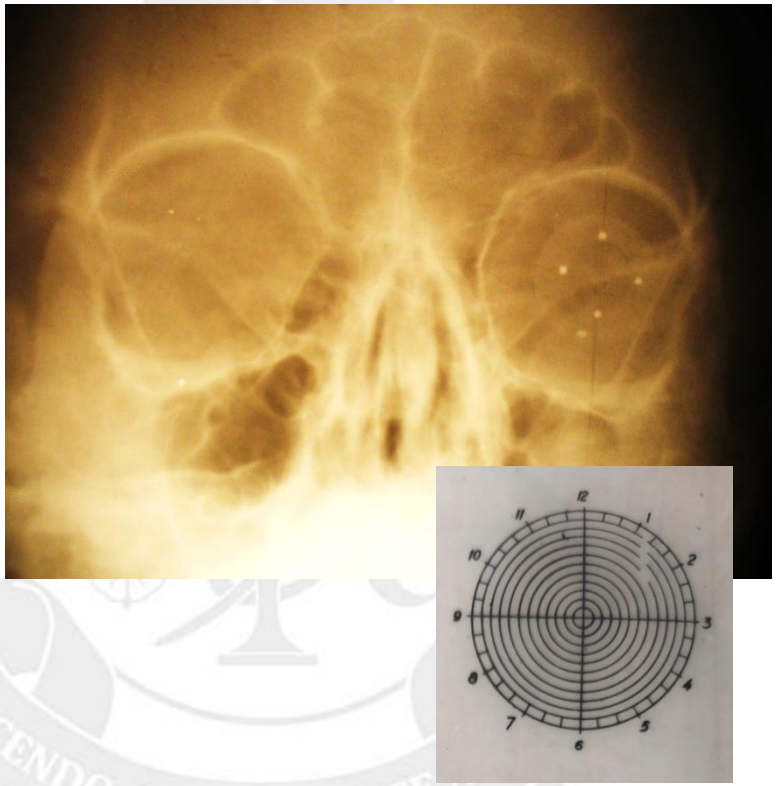
- Computed Tomography
- Comberg – Baltin Radiography
- Ocular ultrasonography

Radiographic Comberg – Baltin method of foreign body localisation:

- Comberg – Baltin device:
  - ring with the shape similar at eye anterior segment
  - wide about 5 mm and internal diameter equal with cornea diameter,
  - it is made from transparent for X-ray material (aluminum etc), with 4 small points implants from non - transparent for X-ray material (lead etc), positioned at step of 90° between them
  - the sterile device is placed after topic anesthesia on eyeball with position of his 4 points respectively at 12; 3; 6; 9 hours

Radiographic Comberg – Baltin method of foreign body localisation:

- foreign body and the four landmarks will be projected on the front cliché
- through the landmarks two lines are drawn - through those located horizontally at 3 and 9 o'clock - a straight line, and through those vertically located at 12 and 6 o'clock - the second line, creating a coordinate system, the center of which corresponds to the projection of the anatomical axis of the eyeball
- based on this cliché, two indices of location of the foreign body are appreciated:
  - *meridian (hours)*
  - *distance (mm) from the ocular anatomical axis*

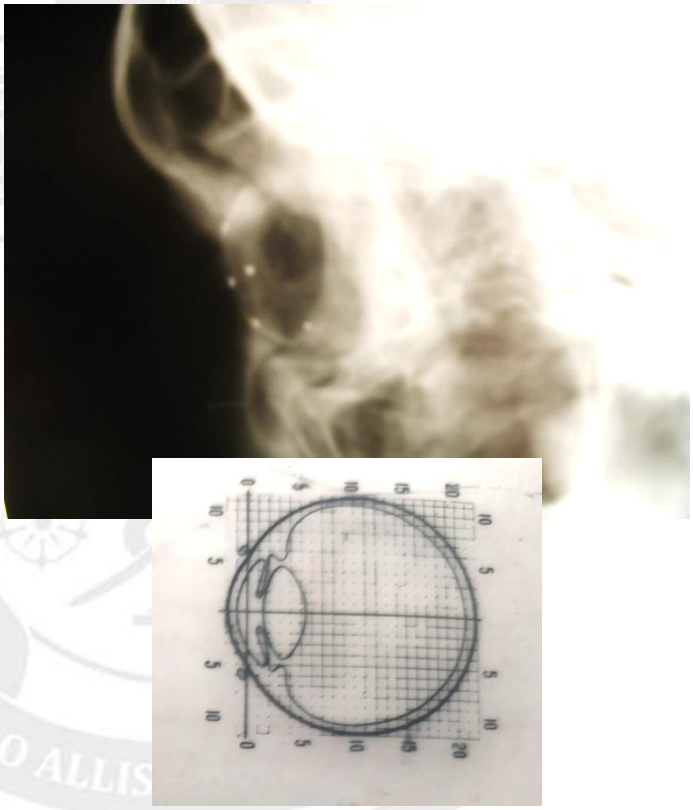


Radiographic Comberg – Baltin method of foreign body localisation:

- on the profile cliché will be present the image of the foreign body and - in the case of an ideally correct position - only three landmarks as result of overlapping of the 3 and 9 o'clock points

- it is considered that the right line drawn vertically through the 12 and 6 o'clock landmarks coincides with the plane of the ocular limbus

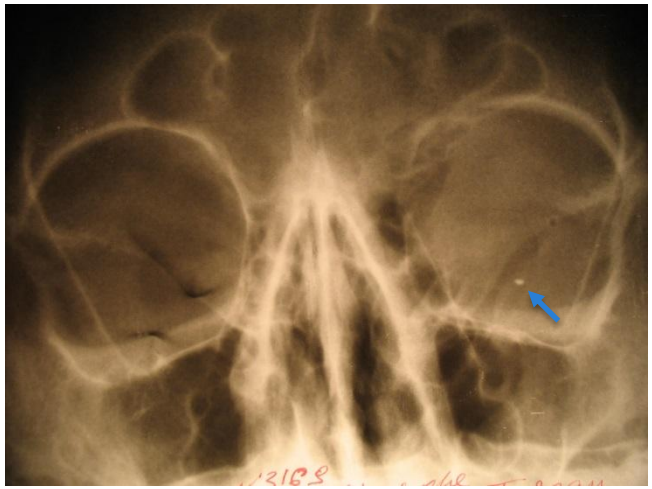
- based on this cliché, measuring the minimum distance between the image of the foreign body and this landmark line, the third location index is appreciated:
  - *depth of placement of the foreign body from the limbus (mm).*

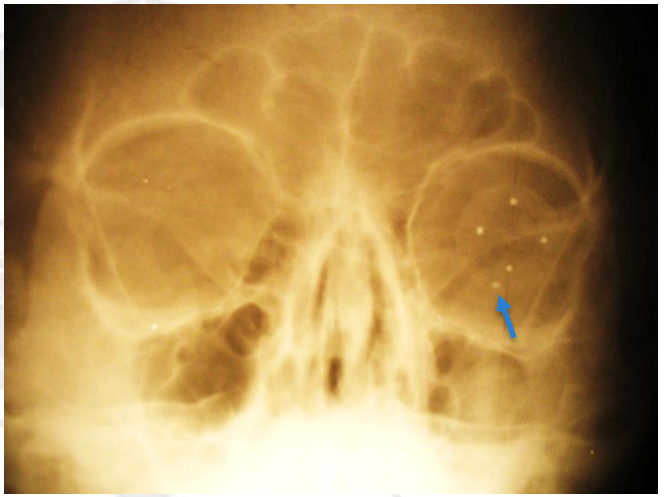


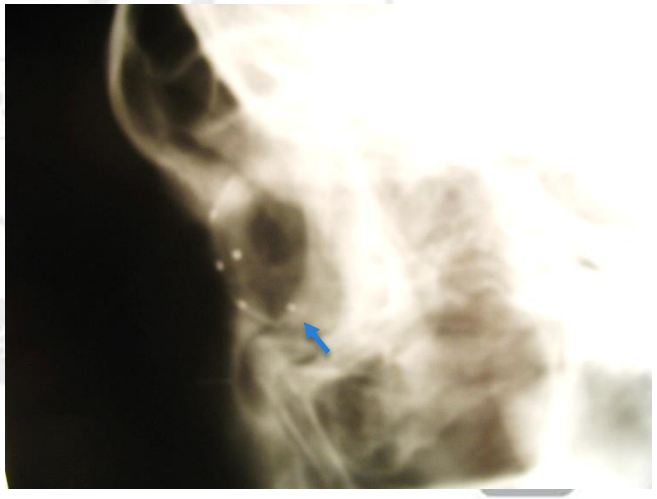
Having the three location indices:
- *the meridian*
- *the distance from the anatomical axis*
- *the distance from the limbus*

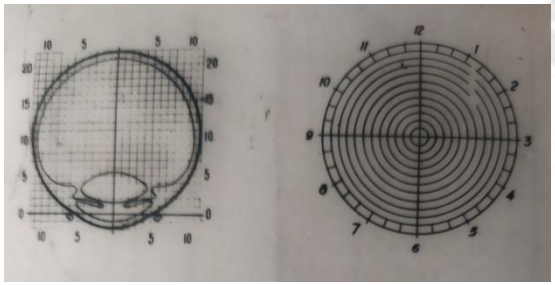
one can conclude about the position of the foreign body (intraocular, extraocular).

Radiographic Comberg – Baltin method of foreign body localisation:









First medical assistance in eye penetrating injury:

- antibacterials topic and sistemic,
- tetanus prophylaxis,
- sterile punch (preferable binocular for some immobilization of eye movements),
- transportation (decubitus dorsal position) of the patient by ambulance to specialized institution/department for emergency ophthalmological assistance

Specialized medical assistance in eye penetrating injury:

- It is performed in the following specialized medical institutions of the republic:
  - Clinical Republican Hospital “Timofei Mosneaga”
  - Clinical Municipal Hospital “Sfânta Treime”
  - Mother and Child Institute Children Clinical Republican Hospital “Emelian Coţaga”

Specialized medical assistance in eye penetrating injury include:

- penetrating wound surgery with its suturing and the maximum possible restoration of the anatomical and structural integrity of the ocular globe:

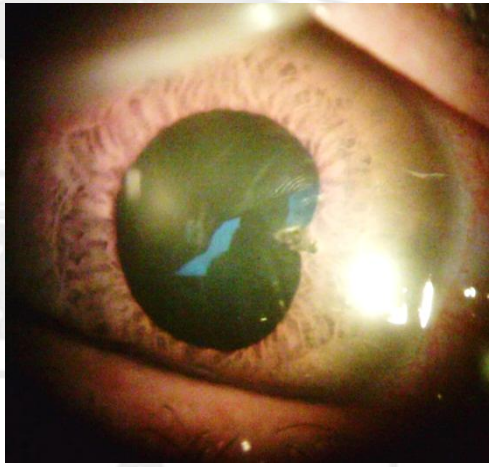
restoration of the anterior chamber, reposition of the iris, iridoplasty, extraction of the traumatic cataract, removal of the foreign intraocular body in case of its presence, etc;

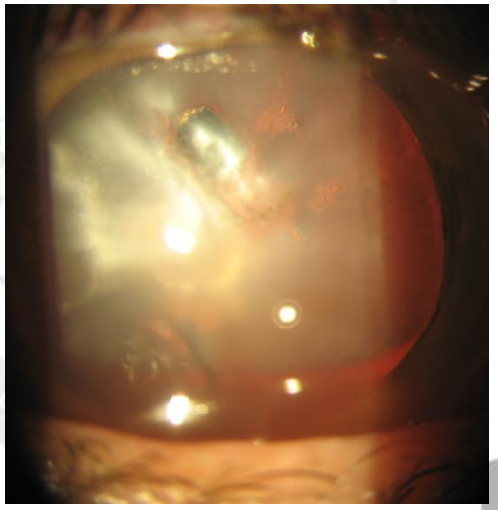
- topical and systemic drug remedies:

antibacterial, antiinflammatory (steroids, AINS), desensitizers; if it is necessary - mydriatics, diuretics, ophthalmohypotensive, hemostatic, resorptive etc.

Removal of the intraocular foreign body:

- from the anterior chamber with the forceps or magnet through:
  - penetrating corneal wound, if the foreign body is partially enclosed in the wound;
  - additional limbus / corneal incision;
- from lens - only if there is a traumatic cataract, which disturbs the visual functions; it is removed with the forceps or magnet together with the damaged lens;
- from the vitreous body





Removal of the intraocular foreign body from the vitreous:

- throuh the scleral penetrating wound with the forceps or the magnet, if the foreign body is partially enclosed in the wound;
- throuh *pars plana* of the ciliary body in the meridian of localization with the magnet, if the foreign body is magnetic and floats in the vitreous body;
- transpupillary by magnet from the vitreous in pupil region and then from the anterior chamber when the lens is missing or traumatized and needed to be extracted;
- diascleral with the magnet throuh scleral incision at the point of position of the foreign body, which is very difficult to do when the foreign body is placed at the extremity of the posterior ocular pole with the necessity in these cases of the sectioning and subsequent repositioning of one or more oculomotor muscles;
- transvitrean - modern method of election - by vitrectomy in all cases of localization of the foreign body in vitreous: free floatation, preparietal, incarcerated in tunics, including non-magnetic foreign body.

Complication of penetrating eye injury:

- Early:
  - uveitis
  - hyphema, hemophthalmos
  - endophthalmitis
  - traumatic cataract
  - lens dislocation
  - IOP variation
  - ciliocoroidal detachment
  - retinal detachment
- Late:
  - metallosis
  - sympathetic ophthalmia
  - post traumatic glaucoma
  - corneal opacity/scarring
  - retinal detachment
  - eyeball atrophy

Metallosis

- slow progressive uveitis, caused by a foreign metallic intraocular body not detected in time as a result of it oxidation, decomposition and the toxic action of these oxidation products on the intraocular strutures;
  - in the case of an iron fragment, the *siderosis* will develop (changing the color of the iris - "rust", etc.),
  - in the case of a copper fragment - *chalcose* (development of complicated cataracts, etc.);

Treatment includes administration of anti-inflammatories, desensitizers and removal of the foreign body, which does not guarantee stopping the pathological process.

From these reasons, the early detection and removal of IOFB is extremely important.

Endophthalmitis

- Infection/suppuration of the penetrating eye wound and of the contents of the eyeball; in this condition is indicated:
  - local massive antibacterial treatment: eye drops, subconjunctival, parabulbar and intravitreal injections;
  - systemic antibacterial treatment;
  - surgical treatment - vitrectomy;

In case of one negative dynamic when is developed panophthalmitis the eyeball is eviscerated.

Sympathetic ophthalmia

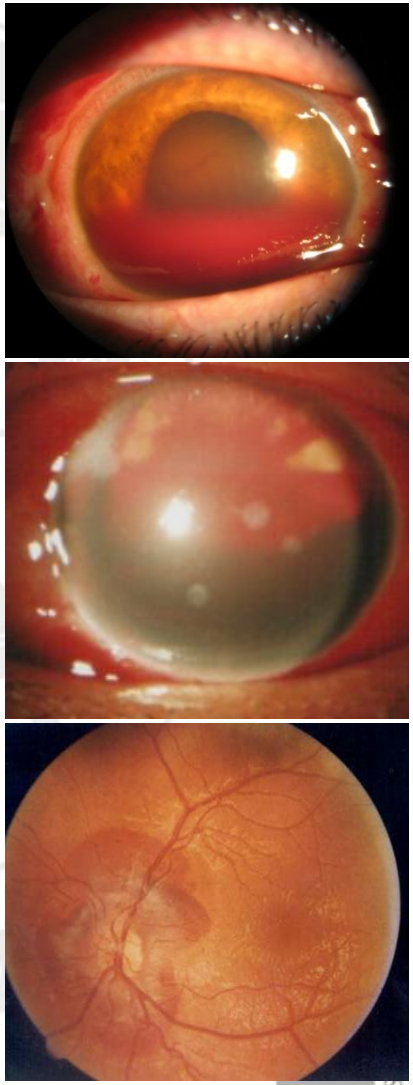
- development of a severe uveitis in the non-traumatized congener eye as result of autoimmune response to ocular autoantigens, triggered by the deterioration of the hemato-ophthalmic barrier into the traumatized eye;
  - general and local anti-inflammatory and desensitizing treatment with wide use of steroids is given;
  - for the prophylaxis of sympathetic ophthalmia is recommended to enucleate the traumatized eye when it retains an severe persistent uveitis, tends to glob atrophy with the absolute lack of visual functions in 2 weeks after the trauma

Eye blunt trauma

- this is a trauma caused by a blunt, not-sharp object.
- they can be direct (punch, ball, champagne stopper etc) and indirect (following explosions, cranio-cerebral traumas etc)
- the usual clinical manifestations:
  - haemorrhages of different location and volume (intensity)
  - ruptures of the ocular structures
  - retinal edema
  - intraocular pressure disorders

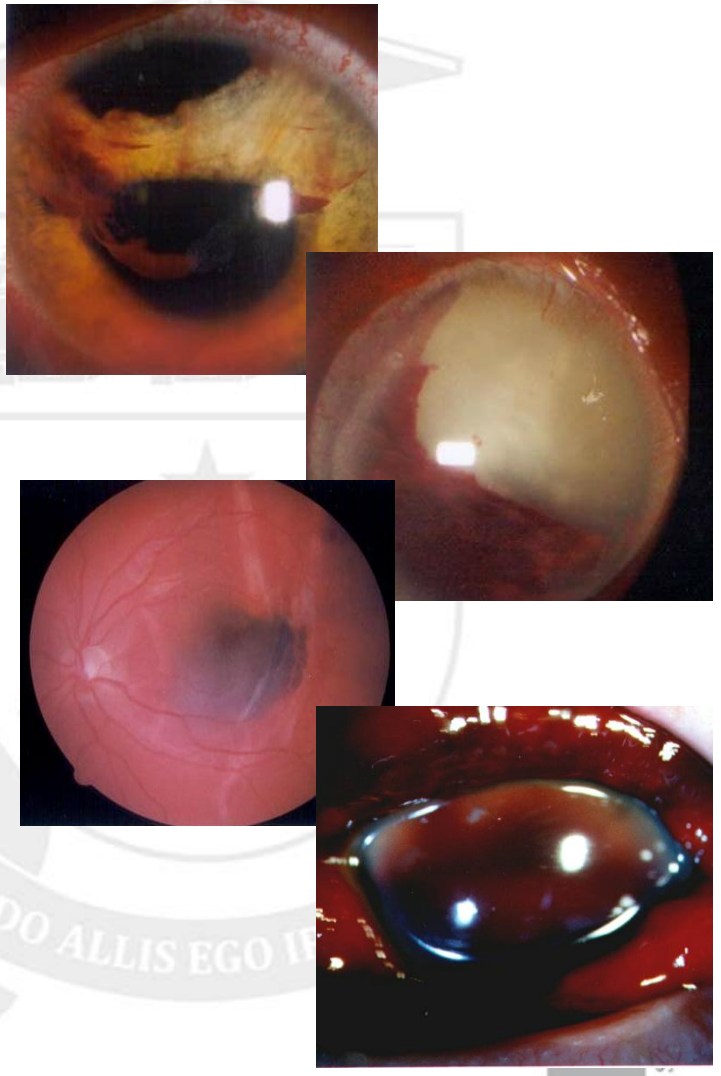
Eye blunt trauma hemorrhages:

- ecchymoses, subcutaneous hemorrhage, eyelid hematoma;
- retrobulbar hematoma - manifests through exophthalmos, ophthalmoplegia, mydriasis (the clinic is associated with superior orbital fissure syndrome);
- subconjunctival hemorrhages - may cause diagnostic difficulties, as they not permit visual inspection of the sclera; in the case of massive subconjunctival hemorrhages it is indicated to perform the circular or sectoral conjunctivotomy in the area of hemorrhage for do the sclerotic revision;
- hyphema - blood in the anterior chamber, in severe cases it can be total, which causes ocular hypertension or even secondary glaucoma with the appearance of hematocornea (hematic corneal imbibition); usually the hyphema appears immediately after the trauma, but in the period 3-7 days after the trauma there is an increased risk of the occurrence of the secondary hyphema, which usually has a much more unfavorable evolution;
- hemophthalmos - is usually considered the blood in the vitreous, but in fact it is a more general notion, which expresses any bleeding in the eyeball cavity;
- retinal hemorrhages: preretinal, retinal, subretinal



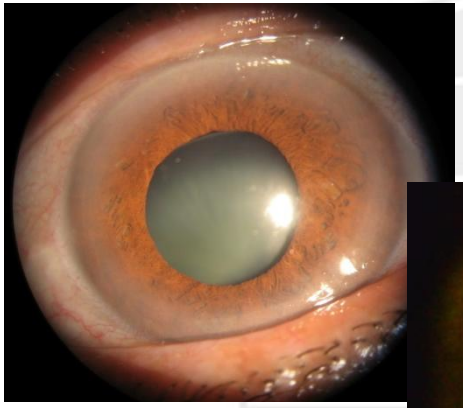
Blunt trauma ruptures of eyeball structures:

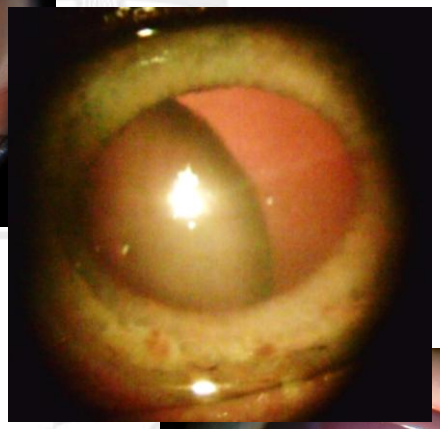
- of iris:
  - pupilar sphyncter (traumatic mydriasis);
  - iridodialisis;
- recesus of anterior chamber angle;
- cyclodialisis;
- traumatic cataract; Vossius ring (pigmentary impregnation of pupil on anterior surface of the lens);
- ruptures of choroid (usually localizated in central zone);
- retinal tears (periferical, central);
- retinal detachment;
- subconjunctival glob ruptures in very hard eye blunt trauma

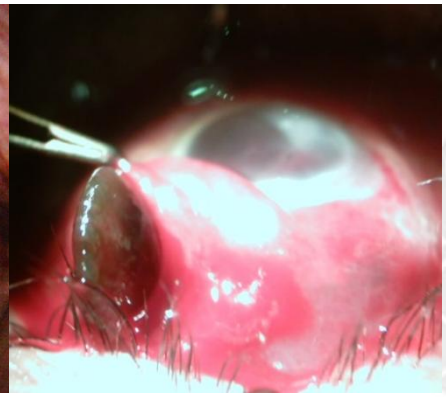


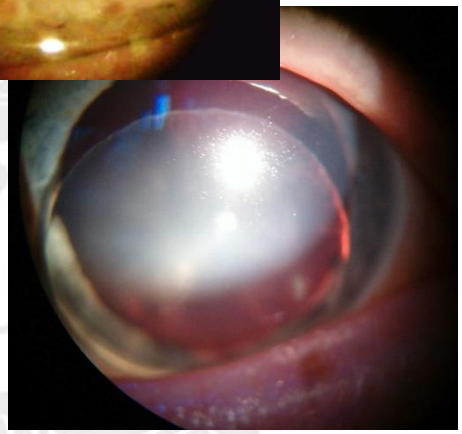
Blunt trauma ruptures of eyeball structures:

- ruptures of the Zinn ligaments with dislocation of the lens in anterior chamber, in vitreous or in scleral wound; can provoke the secondary facotopic glaucoma









Retinal edema in eye blunt trauma:

- peripheral;
- central - "Berlin edema" - edema of the central area of the retina, milky-white appearance; usually has an evolution with a favorable prognosis.

Treatment of eye blunt trauma:

- Medical treatment:
  - hemostatics during first days (aminocapronic ac. etc);
  - antiinflamatories (topic steroids);
  - angioprotectors;
  - antioxidants (vitamines A, E, C etc);
  - diuretics;
  - hypotensives (in high IOP);
  - resorbtives (excepted first days)

Surgical treatment of eye blunt trauma:

- Eye anexes:
  - surgery of eyelid injuries;
  - surgery of conjunctival wounds;
  - reconstruction of lacrimal ducts;
  - orbitotomy (in hard retrobulbar hematoma);

- Eyeball:
  - scleral revision (when is suspected scleral rupture covered by blood);
  - surgery of a scleral wound;
  - paracentesis with evacuation of blood from anterior chamber in total hyphema;
  - removed of dislocated lens:
    - from anterior chamber;
    - from vitreous, specially in case of eye hypertension;
  - filtering surgery in secondary glaucoma;
  - extraction of a traumatic cataract ;
  - implantation of IOL by divers fixation.

Eye burns:

- *Thermal* - first involves the eyelids; but can be exposed to combustion and the eyeball;

- *Chemical* - they are more common and can be caused by various chemical agents, used in agriculture, industry, construction, alimentation, etc.

Eye burns:

- *with acids,* which cause the coagulation of the albumin, in result obtaining a protective "layer", which prevents deeper penetration of the chemical agent, thereby limiting its harmful action;

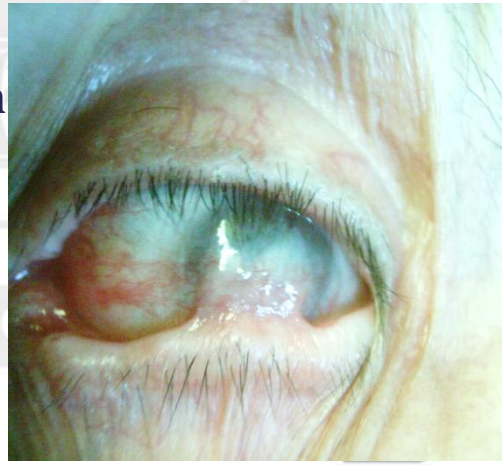
- *with alkaline,* they are considered more dangerous than those caused by acids, because these chemicals cause the colliquation of the albumin and penetrate deeper and deeper into the tissue.

Eye burns:

- *mild* - it is characterized by corneal syndrome, ocular congestion, pronounced edema of the conjunctiva, partial or even total deepithelialisation of the cornea without opacity; rehabilitation is complete without sequels;

- *middle* - is characterized by corneal syndrome, ocular congestion and pronounced conjunctival edema (chemosis), sometimes with areas of ischemia; total deepithelialisation of the cornea with opacity areas; association of persistent uveitis, ocular hypertension; rehabilitation is slow and incomplete, with the organic (opacities, corneal vascularization, etc.) and functional sequelae;

- *severe* - it is characterized by corneal syndrome, extensive conjunctival ischemia, necrosis zones, complete opacity of the cornea, severe uveitis, ocular hypertension; rehabilitation is difficult with severe organic sequelae (complete corneal opacity, symblepharon, secondary glaucoma, etc.), practically without improving of visual functions.



Eye burns treatment:

- the first assistance;
- the specialized treatment:
  - medical;
  - surgical

First aid in eye chemical burns:

- the immediately irrigation of the injured eye with copious quantities (≈ 2 litri) of salin solution (0,9%) or clean water about 30 – 40 minute;
- removing of the solid particles from the conjunctival bag (under the upper and lower eyelids)

Medical treatment in eye burns:

- prophylaxis of infection complication (antibacteriens topic);
- induction of regeneration, epitelisation, contact lens etc;
- stop of eye inflammatory response (antiinflamatories topic, systemic, mydriatics);
- regulation of IOP (hypotensives topic, diuretics);
- prevention of eye burns complications (like symblepharon, corneal opacity etc)

Surgical treatment in eye burns:

- excision of a necrotic tissue;
- anterior chamber paracentesis in the first day for evacuation of aquos humor with chemical agents (in special in alkaline burns);
- cover of cornea by amniotic membrane;
- treatment of complications:
  - reconstruction of conjunctival bag (symblepharon, scars etc);
  - filtering surgery in secondary glaucoma;
  - keratoplasty;
  - keratoprotesis

Radiational eye trauma:

- are caused by different types of radiation:
  - UV;
  - infrared;
  - ionizing
  - phototrauma etc.
- they can manifest clinically by conjunctivitis, keratitis, cataract, retinitis, etc.

UV eye trauma:

- clinical manifestation:
  - corneal syndrome, usually bilateral and extremely pronounced;
  - corneal epitheliopathy;
  - treatment, most often, symptomatic;
  - favorable prognosis with a practically total recovery in 24 hours.