

# EYE TRAUMA

## OBJECTIVES

Upon completion of this lecture, the learner should be able to:

1. Identify the mechanisms of injury which cause eye trauma.
2. Analyze the pathophysiologic changes as a basis for key signs and symptoms of eye trauma.
3. Discuss the nursing assessment of patients with eye trauma.
4. Based on the assessment data, recall appropriate nursing diagnoses associated with eye trauma.
5. Plan appropriate interventions for patients with eye trauma.
6. Evaluate the effectiveness of nursing interventions as related to patient outcomes.

## INTRODUCTION

### Etiology/Mechanism of Injury

The usual mechanism of injury resulting in trauma to the eye and lid is blunt trauma. Rapid deceleration associated with motor vehicle crashes, falls, airplane crashes, or recreational sports injuries can cause substantial damage as the vessels and nerves are torn from delicate eye structures. Penetrating injuries from missiles, such as bullets, knives, explosion debris, are more often associated with hostile or battlefield situations. Additionally, penetrating injuries to the eye result from broken glasses, hard contact lenses, letter bombs, fireworks, exploding car batteries and soft drink bottles, and aggressive recreational sports activities. Penetrating injuries are also more frequently seen in the elderly person who has been subjected to severe blunt trauma.(1) Chemical burns, another type of penetrating injury, may damage the eyes, lids, and surrounding structures.

Actinic injuries occur from exposure to ultraviolet light. The injuries produce diffuse, painful keratitis, and are associated with flash burns from welding devices, sunlamp usage, or exposure to snow-reflected sunlight.

While many eye wounds are due to minute fragments and are minor, these eye injuries are extremely painful and anxiety producing. Diminished vision or blindness secondary to trauma affects not only the self concept of individuals, but also their ability to be a functioning and productive member of the work force and society.

### Usual Concurrent Injuries

Due to the location of the eyes, eye trauma is frequently seen concurrently with head and facial trauma. It is critical to recall that actual life-threatening injuries **MUST** be treated before turning attention to the care of a painful, traumatized eye.(2)

Severe, penetrating trauma to or near the eye can easily penetrate the fragile facial/sinus bones and cause direct injury to the brain, sever the optic nerve or extraocular muscles (without obvious external trauma to the visible sclera or anterior chamber), damage the lower lid, and/or disrupt the lacrimal apparatus. If the supportive tarsal plate is traumatized, the shape of the upper lid is altered significantly. Even when the lid is not completely penetrated, assessment of damage to underlying structures especially the cornea is necessary. Also lateral zygomatic or medial ethmoid orbital fracture can result in ligament avulsion.

### **Other Significant Facts**

The assessment of eye injuries should NOT be forced in the field. The lids should NOT be forced open without the judicious and appropriate use of prescribed topical anesthetic agents to facilitate opening of the lids and examining the eye without further injury. Additionally, the patient with eye injuries should not leave the emergency care setting without a complete exam of eye injuries.

Because eye injuries can quickly and easily result in diminished or lost vision and the inability to function in one's occupational field, these injuries are a high priority for intervention. Eye trauma is triaged second only to those conditions requiring immediate resuscitative efforts. The examination of a swollen eye, deferred for several days, may contribute to serious injury or vision loss in both eyes.

## **ANATOMY AND PHYSIOLOGY**

The eyelids are soft, protective tissue composed of skin, conjunctiva, and muscle. It is the tarsal plate that gives the lids their shape (see Figure 09-01). The skin of the lid is thin and very prone to trauma and subsequent edema. Protecting all of the eye except the cornea, the conjunctiva appears as a pink lining when the lids are everted and seems white as it overlies the white sclera. The lacrimal glands and conjunctiva together provide a lubrication function which is protective as it prevents drying of the eye and washes away debris. The tears drain via the puncta, the slit-like openings on the inner lower lid, into the lacrimal duct and sac via the nasolacrimal duct to the nose.

The eye itself is soft and spherical and is a sensory organ, focusing light on the sensory retina. The iris muscles control the pupil size and the amount of light while the six muscles of the ciliary body adjust the lens thickness to achieve focus. These muscles are controlled by cranial nerves.

The anterior chamber which contains the aqueous humor is visible on inspection and is in front of the lens (see Figure 09-02). With an ophthalmoscope one can view the fundus and visualize the retina, fovea, choroid, macula, disc, and retinal vessels. The posterior chamber is in back of the lens and contains the liquid vitreous humor.

Figure 09-01  
Anatomy of the Eye

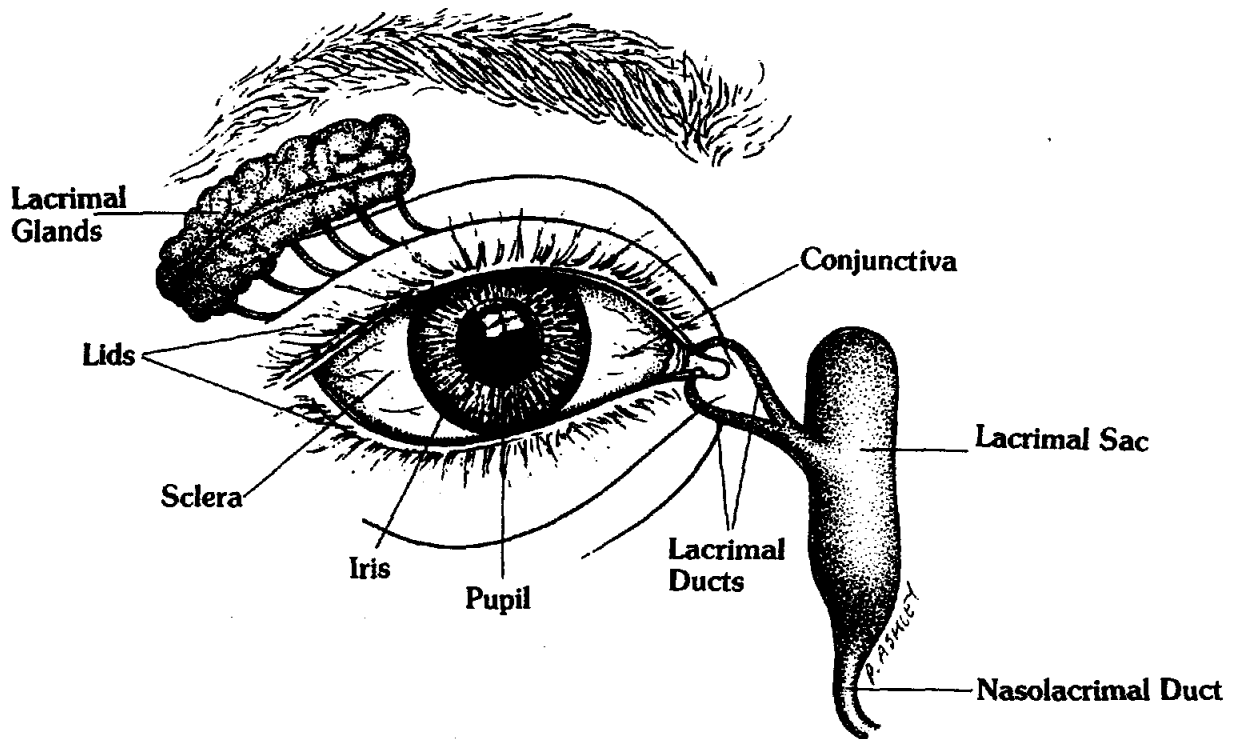
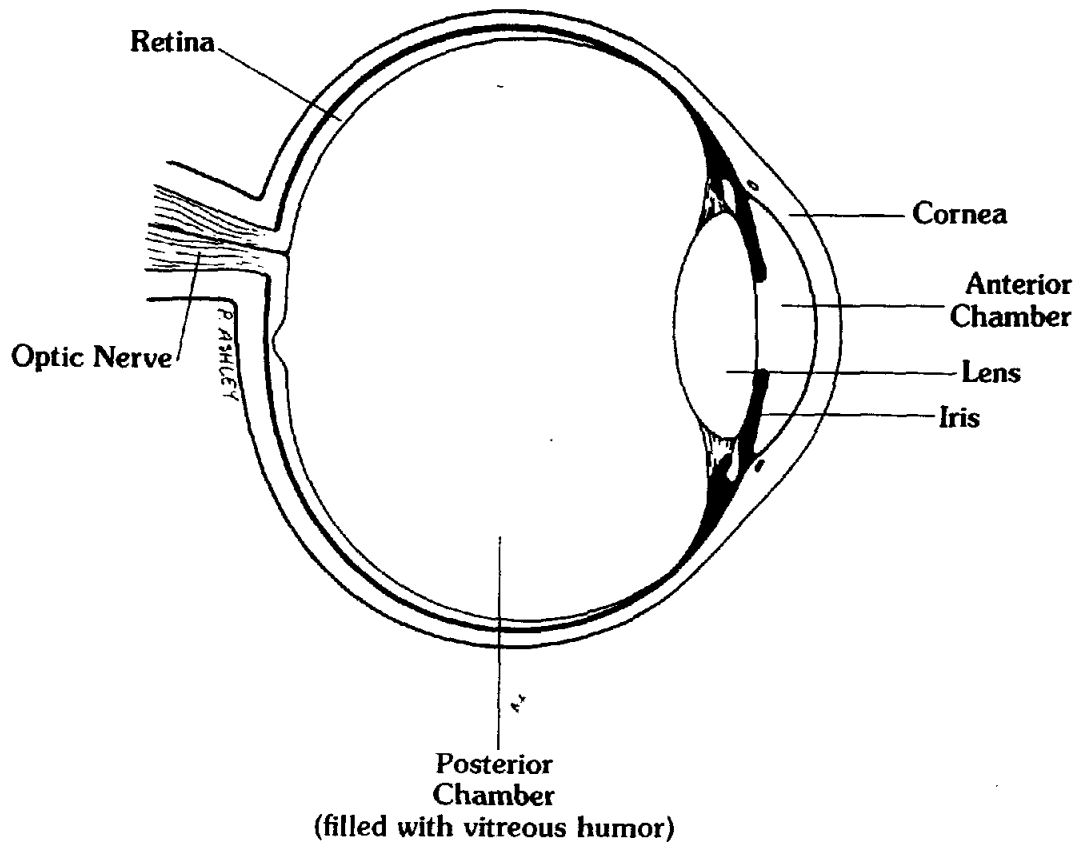


Figure 09-02  
Cross Section of the Eye



## PATHOPHYSIOLOGY AS A BASIS FOR SIGNS AND SYMPTOMS

Contusion of the soft tissue of the orbit with edema, bleeding, and discoloration of the lids results in one of the most frequently and readily encountered signs of eye trauma, the contused or "black" eye. Soft tissue lacerations, especially of the lids, result from either blunt trauma to the thin skin of the lids as they decelerate on the underlying bone or from penetrating trauma. Ptosis seen in eye trauma frequently results from an upper lid injury, laceration of the levator palpebrae superioris tendon, or accompanying gross edema.

Blurred vision can occur from dislocated lens, optic nerve lesions, or retinal hemorrhage. Diplopia or double vision can be bilateral or unilateral. Bilateral diplopia can result from contusion, tears, or trapping of the extraocular muscles (damaged cranial nerves III, IV, or VI) or limited globe movement associated with fractures, hematomas, or foreign bodies. Unilateral diplopia results from a subluxed lens, edema, hematoma in the orbit, macular edema, or superior oblique or rectus muscle damage.

Blindness can occur in anterior or posterior chamber bleeds from blunt trauma, from optic nerve injuries, or globe destruction. Sudden or immediate blindness can result from a hyphema which fills the anterior chamber with blood, vitreous hemorrhage, severed optic nerve with or without basilar skull fracture, globe disruption with extruded contents, occipital injury, or intracerebral hemorrhage.(2)

Blindness with an onset within hours of the trauma is associated with corneal ulcerations, central retinal artery occlusions from dressings or patches that are too tight, and retinal detachment.(2) Blindness with a late onset is usually caused by retinal detachment, ocular infection, or traumatic cataracts.(2)

If on gentle palpation the globe feels "soft", the eye may be extruding through a lacerated conjunctiva. Vitreous or aqueous humor may be visible on or extruding from lacerations of the globe itself.

Blood levels seen inside the cornea result from anterior chamber bleeds. With the effect of gravity, the blood settles or "levels" when the patient sits upright.

A grossly pink or red eye is seen in subconjunctival hemorrhage as blood collects between the conjunctiva and sclera. While the condition may be frightening to the patient, this injury is generally not vision-threatening.

*With no color change*

Pain is associated with most eye trauma. It results from irritation to the lid or globe by minute or large foreign objects, from extensive edema, or from underlying fractures.

## NURSING CARE OF EYE TRAUMA

### Assessment

#### History

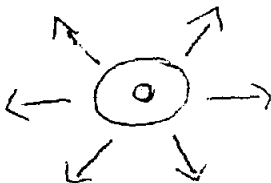
- What was the mechanism of injury?  
What, when, where, and how the injury occurred identifies the risk of other concurrent injuries
- Was the patient wearing protective eyewear such as goggles?  
Protective eyewear serve as a barrier to protect and to slow the velocity of foreign objects.

- Was a foreign object involved? Is it still in the eye?
- Was the foreign object metal, wood, or glass?  
Metal objects are of particular concern as rust rings can form in the cornea from iron fragments. The iron rust ring formation may further impede vision as well as cause corneal deterioration if not removed.
- Was the patient's vision normal prior to this injury, and how is the vision now? Is it present, blurred, or double? Was onset gradual or acute?
- Is there pain with bright light?  
This will identify the possibility of photophobia.
- Does the patient usually wear corrective lenses, glasses, or soft or hard contact lenses? Were they on or in at the time of the injury and are they on or in now?  
Shattered corrective lenses may become foreign objects to penetrate the eye. Contact lenses should be removed as soon as possible.
- Does the patient use eye medications, have a history of eye problems, hypertension, diabetes, or glaucoma?

## Physical Assessment

### INSPECTION

- Note lid edema and ecchymosis
- Observe ptosis
- Assess lacerations
- Identify gross trauma to the sclera, iris, and cornea
- Identify gross/visible foreign objects
- Note scleral and conjunctival redness, lacerations, tearing, and proptosis/enophthalmus or esotropia/exotropia
- Note blepharospasm or blinking
- Assess extraocular movements (EOMs), all six directions bilaterally
- Assess pupil size, equality, shape, and direct and consensual response to light



*“Chemosis”  
Jelly like appearance.*

### PALPATION

- Gently palpate eye and surrounding area for pain or tenderness  
Obviously traumatized globe or eye with a penetrating or foreign object should NEVER be palpated as this increases the danger of penetration and/or increased intraocular pressure.
- Assess for anesthesia, caused by damage to the supraorbital nerve
- Palpate for tenderness, crepitus, depression of frontal bone structures, and notching of the supraorbital ridge which indicate an increased risk of eye trauma

## Diagnostic Procedures

### X RAY

X rays are often necessary to identify the presence of or extent of penetration by a foreign body.

## OTHER

It is often necessary to obtain an order for topical anesthesia to enable the patient to cooperate with diagnostic exams.

- Visual acuity with and without corrective lenses for each eye  
This can be done by testing if and how clearly the patient can: 1) visualize bright light and finger motion or a moving object, 2) count the number of fingers held up by the examiner, and 3) read a wall mounted Snellen chart or hand held Snellen card.
- Visual fields from all directions with and without corrective lenses  
These findings assist in documenting the presence of weak, torn, or paralyzed muscles.
- Fluorescein stain  
Staining identifies de-epithelialized areas made visible under cobalt blue light. Abraded or lacerated areas show up as a green area under this light.(1)
- Slit lamp exam  
This exam identifies hyphemas and foreign bodies in the anterior chamber.

## Nursing Diagnoses

### Actual

- Pain, acute, related to tissue injury
- Self-care deficit related to impaired response to visual stimuli
- Self-concept, disturbance in: role performance, related to possibility of permanent damage to vision

### Potential

- Anxiety, related to diminished or lost vision

### Expected Outcomes

- Pain will be controlled as evidenced by:
  - Patient will rate pain on a 1-10 scale as decreased or absent
  - Absence of autonomic response to pain
- Patient will perform activities of daily living at highest level possible.
- Patient will verbalize understanding of alterations in role performance necessary to function at desired level.
- Patient will report decreased anxiety and/or demonstrate decreased restlessness.

## Interventions

### Critical/Vision-saving

- Apply prescribed topical anesthesia (tetracaine, proparacaine, butacaine, ophthalmic) to prevent blepharospasm, to facilitate adequate assessment, and to diminish discomfort for traumatic injuries. (See page IX-9 for Chemical Burns.)
- Immobilize visible penetrating objects to prevent further damage

- Cover/patch BOTH eyes with a light dressing to prevent eye motion and further pain and injury *Edema Phos.*  
NO pressure should be placed on the globe during this procedure since pressure can induce further damage or bleeding. The patch should be taped from the medial forehead to lateral cheek area and secured tightly enough to prevent blinking.
- Elevate head of bed. Instruct patient not to bend forward as this can increase intraocular pressure and thus cause pain and additional damage to the eye.

### Additional Interventions

- Reassure and continue to orient patient to surroundings to decrease anxiety and increase cooperation with treatment  
Ensure one staff person or significant other remains with patient.
- Facilitate referral to ophthalmologist if there is blurred vision, diplopia, corneal clouding, hyphema, or changes in extraocular muscle function, penetration
- Patch eye if topical anesthetic has been instilled for protection of the eye until anesthesia wears off
- Apply cool packs after assessment and initial interventions to decrease soft tissue edema and associated discomfort
- Instruct about prevention of future injuries

### Interventions to Prevent Complications

- Place NO ocular steroids on eye tray to prevent misuse. These should be used only by an ophthalmologist as they may induce infections and glaucoma. (3)
- Use new tube/bottle of medication with each patient to prevent cross contamination  
Fluorescein strips rather than drops are preferred for the same reason.
- Do not send topical anesthesia home with patient  
Continued use can promote breakdown of the corneal epithelium. (3)
- Instruct the patient to wear sunglasses to decrease photophobia and associated discomfort and excess tearing
- Instruct patient not to squeeze eyelids as this increases discomfort and potential for injury
- Keep eyes moist to prevent drying and exposure keratitis  
Lubricating ointments should be placed within the lower lid margins prior to patching.
- \* ● Administer tetanus immunization as indicated \*
- Administer prescribed antibiotics to prevent infection in penetrating injuries
- Administer prescribed antibiotics and steroids to prevent sympathetic ophthalmia which can develop in the uninjured eye after unilateral penetrating eye trauma  
If not treated immediately, this can cause bilateral panuveitis, possibly an autoimmune response, which is a vision-threatening complication.

## Ongoing Assessment

- Monitor primary survey for life-threatening crises
- Monitor pain for changes in characteristics, intensity, or location
- Monitor vision for decrease or sudden loss
- Assess globe for extrusion of contents especially after change in body position

## SELECTED EYE EMERGENCIES

### | Hyphema

Hyphemas usually are the result of blunt trauma to the eye which results in a tear in the iris vasculature or subconjunctival hemorrhage.

### Signs and Symptoms

- Blood in the anterior chamber  
More difficult to detect in brown eyes than in blue eyes.
- Decreased vision and increased pain  
Due to increased intraocular pressure and distension of intraocular structures.

### Interventions

- Sit the patient in an upright position to assist in detecting the pooled blood.(1)
- Patch bilaterally  
Immobilizes eyes and provides for resolution in hyphemas of 50% or less. Depending on the size of the hyphema, surgical intervention may be necessary.(4)
- \* ● Monitor for rebleeding, especially in the first five days after the trauma. \*

### Penetrating Trauma/Ruptured Globe

Penetrating trauma is usually observed in conjunction with impalement injuries from knives, pencils, knitting needles, or bullet wounds. A ruptured globe is also seen, particularly in the elderly trauma victim, as a result of blunt trauma to a very thin region of the globe at the limbus or below the rectus.(1) These penetrating injuries sever nerves and muscles of the eye with or without rupture of the globe itself. If the floor of the anterior cranial fossa is penetrated, the frontal lobe of the brain is readily injured; meningitis, brain abscess, internal carotid artery tears, or hemorrhage can result. Retinal detachment with painless "light flashes" and blurred vision often accompanies trauma (contusions) to the globe.

### Signs and Symptoms

- Loss of vision
- Extreme pain and anxiety
- Visible impaled or penetrating object, e.g. knife, knitting needle
- Visible hemorrhage
- Extrusion of vitreous or aqueous humor
- Decrease in intraocular pressure - eye will feel softer on palpation than other eye.



## Interventions

- Immobilize impaled or penetrating objects immediately to prevent further damage to intraocular structures and surrounding tissue
- Elevate head of bed to decrease intraocular pressure
- Patch or bandage bilaterally
- Instill NO medications if the trauma is perforating
- Facilitate an ophthalmology consult
- Prepare for admission to the hospital
- Prepare for immediate surgical intervention

## Chemical Burns

Chemical burns of the eye occur primarily in industrial settings. Acid and alkali burns cause destruction of epithelial tissues and the conjunctiva with subsequent scarring. Organic irritants such as pesticides and brake fluid usually cause edema of the cornea and conjunctiva but damage is usually temporary. (3) Proper identification of the chemical agent involved, its concentration, degree and duration of exposure, and prehospital care administered are critical, as well as whether the injured eye was irrigated at the time of injury with large amounts of water. Acid burns tend to penetrate tissue slowly or superficially, but can result in vision loss if not adequately treated. Alkaline substances are proteolytic and continue to burn, destroy, or lyse tissue resulting in ischemia and necrosis until they are removed.

## Signs and Symptoms

pH

- Severe pain
- Opaque cornea may be present

## Interventions

As indicated in "Nursing Care of Eye Trauma" plus:

- Irrigate immediately with running water or normal saline. Be careful not to contaminate opposite eye, irrigate from inner to outer canthus for 30-60 minutes with lids open for acid burns and 60 minutes for alkali.
- Assist with/remove any foreign objects
- Check pH of eye surface periodically until the pH is 7.3-7.7 and again ten minutes after irrigation is discontinued. \*
- Instill prescribed topical anesthesia intermittently to diminish pain and increase ease of irrigation.
- Instill prescribed antibiotic drops
- Patch as indicated
- Instill prescribed cycloplegic drops to relieve ciliary spasm and mydriatic agents to dilate pupils.
- Facilitate ophthalmology consult, reevaluate visual acuity and injury.

IRITIS: Red eye & Ciliary Flush.  
Reduced Visual Acuity.  
Photophobia  
Watery eye ++  
Small Round pupil → OR V shaped adhesions  
Pain +++  
Cycloplegic drops to dilate eye.

## TRIAGE

### Emergent

- Sudden loss of vision with history of trauma
- Impaled or penetrating foreign object
- Severe contusions with evidence of increased intraocular pressure
- Hyphema
- Iris tears
- Lacerated globe
- Chemical burns  
*Acute IRITIS.*

### Urgent

- Traumatic mydriasis (dilation of pupil) with blurred vision or diplopia
- Severe lid lacerations
- Disturbance in vision in patient with history of glaucoma
- Actinic injuries

### Nonurgent

- Ptosis
- Soft tissue edema, ecchymosis without vision change

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