

A decorative graphic on the left side of the slide, consisting of a network of light blue lines and small circles, resembling a circuit board or a neural network, extending from the top to the bottom of the frame.

FOR YOUR EYES ONLY: CORNEAL ABRASION IN ANESTHESIA CARE

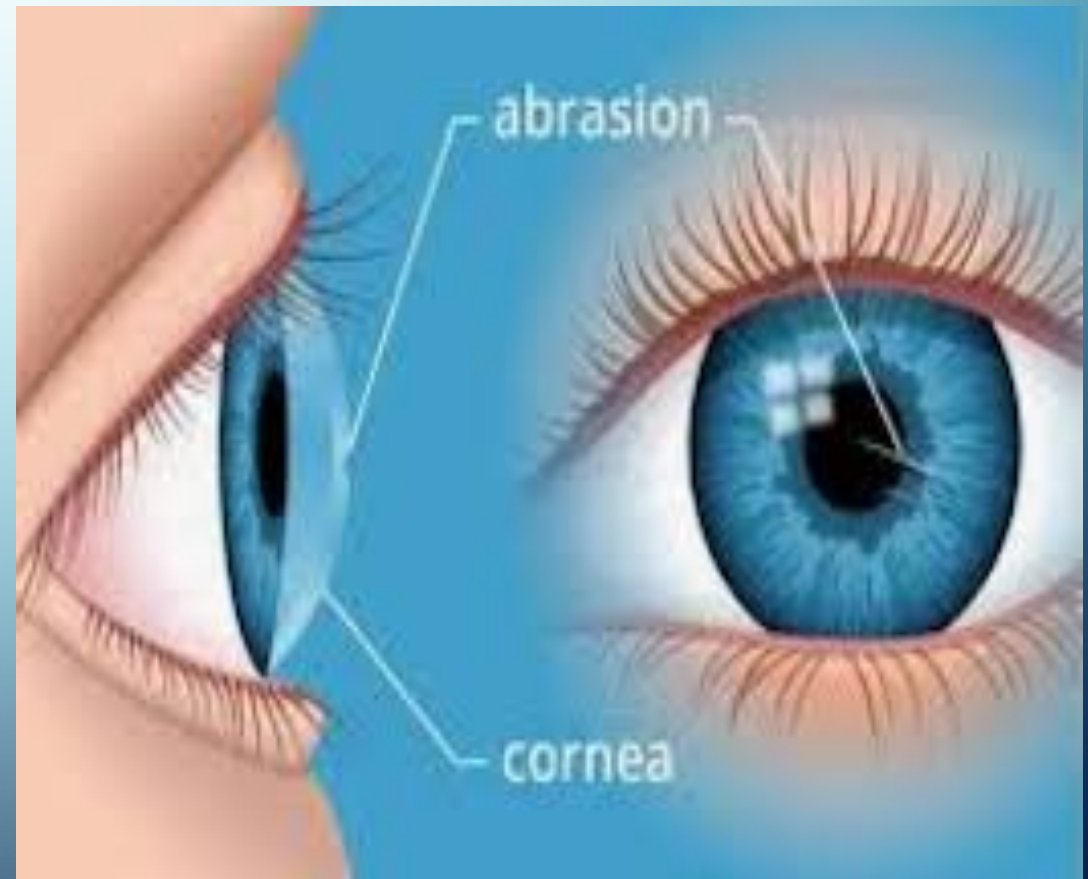
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EYE ANATOMY: CORNEA

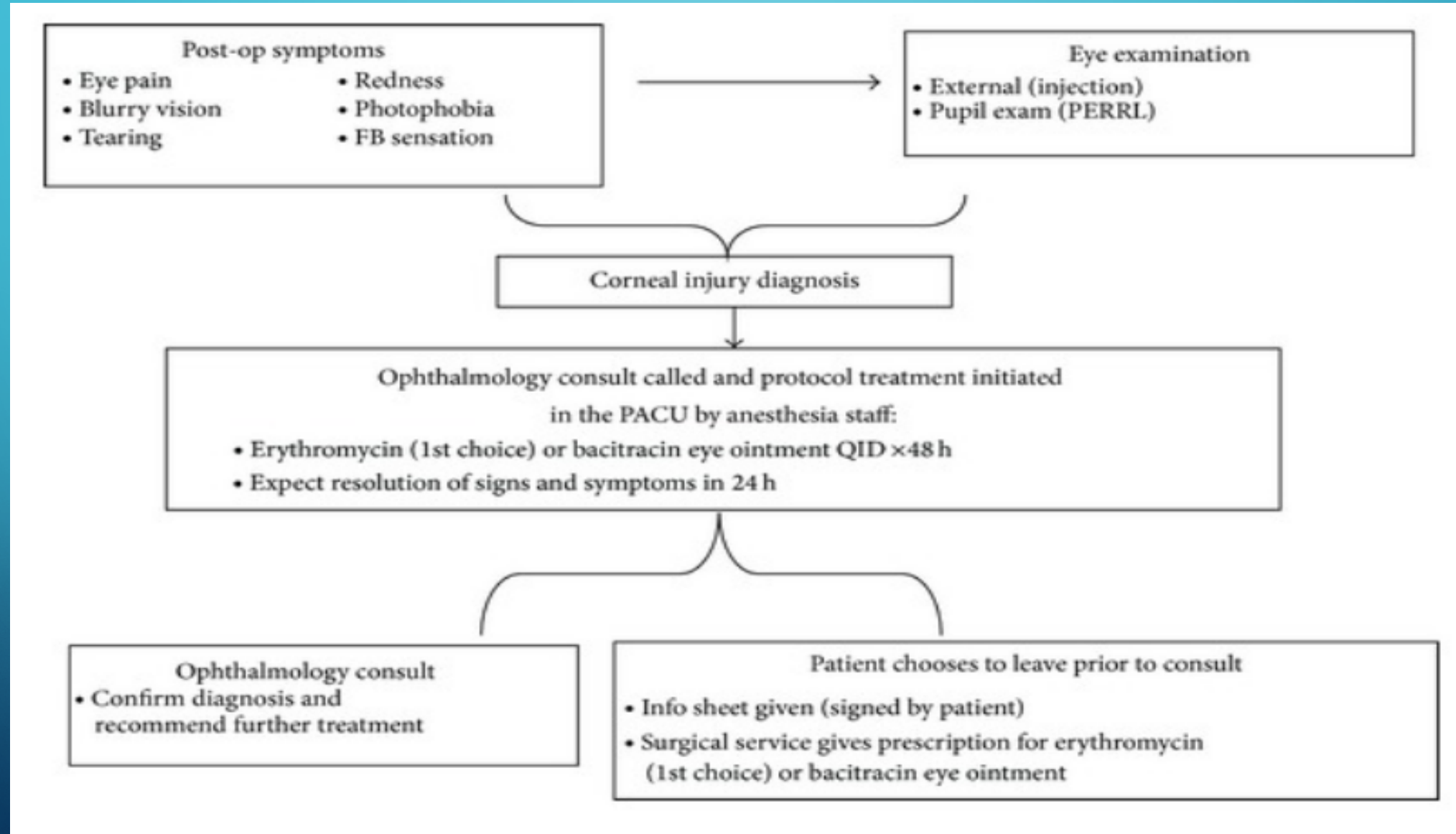
- The cornea makes up the anterior most portion of the sclera. The sclera is a fibrous outer layer that provides both protection and rigidity to maintain the shape of the eye.
- The cornea is a transparent structure that permits light to pass into the internal ocular structures before forming a retinal image
- Research suggests that the cornea's dense sensory innervation is 300-600 times that of the skin, making injury to the cornea excruciatingly painful when an abrasion occurs

CORNEAL ABRASIONS IN ANESTHESIA CARE

- Corneal Abrasion is the most common ophthalmic complication in anesthesia care
- Incidence ranges from 0.13 to 0.17% in non ocular surgeries
- Few risk factors may exists based on retrospective data analysis: Prone, Trendelenburg, Upper head & neck procedures



CORNEAL ABRASION TREATMENT OPTIONS



<i>Medication</i>	<i>Dosage</i>	<i>Cost estimate*</i>
Topical antibiotics†		
Erythromycin 0.5% ointment	0.5-inch ribbon, four times per day for three to five days	\$5 for 3.5-g tube
Polymyxin B/trimethoprim (Polytrim) solution	1 drop, four times per day for three to five days	\$5 (\$45) for 10-mL eye dropper
Sulfacetamide 10% (Bleph-10) solution	1 to 2 drops, four times per day for three to five days	\$5 (\$30) for 15-mL eye dropper
Antipseudomonal antibiotics		
Ciprofloxacin 0.3% (Ciloxan) ointment	0.5-inch ribbon, four times per day for three to five days	NA (\$132) for 3.5-g tube
Ciprofloxacin 0.3% (Ciloxan) solution	1 to 2 drops, four times per day for three to five days	\$30 (\$96) for 5-mL eye dropper
Gentamicin 0.3% ointment	0.5-inch ribbon, two to three times per day for three to five days	\$11 for 3.5-g tube
Gentamicin 0.3% solution	1 to 2 drops, four times per day for three to five days	\$10 for 5-mL eye dropper
Ofloxacin 0.3% (Ocuflox) solution	1 to 2 drops, four times per day for three to five days	\$10 (\$73) for 5-mL eye dropper
Topical cycloplegics‡		
Cyclopentolate 1% (Cyclogyl)	1 drop, may repeat in five minutes if needed	\$30 (\$50) for 5-mL eye dropper
Homatropine 5%	1 drop, may repeat in five minutes if needed	\$15 for 5-mL eye dropper
Topical NSAIDs		
Diclofenac 0.1% (Voltaren)	1 drop, four times per day for two to three days	\$20 (\$85) for 5-mL eye dropper
Ketorolac 0.4% (Acular LS)	1 drop, four times per day for two to three days	\$21 (\$164) for 5-mL eye dropper

NA = not available; NSAIDs = nonsteroidal anti-inflammatory drugs.

*—Estimated price of treatment based on information obtained at <http://www.goodrx.com> and [RxPriceVerify.com](http://www.RxPriceVerify.com) (homatropine price obtained from CVS pharmacy). Accessed July 31, 2012, and September 7, 2012. Generic price listed first; brand price listed in parentheses.

†—Dosing frequency may be decreased to twice per day if there is no foreign body sensation, and may be discontinued when the patient is asymptomatic for 24 hours.

‡—For office use only in patients with ciliary spasm.

CORNEAL ABRASION ASSESSMENT & EVALUATION

- Can occur at any stage in the care of the patient
- Preoperative
- Intraoperative
- PACU
- Floor care

Symptoms of a Scratched Cornea

The symptoms vary and can be mild to severe. They include the following:



Feeling like there
is a foreign
object in the eye



Redness



Blurry
Vision



Pain



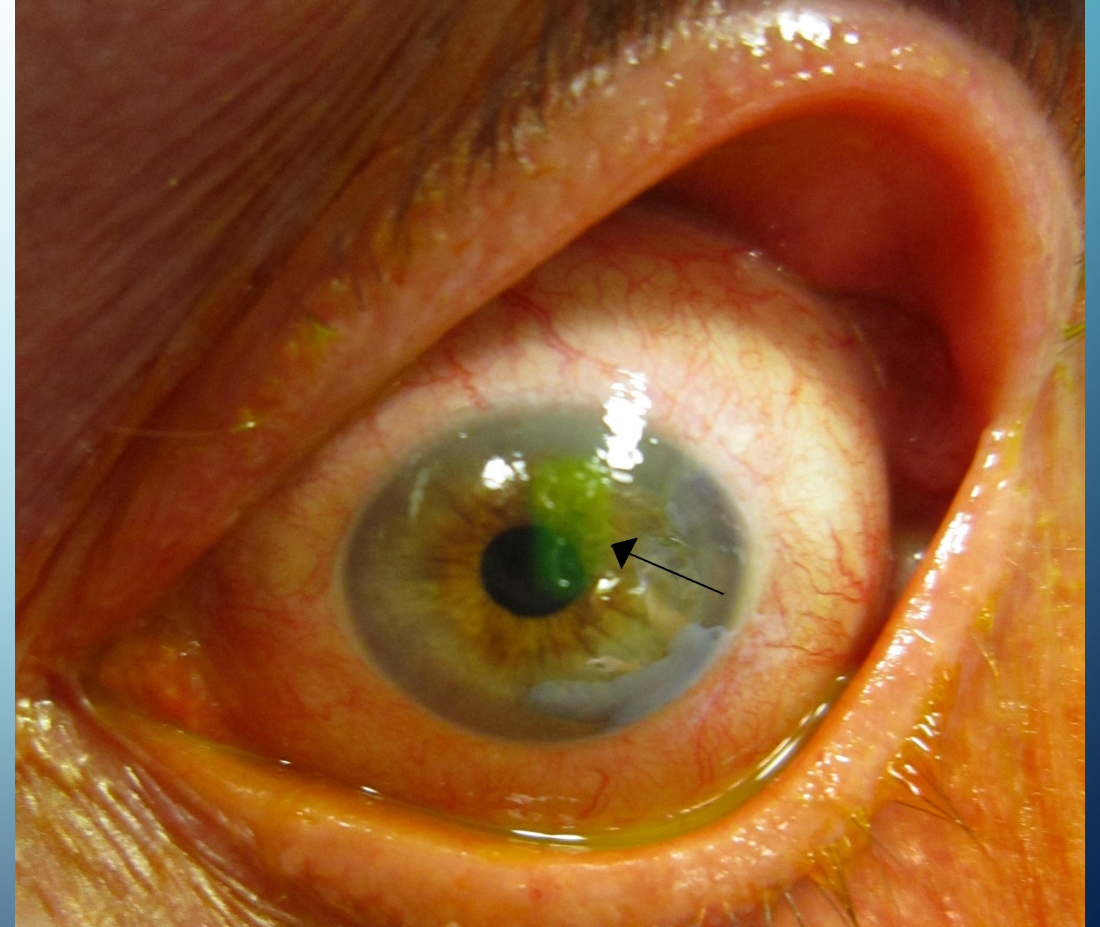
Tearing

WHY DO CORNEAL ABRASIONS MATTER?

- Long-term complications of corneal abrasions are uncommon, the perioperative injury is unexpected, painful, and anxiety inducing for the patient. Patients may complain of blurry vision, tearing, redness, photophobia, and foreign body sensation in the eye. Low risk but long term issues could occur, less common.
- Delay to discharge from the hospital can be delayed as the patient waits for an ophthalmology consultation before diagnosis can be made and treatment initiated
- Decreased patient satisfaction, increased costs to patient & care system

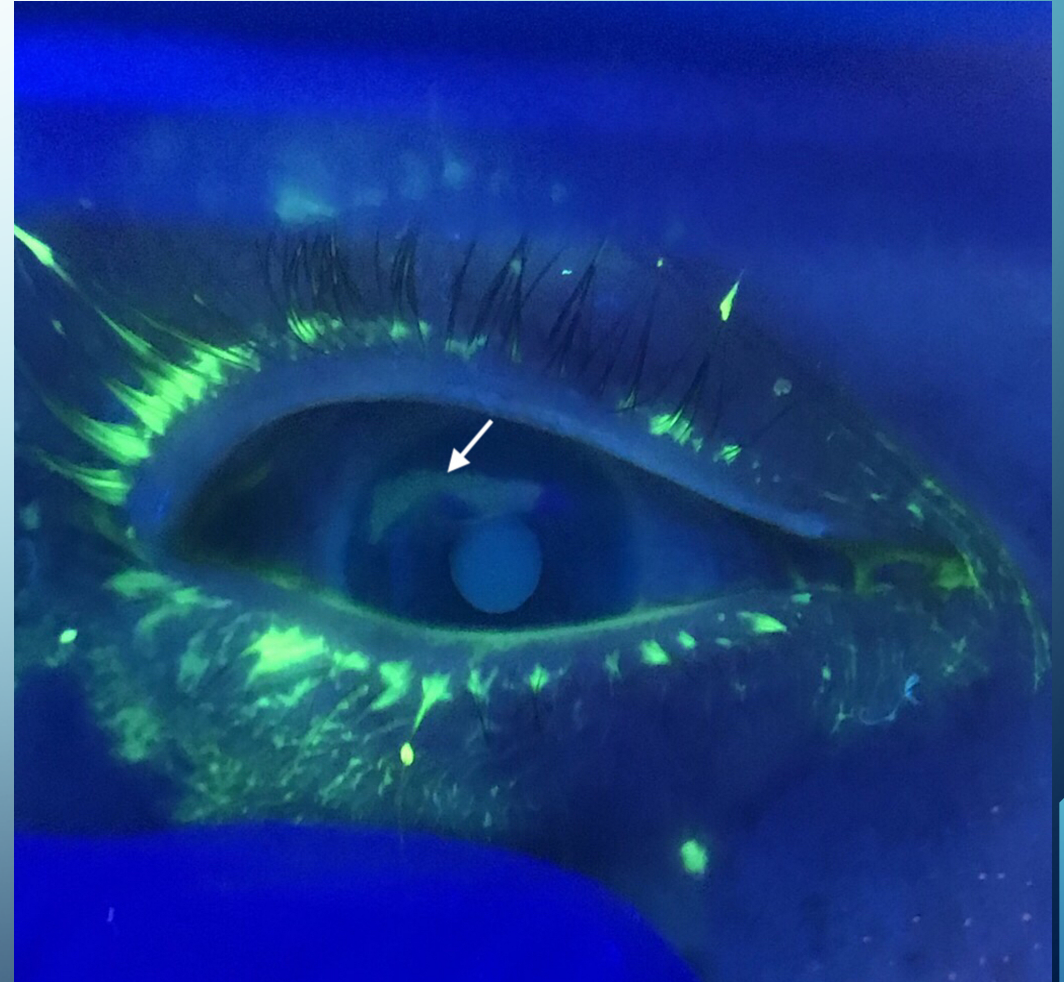
DIFFERENTIAL DIAGNOSIS FOR CORNEAL ABRASIONS

- The differentials of corneal abrasion include but not limited to the following:
- Conjunctivitis
- Dry eye syndrome
- Acute angle-closure glaucoma
- Uveitis
- Infective keratitis (bacterial, fungal, herpetic)
- Corneal ulcer
- Recurrent erosion syndrome



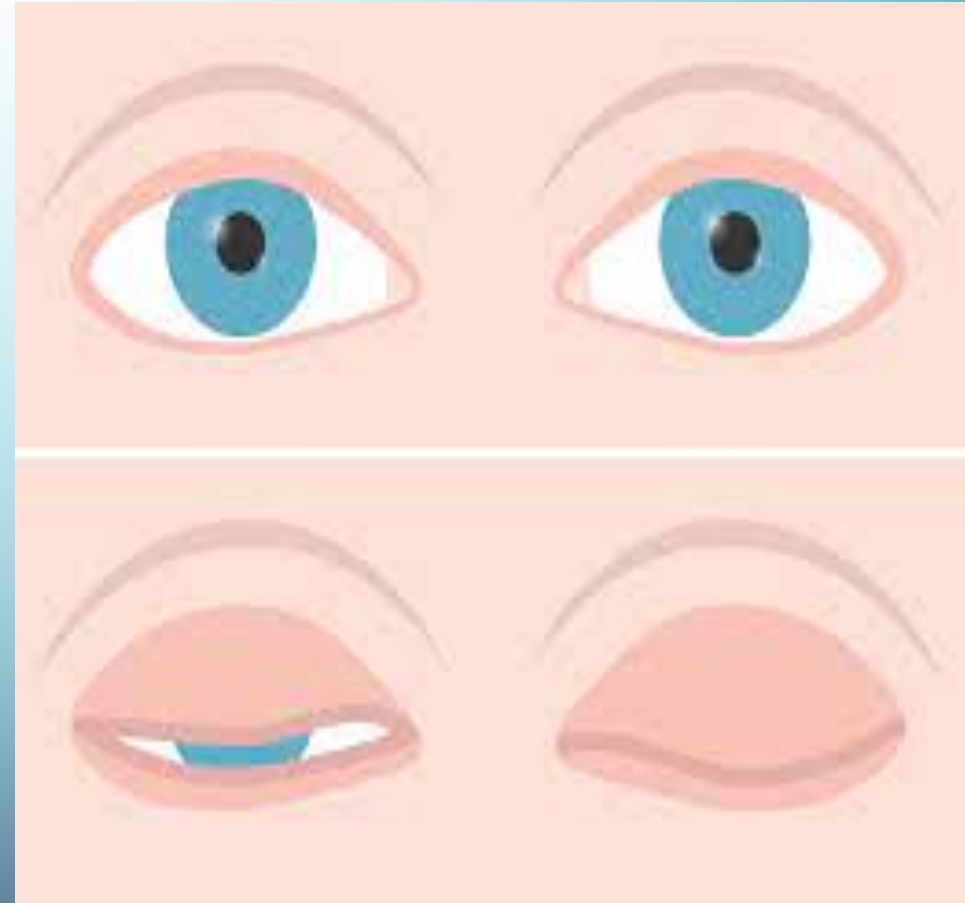
CORNEAL ABRASIONS: MORE THAN JUST CONTACT WITH THE CORNEAL

- Corneal abrasion can occur by direct contact with surgical drapes, masks, other objects (pulse oximeter), chemical burns (solutions) but most occur as a result of the drying of the cornea exposed during general anesthesia due to a reduced amount of tear secretion, the loss of light reflex, or the loss of recognition of pain during the procedure



CORNEAL ABRASIONS: LAGOPHTHALMOS

- Perioperative corneal abrasions under general anesthesia may be attributed to direct chemical or mechanical trauma to the cornea, or to exposure and drying due to lagophthalmos (incomplete eyelid closure) LAGOPHTHALMOS
- Is the Lid completely closed? What eye closure taping methods were used?



CORNEAL ABRASIONS: TO TREAT OR NOT TO TREAT?

- Left untreated, the abrasion could become infected and result in a sore known as a corneal ulcer
- Consider to elements discomfort, future injury risk due to further patient manipulations secondary to discomfort
- Treatments: Ointments versus drops, anesthetic drops versus anti inflammatory drops
- Patching is not effective for treatment of corneal abrasions and is not recommended. Consider topical nonsteroidal anti-inflammatory drugs in patients with corneal abrasions. Topical mydriatics are not effective for treatment of corneal abrasions and are not recommended

ANESTHESIA PATIENT SAFETY FOUNDATION

- Pulse oximeter sensors should be placed on the ring or fifth finger because most patients, on emergence from anesthesia, are unlikely to rub their eyes with these fingers.
- In general anesthesia, following induction and immediate loss of consciousness and lid reactivity, the eyes should be taped shut preferably from upper lid down, making sure that the eyelids are properly apposed. This may prevent injury during mask ventilation and laryngoscopy from objects on the anesthesia providers wrist (watches, bracelets), breast pocket (identity cards), and neck (stethoscope, jewelry).
- Use of appropriate sized masks for ventilation as opposed to oversized ones that impinge on the eyes.
- There is no proven benefit in the use of eye ointments under anesthesia, but a dry cornea is more susceptible to abrasion. In high risk cases, a benefit may be obtained, but care must be taken during application to prevent the tip of the applicator from contacting the eye.
- Removal of the occlusive tape of the eye at the end of surgery should be gentle and preferably from the upper eyelid to the lower.

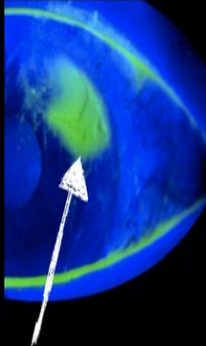
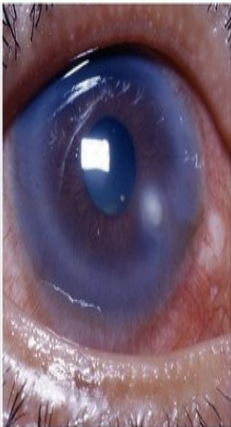
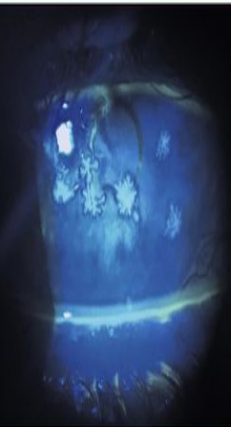
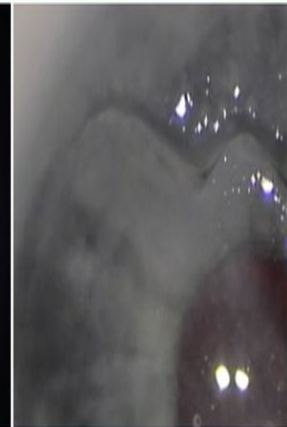
CORNEAL ABRASION TREATMENTS: ANTIBIOTIC OINTMENTS

- If antibiotics are used, ointment: Bacitracin, erythromycin, gentamycin is more lubricating than drops and is considered first-line treatment. In patients who wear contact lenses, an anti-pseudomonal antibiotic (e.g., ciprofloxacin, gentamycin, ofloxacin, should be used, and contact lens use should be discontinued
- Clinical trial data are lacking, but it is recommended that contact lenses be avoided until the abrasion is healed and the antibiotic course completed.



CORNEAL ABRASION FOLLOW UP

- Most patients should be re-evaluated in 24 hours; if the abrasion has not fully healed, they should be evaluated again three to four days later. Patients who wear contact lenses should be re-evaluated in 24 hours and again three to four days later even if they feel well
- worsening of symptoms should prompt a thorough re-evaluation for foreign bodies or full-thickness injuries. Immunocompromised or monocular patients also warrant closer attention and may require earlier ophthalmologic referral

CORNEAL DISEASE IN THE ED				
	CORNEAL ABRASION	CORNEAL ULCER	HERPES KERATOCONJUNCTIVITIS	CORNEAL LACERATION
	 fluorescein uptake			
TREATMENT	Analgesia (NSAIDs - oral and/or ophthalmic drops) Topical antibiotics if contact lenses (ciprofloxacin, ofloxacin, tobramycin)	ciprofloxacin or ofloxacin ophthalmic drops 1 drop every hour	Oral acyclovir Conjunctival involvement: topical trifluridine 1 drop 9 x/day	Small - analgesia, topical antibiotics Large but partial - evaluated in OR for possible closure vs cycloplegics Full thickness - treat as globe rupture
OPHTHO FOLLOW UP	Large or over central axis - within 24-48 hours	Within 12-24 hours	Within 24-48 hours	Emergent if full thickness or large but partial thickness
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Topical NSAIDs

Diclofenac (Voltaren),
0.1% solution

One drop four times daily

\$52 for 5
mL

May delay wound healing.
Use caution in patients
with bleeding tendencies.

Ketorolac (Acular),
0.5% solution

One drop four times daily

\$56 for 5
mL

Avoid use in patients
who wear contact lenses.
Discontinue use if
epithelium breakdown
occurs.

Topical antibiotics

Bacitracin (AK-Tracin),
500 units per g
ointment

1/2-inch ribbon two to
four times daily

\$5 for 3.5 g

Chloramphenicol
(Chloroptic), 1%
ointment

Two drops every three
hours

\$22 for 3.5
g

Discontinue use if no
improvement after one
week.

Ciprofloxacin (Ciloxan),
0.3% solution

Day 1: two drops every 15
minutes for six hours,
then two drops every 30
minutes for rest of day
Day 2: Two drops per hour

Days 3 to 14: Two drops
every four hours

\$45 for 5
mL

Anti-pseudomonal activity

Erythromycin 0.5%
ointment

1/2-inch ribbon two to
four times daily

\$3 to \$6 for
3.5 g

Gentamycin
(Garamycin), 0.3%
ointment or solution

One to two drops every
four hours or 1/2-inch
ribbon two to three times
daily

\$10 (\$5 to
\$10) for 5
mL

Anti-pseudomonal activity

Ofloxacin (Ocuflox),
0.3% solution

Days 1 and 2: One to two
drops every 30 minutes

Days 3 to 7: One to two
drops per hour

Day 8 to treatment
completion: One to two
drops four times daily.

\$40 for 5
mL

Anti-pseudomonal activity

CORNEAL ABRASIONS & TREATMENT OPTIONS

- Ointment formulations provide lubrication to the injured eye & often reduce discomfort plus prevent infection risk
- Contact lens wearers will need coverage for *Pseudomonas* with a fluoroquinolone or aminoglycoside
- Erythromycin ointment may to be used four times daily for five days for non-contact lens-wearing patients.
- Drops are available for sulfacetamide 10%, polymyxin/trimethoprim, ciprofloxacin, or ofloxacin. Aminoglycoside antibiotics should be avoided in non-contact lens-wearing patients. Duration of therapy is variable, but a patient can discontinue therapy entirely if the eye is symptom-free for 24 hours
- Continued symptoms beyond three days warrant evaluation by an ophthalmologist. Never use topical corticosteroids due to delayed healing and increased risk of infection****
- Regarding pain control, small abrasions (less than 4 mm) rarely require analgesia. Mild to moderate pain can typically be controlled with oral nonsteroidal anti-inflammatory drugs (NSAIDs). Ophthalmic topical NSAID solutions provide pain relief however should be limited to 24 hour use as they can inhibit healing of cornea

CORNEAL ABRASIONS

- The prognosis is usually excellent if treatment is prompt; however, untreated corneal abrasions can lead to blindness
- Small corneal abrasions usually heal without difficulty. Larger abrasions, visual disturbance, and abrasions caused by a contact lens will require close outpatient monitoring by an ophthalmologist (remove contact lens routine care)
- Deep abrasions in the central visual axis heal but leave a scar. In such cases, a permanent loss of visual acuity may result from corneal cloudiness or irregular corneal astigmatism

POVL AND RISK FACTORS

- Multicenter research control study has identified risk factors associated with ischemic optic neuropathy for patients undergoing prone spinal fusion surgery. The Patient variables at highest risk for POVL are: obesity, male sex, Wilson frame use, longer anesthetic duration, greater estimated blood loss, and decreased percent colloid usage

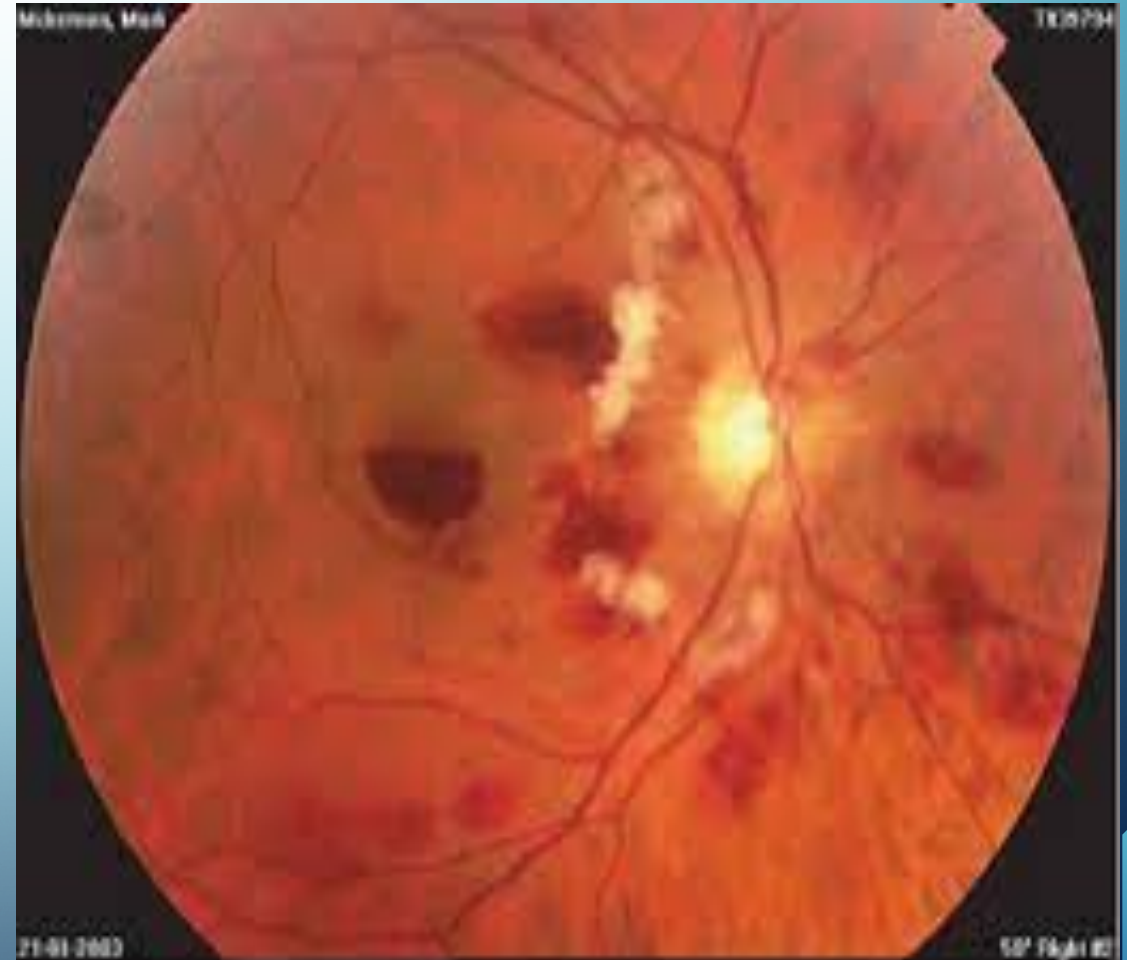
Table 1: Risk Factors Associated with Ischemic Optic Neuropathy After Spinal Fusion Surgery: The Postoperative Visual Loss Study Group (*Anesthesiology* 2012;1016:274-82)

Obesity*
Male gender*
Wilson frame*
Lower % colloid administration*
Longer anesthetic duration
Greater estimated blood loss

*significantly and independently associated with developing ischemic optic neuropathy after spinal fusion surgery

RETINAL ISCHEMIA

- Retinal ischemia can be due to external compression of the eye
- Decreased blood supply to the retina such as an embolism to the retinal arterial circulation
- Decreased blood flow from a systemic cause such as hypotension or increased IOP/impaired venous drainage of the retina.



ISCHEMIC OPTIC NEUROPATHY

Posterior ION

Location

- Posterior to lamina cribrosa

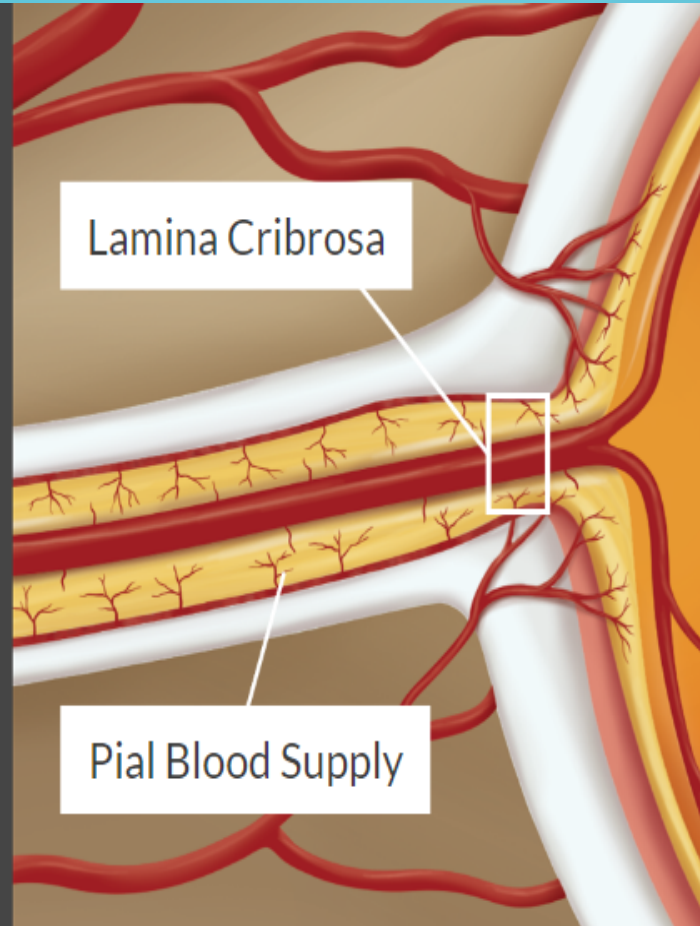
Cause

- Impaired perfusion through pial blood supply of optic nerve

Optic disc involvement

- No

Arteritic vs non-arteritic



Anterior ION

Location

- Anterior to lamina cribrosa

Cause

- Impaired perfusion through ciliary artery

Optic disc involvement

- Yes - appears swollen during acute phase of injury

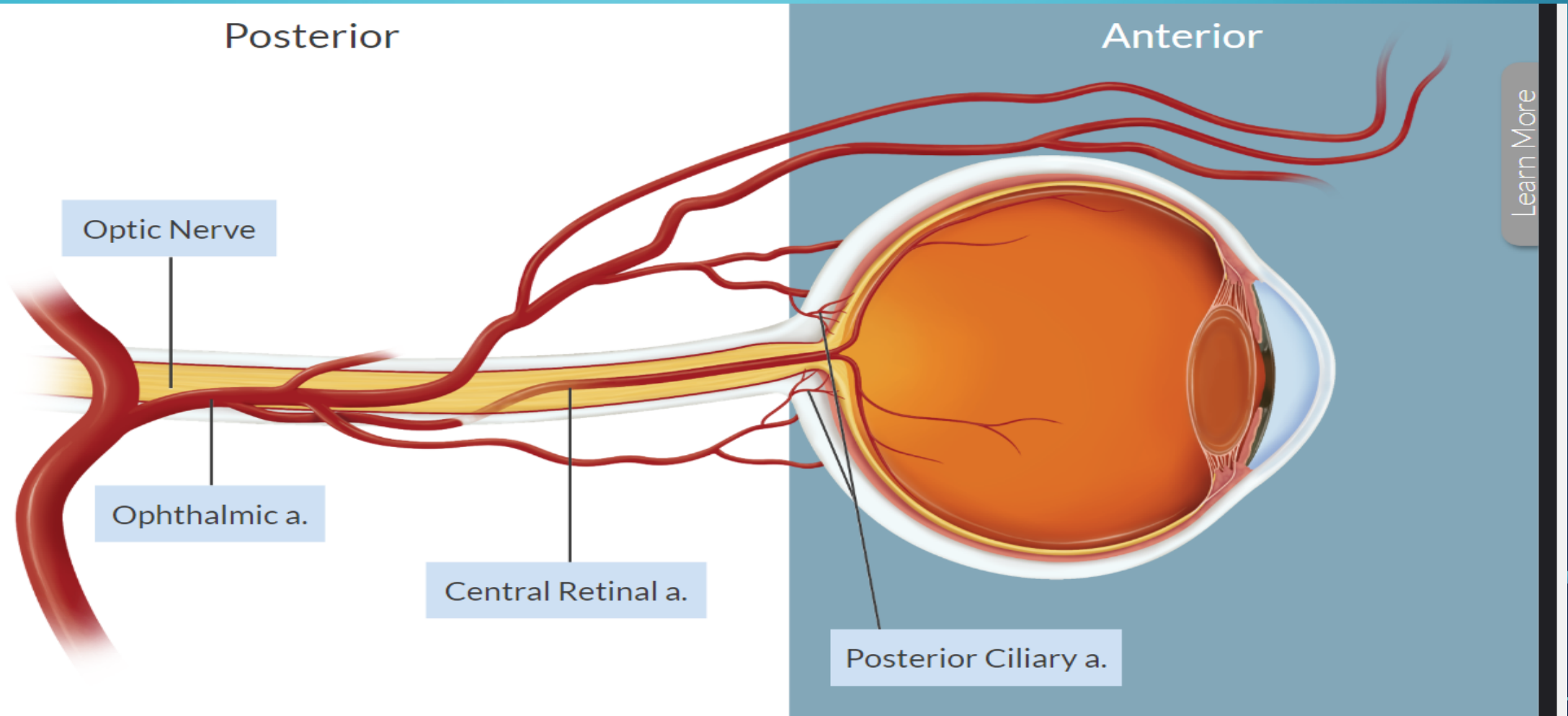
Arteritic vs non-arteritic

PERIOPERATIVE VISION LOSS

- Perioperative visual loss (POVL), a rare, but devastating complication, can follow non-ocular surgery. Highest rates of visual loss are with cardiac and spine surgery. The main causes of visual loss after non-ocular surgery are retinal vascular occlusion and ischemic optic neuropathy.

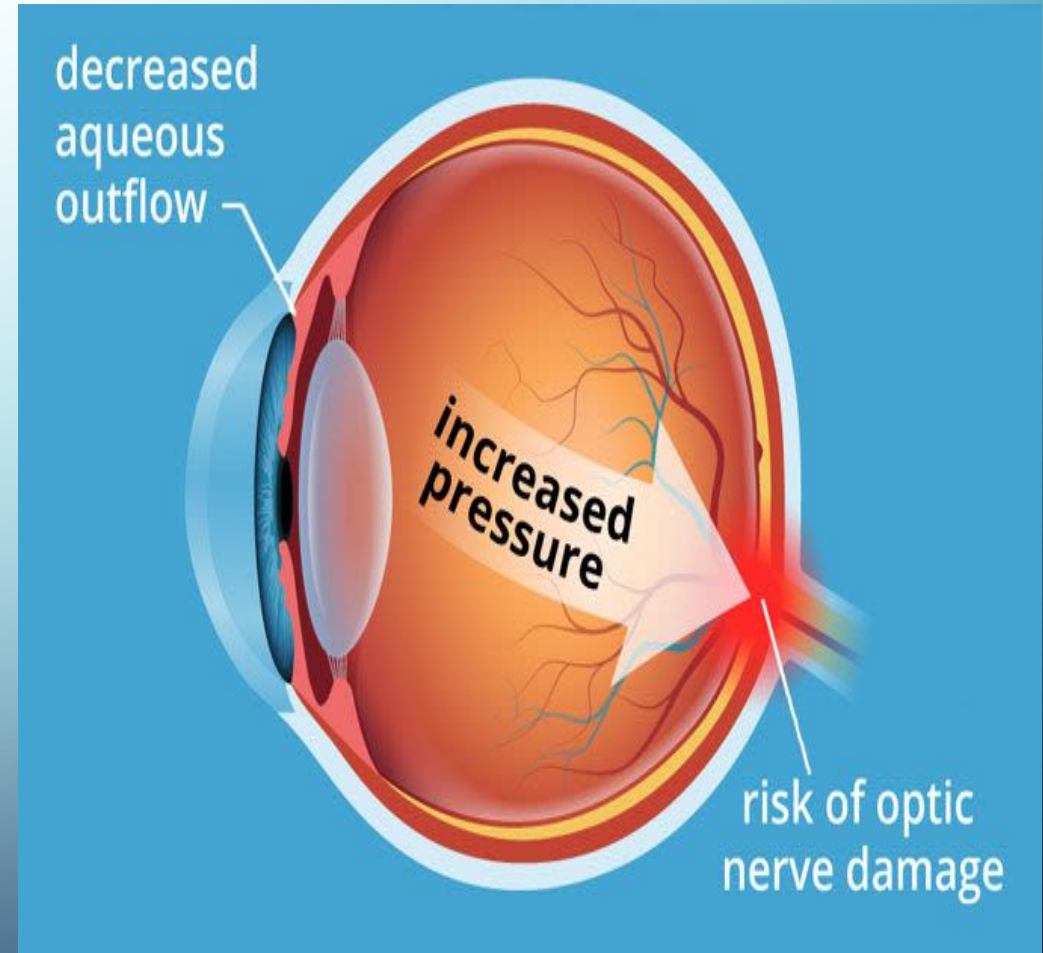


EYE PERFUSION BASICS



POST OPERATIVE VISION LOSS

- There are no effective treatment options for POVl and the diagnosis is often irreversible
- Efforts must focus on prevention and risk factor modification
- The role of crystalloids versus colloids and the use of α -2 agonists to decrease intraocular pressure during prone spine surgery can be a potential preventative strategy for prevention of POVl



POSTOPERATIVE VISION LOSS

- Ischemic optic neuropathy (ION) is the most common cause of POVL and is presumed to be due to impaired blood supply to the optic nerve
- ION is classified as anterior ION or posterior ION, depending on the affected segment of the optic nerve.
- Anterior ION represents an acute ischemic disorder of the optic nerve head supplied by the posterior ciliary artery
- Posterior ION is an acute optic neuropathy due to ischemia in the retrobulbar portion of the optic nerve.

OCULAR PERFUSION COMPONENTS

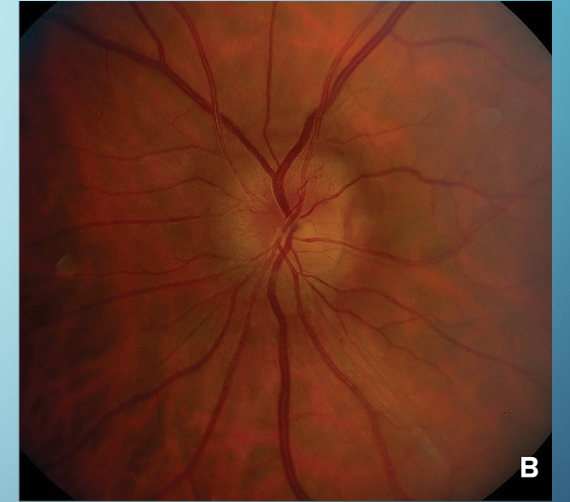
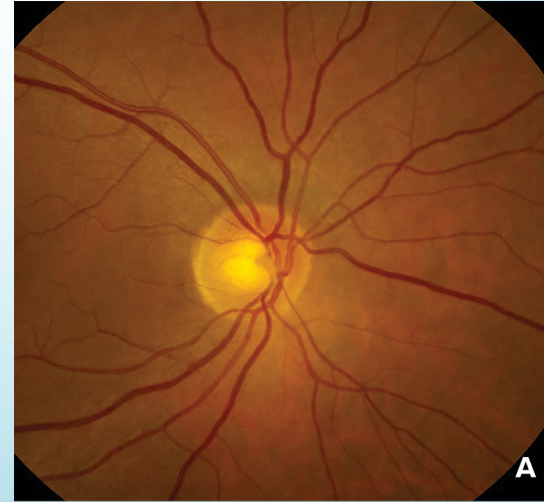
$$\text{Ocular perfusion pressure} = \text{MAP} - \text{IOP}$$

INTRAOPERATIVE VISION LOSS

- ION presents with painless vision loss that may be unilateral or bilateral and includes symptoms ranging from no light perception to color vision deficits, visual field defects, and decreased visual acuity.
- Symptoms are typically reported within one to two days after surgery and frequently upon awakening, although they may be recognized as late as 12 days postoperatively, particularly in patients who remain sedated with the need for postoperative mechanical ventilation
- Fundoscopic exam: Anterior ION is typically associated with optic disc edema and flame-shaped hemorrhage upon symptom onset. In posterior ION, the optic disc often appears normal initially, with mild disc edema days later

RISK FACTORS FOR POVL

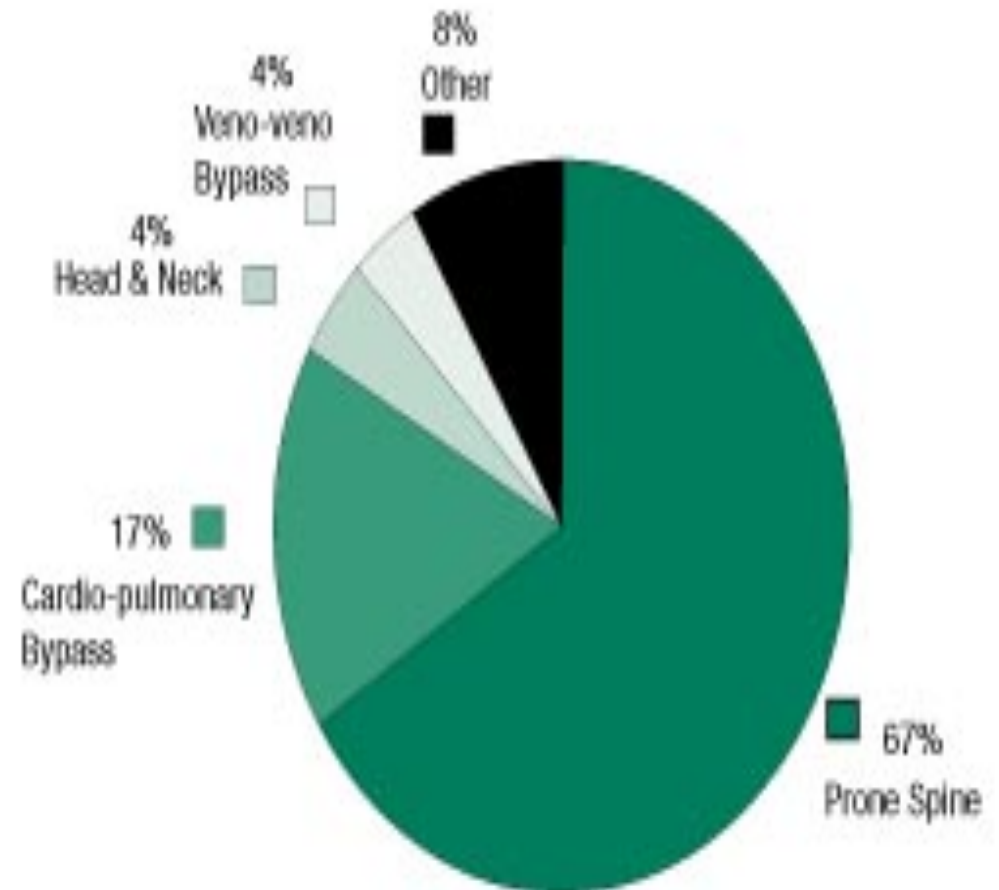
- Ischemic Optic Neuropathy
- Relative hypotension
- Significant, prolonged hypotension can result in ischemic injury to the optic nerve
- Significant blood loss
- Significant blood loss increases fluid shifts, capillary leak, interstitial edema, and systemic inflammation, as well as predisposes to reduced cardiac output and end-organ blood flow



POVL RISKS & CASE TYPES

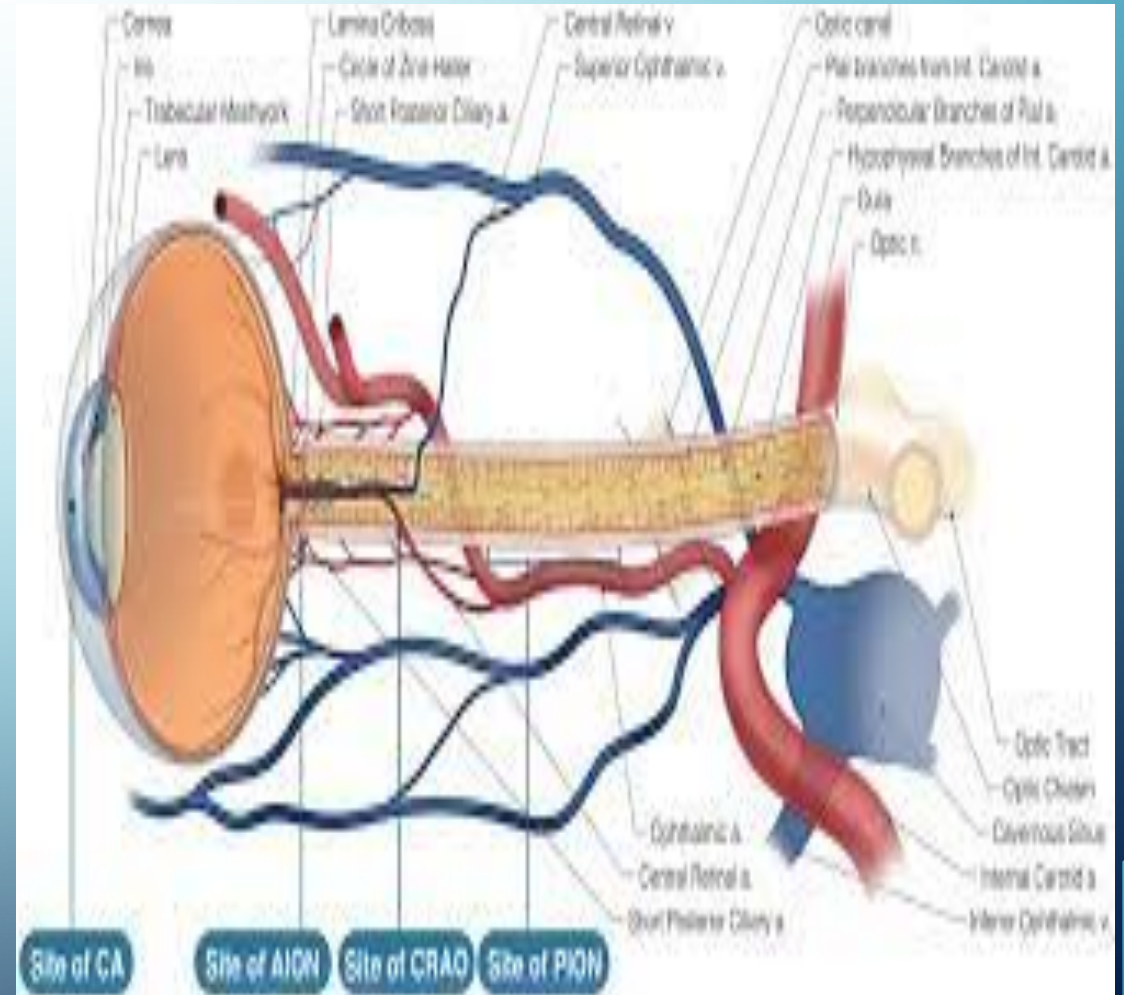
- Longer anesthetic length is associated with an increased risk of postoperative vision loss, likely due to an increased risk of prolonged hypotension, blood loss, and subsequent fluid resuscitation
- Highest rates of postoperative vision loss are seen with cardiac, spinal, head and neck surgery
- Anterior ION is most commonly associated with cardiac surgery.
- Posterior ION is most commonly associated with spinal surgery

Operations Associated with Postoperative Visual Loss



POVL PATIENT SPECIFIC RISKS

- Obesity increases risk related to physiological changes relate to obesity
- Due to increased abdominal girth, obese patients may have increased intraabdominal and central venous pressures in the prone position, thereby causing increased cerebral venous pressure. Subsequently, systemic venous return and cardiac output are reduced, leading to decreased end-organ blood flow
- Male gender increase risk



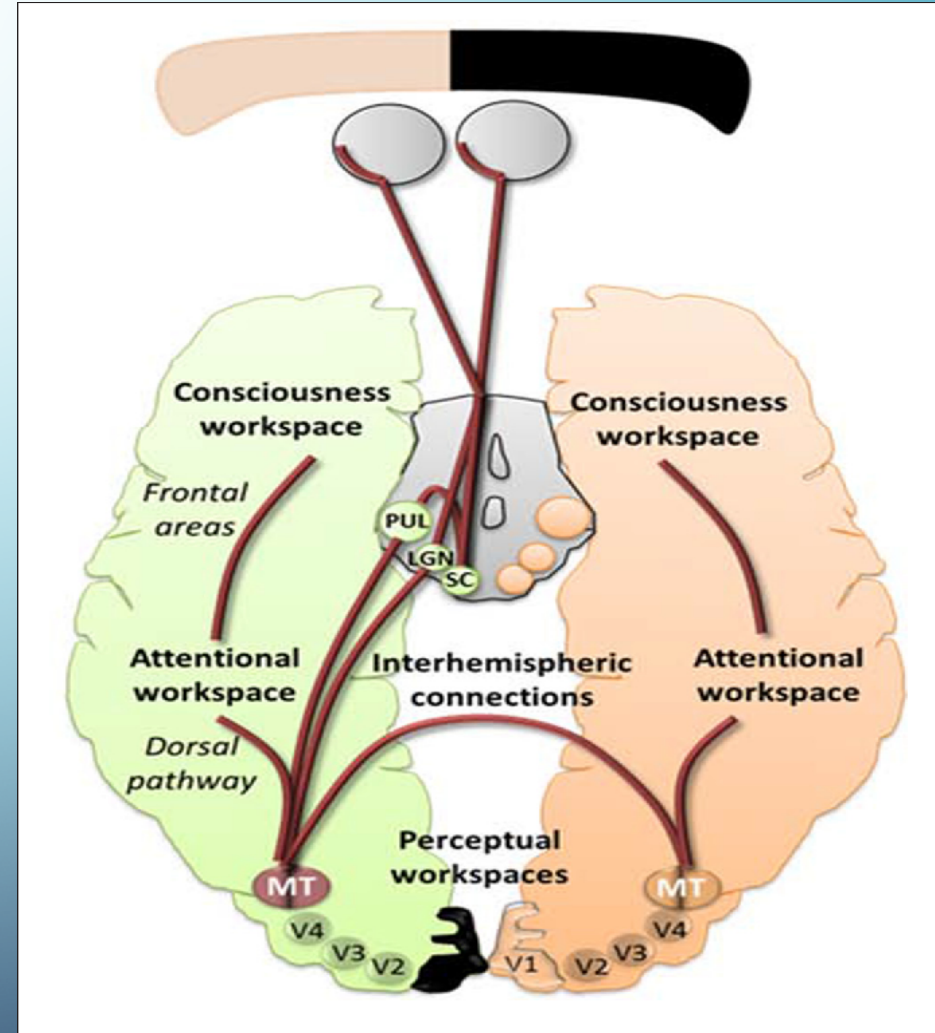
POVL & POSITION RISKS

- Prone positioning increases intraocular pressure as well as central venous pressure by compressing the abdomen and impairing venous drainage via the ophthalmic veins, a complication further exacerbated by obesity
- Use of the Wilson frame predisposes patients to increased venous congestion in the optic canal due to the lower positioning of the head compared to the body
- Prolonged steep Trendelenburg positioning may also decrease cranial venous outflow, causing local capillary bed stasis in the eyes



CORTICAL BLINDNESS

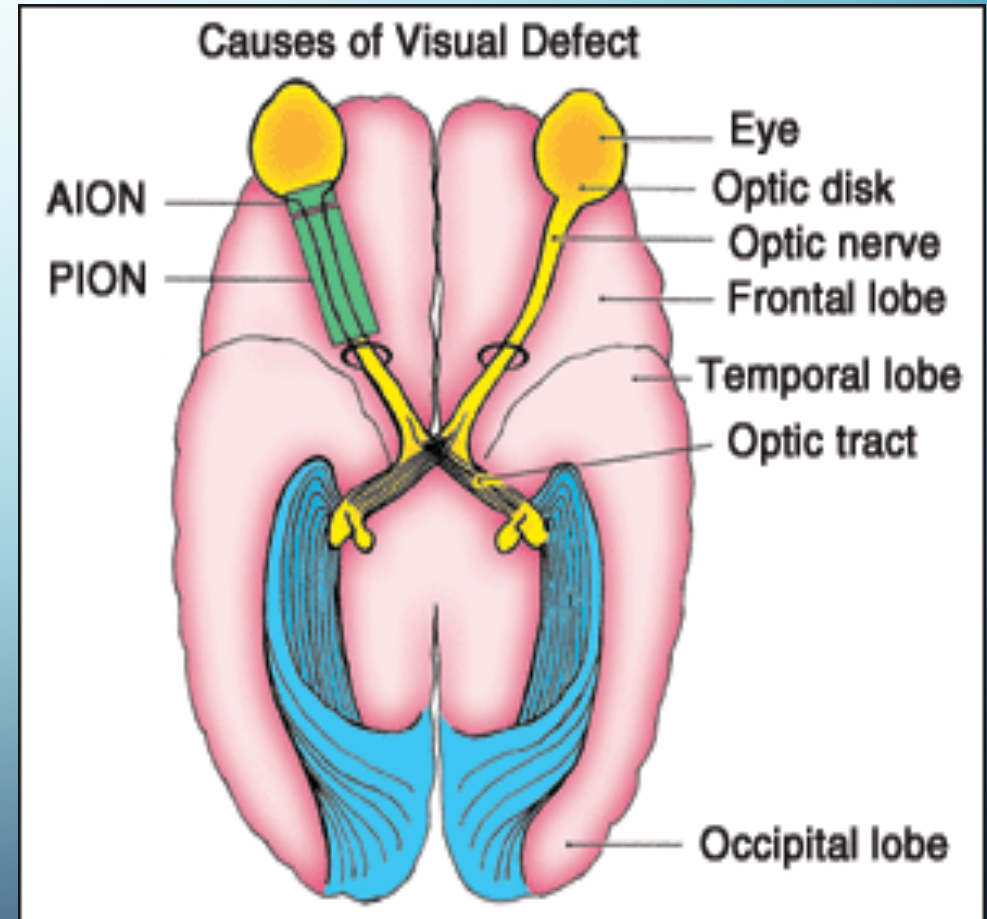
- Cortical blindness is loss of vision caused by ischemia in the visual cortex or afferent sensory pathways.
- This can result from emboli, severe hypotension, acute anemia, hypoxia, or a combination of these factors
- Cortical blindness may present as painless vision loss ranging from partial to complete with retention of pupillary reactions to light.
- Fundoscopic exam is usually normal.



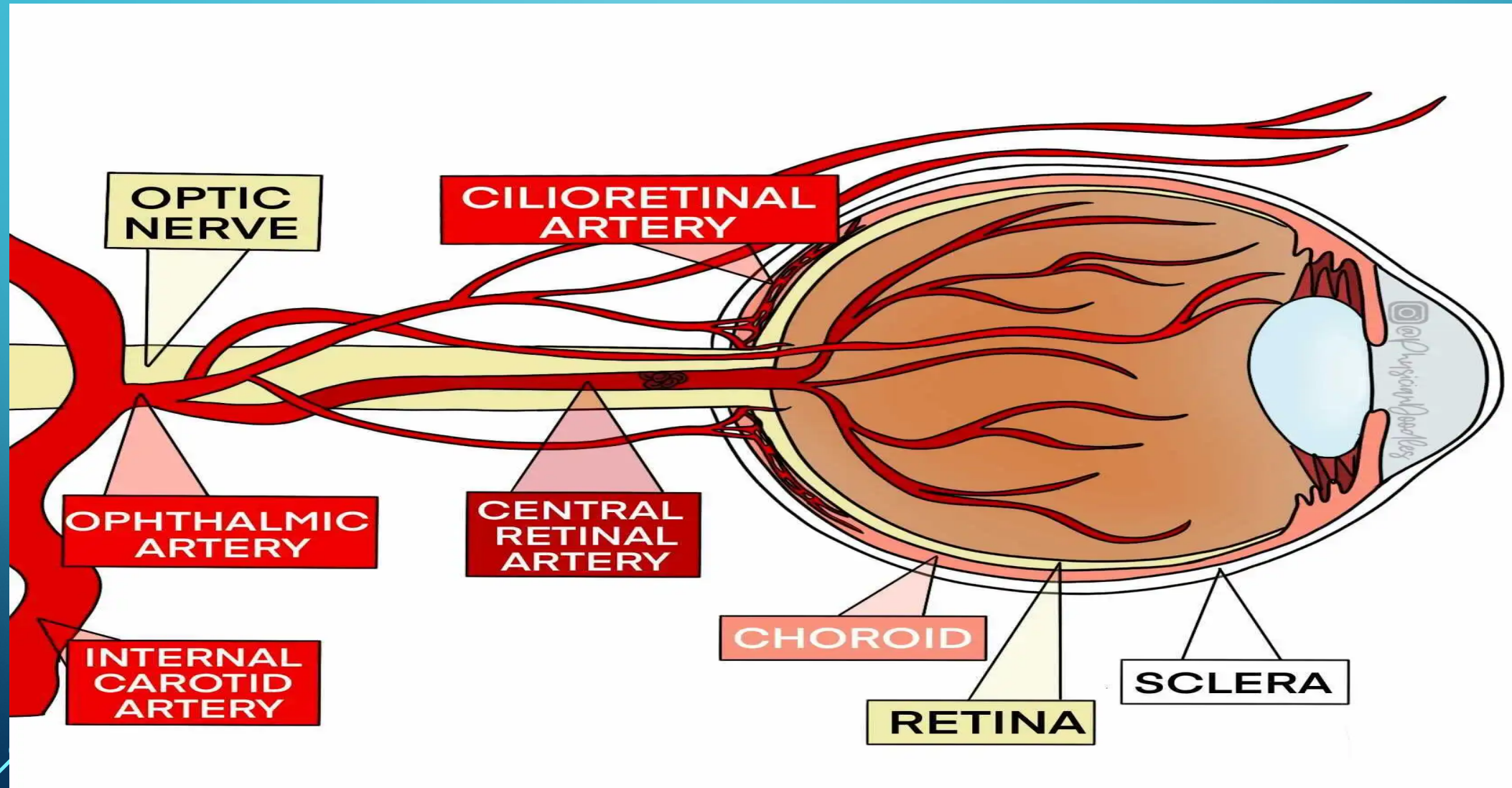
CENTRAL RETINAL ARTERY OCCLUSION

PATIENT CONDITIONS & RISK

- Ocular compression
- Sustained increases in intraocular pressure may impede or stop blood flow in the central retinal artery.
- Various factors that increase the vulnerability for external compression include altered facial anatomy, osteogenesis imperfecta, and exophthalmos
- For prone procedures, the horseshoe headrest may increase the risk of CRAO as the edges of the headrest are very close to the eyes and may cause globe compression



CENTRAL RETINAL ARTERY EMBOLISM



CENTRAL RETINAL ARTERY OCCLUSION

- Central retinal artery occlusion (CRAO) is the blockage of the central retinal artery, resulting in retinal hypoperfusion, rapidly progressive cellular damage, and vision loss.
- Causes include embolism, retrobulbar hemorrhage, and external eye compression resulting in raised intraocular pressure and impaired blood flow through the central retinal artery.
- Patients present with sudden, painless, monocular vision loss.
- On fundoscopy, the retina will appear diffusely pale with a cherry red central spot.



EMBOLISM CONDITIONS & POVLT

- CRAO & Embolism
- In cardiac and head and neck surgery, the etiology of CRAO is often embolic. Identified risk factors for embolism resulting in CRAO include hyperlipidemia, diabetes, carotid stenosis, stroke, aging, and hypercoagulable states.
- Cortical Blindness & Embolism
- Cortical blindness is most often associated with cases with high embolic loads such as cardiopulmonary bypass, spine, bone and joint surgeries.
- Patient comorbidities such as hypertension, hyperlipidemia, diabetes, carotid stenosis, and hypercoagulable states increase the risk of emboli

SUMMARY

- Corneal abrasion remains the most common no life threatening eye complication for NON ocular surgery
- Corneal abrasions require monitoring and assessment by the anesthesia provider to ensure long term ocular damage does not occur
- Post Operative Vision Loss is a more rare but significant potential complication for which there is not treatment thus Prevention is essential

QUESTIONS?

