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Lateral Canthotomy and Inferior Cantholysis

URL: https://www.jove.com/science-education/10266

Overview

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Lateral canthotomy is a potentially eyesight-saving procedure when performed emergently for an orbital compartment syndrome. An orbital compartment syndrome results from a buildup of pressure behind the eye; as pressure mounts, both the optic nerve and its vascular supply are compressed, rapidly leading to nerve damage and blindness if the pressure is not quickly relieved.

The medial and lateral canthal tendons hold the eyelids firmly in place forming an anatomical compartment with limited space for the globe. In an orbital compartment syndrome, pressure rapidly increases as the globe is forced against the eyelids. Lateral canthotomy is the procedure by which the lateral canthal tendon is severed, thereby releasing the globe from its fixed position. Often, severing of the lateral canthal tendon alone is not enough to release the globe and the inferior portion (inferior crus) of the lateral canthal tendon also needs to be severed (inferior cantholysis). This increases precious space behind the eye by allowing the globe to become more proptotic, resulting in decompression. Most frequently, orbital compartment syndrome is the result of acute facial trauma, with the subsequent development of a retrobulbar hematoma.

Examination of the patient will reveal a proptotic globe as it strains from the pressure against the tendons anchoring it in place. Patients experience decreased visual acuity and severe eye pain. Patients may develop a relative afferent pupillary defect (RAFD), otherwise known as a Marcus Gunn pupil, and will have increased intraocular pressure (IOP).

Procedure

1. Confirm need to perform emergent lateral canthotomy.

1. Confirm that an RAFD is present by performing the swinging flashlight test.
2. Swinging flashlight test:
    1. The practitioner first observes both pupils
    2. A light is then directed at the unaffected eye. When this occurs, both pupils (the unaffected and the affected) will constrict in response
    3. The light is then directed toward the affected eye. Both pupils will dilate from their previous constriction (neither pupil will constrict).
    4. The light is then redirected toward the unaffected eye, and constriction is again confirmed in both pupils.

3. Confirm elevated IOP by tonometry. IOP ~40mm Hg is a clear indication for lateral canthotomy
    1. In the trauma patient, IOP must be measured with a hand-held tonometer. Do not perform this assessment if there is suspicion of a penetrating globe injury.
    2. Most hand-held devices operate in a similar fashion. They are easy to use and work by pressing the tip of the device against the patient's cornea.
    3. In the awake patient, topical anesthetic (tetracaine, proparacaine) should be used to help ensure patient compliance. Anesthetic will not alter the accuracy of IOP measurements.
    4. The tip of the hand-held tonometer is then covered with a protective and disposable cover.
    5. Hold the unit as a pencil. Brace the heel of your hand against the patient's cheek to maintain stability.
    6. Approach the cornea perpendicularly, and touch the cornea lightly and briefly.
    7. Successful measurement is confirmed with a "chirp," and the reading is displayed.
    8. IOP should be measured several times consecutively to ensure accuracy.

4. Once the decision to go forward with surgical intervention is made, it is time to gather supplies.
5. Supplies needed: toothed forceps, straight hemostat, iris scissors, anesthetic (lidocaine 1% with epinephrine 1:100,000 is best, as the epinephrine will aid in constricting blood vessels and keep your surgical field clean), small-gauge needle (25 or 27 gauge), syringe, sterile saline, and gauze.

2. Anatomy

1. In order to successfully address an orbital compartment syndrome with surgical intervention, it is important to have a basic understanding of the eye anatomy-specifically, the extraocular anatomy.
2. The orbit is the bony, cone-shaped cavity in which the globe rests. It is approximately 4.5 cm deep and is composed of 7 fused bones. Foramina and fissures within this bony architecture allow nerves and blood vessels to supply the globe and its surrounding structures.
3. There are 6 extraocular muscles that control the movement of the eye within the orbit. These muscles tether the eye to the orbit, but there is a certain degree of laxity that would permit outward movement of the entire globe if other certain structures were compromised.
4. The eyelids (upper and lower) provide protection and nourishing lubrication to the cornea of the eye.
5. The upper and lower lid of the eye are held in position medially by the medial canthal tendon, and laterally by the lateral canthal tendon.
6. The lateral canthal tendon splits into an inferior and a superior portion (inferior crus and superior crus, respectively) as it moves from lateral to medial

3. Protocol

1. As with most truly emergent procedures, full sterile precautions are generally not observed. Care should be taken to perform the procedure "cleanly."
2. Quickly cleanse the lids and lateral canthus area with gauze soaked with sterile saline. Chlorhexidine should be avoided because of the risk of ocular exposure.
3. Draw up 2 mL of lidocaine 1% with epinephrine 1:100,000 in a syringe with a small needle (25 or 27 gauge) attached
4. Anesthetize the lateral canthus and overlying skin by injecting the anesthetic with the needle directed away from the globe of the eye.
5. The needle will enter the skin at the lateral canthus and just superficial to the epidermis. Inject anesthetic slowly, and advance the needle laterally (still in a superficial plane). As the needle advances, continue to inject anesthetic until the needle tip has advanced approximately 1.5-2 cm laterally.
6. Retract the needle back toward the point at which it entered the tissue (lateral canthus), and redirect the needle 45° inferiorly, still keeping the needle in a superficial plane.
7. Again advance the needle slowly while injecting more anesthetic. Advance the needle approximately 1.5-2 cm.
8. Slide the hemostat over the lateral canthus with one prong deep to the skin and superficial to the orbit and the other over the skin. The tissue is thin at this point, and there is only one plane that the hemostats will dissect as they are advanced.
9. Advance the hemostat so that approximately 2 cm of tissue is between the prongs.
10. Crush the skin within the hemostat's grasp. This tissue should remain compressed for 1-2 minutes. This helps to minimizing bleeding and leaves a blanched imprint on the tissue where it was crushed by the hemostat. This imprint is used as a guide for cutting in the next step.
11. Cut along the compressed tissue, through all layers, from the lateral canthus to the orbital rim.
12. This should sever the lateral canthal tendon. Verify this by pulling the upper lid away from the incision; if the tendon is not severed completely, it will be seen and can then be completely cut. The tendon has a shiny white appearance.
13. Pull the lower lid away with the forceps.
14. Identify the inferior crus of the lateral canthal tendon. It will be identified by its shiny white appearance and anatomical position. Cut with the scissors directed inferiorly (at a 90° angle to the first incision).
15. Check the IOP.
16. If the IOP remains elevated, then the superior crus may be released as well
17. If the superior crus is to be cut, this is completed in much the same manner as above. Use the toothed forceps to pull the upper lid away from the globe and superiorly.
18. Superior crus should be visible and identified. Use the Iris scissors to cut through superior crus and completely release the globe.

Summary

Orbital compartment syndrome with elevated IOP is associated with a very poor prognosis unless there is immediate intervention. If suspected, emergent decompressive surgery is indicated, as permanent vision loss can result within two hours from the onset of retinal ischemia.

Vision loss and/or change in visual acuity, coupled with elevated IOP, are paramount in making the diagnosis and deciding to act. A relative afferent pupillary defect may be demonstrated, but can occur in a multitude of unilateral diseases of the retina and optic nerve.

The swinging flashlight test works because the retina is compromised (from ischemia) and the afferent fibers within the optic nerve are compressed in an orbital compartment syndrome. The injured eye does not react to the light because the afferent fibers are unable to carry the signal away from the eye toward the brain. When the light is directed into the uninjured eye, however, the afferent fibers carry the signal away from the eye to the brain, which directs the motor response of constriction to both eyes (consensual response); this response is conducted through efferent fibers within the oculomotor nerve.

If an orbital compartment syndrome is decompressed by the non-ophthalmologic practitioner in emergent conditions, an ophthalmologist should be consulted. Complications from performing an emergent lateral canthotomy include bleeding, infection, and injury to the surrounding tissue. Globe puncture is a rare but potential complication. All of these risks are considered small in the face of imminent and permanent vision loss from an untreated orbital compartment syndrome.