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CONCEPTS

Orbital Compartment Syndrome: Alternative Tools to Perform a Lateral Canthotomy and Cantholysis

Kenneth V. Iserson, MD, MBA; Zelda Luke-Blyden, MD; Scott Clemans, BSME

From the Department of Emergency Medicine, University of Arizona, Tucson, AZ and the GPHC Emergency Medicine Residency, Georgetown, Guyana (Dr Iserson); Department of Emergency Medicine, Georgetown Public Hospital Corporation, Georgetown, Guyana (Dr Luke-Blyden); and Buecher Biological Consulting, Tucson, AZ (Mr Clemans).

Orbital compartment syndrome acutely threatens vision. Lateral canthotomy and cantholysis ameliorate the compartment syndrome and, to save a patient's vision, must be performed in a timely manner. This requires appropriate tools. In resource-poor settings, the straight hemostat and iris scissors that are generally used for this procedure may be unavailable. In such situations, safe alternatives include using a multitool in place of a hemostat and a #11 scalpel blade instead of the iris scissors. As when using hemostats of varying sizes, the pressure applied to the multitool must be carefully modulated. When using a scalpel blade for the lateral canthotomy, the hemostat arm remains beneath the lateral canthus as a "backstop" to protect deeper tissues. For the cantholysis, use the back of the blade to "strum" for the ligaments, reversing its direction only to cut the ligament when it is identified.

Key words: lateral canthotomy, cantholysis, orbital compartment syndrome, retrobulbar hematoma, ophthalmic trauma

Introduction

Orbital compartment syndrome acutely threatens vision by compressing the ophthalmic artery. Although there are numerous possible causes (Table),[1,2] trauma-induced hemorrhage is the most common in patients presenting for emergency medical care. Since the early 1990s, lateral canthotomy and cantholysis has been the accepted method for emergency treatment of this condition.[1] Although a standard, simple technique for this procedure exists using common equipment, these basic tools may be unavailable in resource-poor situations, such as remote areas or developing countries. Therefore, a method using alternative equipment is necessary. In this case, emergency physicians in a resource-poor, very busy emergency department (ED) quickly devised a method to safely perform a lateral canthotomy and cantholysis using tools often available in austere settings. This improvisation offers a viable alternative method for those needing to perform this procedure.

Lateral Canthotomy/Cantholysis: Case

A 46-year-old man with a blunt cranial and globe injury arrived in the ED unconscious (Glasgow Coma Score = 5) and with obvious proptosis. As head injury treatment was initiated, the eyes were evaluated, showing that they were both midpoint and nonreactive to light, with the left eye proptotic and resistant to retropulsion with light digital orbital compression. There was no tonometer. It was uncertain whether the eye was salvageable, but the globe appeared intact. No ophthalmologist was immediately available.

A lateral canthotomy and cantholysis was indicated. However, in our resource-poor setting, there were no iris or similar scissors, a key part of the standard procedure. Even so, the clinicians successfully performed the procedure using a #11 scalpel blade. No anesthesia was needed as the patient was unconscious. Although no vasoconstrictor was used, only minimal bleeding ensued when cutting the lateral canthus, and it was easily controlled with minimal pressure over the bony orbit. As is usual, minimal blood emerged from the orbit.

The hospital ophthalmologist subsequently assessed the procedure as having been "done perfectly." The patient died of his head injuries several days later without regaining consciousness.

Discussion

RELEVANT ORBITAL ANATOMY

The orbital cavity is a 30-mL, 4-sided pyramid enclosing the globe, with the superior and inferior orbital septa

Corresponding author: Kenneth V. Iserson, MD, MBA, Department of Emergency Medicine, University of Arizona, 4930 N. Calle Faja, Tucson, AZ 85718 (e-mail: kvi@u.arizona.edu).

Table. Causes of orbital compartment syndrome[1,2]

Traumatic retrobulbar bleeding
Acute orbital/facial trauma (most common)
Eyelid surgery
Intranasal or external ethmoidectomy
Recent retrobulbar anesthesia
Spontaneous retrobulbar bleeding/hematomas
Atherosclerosis
Hemophilia
Hypertension
Intraorbital aneurysm of the ophthalmic artery
Leukemia
Valsalva maneuvers
Venous anomalies
Von Willebrand's disease
Less common conditions
Orbital abscess
Orbital cellulitis
Orbital emphysema
Orbital inflammation
Tumors

anteriorly (Figure 1). The walls are composed of 7 bones (maxilla, palatine, zygomatic, sphenoid, frontal, ethmoid, and lacrimal). The globe itself has a volume of 7 mL, with the optic nerve and ophthalmic artery tethering it posteriorly, limiting forward movement.[3]

The medial and lateral canthal tendons attach the muscular layer of the eyelids to the bone at the orbital rim (Figure 2).[4] They further prevent any anterior globe displacement.[5] These tendons often are termed the medial and lateral canthal (or palpebral) ligaments, although they are actually muscular insertions into the bone.[4] Superficial to the lateral canthal tendon and barely separated from it is a fibrous fascial plane, the lateral canthal raphe. The inferior and superior canthal ligaments run from the orbital periosteum to tissues of the interior lids.

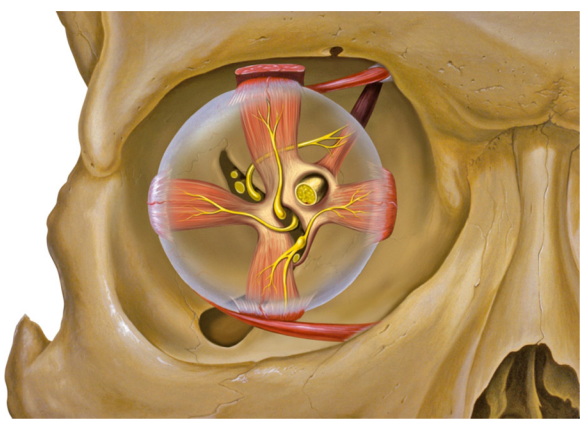

Figure 1. Orbit, globe, and adjacent structures. (Peter J. Lynch, Medical Illustrator, Creative Commons. Uploaded Dec. 23, 2006).

ORBITAL COMPARTMENT SYNDROME

Increased pressure within the orbital cavity is an emergency that requires prompt diagnosis and intervention to prevent blindness. Retrobulbar bleeding is the most common cause of orbital compartment syndrome, causing blindness in nearly half of patients who lose their vision after orbital or facial trauma.[6] Bleeding within this cavity compromises neurovascular structures passing into the orbit because there is little room for decompression. Although the optic nerve is very sensitive to reduced orbital perfusion pressure, the retina may be at greatest risk from central retinal artery occlusion.[3] Without decompression, which is "the facial equivalent of a fasciotomy in an injured extremity,"[7] irreversible vision loss may occur in as little as 90 to 120 minutes.[8]

By 1976, ophthalmologists were aware that a canthotomy and cantholysis could relieve lid pressure on the globe.[4] In 1994, Yung et al. [9] demonstrated that lateral canthotomy combined with inferior cantholysis provides a significantly greater decrease in intraocular pressure (IOP) than either procedure alone. Because these techniques are uncommon in EDs, practitioners have learned and practiced them on sheep and primate models and on human cadavers.

IDENTIFYING PATIENTS WITH ORBITAL COMPARTMENT SYNDROME

Emergency physicians must recognize orbital compartment syndrome and treat it in a timely manner to avoid or reverse visual loss.[8] A history of orbital or facial trauma and symptoms such as eye pain, decreased visual acuity, diplopia, or lack of motility (in conscious patients) strongly suggest the diagnosis. Digital orbital compression, although highly inaccurate, may indicate a resistance to retropulsion. Although infraorbital hypesthesia is frequently cited as a key symptom of orbital compartment syndrome, it may be difficult to assess and its clinical significance is minimal because it is found in many conditions. If an orbital compartment syndrome diagnosis is probable, especially with decreased visual acuity, clinicians should not delay the release procedures to obtain imaging because irreversible vision loss may occur if retina ischemia time is greater than 90 to 120 minutes.

As in the case presented, many such patients have concomitant head injuries, so clinicians may need to suspect this diagnosis based only on physical findings. These may include limited extraocular movements