Emergency Lateral Canthotomy and Cantholysis: A Simple Procedure to Preserve Vision from Sight Threatening Orbital Hemorrhage

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Abstract

Retrobulbar hemorrhage is an uncommon, but potentially devastating complication associated with facial trauma. It can rapidly fill the orbit and cause an "orbital compartment syndrome" that subsequently cuts off perfusion to vital ocular structures, leading to permanent visual loss. Treatment must be initiated within a limited time in order to prevent these effects; however, specialty consultation is not always available in remote field environments. This article addresses the mechanism, diagnosis, and treatment of retrobulbar hemorrhage via lateral canthotomy and cantholysis, and recommends that 18D medical sergeants be properly trained to evaluate and perform this sight-saving procedure in emergent settings where upper echelons of care are not immediately available.

Introduction

Retrobulbar hemorrhage is a vision-threatening emergency often necessitating immediate lateral canthotomy for preservation of vision.[1] Prompt recognition and appropriate treatment of this ocular emergency is imperative, for timely management determines the ultimate outcome.[2] The medical literature describes multiple causes for true spontaneous orbital hemorrhage; however, head and facial trauma, as well as post-surgical complications, constitute the majority of emergent cases.[3-14] Reports of injuries in Operation Iraqi Freedom document the risk of orbital hemorrhage and subsequent orbital compartment syndrome (OCS) from penetrating trauma and the potential vision-threatening consequences.[15]

Retrospective studies show an incidence of coexisting retrobulbar hemorrhage in patients with orbital fractures of only 0.45-0.6%.[16] However, in patients experiencing acute vision loss in the setting of traumatic retrobulbar hemorrhage, the potential for permanent blindness is high (44-52%).[17,18] Although rare, the potential ophthalmic concern in a war-time environment becomes increasingly real, due to the higher incidence of facial trauma and delayed presentation to upper echelons where definitive ophthalmic care can be undertaken.

We agree with earlier assessments that the skills to recognize and treat vision-threatening orbital compartment syndrome (OCS) due to retrobulbar hemorrhage should be within the scope of a Special Operations Forces (SOF) medic and concur with the recommendation of Burns and DeLellis that the procedures of lateral canthotomy and cantholysis could and should be introduced into the SOF medical training curriculum.[19]

Mechanism

Retrobulbar hemorrhage causes a mass effect within the confined space of the orbit, and as it expands it impinges on sensitive ocular tissues reducing perfusion of the optic nerve.[20] The compartment is restricted in its ability to expand due to the bony walls. Anterior expansion does occur, causing subsequent proptosis, but it is ultimately limited by the orbital septum and the fact that the globe is tethered to the optic nerve.[16,21-24] An OCS ultimately develops, increasing orbital pressure, damaging the optic nerve by direct compression, and causing ocular ischemia via decreased perfusion from compromised vascular flow, not unlike that seen in other compartment syndromes.[25] If the patient is unconscious or uncooperative and has periorbital trauma,

the only sign of OCS may be elevated intraocular pressure (IOP).[26] Without proper perfusion, sensitive structures such as the optic nerve and retina have a limited time for survival and recovery. Review of the literature suggests that the window for visual recovery from the onset of decreased visual acuity to decompression is perhaps limited to approximately 120 minutes.[10,27] Two case reports document a four hour delay with improvement in vision to baseline, but these appear to be rare exceptions.[28] Hayreh's studies on Rhesus monkeys demonstrated central retinal artery occlusion of 105 minutes or longer produced irreversible optic nerve damage, and total optic nerve atrophy occurred with occlusion times that were greater than 240 minutes.[16,29] It is therefore of the utmost importance to recognize and treat retrobulbar hemorrhage with prompt decompression early in this 120 minute window if the devastating effects on vision are to be reversed.

Referral for immediate specialist assessment, if available, should not be delayed even in doubtful cases.[24] Similarly, primary examiners should not waste precious minutes with unnecessary investigations that delay treatment in the event specialist care is not present.[24,28,30] Ideally an ophthalmologist would be expected to perform this emergency orbital decompression. However, if an emergency ophthalmology consult is unavailable, any emergency responder trained to do the procedure should act immediately.[26] According to U.S. Navy family physician Dr. Mark Benton, "Knowledge of this procedure is a must for physicians, especially those in remote areas where access to ophthalmology is not readily available. The emergent lateral canthotomy can be a potentially sight-saving procedure."[31] In the setting of the military field environment, this time window can easily lapse prior to presentation to a trained ophthalmologist. Special Forces units are at particular risk due to separation from upper levels of care. In these settings, prompt recognition and treatment by 18D medical sergeants may be required for vision saving care to be provided.

Diagnosis

In order to undertake proper treatment, it is imperative to recognize the signs and symptoms of acute retrobulbar hemorrhage in the setting of trauma. OCS should always be considered whenever there is impairment of vision following blunt facial trauma.[32] As the pressure increases, patients may experience double vision, nausea, and vomiting. Signs of retrobulbar hemorrhage include a progressively tense and painful proptosis, decreasing ocular motility, asymmetric visual acuity, field restriction on confrontation testing, and decreased pupil responsiveness – including failure to constrict to direct light stimulation or even loss of the consensual response in comparison with the other eye. The eyelids can become tense and edematous, and periorbital or subconjunctival hemorrhage/ecchymosis are frequently present (Figure 1).[24,33] These signs and symptoms are progressive over minutes and changes should raise suspicion of retrobulbar pathology.[16,34,35]

Figure 1: *OCS secondary to acute retrobulbar hemorrhage of the left eye sustained from orbital trauma.*

In the setting of blunt or penetrating trauma, retrobulbar hemorrhage and OCS may be accompanied by open globe injuries. When evaluating these patients, it is imperative that first responders maintain a high suspicion for globe perforation first. Care should be exercised during examination of the ocular and periorbital structures to avoid undue pressure on the affected eye. Manipulation of the lids should be minimal to limit the risk of extrusion of intraocular contents in the event globe trauma is present. If suspicion remains based on clinical history, or signs of obvious foreign body, irregular globe shape, peaked pupil, visible corneal or conjunctival lacerations, flat anterior chamber, or hyphema, the eye should be protected with a shield and intervention should be left for upper echelons of care. Nevertheless, even in ideal settings, retrobulbar hemorrhage is a *clinical* diagnosis. Treatment cannot wait for imaging to confirm the presence of hemorrhage within the orbit or for on-call ophthalmologic personnel to arrive. Delays for such studies are at the expense of continued ocular ischemia. Definitive care must be undertaken immediately, once the diagnosis of orbital compartment syndrome from retrobulbar hemorrhage is made and the potential of rupture or penetrating injury has been carefully ascertained and ruled out sufficiently to proceed.

Medical/Surgical Intervention

Mild cases of retrobulbar hematoma have been managed with simple observation and medical treatment.[36-38] Acute OCS requires surgical intervention to prevent vision loss.[39] However, there is often reluctance to interfere surgically in cases of orbital hemorrhage. According to Markovits, when imperative, various methods including aspiration, continuous suction, and open orbitotomy by brow and lateral approach can be

used.[40-42] The goal of treatment for retrobulbar hemorrhage is orbital decompression to release the pressure on sensitive orbital contents — such as the optic nerve and vessels. By far the most common method involves performing a canthotomy and cantholysis of the tendon securing the lateral eyelid. This technique is described in many ophthalmic and surgical texts.[21-23,27,30,34,35,43,44] Performing a lateral canthotomy exposes the lateral canthal tendon, allowing surgical section via cantholysis of the inferior and/or superior crus of the tendon from their natural attachments. This causes laxity of the lower lid and provides a sufficient increase in orbital compartment space to immediately relieve the compressive forces in most instances.

Technique of Lateral Canthotomy and Cantholysis

The procedure can be performed in the following stepwise fashion:

A. The surgical area of the affected eye should be prepped in sterile fashion if possible. If available, gently clean with 5% betadine; however, due to the immediate nature of the situation, saline irrigation is sufficient if this is not available.

B. Pain control and hemostasis are achieved via local injection of approximately 1cc of 2% lidocaine with epinephrine. Using a 27-gauge needle, anesthetize the cutaneous and deep tissues just lateral to the lateral angle of the affected eyelid with the needle directed away from the eye. Care should be taken to inject into the local cutaneous region and NEVER into the eye or orbit itself. The quantity of anesthetic should be sufficient to cover the region between the angle and the bony lateral orbital rim, and additional anesthetic should be applied if the patient is experiencing discomfort (Figure 2).

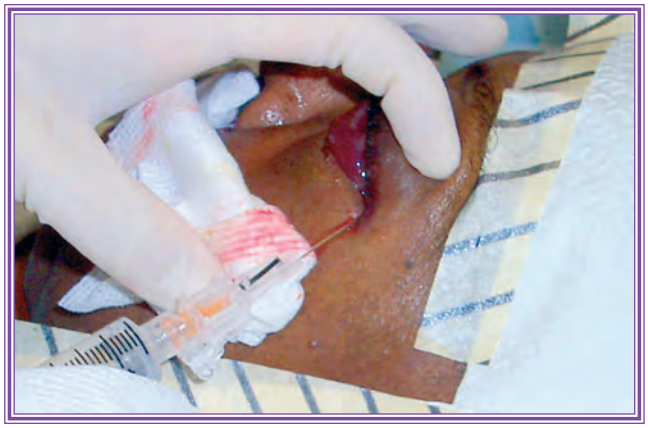

Figure 2: *The cutaneous and deep tissues just lateral to the lateral angle are anesthetized with 2% lidocaine with epinephrine.*

C. Advance the jaws of a small hemostat (one anterior and one posterior to the tissue plane) horizontally across the lateral canthus from the angle of the eyelid to the margin of the lateral orbital rim and clamp shut for one minute. This crushing force will help compress the swollen tissues, provide additional hemostasis, and leave a physical marker of the proper region to be cut during the canthotomy (Figure 3).

Figure 3: *Clamp a small hemostat horizontally across the lateral canthus from the angle of the eyelid to the margin of the lateral orbital rim.*

D. After removing the hemostat, advance a pair of blunt tipped scissors with blades open, one anterior and one posterior to the crushed region previously marked. With the scissors, the lateral canthotomy is then performed by cutting horizontally, from the lateral angle of the eyelid to the bony margin of the orbital rim; approximately a 1cm cut (Figure 4).

Figure 4: *With blunt tipped scissors, cut horizontally from the lateral angle of the eyelid to the bony margin of the orbital rim along the line left by the hemostat.*

E. The canthotomy allows for additional exposure of the deeper tissue, including the inferior and superior crus of the lateral canthal tendon. Maximize this exposure by gently taking your hemostat or tooth forceps to grasp the lower lid laterally and pull down and away to help evert the lid and expose this tissue plane.

F. Identify the now exposed tendon in the surgical field. This can be done more easily by palpation than visually. Using the closed blades of a pair of scissors it is possible to strum the crus in order to further identify the proper structure.

G. Once identified, a cantholysis can be performed. Cut the inferior crus of the lateral canthal tendon with the scissors pointed inferoposteriorly to release it completely from its attachment to the lower lid (Figure 5). This incision will be 1-2cm in length and depth. Upon proper cantholysis the lower lid should fall away from the lid margin. If not, repeat this step until the tendon has been released properly and the lid relaxes (Figure 6).

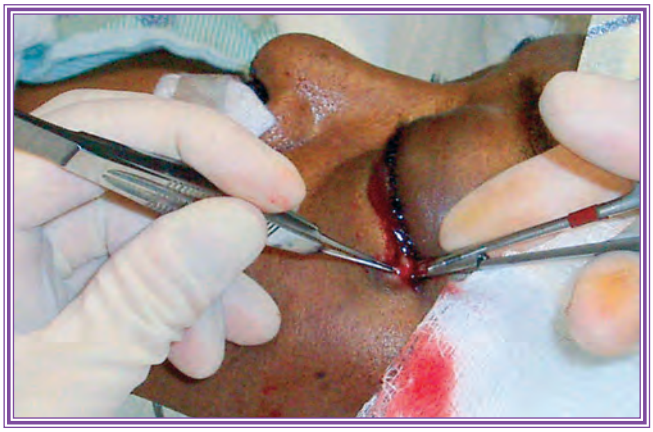

Figure 5: *Cut the inferior crus of the lateral canthal tendon with the scissors pointed inferoposteriorly to release it completely from its attachments.*

Figure 6: *Upon proper cantholysis the lower lid should fall away from the lid margin.*

H. Do not close the surrounding tissue. The surgical field can be covered lightly by gently taping a sterile 4x4 gauze pad loosely over the area, but closure should be delayed for a higher echelon of care after the acute retrobulbar hemorrhage has resolved.

Complications

If properly performed, the risks of this procedure are relatively low. Cosmetic concerns due to the loss of suspension of the lower lid can be addressed at a later date by trained ophthalmologists with excellent results and minimal scarring, despite the delay in closure. Deeper orbital contents can be avoided. Sensitive surrounding structures, including the levator aponeurosis, lacrimal gland, and the lacrimal arteries are found superior to the surgical site and easily avoided with good technique. The key to minimizing surgical complications is recognizing the indications and contraindications for performing orbital decompression, and conducting proper training of first line responders in the correct lateral canthotomy and cantholysis technique.

Lateral canthotomy and cantholysis is performed infrequently in emergency departments; therefore, a laboratory-based curriculum using a swine model was developed to teach emergency medicine residents and pediatric emergency medicine fellows the proper technique and to provide them with hands-on training.[45] The University of Nebraska Medical Center Department of Emergency Medicine has an organized "Emergency Procedures Laboratory" that provides an opportunity to assess procedure skills, including lateral cantholysis, in a controlled environment.[46] Successful use of a porcine model for training has been documented in the literature and would be an excellent option for teaching the proper skill set to forward personnel.[45,47]

Conclusion

Wartime environments task first line providers with the difficult responsibility of providing immediate care to save life, limb, and sight. As described above, the uncommon complication of retrobulbar hemorrhage can quickly become a vision-threatening emergency in patients with facial trauma, particularly when higher echelon assets are unavailable for definitive care. In these circumstances, knowledge of how to recognize and treat this threat to sight immediately upon presentation is necessary for vision preservation.

While the overall incidence may be low, when present it is a blinding condition where visual outcomes could otherwise be saved by well-trained non-ophthalmologists comfortable handling live tissue. Although all first responders do not have the basic training necessary to perform this technique, EMT-P trained providers, such as 18D medical sergeants, have attained a reasonable skill set through prior handling of live tissue from which a method for basic orbital decompression could be appropriately added. In addition, 18D medical sergeants

are more likely to find themselves in austere environments where delayed evacuation would merit the need for such skills. Teaching this subset of first responders how to properly perform a lateral canthotomy and cantholysis would provide them an invaluable tool to better care for their wounded in a timely fashion. This training could occur through the use of live tissue models under supervision, as occurs for emergency physicians in their residency programs. Training 18D medical sergeants to recognize and treat the clinical signs and symptoms of OCS from retrobulbar hemorrhage via this technique brings a potentially vision-saving intervention closer to the Soldier who is in need of emergent care.

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