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Techniques and Procedures

OCULAR COMPARTMENT SYNDROME AND LATERAL CANTHOTOMY PROCEDURE

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☐ **Abstract—Background: Ocular compartment syndrome (OCS) is a serious ophthalmological emergency that should be diagnosed and treated immediately to prevent permanent loss of vision. It is usually caused by a retro-orbital bleed that will subsequently increase intra-orbital pressure and threaten the patient's vision. Lateral canthotomy and cantholysis is a minor bedside procedure using simple equipment that is readily available in emergency departments, and the aim of such a procedure is to free the eye globe from its lateral attachment to the bony orbital wall and allow more eye protrusion and hence reduce intra-orbital pressure and save the patient's sight. The case we present describes a 42-year-old man who presented with facial injuries following an alleged assault and in whom a computed tomography scan of the head showed a retro-orbital hemorrhage. The patient had subtle signs of increased intra-orbital pressure for which lateral canthotomy and cantholysis was indicated. Discussion: OCS is an ophthalmological emergency that can present with subtle signs of increased intraocular pressure that can lead to irreversible loss of vision if not treated with a simple bedside operation called lateral canthotomy and cantholysis within a specific time frame. We explore the pathophysiology and presentation of OCS and how to perform the lateral canthotomy with cantholysis procedure. Conclusions: The aim of this case presentation is to highlight the importance of diagnosing OCS as an ophthalmological emergency and discuss how to perform the sight-saving procedure.** **Crown Copyright © 2018 Published by Elsevier Inc. All rights reserved.**

☐ **Keywords—ocular compartment syndrome; intra-orbital pressure; lateral canthotomy; cantholysis; hematoma**

INTRODUCTION

Here we present a case of acute ocular compartment syndrome (OCS) resulting from an expanding retro-orbital hematoma complicating a traumatic head injury after an alleged assault. This case was seen in the emergency department and required an urgent lateral canthotomy and cantholysis procedure to save the patient's vision, which could have been lost if the procedure was not done or was delayed.

OCS is a rare yet serious sight-threatening condition that requires prompt diagnosis and treatment in the emergency department, involving a simple minor surgical procedure that helps relieve retro-orbital pressure and in turn alleviate the ischemic pressure on the patient's retina and optic nerve (1).

CASE REPORT

A 42-year-old man who presented with a head injury following an alleged assault that involved being hit with a metal pipe multiple times on the head. The patient sustained multiple bruises to the forehead and left face,

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including a significant left periorbital ecchymosis (2). Examination of the patient was remarkable for reduced vision in the left eye (visual acuity [VA] of 6/3 meter, 20/10 feet on Snellen chart). There was also some subtle left eye proptosis with conjunctival injection and afferent pupillary defect. Extraocular movements were intact, with no evidence of any ocular muscle impingement. Given the history of loss of consciousness, persistent severe headache, and the fact that the patient vomited a few times after the head injury, the decision was made to get an urgent head computed tomography (CT) as recommended by National Institute for Health and Care Excellence guidelines (2014 updated review). Head CT (unenhanced) was reported in < 1 h by the on-call radiologist describing a left retro-orbital hematoma with no evidence of any intracranial bleed or skull fracture. The case was urgently discussed with the offsite ophthalmology doctor on call at Moorfield Hospital, where advice was given to perform an emergency lateral canthotomy and cantholysis procedure to save the patient's sight from irreversible loss secondary to OCS and subsequent increased intraocular pressure. The patient was immediately taken to a resuscitation bay in the department where the lateral canthotomy and cantholysis procedure was done under aseptic technique and with remarkable improvement in patient's headache and left eye VA (post procedure VA of 6/7 meter, 20/25 feet on Snellen chart). The patient was then followed by the ophthalmology service at the local Essex County Eye Clinic with a remarkable recovery. The patient is now working as a taxi driver with his vision back to his normal baseline and with a very minimal cosmetic scar to the lateral side of his left eye that is hardly noticeable.

DISCUSSION

Pathophysiology of OCS

As the retina and the optic nerve have always been considered an extension of the brain and the central nervous system, it is no surprise that the orbit will follow the same pathophysiology of the cerebral blood perfusion being affected by increased intracranial pressure. Similarly, the orbit can only accommodate a small increase in pressure before causing optic nerve and retinal artery pressure ischemia. Retinal ischemia lasting > 90–120 min will cause irreversible blindness, hence the importance of early detection of such an ophthalmological emergency and providing effective treatment (3,4).

In cases of OCS secondary to retro-orbital hematoma, the usual suspect is the infraorbital artery or one of its branches that can bleed profusely, leading to an acute rise in the retro-orbital pressure and consequently in the orbital pressure unless there is communication with the paranasal sinuses through a fracture (5,6).

Although traumatic retro-orbital hematoma is by far the most common cause of OCS, there are many other causes, such as aggressive large-volume fluid resuscitation, extraverted contrast, spinal surgery in the prone position, disseminated intravascular coagulation, and spontaneous retro-orbital bleeding from nearby vascular anomalies.

Presentation of OCS

Symptoms of OCS may include severe headache, ocular pain, blurred vision, reduced ocular movements, proptosis, and visual loss. Examination of the affected eye will depend on the degree of compartment syndrome and may include ecchymosis of eyelids, chemosis, subconjunctival injection, ophthalmoplegia, proptosis, afferent pupillary defect (Marcus Gunn pupil), central retinal artery pulsation, papilledema, optic atrophy, cherry red macula and reduced visual field, and visual acuity. It is also important to consider other important differential diagnoses when assessing patients with suspected OCS, as there are many other clinical conditions that can mimic this ophthalmological emergency, such as orbital floor fracture with inferior rectus entrapment, Graves' disease, ocular retinoblastoma, lens dislocation, and direct optic nerve injury.

Lateral Canthotomy and Cantholysis

The lateral and medial canthal tendons are strong anchors that connect the eyelid tarsal plates to the orbital rim and, as such, are important in preventing the forward movement of the eye globe (Figure 1). In a case of OCS, the increasing orbital pressure can be accommodated by cutting the lateral canthal tendon and its inferior crus to free the eye globe and allow more space for anterior eye protrusion. Lateral canthotomy and cantholysis is indicated when intraocular pressure (IOP) is > 40 mm Hg (normal IOP is 10–21 mm Hg) especially when there is an associated Marcus Gunn pupil (7). The only contraindication to lateral canthotomy is eye globe rupture in which the affected eye will show clinical signs such as hyphemia, subconjunctival hemorrhage, misshapen pupil, enophthalmos, and exposed uveal tissue (8). This absolute contraindication is because of the high risk of hemorrhage, infection, and risk of causing additional iatrogenic damage to the eye globe as a complication of the procedure (9).

How to Perform the Procedure

First, obtain consent from your patient after explaining the benefit and risks of such a procedure and why it needs

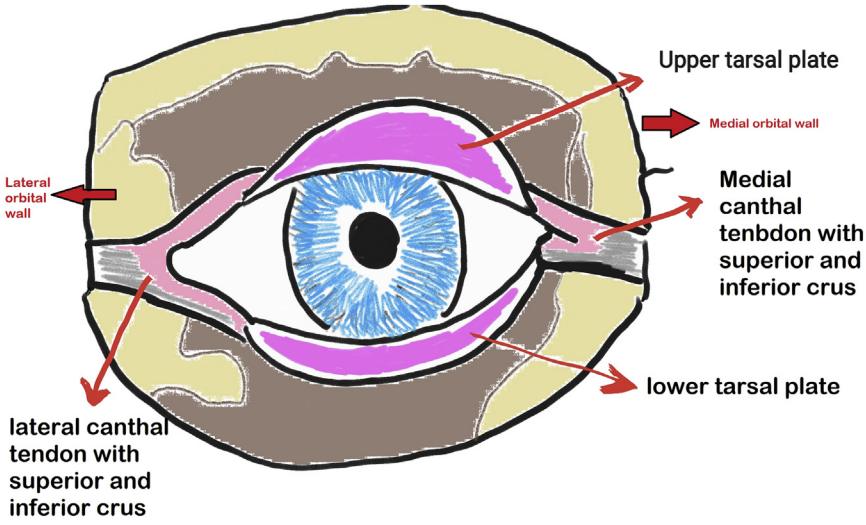

Figure 1. Lateral and medial canthal tendons.

to be done urgently and not electively. Make sure you give your patient adequate analgesia and ensure there is adequate space and lighting. The use of medical examination light is very useful to get a good visual of related anatomy. Make sure to document the VA and the IOP before and after the procedure.

The required equipment includes the following:

1. sterile field with sterile gloves and gown;
2. dressing pack with sterile drapes;
3. normal saline for cleaning the skin;
4. suture kit;
5. lidocaine 1% (with or without adrenaline) to anesthetize the skin; and
6. syringe with a 23-gauge needle (blue needle).

Procedure steps are as follows:

- Position your patient in supine position with the head elevated to about 10–15°.
- Make sure to have an assistant to help maintain head position, as any sudden movements can lead to ocular or facial injuries.
- Clean the lateral canthus and the surrounding area with normal saline water and use a sponge to dry the cleaned skin.
- Identify the lateral canthus and inject about 1–2 mL lidocaine 1% (the mixed form with adrenaline may be preferred, as it will reduce the bleeding, but it is not essential). Tip: When injecting the local anesthetic, make sure to point the needle laterally towards the lateral orbital rim instead of medially towards the globe to reduce the risk of injuring the globe (Figure 2).

Figure 2. Identifying the lateral canthus (white arrow). (Reprinted from Ramakrishnan VR, Palmer JN. Prevention and management of orbital hematoma. Otolaryngol Clin North Am 2010; 43:789–800, with permission.)

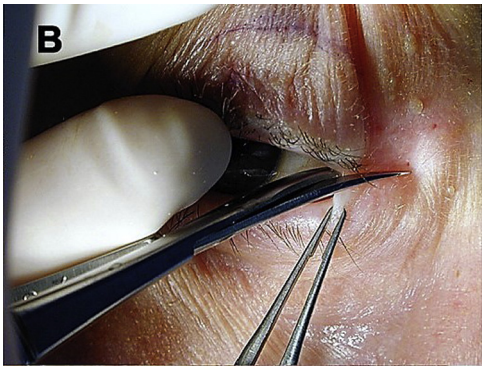

Figure 3. Crushing the lateral canthus with forceps. (Reprinted from Ramakrishnan VR, Palmer JN. Prevention and management of orbital hematoma. Otolaryngol Clin North Am 2010; 43:789–800, with permission.)

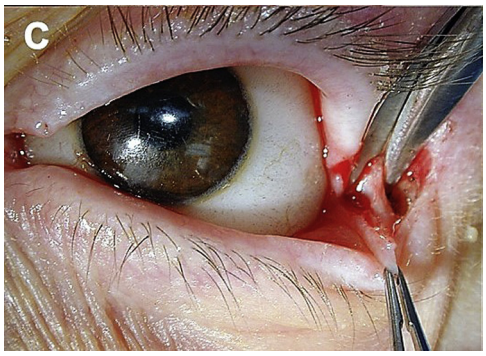

Figure 4. Cut the lateral canthus and retract the lower eyelid to expose the inferior crus. (Reprinted from Ramakrishnan VR, Palmer JN. Prevention and management of orbital hematoma. Otolaryngol Clin North Am 2010; 43:789–800, with permission.)

- Using toothed forceps from the suture kit, clamp-crush the lateral canthus for about 1 min to aid in the reduction of bleeding from the canthus after incision (Figure 3).
- Using sterile scissors from the suture kit, cut the lateral canthus until the lateral orbital rim, this step is called lateral canthotomy (Figure 4).
- The lateral canthus divides into the superior and inferior crus. Identify the inferior crus, which might require you to gently retract the lower eyelid to make it visible. Cut the inferior crus using the same sterile scissors, aiming towards the inferolateral orbital rim, this step is called cantholysis (Figure 5).
- After performing the cantholysis, the eye globe and the lower eyelid should protrude antero-inferiorly.
- Now you can measure the IOP. If it is still > 40 mm Hg, then cutting the inferior crus is inadequate, and you need to proceed to cut the superior crus as well, using the same technique.
- A successful procedure is evident by improved VA and IOP reduced to < 40 mm Hg (10).

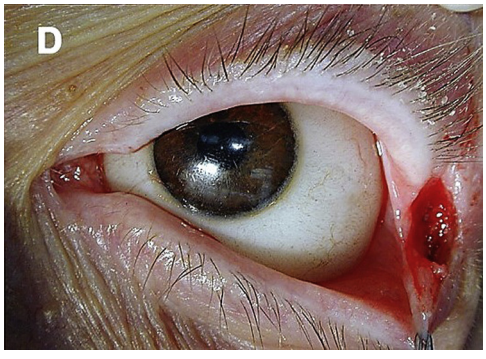

Figure 5. Cutting the inferior crus (cantholysis). (Reprinted from Ramakrishnan VR, Palmer JN. Prevention and management of orbital hematoma. Otolaryngol Clin North Am 2010; 43:789–800, with permission.)

The following are complications of the procedure:

- globe or lateral rectus injury;
- ptosis due to levator aponeurosis injury;
- injury to lacrimal apparatus;
- bleeding;
- infection;
- visual loss due to late or delayed procedure (golden time is 90–120 min);
- ectropion due to excessive cantholysis; and
- cosmetic issues (11,12).

CONCLUSIONS

Lateral canthotomy and cantholysis is an emergency procedure that every emergency physician should be familiar with. It should be done in a timely fashion to treat OCS, as delaying treatment will lead to unavoidable and irreversible blindness. The aim of such a procedure is not to drain a retro-orbital hemorrhage but rather to allow free movement of the globe and thus more proptosis of the globe to accommodate increasing retro-orbital pressure and, in turn, intra-orbital pressure. It is a relatively easy bedside procedure done with simple equipment that every emergency physician uses in daily practice.

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