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Research Article

A Novel Use of a Point-of-View Camera for Teaching Lateral Canthotomy and Cantholysis to Emergency Physician Trainees

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Abstract

Purpose: To evaluate a novel use of a point-of-view recording system for teaching emergency physician trainees integral skills, such as lateral canthotomy and cantholysis (LCC).

Methods: The point-of-view head mounted camera captures the LCC procedure from the physician's point of view.

Results: The recording system was effective in capturing the surgical field, fine detail of the procedure, and positioning of the instruments. The instructive teaching of the LCC procedure was done simultaneously during the surgery filming, with minor editing post-surgery.

Conclusions: Point-of-view cameras have great potential in assisting the education at the post-graduate level within residency training programs. Video recording from the physician's perspective simulates the experience for trainees and could leave them feeling more confident in their ability to perform the procedure.

Keywords: *Lateral Canthotomy and Cantholysis; Orbital Compartment Syndrome; Ocular Trauma; Education; Teaching; Point of View Camera, Video*

Introduction

Orbital compartment syndrome (OCS) is a vision threatening emergency that occurs when there is a sudden rise of pressure in the orbital space. Retrobulbar hemorrhage secondary to trauma, surgery or retrobulbar injections is the most frequent cause of OCS [1,2]. The increase in orbital pressure is incompletely compensated through proptosis as the forward movement of the globe is restricted by the medial and lateral canthal tendons [3]. Vascular supply is impeded, potentially resulting in ischemia and irreversible vision loss within 1.5 - 2 hours [1,4-6]. Lateral canthotomy and cantholysis (LCC) is a simple procedure used to decompress the orbit. This can restore blood flow to the retina and preserve vision in the affected eye if performed promptly. Consultation and intervention by an ophthalmologist would be ideal; however, it is often not possible in a timely manner. Emergency physicians should be comfortable evaluating, diagnosing, and performing a LCC to manage an OCS to decrease the risk of vision loss. Developing this skill is challenging as this procedure is seldom performed, therefore resources need to be available. Current training videos are an excellent learning tool but are limited by several factors. For example, overhead cameras are costly and require frequent repositioning to capture all aspects of the procedure. A dedicated videographer recording from either a tripod adjacent to the physician or over the physician's shoulders introduces disruption to the work-flow. The biggest shortcoming of these traditional videos is that they do not capture the perspective of the physician performing the procedure.

Point-of-view (POV) cameras show the physician's perspective, which is more conducive to training as it provides a first person experience for trainees. This recording system has become a rapidly evolving tool in medicine, and the literature provides many examples demonstrating its value. POV cameras have been used to describe high quality recording of scleral buckling surgery [7,8], neurosurgery [9], and plastic and reconstructive surgery [10]. We report our novel technique of recording a LCC using a head-mounted POV camera as a resource for emergency physician trainees to learn this procedure reliably and skillfully.

Methods

The study adhered to the principles of the Declaration of Helsinki. Ethics Committee approval was not sought as there were no modifications to the surgical techniques the patients underwent. All patients involved in the study consented to their surgery and the recording of video and still images. Our recording system uses a head mounted POV GoPro Hero 4 Silver camera (GoPro, San Mateo, CA, U.S.A.) with a modified 5.4 mm f/2.5 aftermarket lens with a 60° field of view (Peau Productions Inc, San Diego, CA, U.S.A.). This lens was pre-focused to a working distance of 17 inches, which is the same as the working distance as the loupes used by the surgeon in our study (KP). We used a GoPro Hero4 Silver (GoPro, San Mateo, CA, U.S.A.) set to 1080P on narrow recording at 48 frames per second, with spot metering and the low light functions turned on.

The camera functions were controlled remotely by an assistant with the use of the GoPro App on a tablet computer to ensure proper framing of the video recording.

Figure 1: *The surgical set-up showing the surgeon (KP) wearing the head-mounted camera.*

Lateral Canthotomy and Cantholysis

All of the equipment used can usually be found on a suture tray from the emergency department. The procedure began with irrigating

the area around the lateral canthus using normal saline. This was followed by subdermal injections of 1 - 2cc of 1 - 2% lidocaine with epinephrine into the lateral canthus to assist in both pain relief and hemostasis. This should be injected away from the eye. Local anesthesia may not be successful due to the nature of the environment from the trauma, thus a hemostat should be considered to assist with devascularization. We applied a hemostat from the lateral canthus towards the bony orbit to devascularize the area for 60 seconds. After the hemostat was removed, a cut was made along the lateral canthus laterally 1 - 2 cm in length, away from the globe and towards the bone of the lateral orbital rim. The lower lid was pulled down using forceps to visualize the inferior crus of the lateral canthal tendon. A 1 cm long incision was made through this tendon directed inferiorly and laterally away from the globe. When successfully executed in the setting of OCS, the eyelid should move away from the globe, the IOP should decrease, and the retina should re-perfuse.

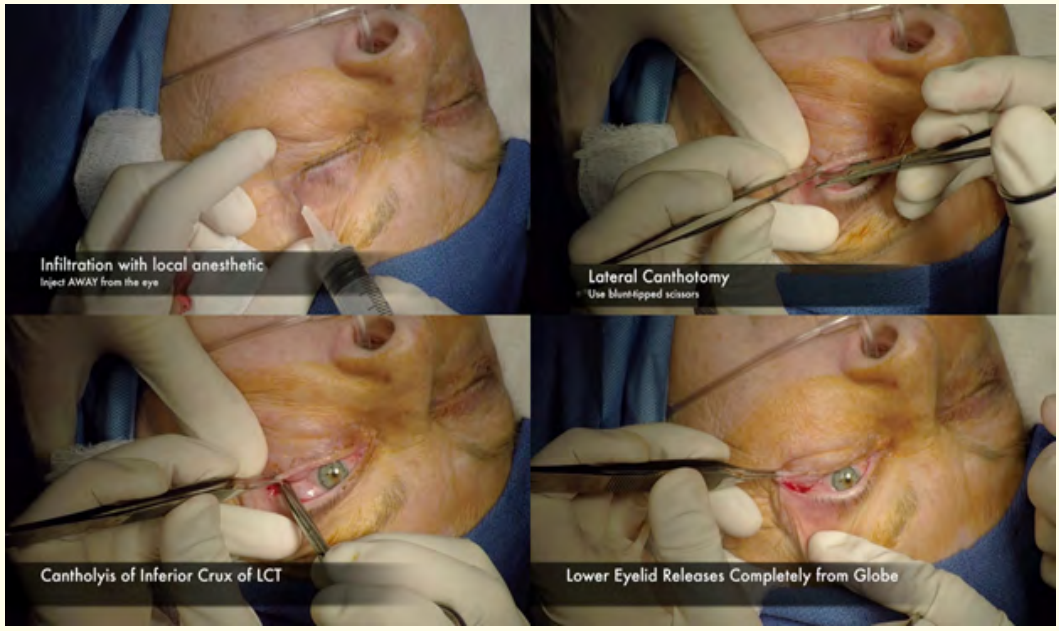

Figure 2: *Still images captured from the video.*

Results

The recording system was effective in capturing the surgical field, fine detail of the procedure, and positioning of the instruments. The instructive teaching of the LCC procedure was done simultaneously during the surgery filming, with minor editing post-surgery. Video can be found at: https://youtu.be/6A238b7ZPEo.

Discussion

Our novel use of a POV camera for recording LCC is an efficient, cost effective tool useful for medical education at an academic institution, as well as a valuable resource for emergency room clinicians. Video assisted learning is on the rise in medical education ranging from podcasted lectures to technical skill training. One of the key advantages of this technology is the ability to replay the video as often as needed to master the concept or technique. Training videos utilizing the POV camera are the most conducive to learning as they present a view from the perspective of the physician allowing additional use of cognitive skills such as visual processing and visual memory. This technique essentially provides a simulation for trainees leaving them feeling more comfortable in their ability to perform the procedure.

The POV recording system has grown in the literature with its potential in medical education. Gooi., *et al*. [11] described mounting a POV camera to a microscope to record hand positions during ophthalmic surgery and its potential use for trainees. Karam., *et al*. [12] demonstrated that the use of head mounted video recording of a resident's surgical performance on a standardized articular fracture trainer improved skills due to providing guided video-based feedback. Our POV recording system incorporates a modified lens which provides more magnification to see detail, but at the same time has a usable depth of field.

A challenge of emergency physicians is maintaining competency and preparedness for a large variety of procedures. This is a useful point of care reference video that could be briefly reviewed prior to performing a LCC, or other procedures they do not perform as frequently. This will ultimately help ensure procedures are performed reliably and skillfully. Emergency ophthalmology consult for a LCC is ideal, but not always possible in this time sensitive situation. This becomes more of an issue in remote areas without immediate access to ophthalmology. The POV recording system can be a training device in an emergency setting for performing a LCC or other procedures that emergency physicians may seldom encounter.

The POV camera system has its limitations. Recording of longer procedures may be restricted by various factors. On a fully charged battery, our camera has an approximate battery life of one hour of continuous recording time. However, this can be compensated with a USB power supply to allow for extra time. The weight of the system may cause physician neck strain, particularly during longer procedures [13]. Additionally, an assistant is still need to help with initial setup and periodic checking to make sure the camera is properly oriented to capture the field of interest. Despite these limitations, this method is a major improvement from the overhead camera system, which is costly, labor intensive, and lacks the physician's perspective. Our camera system will aid in teaching technical skills using visualization, which is a fundamental aspect of the cognitive process.

This novel technique has the capacity to not only contribute to medical education, but can be an asset in an emergency setting for established physicians. This resource can be used in various areas of medicine, and amongst the education of the entire medical support team, such as nurses, operating room staff, and other interdisciplinary professions. Ultimately this technology will improve the quality of care for patients in many areas of medicine.

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