



Case Review

Out-of-Hospital Lateral Canthotomy and Cantholysis: A Case Series and Screening Tool for Identification of Orbital Compartment Syndrome



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Orbital trauma is frequently encountered by emergency medical service (EMS) providers. Rarely, it can result in orbital compartment syndrome (OCS), an acute sight-threatening condition that requires time-sensitive intervention to preserve vision. OCS may result from an orbital mass, which in the setting of trauma may be a retrobulbar hematoma (RBH), or from edema resulting from blunt trauma or a high-energy penetrating injury in proximity to the orbit.¹ OCS may also occur subacutely from a tumor or abscess. Both medical and surgical methods exist for managing this condition. Lateral canthotomy and cantholysis (LCC) is indicated for the management of OCS. This is a simple vision-saving procedure that is well-documented and described in the literature.^{2–4} The authors of this article could locate only 1 previously described case of LCC being performed in an out-of-hospital setting.⁵ This case series describes the care of 3 patients who suffered separate traumas, 2 motor vehicle accidents and 1 fall from standing height, in the years 2016 and 2017 who had emergent LCC in the field by physicians staffing a civilian rotary wing air ambulance. LCC is generally not included as a skill within the scope of practice of EMS providers. These cases highlight the difficulty of accurately identifying OCS in an out-of-hospital setting. A method for screening patients for OCS is described, as well as the logistics of performing LCC in an out-of-hospital setting.

Case 1

A 60-year-old man suffered a fall from a standing position sustaining trauma to his left face and orbit. A local basic life support

ambulance and advanced life support squad were dispatched and initiated prehospital care. Subsequently, a flight team was used to transfer the patient to a tertiary level 1 trauma center for advanced care. Local ground EMS treatment included the insertion of a 16-G peripheral intravenous line in the right antecubital fossa, infusion of normal saline, and placement in cervical spine immobilization.

The helicopter EMS medical team intercepted with the patient in the back of the ambulance. The primary survey revealed stable critical systems without effects to the patient's airway, respiratory status, or hemodynamic stability. The patient's blood pressure was elevated to 205/105, and the pulse oximetry was 94%. His Glasgow Coma Scale (GCS) score was 13 (eyes: 3, verbal: 4, and motor: 6) with decreased movement of the right lower extremity. It was unclear whether the patient had loss of consciousness given that he was confused with clinical intoxication (later found to have an ethanol level of 331). During examination, the patient was found to have trauma to the left side of his face and orbit; his left eyelids were noted to be tensely swollen and proptotic. No visual acuity was assessed given the tenseness of the eyelids interfering with eye opening. The rest of the examination including chest, abdomen, pelvis, and extremities was grossly unremarkable.

Given the swelling of the eyelids and proptosis, the air medical crew made the decision to perform LCC because of concern for the presence of an RBH. Lateral canthotomy was performed, and inferior cantholysis was attempted. One hundred micrograms of fentanyl and 4 mg

ondansetron were given for pain and nausea. Local analgesia was provided with subcutaneous lidocaine, and the skin was cleansed with chlorhexidine. The lateral canthus was clamped with a hemostat and then incised with scissors. Next, an attempt was made to perform cantholysis of the inferior canthal ligament; however, this was hindered because of swelling and bleeding from the canthotomy site. The procedure took approximately 10 minutes. The patient was prepared for transport and flown to the nearest level 1 trauma center. In flight, the patient was administered 15 L oxygen via a nonrebreather mask for persistent hypoxia to the low 90s. The air ambulance response time from dispatch was 8 minutes, the on-scene time was 25 minutes, and the transport time was 10 minutes to the trauma center.

Hospital Course

Once in the emergency department, the patient was evaluated by the emergency department physicians in conjunction with the trauma surgery service. The patient remained hemodynamically stable with a GCS score of 13 (eyes: 3, verbal: 4, and motor: 6). It was also noted that the patient's right leg had no motor function. The patient underwent trauma computed tomographic (CT) imaging including maxillofacial scans without intravenous contrast. Imaging revealed a left parietal and frontal intracranial hemorrhage measuring 2 × 1.4 cm and 1.3 × .6 cm, respectively. Additionally, left zygoma, left maxillary sinus, and left lateral orbital wall fractures were identified (Fig. 1).

Neurosurgery was consulted for the intracranial hemorrhage, which was managed nonoperatively. The patient's



Figure 1. CT Imaging of the head revealing a proptotic left eye for the patient discussed in case #1.

international normalized ratio was elevated to 2.4, and he received 2 units of fresh frozen plasma and vitamin K. The patient was not on blood thinners. The plastic surgery service was consulted for the evaluation and treatment of the identified facial fractures. The physicians felt that the injuries identified were nonoperative in management. The ophthalmology service was consulted given the performance of out-of-hospital canthotomy as well as for evaluation of the lateral orbital wall fracture. They were unable to assess visual acuity given the patient's depressed mental status. Intraocular pressures (IOPs) were 18 on the right (oculus dexter [OD]) and 17 on the left (oculus sinister [OS]). Pupils were symmetric and reactive bilaterally without a relative afferent pupillary defect (RAPD), and extraocular movements were preserved. Local exploration of the lateral canthotomy site revealed that the inferior canthal ligament was still intact. The patient was admitted for 6 days, spending 4 days in the intensive care unit and 2 days on the floor. During this time, his mental status normalized, and he regained partial motor function of his right leg. He was discharged to a skilled nursing facility for continued rehabilitation. The patient followed up with the ophthalmology service as an outpatient 11 days after the initial injury; he was doing well with preserved sight and normal IOPs, and the canthotomy site had healed well by secondary intention.

Case 2

A 45-year-old man was involved in a single-vehicle rollover motor vehicle accident and was ejected, suffering extensive head and facial trauma. He was evaluated by a local advanced life support squad who requested an air ambulance because of the need for emergent trauma evaluation in a timely fashion. Ground EMS providers ini-

tially found the patient lying prone in the roadway unconscious and unresponsive, only withdrawing to pain, and with a possible open depressed skull fracture. Before helicopter arrival, they had established an intravenous line. Given the concern of a critical traumatic brain injury, the team administered 3% hypertonic saline and initiated bag-valve-mask ventilation because of a depressed ventilatory rate, although the patient was reportedly neither hypoxic nor hypotensive.

The helicopter EMS medical team intercepted with the patient in the back of the ambulance. The primary survey revealed a patent airway, normal pulse, and normal blood pressure. Pulse oximetry was 99% with bag-valve-mask assistance. The GCS score was 6 (eyes: 1, verbal: 1, motor: 4). On secondary examination, he was found to have a frontal scalp laceration with an underlying depressed calvarial fracture. The pupils were asymmetric with right 2 mm and sluggishly reactive and left 4 mm and sluggishly reactive with the presence of an RAPD. The left eye examination revealed proptosis and tense lids. No visual acuity could be assessed because of the depressed mental status. The rest of the examination including chest, abdomen, pelvis, and extremities was grossly unremarkable.

Given the depressed GCS score and the anticipated clinical course, the patient was prepped for rapid sequence intubation using ketamine for induction and succinylcholine for muscle relaxation by the air medical crew. The patient became combative and would not tolerate preoxygenation, so the decision was made to perform a delayed sequence intubation. Ketamine was administered, and the combativeness dissipated. The patient was adequately preoxygenated, and subsequent denitrogenation was achieved. Succinylcholine was administered, and the patient

was intubated on first pass without hypoxia using a video laryngoscope. Endotracheal tube placement was confirmed with waveform capnography and the presence of symmetric breath sounds. Next, the patient was placed on the stretcher and “hot loaded” into the helicopter. In flight, ventilator settings were adjusted to target an end-tidal carbon dioxide level of 35 to 40 mm Hg; 3% hypertonic saline was continued, and intermittent Versed and fentanyl were given for analgesedation. The patient never met triggers for blood product transfusion.

Given the proptotic left eye with the presence of an afferent pupillary defect, the flight medical crew was concerned for OCS and decided to proceed with LCC in flight. Because the patient was intubated and sedated with Versed and fentanyl, no additional analgesia with local lidocaine was needed. The lateral canthus was clamped with a hemostat and then incised with scissors. Next, the lower lid was lifted, and the inferior crux of the lateral canthal ligament was identified and cut with scissors. Hemostasis was achieved with gauze and pressure. The procedure took approximately 5 minutes. The patient was flown to the nearest level 1 trauma center. In flight, the patient remained hemodynamically stable and tolerated his ventilator settings. The air ambulance response time from dispatch was 12 minutes, the on-scene time was 14 minutes, and the transport time was 19 minutes.

Hospital Course

In the emergency department, the patient met criteria for a trauma stat evaluation given his depressed GCS score and was evaluated by the emergency department physicians in conjunction with the trauma surgery service. He remained hemodynamically stable with a GCS score of

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