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# Update on orbital decompression as emergency treatment of traumatic blindness

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ABSTRACT

*Introduction:* Blindness is a rare and severe complication of craniofacial trauma. The management of acute orbital compartment syndrome (AOCS) is not well defined and there is no standard treatment. Our objective was to find indications for orbital decompression, the best time for treatment, and the appropriate techniques.
*Materials and methods:* A literature review was made from articles published between 1994 and 2014 in the PubMed database, on the emergency treatment of AOCS.
*Results:* 59 of the 89 patients treated surgically for AOCS presented with significant improvement of visual acuity (VA) after orbital decompression. The delay between trauma and surgery was short. A lateral canthotomy with inferior cantholysis (LCIC) was the most frequently used technique.
*Discussion:* AOCS with a risk of visual impairment must be decompressed in emergency, at best in the 2 hours following trauma, most often by LCIC to have the best chance of recovering VA. Adjuvant medical treatment (acetazolamide, mannitol, corticosteroids) should not delay surgery. Postoperative corticosteroid therapy is not indicated, especially in patients with severe head trauma.


## 1. Introduction

Blindness is a rare but serious complication of craniofacial trauma. There are three main causes of decreased visual acuity (VA) in facial trauma: acute orbital compartment syndrome (AOCS), traumatic optic neuropathy (TON), and globe lesions. We chose to focus this update on AOCS because it is the one that benefits the most from the emergency orbital decompression. AOCS may be due to a traumatic retrobulbar hemorrhage (TRBH), to edema of intra-orbital tissues, and, more rarely, to orbital emphysema (Key et al., 2008; Tomasetti et al., 2013.). The incidence of TRBH was estimated at 0.6% in orbital fractures by Hislop et al. (1996) and 0.45% by Gerbino et al. (2005). The risk of permanent vision loss in patients with an impaired VA due to TRBH ranges from 44% to 52% (Zachariades et al., 1996; Gerbino et al., 2005). There is no standard management for AOCS, and the action of orbital decompression is not well defined.

The purpose of this article was to provide an update by answering the following three questions: What are the indications for orbital decompression? How quickly should this decompression be performed? What are the best decompression techniques?

We deliberately removed TON and ocular injuries because they do not require emergency orbital decompression.

## 2. Material and methods

We conducted a literature review from articles published between 1994 and 2014 in the PubMed database dealing with the emergency management of AOCS. The keywords used were “orbital”, “decompression”, and “trauma”.

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## 3. Results

A total of 228 articles were found with those keywords. We eliminated off-topic articles, meta-analyses, and all those that did not bring adequate answers to the three questions raised above.

Ultimately we selected 25 articles that answered those questions, and that did not concern direct ocular injuries or TON. These 25 articles on AOCS were distributed as 21 clinical cases and case series, one technical note, one epidemiological article, and two articles on the pathophysiology of AOCS.

Of the 89 patients treated surgically for AOCS, 59 presented with significant improvement of VA after orbital decompression (Table 1).

AOCS benefited from quick surgical management, usually between 0.7 and 48 h, but in 58.8% of cases the exact delay was not documented (Table 1). There were also 3 cases of orbital decompression 6 days after trauma (Korinth et al., 2002).

The most commonly used orbital decompression technique in emergency was lateral canthotomy (LC) with or without inferior cantholysis (IC) under local anesthesia (LA) (Hislop and Dutton, 1994; Goodall et al., 1999; Larsen and Wiesland 1999. McInnes and Howes, 2002; Vassallo et al., 2002; Key et al., 2008; Jamal et al., 2009. Chen et al., 2012; Sun et al., 2014), sometimes even before obtaining orbital imaging (Lee et al., 2006; Popat et al., 2007; Colletti et al., 2012). Complementary orbital decompression was performed in the operating room under general anesthesia if there was no rapid recovery of VA or in cases of persistent pressure at the orbital level (Lee et al., 2006; Chen et al., 2012; Colletti et al., 2012). The techniques used in that case depended on the location of orbital bleeding: subcutaneous upper or lower tarsal approach (Gerbino et al., 2005), infraorbital approach (Maurer et al., 2013; Zimmerer et al., 2013.), lateral eyebrow approach (Hislop and Dutton, 1994; Chen et al., 2012.) transconjunctival approach (Colletti et al., 2012; Tomasetti et al., 2013.), and, more rarely, intracranial pterional approach (Korinth et al., 2002) or coronal approach (Gerbino et al., 2005).

## 4. Discussion

AOCS with a risk of visual impairment must be decompressed in an emergency, often using lateral canthotomy with inferior cantholysis (LCIC) under LA (Goodall et al., 1999; McInnes and Howes, 2002; Carrim et al., 2007; Chen et al., 2012; Colletti et al., 2012; Sun et al., 2014) to have the best chance of total VA recovery.

Most authors consider that the diagnosis of AOCS is primarily clinical and should be considered in case of facial trauma with sudden or rapidly progressive onset of painful decrease of VA (present in 100% of cases, Sun et al., 2014). Other symptoms are often associated: proptosis, periorbital hematoma, diplopia, ophthalmoplegia, relative afferent pupillary defect (RAPD), reduction or disappearance of the pupillary light reflex (PLR), ocular globe pressure (Popat et al., 2007; Chen et al., 2012; Colletti et al., 2012; . Sun et al., 2014). The diagnosis is made, for comatose patients, in case of proptosis with RAPD or loss of PLR. The most sensitive symptom of severe optical nerve insult was RAPD (Hislop and Dutton, 1994; McInnes and Howes, 2002; Chen et al., 2012; Sun et al., 2014), observed in 88% of cases (Sun et al., 2014). The innervation of the pupillary constrictor muscle is provided by the oculomotor nerve (third cranial pair). If there is no RAPD, then the third cranial pair is normal, and the optical nerve injury is minimal (Chen et al., 2012).

Once the clinical diagnosis is considered, and when there is blindness with RAPD, orbital decompression should be performed in an emergency, at best within 2 h after trauma (Ballard et al., 2009; Colletti et al., 2012; Sun et al., 2014), if the patient is globally stable. Any action that could delay surgical treatment should be avoided (imaging, medical treatment). The most frequently used technique in emergency is LC with or without IC; LC is a simple procedure performed under LA at the patient's bedside (Ballard et al., 2009). Haubner et al., 2015, demonstrated on a cadaveric model that to achieve an effective decompression of the orbit, LC should be associated with inferior cantholysis, and sometimes with superior cantholysis. A superior or inferior higher blepharolysis does not provide any additional reduction in intraorbital pressure. The complications of this technique are rare, never severe, and may be managed later (ectropion, esthetic sequelae). The incision is often managed by controlled wound healing, but sometimes it can be closed 2 to 3 days later (Ballard et al., 2009).

If there is no immediate risk for VA or after decompression under AL, a cerebral and facial CT scan is necessary to assess bone lesions, to make an accurate diagnosis of the AOCS etiology (TRBH, traumatic edema of orbital tissues, or orbital emphysema), to know

**Table 1**
Clinical cases and case series dealing with orbital decompression for AOCS published between 1994 and 2014.

| Authors, year | Number of surgical cases | Delay before surgery | Improvement in VA (%) | Preoperative corticosteroid therapy |
|---|---|---|---|---|
| Hislop and Dutton, 1994 | 3 | Short | 66.6% | 2/3 |
| Goodall et al., 1999 | 5 | Short | 100% | No |
| Larsen and Wiesland, 1999 | 1 | 2 h 30 min | 100% | No |
| Korinth et al., 2002 | 15 | 2 to 360 h | 53.3% | No |
| McInnes and Howes, 2002 | 1 | Short | 100% | No |
| Vassallo et al., 2002 | 1 | 3 h | 100% | No |
| Gerbino et al., 2005 | 8 | <12 h | 90% | 3/8 |
| Popat et al., 2005 | 1 | 5 h | 0% | No |
| Lee et al., 2006 | 1 | Short | 100% | No |
| Carrim et al., 2007 | 1 | Short | 100% | No |
| Key et al., 2008 | 2 | Short | 100% | No |
| Perry, 2008 | 10 | | 30% | |
| Jamal et al., 2009 | 2 | Short | 100% | No |
| Leovic et al., 2011 | 2 | Short | 100% | No |
| Roccia et al., 2011 | 8 | <48 h | 87.5% | 8/8 |
| Chen et al., 2012 | 2 | <22 h | 100% | |
| Colletti et al., 2012 | 2 | <1 h | 100% | No |
| Tomasetti et al., 2013 | 1 | Short | 100% | No |
| Maurer et al., 2013 | 6 | 1 h–2 h 36 min | 66.6% | No |
| Zimmerer et al., 2013 | 9 | Short | 86% | No |
| Sun et al., 2014 | 8 | 0.7–7 h | 62.5% | No |

ACOS = acute orbital compartment syndrome; VA = visual acuity.