

### 1.10.1 Introduction and Definition

While the definition of an injury-related ophthalmic emergency may appear straightforward, in reality it is not so unambiguous:

- A *chemical* insult is a clear case of emergency to both patient and ophthalmologist.
- A welder's *photokeratitis* is an absolute emergency to the patient, yet it may cause nothing but aggravation to an ophthalmologist who is awakened at night after a full day of work for such a non-sight-threatening and easily avoidable condition.
- A full-thickness corneal *wound* with iris prolapse leads the ophthalmologist to at least consider an emergency intervention, although the patient does not necessarily understand the acute need for surgery.
- Even ophthalmologists disagree among themselves whether conditions such as an IOFB or a retinal detachment truly require immediate surgery.

The definition of “emergency” depends on the severity of the pathology and on the projected loss of function that would be preventable or reversible with urgent therapy.

In this chapter we include conditions that forces the ophthalmologist and/or the patient to perform or at least consider immediate intervention. The urgency may be due to pain and/or for the fear of irreversible anatomical and/or functional damage. Since all conditions are addressed in other chapters in this book, only a brief summary is provided here, and the reader

is referred to the relevant chapters for further information. The conditions are presented in alphabetical order, but their acuteness<sup>1</sup> is indicated by a scale where \*\*\* represents an absolute emergency and \* represents one that is a relative urgency.

## 1.10.2 Specific Conditions

### 1.10.2.1 Chemical Injury\*\*\*

This is the insult that requires the most urgent intervention, especially if an alkali agent is involved. Alkali agents cause colliquative necrosis: the destruction of tissue continues as long as the agent is present. The agent can penetrate intraocularly, resulting in severe late complications such as secondary glaucoma. Conversely, acid agents cause coagulative necrosis: the process slows down and eventually stops tissue destruction beyond the original insult.<sup>2</sup>

#### 1.10.2.1.1 Recognition

Recognition of the condition is usually easy as the victim immediately seeks medical attention and describes what happened; however, in unconscious patients the ophthalmologist must take a more proactive role.

#### 1.10.2.1.2 Management

As mentioned previously, management must be immediate:<sup>3</sup>

- *Irrigation* is what can arrest the destruction and prevent loss of vision or even the eye. Neutral fluids are preferred, although virtually any fluid suffices if a neutral fluid, such as water, is unavailable. A litmus paper must be used to check the pH in the conjunctival fornix to determine

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1 From the ophthalmologist's, not from the patient's, viewpoint

2 This must not be interpreted as if acids could not lead to fatal ocular consequences.

3 "Intervene first and ask later."

when irrigation can be stopped, but the pH must periodically be rechecked to assure that the equilibration is maintained.

- *Mechanical cleansing/debridement*<sup>4</sup> must follow, removing agent remnants and/or necrotic tissue from all surfaces, including the upper fornix. This requires double eversion of the lid, for which a Desmarres lid retractor may be necessary (see Chap 2.1).
- *Complementary treatment* (Table 1.10.1; see Chap. 3.1 for further details).

### 1.10.2.2 Corneal Erosion\*

The erosion can be caused by an object still present (FB on the tarsal conjunctiva) or already withdrawn (e.g., a fingernail), or by noncontact mechanism (e.g., welding). In this condition the patient demands intervention; the urgency is determined by the pain, not by the condition's significance as it relates to vision.

#### 1.10.2.2.1 Recognition

Recognition represents no difficulty because of the excruciating pain. Vital stains can be used to delineate the area of epithelial loss.

#### 1.10.2.2.2 Management

Management is aimed at reepithelialization, preferably without the use of anesthetic drops. (See Chap. 2.2 for further details.)

### 1.10.2.3 ECH\*\*\*

In this under-recognized condition,<sup>5</sup> bleeding from a severed ciliary artery rapidly leads to the extrusion of intraocular tissues. Progression is

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- 4 Topical anesthesia may be necessary to alleviate the pain, without which even the irrigation may be difficult to complete. Since all anesthetics are toxic, their application should be kept to a minimum.
  - 5 The author has reviewed 30 eyes removed after severe rupture. All pathological specimens showed significant amounts of suprachoroidal blood, and none were described clinically.

**Table 1.10.1** Secondary elements in the acute treatment of patients with chemical injury

Medication (route)	Dosage	Comment
Cycloplegics (topical)	As needed	To keep the pupil wide; avoid vasoconstrictors such as phenylephrin
Corticosteroids (topical)	Hourly or at least several times a day	Discontinue after the first week
Antibiotics (topical)	As needed	To lessen the risk of suprainfection
Antibiotics (oral)	Tetracycline 4×250 mg or doxycycline 2×100 mg daily	To lessen the risk of suprainfection
Sodium citrate (10%) and ascorbate (10%; topical)	Hourly	
Sodium ascorbate	2–4×2 g daily	
Artificial tears (topical)	As needed	
Antiglaucoma (topical, oral)	As needed	
Antipain medication	As needed	
Patching	As needed	To maintain high oxygen supply to cornea, it is preferred not to patch; however, most patients prefer it

halted only when the extruded tissue tamponades the wound or the surgeon closes it.<sup>6</sup>

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- 6 If the condition is caught intraoperatively, the surgeon has at least a chance to arrest it; if it occurs outside the OR, the only chance is literally put a finger on it, trying to tamponade the wound and stop the bleeding.

### 1.10.2.3.1 Recognition

Recognition is easy when the tissue extrusion is in progress but more difficult once a natural tamponade has stopped it. It is therefore important to always keep in mind the ECH potential when dealing with tissue prolapse.

### 1.10.2.3.2 Management

Management is straightforward: if an ECH is occurring, the wound must be closed immediately, irrespective of whether tissue gets incarcerated in the wound. This and other complications must be addressed in a subsequent surgery. If the ECH has been tamponaded by prolapsed tissue, cautious intervention is still urgent<sup>7</sup> by an experienced surgeon under proper circumstances in the OR. (See Chaps. 2.4 and 2.8 for additional details.)

### 1.10.2.4 Endophthalmitis\*\*/\*\*

Since the proportion of eyes having the purulent infection caused by *Bacillus* species is much higher in the context of trauma than following surgery, the presence (or even the risk) of infection constitutes an emergency. Unlike in cases of a chemical injury or ECH, however, minutes do not count; there is a little more time for planning the intervention. One exception is *Bacillus* infection, which can destroy any hope for retaining vision in a matter of hours, making vitrectomy a uniquely urgent indication.

#### 1.10.2.4.1 Recognition

Recognition is much more difficult in the injured eye than in those with a postoperative infection. Even if a hypopyon is not visible, the presence of undue pain may be a helpful hint, as is a stronger than expected periocular reaction (edema, erythema, proptosis).

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7 To prevent reopening of the wound by the patient somehow exerting pressure on the eye (even strong squeezing may be enough) or by elevation of the systemic the blood pressure.

#### **1.10.2.4.2 Management**

Management is immediate surgery, typically vitrectomy, with intravitreal and systemic antibiotics or antifungal agents. (See Chap. 2.17 for additional details.)

#### **1.10.2.5 High IOP\*/\*\*\***

Although rarely requiring immediate surgical intervention, occasionally the IOP may be very high and difficult to control with medications. The condition is most commonly seen in eyes with severe intraocular hemorrhage or a disrupted crystalline lens, especially in children.

##### **1.10.2.5.1 Recognition**

Recognition is easy because of the pain and the high tonometry reading.

#### **1.10.2.5.2 Management**

Management is determined by the underlying condition (e.g., removal of the blood or the injured lens). If the IOP is very high, however rare, the case does constitute an emergency. (See Chaps. 2.5, 2.7, and 2.18 for further details.)

#### **1.10.2.6 NLP vision\*\*/\*\*\***

Although this is a functional finding, not a pathology, loss of the eye's ability to recognize light is – and should be – a condition that the ophthalmologist appreciates as an emergency. The direct cause for the loss of LP may be intraocular (bleeding, retinal detachment) or intraorbital (see below).

##### **1.10.2.6.1 Recognition**

Recognition is straightforward; as opposed to common practice, a candle or a penlight projects insufficient light to determine whether vision is truly NLP.

#### **1.10.2.6.2 Management**

Management is immediate: orbital decompression if the cause is orbital; if an intraocular etiology is responsible, which is the majority of the cases,

early surgery is to be performed, after extensive counseling. (See Chap. 1.8 for further details.)

### **1.10.2.7 Open Wound\*\***

Deferring closure for a few hours has no adverse impact on the outcome; however, urgent closure is necessary if the risk of ECH or infection is high.

#### **1.10.2.7.1 Recognition**

Recognition is usually easy at the slit lamp, although occult ruptures can pose a significant diagnostic dilemma (see Chaps. 1.9, 2.12).

#### **1.10.2.7.2 Management**

Management is proper wound closure unless the wound is securely self-sealing or too posterior. (See Chaps. 1.8, 2.2–2.4, 2.11–2.14 for additional details.)

### **1.10.2.8 Orbital Cellulitis\*\*/\*\***

Prior to the antibiotic age, blindness and death from orbital cellulitis were common. The prognosis is much better today, but the condition is still serious enough to warrant immediate and appropriate therapy.

#### **1.10.2.8.1 Recognition**

Recognition is relatively easy with proptosis and ophthalmoplegia being the lead symptoms. Pain, especially on eye movement, is also present. The lids are livid and swollen, as is the conjunctiva, and there may be purulent discharge.

#### **1.10.2.8.2 Management**

Management primarily consists of intravenous, broad-spectrum antibiotics, although surgical drainage may also become necessary. If an ophthalmologist specialized in the orbit is unavailable, an ear–nose–throat specialist or a neurosurgeon should be consulted.

### 1.10.2.9 Orbital Hemorrhage\*/\*\*\*

Bleeding into the orbit can occur both in the context of penetrating trauma<sup>8</sup> or a contusion. The condition is benign if the amount of blood is small, but it may warrant instant intervention if it results in the loss of LP and the intraorbital and intraocular pressures are highly elevated so that the central retinal artery becomes occluded.

#### 1.10.2.9.1 Recognition

Recognition is relatively straightforward, as there are signs of a elevated intraorbital pressure (e.g., pain, decreased motility, proptosis, swollen lids).

#### 1.10.2.9.2 Management

Management is medical in mild cases, but canthotomy or cantholysis has to also be considered if the retinal perfusion is seriously affected. Lateral orbitotomy is necessary if the central retinal artery does not reopen. If an ophthalmologist specialized in the orbit is unavailable, an ear–nose–throat specialist or a neurosurgeon should be consulted.

### 1.10.2.10 Retinal Detachment\*/\*\*

For many ophthalmologists a nontraumatic retinal detachment represents an emergency condition.<sup>9</sup> Conversely, a traumatic retinal detachment often does not invoke the same sense of urgency. Closing the wound during the first intervention and deferring retinal reattachment surgery for a few days is not uncommon, even though common sense does argue for very early intervention.

Within the retinal detachment category, a hemorrhagic macular detachment, especially if the subretinal blood is thick, constitutes a real emer-

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8 Can be the consequence of a retro- or even peribulbar injection

9 For many ophthalmologists, a retinal detachment calls for a Saturday night operation if need be, and deferral of the case until the regular Monday morning shift is unacceptable, for medical and legal reasons.



gency since photoreceptor death can occur within a very short period of time.

#### **1.10.2.10.1 Recognition**

Recognition is much more difficult than in a nontraumatic setting since the visual acuity may be poor for other reasons (e.g., vitreous hemorrhage) and ultrasonography may not be performed acutely or its interpretation can be misleading (see Fig. 1.9.5).

#### **1.10.2.10.2 Management**

Management depends on the type and extent of the retinal detachment and on the coexisting tissue injuries. (See Chap. 2.9 for additional details.)

#### **1.10.2.11 TON\*\***

A variety of conditions can cause TON, and some of the consequences may be reversible with proper intervention.

##### **1.10.2.11.1 Recognition**

Recognition is difficult and may require advanced radiological testing; an APD is always present.

##### **1.10.2.11.2 Management**

Management is usually medical (high-dose intravenous methylprednisolone therapy), although surgical intervention (optic canal/sheath decompression) may also become necessary.

**DO:**

- be mentally prepared to deal with ophthalmic emergencies and also have the facility ready (materials, personnel); in cases of chemical trauma, irrigation should not be delayed for the sake of taking a detailed history

**DON'T:**

- forget that pain caused by, and the severity of, the condition are usually inversely proportional
- delay vitrectomy if a Bacillus infection can be suspected
- rush to close an injury-associated open wound, nor defer it beyond a few hours

**Summary**

There are relatively few diseases in ophthalmology where treatment delay can be catastrophic. In traumatology, a disproportionately high number of such conditions exist. Since there may be no time available to consult a colleague or a textbook, extensive knowledge of how to recognize and act in such conditions is mandatory for all practicing ophthalmologists.