Ocular emergencies

Prompt action can improve outcomes

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Ocular emergencies include physical and chemical trauma to the eye and conditions such as retinal detachment and vascular events. For patients who present to a GP with an ocular emergency, organising referral to the available ophthalmic services is paramount, but basic investigation and in some cases treatment can be of benefit.

The role of the GP in diagnosing and managing patients with an ocular emergency depends largely on patient access to specialist care or emergency facilities. However, all GPs need to be aware of the types of eye emergencies that may be seen in general practice and how to triage patients effectively. A basic patient assessment can provide essential clues to the diagnosis and guide referral, thereby optimising the short- and long-term recovery of the patient.

Here we discuss a range of ocular emergencies and the recommended actions for patients who present in general practice. We also outline an approach to ocular examination for GPs.

KEY POINTS

- Although patients with ocular emergencies present infrequently to GP clinics, GPs require an awareness of these conditions and how to triage patients effectively.
- Prompt action by the GP can significantly benefit the short- and long-term rehabilitation of patients with ocular emergencies.
- In some cases, the GP may need to provide treatment, but the main goal is early recognition and appropriate referral.
- Basic visual assessment can be completed in the general practice setting to provide the specialist with key information.
- Systemic conditions are risk factors for several significant ocular conditions; the GP remains an essential part of the diagnostic and treatment team.

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Chemical burns

Case 1. Matthew, aged 25 years, was working on a building site when he dropped the bucket of lime he was carrying. The substance splashed across his face and he immediately felt extreme pain in his left eye. He washed his face and eye briefly before heading directly to your general practice.

Figure 1. Severe alkali burn, showing limbal ischaemia and severe corneal haze, resulting in a white-appearing eye.

Diagnosis

Chemical eye exposures are relatively common in Australia. Although most occur in the workplace, up to one-third occur within the home.[1] A chemical eye exposure is an ocular emergency with potential long-term consequences for visual acuity.[1]

The diagnosis of a chemical burn is usually straightforward given the patient's history. However, it is essential to identify the substance involved and its duration of contact with the eye, which largely determine the severity of the injury.[2]

Chemical burns can be broadly divided into two categories: acid and alkaline injuries. These affect the eye in different ways. Acid burns result in coagulation necrosis. Although surface wounds can be significant, the protein denaturation of acid burns generally prevents deep penetration within the anterior chamber, with hydrofluoric acid a notable exception.[3]

Alkali burns cause liquefactive necrosis, which can lead to deeper penetration within the eye. This can damage the anterior chamber, leading to secondary complications such as acute intraocular pressure rises and cataract formation. Long-term ocular surface recovery may be disrupted by the destruction of limbal stem cells, which results in defective re-epithelialisation of the corneal surface, leading to poor vision and significant discomfort.

Initial management

Irrigation

Any examination remains secondary to treatment. If the patient telephones the practice then they should be encouraged to irrigate the eye extensively for 20 to 30 minutes before presentation. Ideally, this is performed with an eye wash or a buffering solution, but tap water may be used if neither of these is available.

If the patient presents directly to the practice then the injured eye must be irrigated immediately. Topical anaesthetic drops may provide some additional relief and assist the irrigation process. The goal of irrigation is to remove residual chemicals or particulates and to restore the pH level of the surface of the eye to normal levels. The pH can be measured intermittently during irrigation with a universal indicator or litmus paper. Two to three litres of fluid may be required to neutralise the ocular surface (pH 7.0 to 7.5). It is important to evert the upper eyelid, as particles can adhere to the tarsal conjunctiva, and also to irrigate both the superior and inferior conjunctival fornices.

Examination

The presentation of the eye after chemical burns varies. Mild burns leave the eye hyperaemic and the conjunctiva chemotic and swollen. In severe cases, the eye may appear white because of extreme ischaemia of the limbal and conjunctival vessels. This appearance demands immediate patient transfer to a hospital emergency department (Figure 1).

Visual acuity may be difficult to measure after extended irrigation because of excessive light sensitivity and epiphoria. However, a baseline level of vision can be useful.

TABLE 1. SEVERITY OF OCULAR BURNS AND URGENCY OF REFERRAL

Roper-Hall classification of severity			Prognosis	Referral urgency
Grade	**Cornea**	**Conjunctiva and limbus**		
I	Epithelial damage	No limbal ischaemia	Good	Within 24 hours
II	Corneal haze	Less than one-third limbal ischaemia Iris details visible	Good	Immediate
III	Total epithelial loss	One-third to one-half limbal ischaemia Stromal haze Iris details obscured	Guarded	Immediate
IV	Cornea opaque	More than half limbal ischaemia Iris and pupil obscured	Poor	Immediate

Figures 2a to c. Pressure patching. The application of one patch on top of the other (dual patching) is useful to minimise eye movement while the patient travels to the emergency department or specialist.

Referral

The urgency of referral depends on the severity of the ocular burn (Table 1). Pressure patching of the eye is helpful to minimise eye movement before referral (Figures 2a to c). Use of a cycloplegic agent such as tropicamide can help reduce pain.

Case 1 continued. After irrigation, Matthew achieves a visual acuity of 6/24 in his left eye. On further examination, the eye appears hyperaemic and the cornea has a mild haze. You discuss Matthew's case with the ophthalmology resident at the local hospital, who advises you to pressure patch the eye and send Matthew immediately to the hospital emergency department for additional assessment and treatment.

Figure 3. Hyphaema after trauma.

Follow up

After a chemical burn, assessment of the intraocular structures is often impeded by corneal opacification. The prognosis for visual rehabilitation after a chemical burn depends on the intensity of the initial injury and the speed of pH normalisation. Intraocular pressure should be monitored in consideration of possible damage to the trabecular meshwork and aqueous outflow. Restoring the ocular surface remains a primary goal. This may be achieved with intensive ocular lubrication in mild cases but may require surgical intervention in significant injuries. Limbal stem cell or amniotic membrane transplantation procedures have been used recently with success in providing both symptomatic relief and restoration of the ocular surface.[2]

Nonpenetrating eye injury

Case 2. Jack, a 31-year-old man, presents to your practice mid-Saturday morning. He has eye pain and blurred vision after being hit in the eye by a tennis ball during this morning's match.

Diagnosis

With the specific patient history available, the GP's primary concern should be to understand any immediate surface or intraocular damage.

The object causing the trauma may provide a clue to the potential ocular damage. An object larger than the orbit, such as a rugby or soccer ball, is less likely to directly impact the patient's eye. However, high impact force may lead to globe rupture and substantial oedema. A smaller object such as a squash ball or fist may directly contact the eye and cause significantly more damage. Possible complications include corneal abrasions, hyphaema (blood in the anterior chamber), traumatic pupillary dilatation, angle recession (damage to the drainage pathways of the eye), lens dislocation, vitreous and retinal haemorrhages, retinal detachment and blowout fracture of the orbit (Figure 3).

Initial management

Case 2 continued. Lid swelling makes observation of the eye difficult, but you notice hyphaema. Assessment of the pupil is also difficult because of the presence of blood and general swelling. Vision in the impacted eye is 6/18 but is difficult to assess because of Jack's photophobia and epiphoria.

The need for and urgency of referral after a nonpenetrating eye injury (blunt trauma) depend on the patient's level of visual acuity and the presence of a pupillary

TABLE 2. SEVERITY OF BLUNT TRAUMA AND RECOMMENDED ACTION AND REFERRAL

Severity of blunt trauma	Visual acuity	Hyphaema	Pupil abnormality	Recommended action	Referral
Mild	Better than 6/12	No	None	Dilated fundus examination	Within 48 hours and/or speak to tertiary referral for guidance
Moderate	6/12 to 6/24	Micro	Dilated	Dilated fundus examination, eye shield	Within 24 hours, speak to tertiary referral for guidance
Severe	Worse than 6/24	Macro	Defect	Eye shield	Immediate referral to hospital emergency department, nil by mouth

defect and hyphaema (Table 2). Mild hyphaema by itself is not an ophthalmic emergency; however, because of the history in Jack's case, additional damage due to the injury must be ruled out through a dilated intraocular assessment. If the posterior segment is unable to be seen clearly then CT or ultrasound imaging of the orbit to rule out lens or retinal anomalies may be undertaken on the advice of the treating ophthalmologist.

Follow up

Hyphaema is generally reabsorbed over seven to 10 days after the injury. The patient should be monitored for intraocular pressure changes caused by possible obstruction of the aqueous outflow by haemorrhage. Rebleeding occurs during recovery in a small percentage of patients.[4] Rebleeding can be more damaging than the original hyphaema and thereby increases the risk of additional vision changes and secondary glaucoma. However, fewer than 10% of patients proceed to extended intraocular pressure complications.[5] In Jack's case, the risk may be higher given the extent of bleeding. The possibility of anatomical changes to the iris angle caused by the trauma requires long-term review after the injury.

Penetrating eye injury

Case 3. Steven, a 59-year-old man, was gardening when he lost his balance and fell into a hedge. He immediately felt a sudden sharp pain in his right eye. An eyelid laceration caused significant bleeding. He placed a bandage on his eye to reduce the bleeding and was driven to a local GP clinic, which was much closer than the nearest hospital emergency department.

Diagnosis and initial management

Although penetrating ocular injuries are uncommon, they typically present with acute signs and symptoms. If the penetrating object remains within the eye, it is essential that no action is undertaken to remove the object as this could lead to further herniation of the ocular contents. If it is possible without significant movement of the eye then anaesthetic and antibiotic drops may be placed within the eye to minimise discomfort and the ongoing risk of infection.

After stabilisation of the patient, immediate specialist referral is essential. If indicated, the GP may administer a booster tetanus vaccine. Patients should be advised not to eat and drink as a precaution because of the likelihood they will require ocular surgery.

If appropriate, a shield may be placed over the eye to provide interim protection (Figures 4a to c). The cut-off bottom of a paper cup is a ready substitute if an eye shield is unavailable. A pressure patch must be avoided.

Follow up

Surgery is aimed at restoring ocular integrity. Visual rehabilitation may require additional procedures because of traumatic cataract formation or retinal involvement. The prognosis generally depends on the significance and location of the injury. Corneal wounds may result in scarring (Figure 5). If scarring occurs across the line of sight then it will impact on vision. Therapeutic laser treatment or, in significant cases, corneal transplantation may be required to remove scarring. Involvement of the iris may lead to prolonged photophobia, which may necessitate reconstruction at a later stage.

Figures 4a to c. a (left). Use of an eye shield. b and c (below). The cut-off base of a disposable cup can be used as a makeshift eye shield.

Figure 5. Peripheral corneal scar and iris disorganisation after trauma.

Retinal detachment

Case 4. Robyn is a 73-year-old woman who presents to your practice with a three-day history of flashes and floaters. Yesterday, she noticed a black area across her inferior field, which has increased this morning. She feels that her vision is also reduced. She does not report pain. She takes medication for type 2 diabetes that remains well controlled. She has worn glasses for many years for moderate myopia.

Differential diagnosis

As Robyn's symptoms appear to be increasing, they are a priority for further investigation. Her symptoms may be related to several conditions, and further questioning will help provide a clearer picture of their origin. Knowledge of her previous general and ocular health is essential.

Visual auras are the most common form of migraine aura and appear in approximately 40% of migraine episodes, albeit less so with age.[6,7] However, migraine aura is often followed by the onset of migraine, and symptoms rarely persist for an extended time.

Diabetes is a significant risk factor for ocular conditions, with retinopathy representing the most frequent microvascular complication of diabetes.[8] Visual loss in diabetic retinopathy is determined by the extent and location of vitreous and retinal haemorrhages. Ophthalmic presentation is typically linked to poorly controlled diabetes and concurrent systemic disease, such as hypertension.

Retinal detachment occurs when the neurosensory layer of the retina separates from the underlying retinal pigment epithelium. The condition is progressive, leading to increasing symptoms such as flashes and floaters and vision loss. Patients typically describe a 'cloud' across the visual field. A recent history of direct or indirect trauma is an important consideration, but other risk factors include myopia, older age and previous intraocular surgery.

Diagnosis and initial management

Case 4 continued. On examination, Robyn's visual acuity with glasses is 6/60 in her right eye and 6/6 in her left eye.

Vision is a nonspecific feature of general posterior eye disease, but poor vision in patients with retinal detachment suggests macular involvement. In this situation, the prognosis for visual recovery is guarded, particularly if the detachment is left untreated. Vision assessment is important for baseline and medicolegal reasons.

Case 4 continued. Confrontation visual field assessment suggests Robyn has moderate inferior field loss in her right eye. The left visual field appears normal. The red reflex is diminished in the right eye, with a darkened area superiorly. On ophthalmoscopy, visualisation through the undilated pupil is difficult. The superior retina in the right eye appears to be poorly defined and out of focus.

The combination of symptoms and examination results suggests a diagnosis of retinal detachment, which is an ophthalmic emergency that requires immediate referral. Robyn's visual acuity and confrontation visual field assessment indicate that the central macula may be involved, which increases the urgency for her to seek specialist attention.

Follow up

Case 4 continued. Dilated fundus examination confirms a large superior retinal detachment (Figure 6). Because of the size of the detachment, surgical treatment is recommended. A silicon band (scleral buckle) is placed around the sclera to indent the wall of the eyeball, thereby opposing the detached retinal back towards the underlying layers. A laser is then used to seal the retinal holes.

Figure 6. Superior retinal detachment. The detached area covers most of the superior retina and encompasses the macula, leading to a significant reduction in vision. Note that the green reflection is an artefact of the imaging system.

Small retinal tears or detachments within the periphery may be sealed using laser photocoagulation, but more severe cases require surgical intervention. Surgical treatment may require a combination of approaches depending on the size and location of the detachment, but outpatient treatment is common.

Final visual recovery depends on the extent and duration of detachment of the neurosensory layer. About three-quarters of patients achieve best corrected vision of 6/12 or better, which represents the legal limit for holding a driver licence.[9] However, the proportion who achieve this is significantly reduced if the central macula has been involved for an extended period.

After detachment repair, field loss often improves with time, and patients rarely complain of a permanent loss of peripheral vision. High myopia is a significant risk factor and these patients should be routinely assessed for contralateral eye involvement. Up to 20% of patients with myopia and retinal detachment in one eye will be diagnosed with involvement of the other eye.[10]

Sudden visual loss

Case 5. Kate is a 70-year-old woman who presents to your GP clinic with a four-hour history of painless loss of vision in her left eye. She is being treated for hypertension and hypercholesterolaemia.

Differential diagnosis

Various aetiologies may contribute to sudden visual loss. History taking and observation remain essential to diagnosis.

Acute angle closure glaucoma caused by a sudden intense rise in intraocular pressure can lead to significant unilateral visual loss. This is, however, often accompanied by extreme ocular pain, headache and nausea. Patients are typically over 50 years of age, female and have a history of long-sightedness and glaucoma. The prevalence is also increased in certain ethnic groups, such as people from east Asia.

Optic neuritis may be unilateral or, less commonly, bilateral. Patients generally present at a younger age (18 to 45 years) than with acute angle closure glaucoma and may experience pain on eye movement and colour vision abnormalities. A relative afferent pupillary defect may also be present.

Retinal detachment is routinely preceded by additional symptoms, including flashes and floaters. Visual loss is more likely to occur over a relatively extended time period.

Anterior ischaemic optic neuropathy caused by giant cell arteritis may lead to acute vision loss. The patient often presents as unwell and there may be tenderness of the temporal artery on examination.

Retinal vascular events often present with sudden, painless loss of vision. These are more likely in the elderly population and in patients with additional systemic risk factors such as hypertension and diabetes.

Examination and diagnosis

Case 5 continued. On examination, Kate's visual acuity in the left eye is 6/60; she is able to count fingers at 1 m. In the right eye it is 6/7.5 with glasses. She notes no difference in colour intensity between the two eyes. On testing the red reflex, the left eye appears pale compared with the right eye. On ophthalmoscopy, the left peripheral retina appears pale.

Referral and follow up

You send Kate immediately to a local ophthalmologist. A dilated ophthalmoscopic examination shows an occlusion of the right superotemporal branch retinal arteriole in the left eye (Figure 7). A retinal embolism (Hollenhorst plaque) is also identified, and the patient is referred for investigation of the source.

The ophthalmic branch of the internal carotid artery allows a direct route for embolic material. The risk of this condition is increased significantly in the presence of hypertension.[11] The risk of all cause and stroke-related mortality is increased in patients with retinal artery occlusion. They should be monitored closely in conjunction with the GP.[11]

Visual rehabilitation is determined by the speed of restoration of the artery circulation. This may be achieved by pharmacological lowering of the intraocular pressure, anterior chamber paracentesis or ocular massage, but the success rates of these treatments are usually poor.

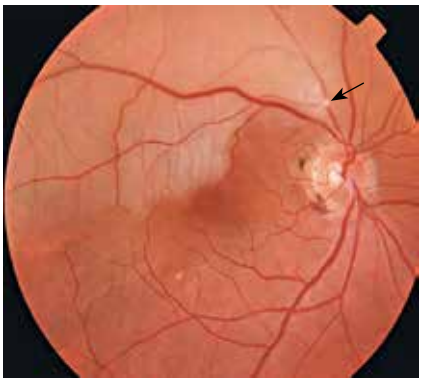

Figure 7. Fundus photograph showing central retinal vein occlusion with superior emboli (Hollenhorst plaque, arrow). Note the paleness of the superior retina as a result of impaired blood flow.

Hyperbaric oxygen therapy may play a role in management, particularly if it can commence shortly after the occlusion occurs.[12]

Ocular examination in general practice

Although most ocular emergencies require immediate specialist referral, the GP can readily complete practical investigations that may significantly benefit specialist assessment. The following tests can be performed within the scope of general practice.

Figure 8. Visual acuity assessment at a distance of 1 m. Note the patient matching the number of fingers shown by the examiner.

Figure 9. Confrontation visual field assessment.

Visual acuity

Visual acuity represents an important marker for many ocular emergencies and provides a useful guide for the long-term visual potential. Vision in each eye should be tested with the patient covering the other eye with their hand or an occluder.

Visual acuity may be difficult to assess adequately because of the patient's condition and reduced capacity to keep their eye open during examination. Gross measures of visual acuity may be recorded if the patient's condition makes it difficult to adequately assess vision with a standard chart. This may include identifying the ability to count fingers, a moving hand or a light directed from a pen torch in the various quadrants of the patient's field of vision. The distance at which the object is correctly identified should be recorded. For example, the patient could be asked to count fingers at a distance of 1 m (Figure 8).

Figure 10. Assessment of the red reflex through an ophthalmoscope.

Visual field assessment

Confrontation visual field assessment can help identify gross field loss. The patient is asked to cover one eye. Sitting opposite, the examiner closes their corresponding eye, thereby providing their own visual field as a reference or control. Keeping an equivalent distance from the subject, the examiner brings one hand slowly inwards from the periphery until the patient can confidently identify the location of the moving hand or object. The examiner should extend both arms to reduce any obvious bias (Figure 9). The field loss can be described accordingly (e.g. 'inferior field loss to patient's midline').

Red reflex

The retinal reflection is often assessed to identify posterior eye abnormalities in babies or young patients and can also provide useful objective evidence in patients with an ophthalmic emergency. Red reflex assessment is performed with an ophthalmoscope held at a distance of about 50 cm from the patient. If possible, the patient should be directed to look towards the light. The examiner observes the colour of the reflex through the ophthalmoscope, in particular looking for asymmetry between the eyes (Figure 10). A dark or absent reflex indicates an obstruction, which may reflect an intraocular foreign body or a possible detached retinal layer. Awareness of the patient's history and ocular health is helpful as chronic conditions such as a cataract may give a false-positive result.

Observation

The presence of foreign bodies, blood (hyphaema) or pus (hypopyon) in the anterior chamber of the eye or chemosis can be readily identified with the use of a bright light or pen torch. An ophthalmoscope with a plus setting provides additional magnification. If localised swelling makes it difficult to open the lid then a sterilised adjusted paper clip may serve as a basic lid speculum (Figure 11). Care must be taken to avoid damaging

Figure 11. A bent paper clip can be used as a lid speculum.

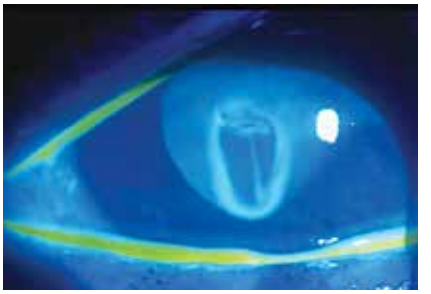

Figure 12. Anterior chamber leakage viewed under a blue light (Seidel test). In this test, the tear film is stained with fluorescein, which appears green under a blue light. Any aqueous leak dilutes the dyed tears at the site of the leak, making it more obvious.

Figure 13. A medicine bottle with a brightly coloured lid can be used in a simple test of colour vision. The patient scores the intensity of the lid colour viewed with each eye on a scale of 1 to 10 and the scores are compared.

the eye. If there is any concern then the patient should be immediately referred to an ophthalmologist. A flat anterior chamber may be observed in the presence of a penetrating injury or during an acute angle closure glaucoma episode.

Fluorescein staining and examination of the eye under a blue light may further help determine the extent of a corneal injury. If a full thickness injury has occurred then it may be possible to see aqueous humour leaking from the wound itself. This is another ophthalmic emergency (Figure 12).

Restriction of ocular movements can confirm general obstruction, which may occur after rupture of the orbit caused by direct trauma. However, orbital swelling may also affect eye movements, reducing the diagnostic benefit of an ocular movement test. This test should not be attempted in patients with a penetrating eye injury.

Colour vision

Optic neuritis can lead to colour desaturation. A simple assessment involves presenting a medicine bottle with a red lid and asking the patient to compare the intensity of the colour seen with each eye (Figure 13).

Imaging

The evolution of smartphone cameras provides clinicians with a ready option for recording the appearance of eye injuries. GPs who have an existing relationship with a local specialist can forward images to the specialist, thereby helping to guide the eventual referral. However, the eyelids should not be manipulated to photograph the eye in patients with a penetrating injury.

Conclusion

Despite the relatively high prevalence of ophthalmic emergencies in Australia, patients are unlikely to present to general practice except on weekends or in rural areas where access to specialist services may be limited. Organising referral of patients to the available ophthalmic services is important, but basic investigation and in some cases treatment can be of benefit and may influence long-term rehabilitation and prognosis. MT

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