medications should be documented. It is important to note any drug allergies and status of tetanus immunization. If an open globe injury is suspected, general anaesthesia would be required and the patient should be asked about the time he last consumed solids and liquids.

OCULAR EXAMINATION

External inspection in diffuse illumination

Prior to examining the patient on the slit-lamp, a gross evaluation of the ocular condition can be made out with the help of a diffuse illumination of a pen torch.

- *Forehead and the periorbital tissues* should be inspected under bright illumination. Evaluate for the presence of any laceration, abrasion, periorbital edema and ecchymosis.
- *Look for exophthalmos*, enophthalmos or any foreign body, such as a stone present in the margins of the laceration.
- *Orbital walls* should be palpated to look for evidence of any bony discontinuity.
- *Crepitus and infraorbital hypoesthesia* may indicate an orbital fracture.

Inspection of globe

Attention should now be given to the ocular structures per se. The eyelids may be parted with the help of an eye speculum or a lid retractor in individuals wherein the periorbital edema makes examination difficult. Inspect the globes for:

- Prolapse of intraocular contents
- Protruding foreign bodies, and
- Any sign of occult open globe injury (hemorrhagic chemosis, pupillary peaking).

Note. It should be kept in mind that no pressure is given on the globe lest the intraocular contents prolapse out. In cases of highly swollen lids or an uncooperative patient, the examination of the globe can be deferred till imaging is done or can be carried out under sedation.

Visual function assessment

Visual acuity. The presenting visual acuity is a crucial prognostic indicator in determining the outcome of injury. The visual acuity is measured separately for each eye. It should be preferably recorded on a standardized chart (ETDRS or Snellen). If the patients are immobilized or on a stretcher, due to systemic comorbidities, visual acuity can be assessed by asking the patient to count fingers at a specific distance. Poor vision can be recorded as either hand motions or light perception with a documentation of projection of rays. The test of light perception and projection of rays should be carried out with the brightest possible light (indirect ophthalmoscope).

Relative afferent pupillary defect. The presence or absence of RAPD is an indicator of gross visual dys function. The test is performed as a swinging flash-light test with a bright light source. Apparent dilation of the pupil of the eye in which light is shown points towards the presence of RAPD. It indicates an optic nerve or a severe retinal damage with a poor prognosis.

Afferent pupillary defect can also be elucidated in cases where-in the iris is injured and the pupil is not reacting. In this case rather than visualizing the direct pupillary response in each eye, only the response in the normal reacting pupil is observed. RAPD is said to be present when the pupil of the fellow eye dilates when light is moved to the injured eye.

Visual field assessment. Rapid assessment of the peripheral visual field can be carried out in the emergency setting using the confrontation test. It can give additional information about retinal or optic nerve damage.

Ocular motility assessment

- If *injury to the cranial nerves* or bony orbital margin is suspected, ocular motility must be evaluated.
- *A case of blow-out fracture* with an entrapped inferior rectus muscle can be made out at this stage and treatment modified accordingly.
- However, it is not always possible to examine for motility as the patient's periorbital oedema or lack of cooperation may mask the findings.

Examination of conjunctiva

Foreign bodies or precipitates of chemicals may be lodged within the conjunctival fornices. The lids should be everted and fornices examined.

- *Ibuprofen. Children*: 10 mg / kg orally, 4 doses in 24 hours. Ibuprofen has the lowest side effect of the non-steroidal anti-inflammatory drugs. Avoid in renal and use with care in asthma. Not in children <7 kg.
  Adults: 400 mg orally, 4 doses maximum in 24 hours.
- *Diclofenac. Children*: 1 mg / kg orally or rectally, 3 doses in 24 hours. Cautions as for Ibuprofen.
  Adults: 150 mg total by any route in 24 hours.
- *Codeine phosphate* 0.5 mg / kg orally 6 hourly. Use with care when co-administered with other opioids.

Anti-emetic drugs

- *Droperidol.* 0.5 to 1 mg in adults, up to 3 times a day, cheap and effective but causes drowsiness, sedation, anxiety and restlessness. Risk of extrapyramidal effects.
- *Cyclizine. Children*: 1 mg / kg IV up to 3 times a day.
  Adults: 50 mg IV antihistamine and anticholinergic effect.
- *Ondansetron. Children*: 0.1 mg / kg IV 3–4 doses per 24 hours.
  Adults: 4 mg IV expensive but effective with low side effect profile. Does not protect against aspiration of gastric contents. Its use in emergency anaesthesia is, therefore, limited.

Analgesia and control of nausea and vomiting

It is possible to manage pain in the majority of patients after eye surgery with oral analgesia. Avoiding opioids, if possible, helps prevent nausea and vomiting. Regular doses of paracetamol (acetaminophen) and a non-steroidal anti-inflammatory drug (ibuprofen, diclofenac, ketoprofen) should be prescribed. Codeine phosphate can also be added. These drugs are best accepted by children, if given as an elixir (syrup).

In patients having surgery with general anaesthesia, it is a good idea to ask the surgeon to perform a local anaesthetic block before waking up the patient. If stronger analgesia is required this is best given as small intravenous doses of morphine or pethidine.

Nausea and vomiting after emergency eye anaesthesia can be a major problem in some patients. Anti-emetic prophylaxis may help prevent this. Some patients may benefit from a regular anti-emetic in the postoperative period. There is a vast number of anti-emetic drugs available. Most have a limited efficacy. Using a combination of small doses of anti-emetic drugs from different pharmacological classes may enhance efficacy and reduce side effects.

A PRACTICAL APPROACH TO EMERGENCY EYE ANAESTHESIA

- *Assess the indication for emergency anaesthesia* in discussion with the surgeon. Can surgery be deferred until normal working hours and to allow adequate fasting?
- *Carry out a full preoperative assessment* including a history and examination.
- *Are there any medical/trauma issues that need addressing first?* Decide on choice of anaesthetic technique. Provide the patient with a full explanation. Tell the patient what to expect, if a local anaesthetic technique is to be used.
- *If a general anaesthesia is chosen,* decide if the patient has a full stomach and is at risk of aspiration.
- *If the patient has a full stomach,* a rapid sequence induction technique should be used. They should be preoxygenated with 100% oxygen. Pressure on the affected eye from the mask must be avoided. The patient should then be induced with an intravenous anaesthetic agent (e.g. thiopentone 47 mg / kg) and a rapid onset muscle relaxant (suxamethonium 1–1.5 mg / kg is currently the only realistic option). While the patient is being induced, cricoid pressure should be applied by an assistant (Sellick's manoeuvre) thus occluding the oesophagus behind. The patient's trachea should be intubated after which the cricoid pressure can be removed. Note that the endotracheal tube tie should not be tight around the neck as this impedes venous drainage and raises intraocular pressure.
- *Choice of maintenance depends* on local availability, e.g. 40% O_2, 60% NO and an inhalational agent note that all inhalational agents reduce intraocular pressure.

for the initial 48–72 hours. A surgical intervention is usually reserved at a later date, if at all indicated.

INTRAORBITAL FOREIGN BODY

An intraorbital foreign body can be considered in high velocity periocular injuries.

- *CT scan* can be helpful in determining the site of lodging of the foreign body.
- *Foreign bodies can be either organic or inorganic*. Inorganic foreign bodies are usually inert and the injury that they cause is only limited to the initial act of the trauma.
- *Anteriorly located foreign bodies* are usually easy to remove.
- *Posteriorly located inorganic foreign bodies*, if causing no inflammation or pain, can be left in situ lest it should cause mechanical damage to the orbital contents during its surgical extraction. The same, however, cannot be said for organic foreign bodies which need to be removed as they are more likely to lead to infective complications, like orbital cellulitis, orbital abscess, meningitis and a chronically draining fistula.
- Anti-tetanus prophylaxis should be instituted for all patients.

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5. *A badly (severely) wounded eye.* It refers to extensive corneoscleral tears associated with prolapse of the uveal tissue, lens rupture, vitreous loss and injury to the retina and choroid.

II. ***Introduction of infection.*** Sometimes, pyogenic organisms enter the eye during open globe injuries, multiply there and can cause varying degree of infection depending upon the virulence and host defence mechanism. These include: ring abscess of the cornea, sloughing of the cornea, purulent iridocyclitis, endophthalmitis or panophthalmitis (Chapter 9). Rarely tetanus and infection by gas forming organisms (*Clostridium welchii*) may also occur.

III. ***Post-traumatic iridocyclitis.*** It is of frequent occurrence and if not treated properly can cause devastating damage.

IV. ***Sympathetic ophthalmitis.*** It is rare but most dangerous complication of open globe injury. Sympathetic ophthalmitis refers to bilateral granulomatous panuveitis which follows open globe trauma. The injured eye is called exciting eye and the fellow involved eye is called sympathizing eye.

INTRAOCULAR FOREIGN BODIES

Modes of trauma

Penetrating injuries with foreign bodies are not infrequent. Seriousness of such injuries is compounded by the retention of intraocular foreign bodies (IOFB).

Common foreign bodies responsible for such injuries include: chips of iron and steel (90%), particles of glass, stone, lead pellets, copper percussion caps, aluminium, plastic and wood. It is important to note that during chopping a stone with an iron chisel, it is commonly a chip of the chisel and not of the stone which enters the eye.

Modes of damage

A penetrating / perforating injury with retained intraocular foreign body may damage the ocular structures by the following modes:

- Mechanical effects
- Introduction of infection
- Reaction of foreign bodies
- Post-traumatic iridocyclitis
- Sympathetic ophthalmitis

A. Mechanical effects

Mechanical effects depend upon the size, velocity and type of the foreign body. Foreign bodies greater than 2 mm in size cause extensive damage. The lesions caused also depend upon the route of entry and the site up to which a foreign body has travelled. In general these include:

- Corneal or / and scleral perforation
- Hyphema, iris hole and injury to ciliary body
- Rupture of the lens and traumatic cataract
- Vitreous haemorrhage and / or degeneration
- Choroidal perforation, haemorrhage and inflammation
- Retinal hole, haemorrhages, oedema and detachment.

B. Introduction of infection

Intraocular infection is the real danger to the eyeball. Fortunately, small flying metallic foreign bodies are usually sterile due to the heat generated on their commission. However, pieces of the wood and stones carry a great chance of infection. Unfortunately, once intraocular infection is established, it usually ends in endophthalmitis or even panophthalmitis.

C. Reactions of the foreign body

I. ***Inorganic foreign body.*** Depending upon its chemical nature, following four types of reactions are noted in the ocular tissues:

1. *No reaction is* produced by the inert substances which include glass, plastic, porcelain, gold, silver and platinum.
2. *Local irritative reaction* leading to encapsulation of the foreign body occurs with lead and aluminium particles.
3. *Suppurative reaction* is excited by pure copper, zinc, nickel and mercury particles.
4. *Specific reactions* are produced by iron (siderosis bulbi) and copper alloys (chalcosis).

II. ***Reaction of organic foreign bodies.*** The organic foreign bodies, such as wood and other vegetative materials, produce a proliferative reaction characterized by the formation of

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