ANAESTHESIA FOR EMERGENCY EYE SURGERY

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Introduction

Anaesthesia for emergency eye surgery can present special problems to the anaesthetist. An understanding of some basic principles and techniques of eye anaesthesia have been discussed in previous issues of Update (Nos. 6 & 8).

This article discusses the specific problems of emergency anaesthesia for eye surgery. We try and answer the common questions concerning these patients and provide a practical guide.

Indications for emergency eye surgery

An emergency is defined as an event that has to be dealt with immediately, usually within the first hour after presentation. The commonest eye emergencies that fall into this category are chemical burns of the eye and retinal artery occlusion. Neither of these requires surgery as part of the initial management. The majority of cases presenting as emergencies can therefore be defined as urgent cases.

Trauma is by far the commonest indication for urgent surgery. Traumatic injuries can be blunt or penetrating ("open eye"). The incidence is highest in young adult males and children. Trauma is often associated with industrial or motor vehicle accidents. Eye protection in the work place and car safety belts have lowered the incidence of eye trauma in many countries. Eye trauma is usually confined to one eye. Some patients may present with trauma to both eyes or with multiple injuries.

Non-traumatic surgical "emergencies" include spontaneous retinal detachment, infections, and complications of previous surgery. One of the factors which determines the degree of urgency for retinal detachment surgery is the condition of the macula. The risk of a detachment progressing and resulting in loss of the macula increases the sense of urgency. There is usually enough time however to allow for fasting prior to surgery.

Timing of surgery

Ideally all patients should be fasted before undergoing general anaesthesia to minimise the risk of aspiration and subsequent lung injury. This obviously has to be weighed against the risk to the eye that delaying surgery may cause. It is essential to liase closely with the surgeon to establish the degree of urgency. Most cases involving blunt trauma can usually be delayed to allow for patient fasting.

Penetrating injuries may need to be dealt with more urgently due to the risk of infection and endophthalmitis. If the patient has an open eye injury there is also the risk of vitreous loss and retinal detachment. Even with open eye injuries many ophthalmic surgeons are willing to delay surgery until a patient is adequately fasted prior to anaesthesia. This is especially the case where there is severe damage to the eye and surgery is not going to improve sight. This group of patients are usually admitted for bed rest and have an eye shield covering the injured eye until they are ready for primary closure of their eye wounds. Open eye injuries in which the eye is still largely intact and the visual prognosis is good need to be dealt with more urgently. Decision making needs to be made on a case by case basis. The degree of urgency will depend on the size of the laceration and commensurate risk of loss of ocular contents, how dirty the wound is and the risk of infection.

A fast of six hours is normally suggested in the uncomplicated patient. It is now common practice to allow patients to drink clear fluids (water, non-fizzy fruit drinks) up to two to four hours prior to the time of surgery. In patient's who have had trauma or received opioids, it can take up to 24 hours for gastric emptying to take place. The most important time interval is that between the last meal and the time of the injury. If trauma occurs soon after a large meal the patient may still have a full stomach after the standard six hour fast. Alcohol also delays gastric emptying. If surgery is necessary in a patient with a full stomach then a rapid sequence induction technique should be used (see below).

How long patients should be fasted for prior to surgery with a local anaesthetic block is controversial. We feel that in the patient undergoing emergency eye anaesthesia the above principles regarding fasting should be used irrespective of the anaesthetic technique chosen.

Does the patient have other medical problems ?

Eye trauma requiring surgery may be associated with other injuries that may or may not require surgery. In the multiply injured patient normal trauma principles must always be applied. Life-threatening problems should be dealt with before sight-threatening problems. The principles of managing the patient with major trauma have been discussed in Update 1996;6. Patients with other disease

processes such as diabetes or ischaemic heart disease should have these optimised prior to surgery if time allows.

Choice of a local or general anaesthetic technique

The choice of technique will depend on patient factors as well as local facilities and surgeon preferences. In many countries extra-ocular, anterior segment and vitreo-retinal eye surgery is routinely performed using local anaesthetic techniques. However there are many practical reasons why a general anaesthetic is often preferable for emergency cases. Firstly, the patient must be able to lie flat, still and protect his or her own airway safely for the duration of the procedure. Thus, children, uncooperative or intoxicated patients are usually better candidates for a general anaesthetic. An uncooperative patient with an open eye is extremely difficult to manage. Spread of local anaesthetic agents is poor in patients with eye and orbital infections. Some procedures such as scleral banding (scleral buckling) for retinal detachment can be extremely uncomfortable even with a good local anaesthetic block. In our experience younger adults tend to tolerate surgery with a local anaesthetic technique poorly compared with elderly patients.

In open eye injuries local anaesthetic techniques are usually avoided. Injection of local anaesthetic using peribulbar and retrobulbar techniques is associated with an increase in intra-ocular pressure which may lead to vitreous loss. Oculocompression after the block is also not an option if the patient has an open eye injury. In some patients it may be possible to operate on small open eye injuries using topical anaesthesia, sub-tenon blocks or a careful peribulbar or retrobulbar block.

Is sedation an option ?

Sedation should be used cautiously. Oversedation can easily turn a cooperative patient into a difficult to manage patient due to airway problems and patient confusion. Sedation should not be used as an alternative to a general anaesthetic in a patient with a full stomach. If a patient develops pain during surgery using a local anaesthetic technique the patient requires analgesia and not sedation. The surgeon should supplement the block using local anaesthesia or small doses of intravenous analgesia should be given.

If sedation is to be used then small doses of a short acting agent such as midazolam should be given. Diazepam in small doses may also be an option. Propofol in small 10mg increment doses can also be used especially prior to performing a local anaesthetic eye block. Some anaesthetists use small doses of alfentanil or fentanyl. The key to good sedation is to maintain verbal contact with the patient.

Careful surgical draping is also important. Patients become claustrophobic if their faces are draped. Use of a bar to hold up the drapes can allow a tent to be made to allow better ventilation (figure 1). Oxygen should be given to the patient, especially if sedation is to be used. Patients may find a face mask or nasal oxygen cannulae uncomfortable. Oxygen can be insufflated under the drapes using a breathing circuit. This also improves air circulation under the drapes.

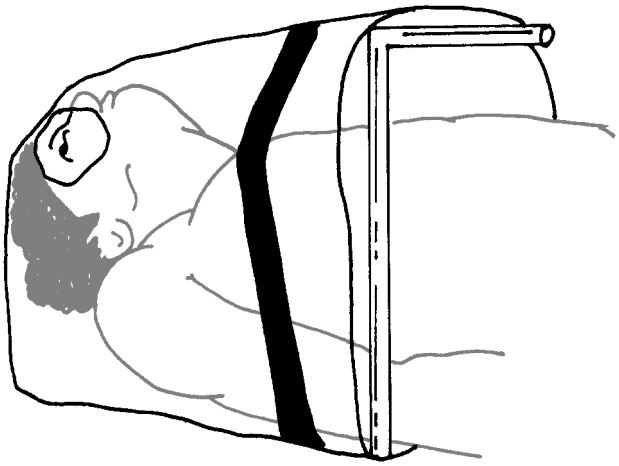

Figure 1

Many of the problems associated with local techniques can be avoided with a clear explanation of the procedure to the patient prior to commencing surgery, having a comfortable operating table, and somebody to hold the patient's hand throughout. Allowing patients to empty their bladders prior to surgery also helps.

Choice of drugs for general anaesthesia

The choice of intravenous induction agent will depend on local availability and user familiarity. Most intravenous induction agents reduce intra-ocular pressure therefore preventing further damage to the injured eye.

Ketamine possibly raises intra-ocular pressure although the literature is conflicting. Most textbooks state that it should be avoided in open eye injuries. If it is to be used it is best to use it in combination with small doses of a benzodiazepine (midazolam, diazepam) to blunt its excitatory effects. The majority of problems with ketamine and intra-ocular pressure seem to occur when it used as a

sole agent in a patient with an unprotected airway breathing spontaneously. Ideally ketamine should be used with a muscle relaxant and controlled ventilation if intra-ocular pressure control is important.

All the non-depolarising muscle relaxants can be used without adverse effects on the eye so choice will depend on availability. Suxamethonium (scoline) increases intra-ocular pressure. The exact mechanism is unclear but it is not thought to be solely due to contraction of the extra-ocular muscles. Suxamethonium also causes an increase in the intra-ocular blood volume and this may contribute to the rise in intra-ocular pressure. The rise in intra-ocular pressure occurs after one to two minutes and wanes after six to ten minutes. The extent of the rise in intra-ocular pressure will depend on the other drugs used and the response to laryngoscopy and intubation. Its use in penetrating eye injury anaesthesia is controversial. The majority of eye surgeons prefer if it is not used. Adequate fasting prior to surgery will allow suxamethonium to be avoided for the majority of urgent cases. This obviously presents a dilemma in the patient with a full stomach as suxamethonium is used as part of a 'rapid sequence induction' to enable an airway to be secured quickly. In this situation the relative risks need to be weighed, i.e. prevention of aspiration (potentially life threatening) verses ocular damage (potentially sight threatening). Suxamethonium avoiding techniques include the use of large doses of vecuronium or pancuronium to speed up its onset of action as part of a modifed rapid sequence induction technique. The non-depolarising neuromuscular blocker rocuronium has a rapid onset of action with a duration of 30 to 40 minutes. It can be used for a rapid sequence induction technique but can only be recommended to those who have gained experience in its use and for patients in whom airway problems are unlikely to occur.

On balance there are no case reports of ocular damage with suxamethonium use, and no good evidence that suxamethonium-avoiding techniques are any better or safer.

Airway management and mode of ventilation

It is considered good practice to intubate and ventilate the patient to ensure a secure airway (the surgical field is in close proximity) and to facilitate mild hypocarbia (this reduces intra-ocular pressure). The laryngeal mask airway is a popular choice for airway management for elective eye surgery in the UK. Laryngeal mask insertion avoids the pressor response to laryngoscopy and intubation causing raised intra-ocular pressure. The laryngeal mask

Analgesic Drugs

Drug	Dose	Comments
Paracetamol (Acetominophen)	Children: 90 mg/kg total per 24 hours orally or rectally in 4-6 divided doses Adults: 1g orally or rectally. 4g total per 24 hours	Avoid if liver dysfunction. Decrease dose to total of 60 mg/kg per 24 hours if treatment for more than 48 hours.
Ibuprofen	Children: 10mg/kg orally. 4 doses maximum in 24 hours. Adults: 400 mg orally. 4 doses maximum in 24 hours.	Ibuprofen has the lowest side effect profile of the non-steroidal anti-inflammatory drugs. Avoid in renal and peptic ulcer disease. Use with care in asthma. Not in children <7kg.
Diclofenac	Children: 1mg/kg orally or rectally. 3 doses in 24 hours. Adults: 150 mg total by any route in 24 hours	Cautions as for Ibuprofen.
Codeine Phosphate	0.5 mg/kg orally 6 hourly	Use with care when co-administered with other opioids

Drugs for nausea and vomiting

Drug	Dose	Comments
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 1mg/kg iv	Up to 3 times a day
	Adults 50 mg iv	Anti histamine and anti-cholinergic 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 (acetominophen) 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). Some analgesic drugs are listed in the table below. 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 post-operative 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. Some anti-emetic drugs are listed in the table below.

A practical approach to emergency eye anaesthesia

1) Assess the indication for emergency anaesthesia in discussion with the surgeon. Can surgery be deferred until normal working hours and to allow adequate fasting?

2) Carry out a full preoperative assessment including a history and examination.

3) 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.

4) If a general anaesthesia is chosen decide if the patient has a full stomach and is at risk of aspiration.

5) 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 (eg thiopentone 4-7mg/kg) and a rapid onset muscle relaxant (suxamethonium 1-1.5mg/kg is currently the only realistic option). While the patient is being induced cricoid pressure should be applied by an assistant (Sellick's manouvre) 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 intra-ocular pressure.

6) Choice of maintenance depends on local availability e.g. 40% O_2, 60% N_2O and an inhalational agent. Note that all inhalational agents reduce intra-ocular pressure.

7) Control ventilation during the procedure aiming for low to normal end-tidal carbon dioxide. This may require the use of a longer acting muscle relaxant (e.g. vecuronium 0.1mg/kg). A slight head up tilt helps reduce intra-ocular pressure.

8) At the end of the procedure the patient should be extubated on their side and once airway protective reflexes have returned. In patients not deemed at risk of aspiration extubation with the patient deep and breathing spontaneously may prevent coughing. Severe coughing and straining needs to be avoided as this increases the risk of ocular haemorrhage.

9) If the patient does not have a full stomach and is not deemed at risk of aspiration, general anaesthesia should proceed as for an elective patient. Pre-oxygenate the patient for safety and induce with an intravenous agent. Give a long acting muscle once ability to hand ventilate is established. Laryngoscopy should be performed gently. Consider spraying the vocal cords with lignocaine to minimise the pressor response to intubation. This may also decrease the risk of coughing on intubation. Intubate, ventilate and maintain anaesthesia as above.

10) Post operatively nausea, vomiting and pain should be kept to a minimum as they can cause rises in intra-ocular pressure. Prescribe regular oral analgesia and an anti-emetic. Some patients may need stronger analgesia early after surgery. Titrate small doses of intravenous opioid (morphine, pethidine) to control pain.

References

1. Mcgoldrick KE. The open globe: is an alternative to succinylcholine necessary ? J Clin Anaesth 1993, 5: 1-4.

This article argues that suxamethonium is probably still the best muscle relaxant for the real emergency. It also discusses the use of pretreatment.

2. Libonati MM, Leahy JJ, Ellison N: The use of succinylcholine in open eye surgery. Anaesthesiology 1985, 62: 637-40.

This paper studied 100 patients needing “open eye” surgery with suxamethanium.