

ANAESTHESIA FOR EYE SURGERY

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Surgery on the eye can be performed under either local or general anaesthesia. In the previous issue of Update techniques for local anaesthesia were described. In this article the principles of general anaesthesia for eye surgery are outlined.

General anaesthesia for eye surgery presents a number of special considerations for the anaesthetist. Patients are frequently at the extremes of age and in the case of the elderly concomitant medical conditions are not uncommon, particularly diabetes and hypertension. Drugs used in ophthalmology may influence the course of the anaesthetic. For example agents used in the treatment of glaucoma may include timolol, a beta blocking agent, or phospholine iodide which has anticholinesterase properties and may prolong the action of suxamethonium.

The anaesthetist must be familiar with the factors which influence intra-ocular pressure (IOP). This is the pressure within the eyeball and is normally in the region of 10-20mm Hg. When the surgeon is operating within the globe (eg cataract surgery) it is important that the anaesthetist controls the IOP. A rise in the IOP will impair the operating conditions and may cause an expulsion of intraocular contents with permanent damage to the eye. On the other hand a mild reduction in IOP will improve operating conditions for the surgeon.

A rise in IOP can generally be attributed to one or more of the following: pressure from outside, an increase in the volume of blood in the vessels within the eye or an increase in the volume of aqueous or vitreous humor.

Factors increasing IOP include:

1. External pressure eg face mask
2. Raised venous pressure, eg by coughing, straining, vomiting
3. Raised arterial pressure
4. Hypoxia and hypercarbia which cause vasodilation of intraocular blood vessels
5. Suxamethonium - the precise mechanism is unknown but may be due to contraction of

extraocular muscles during fasciculation or dilation of blood vessels. The effect is maximal at 2-4 minutes returning to normal within 7 minutes.

6. Ketamine

Factors lowering IOP include:

1. Reduced venous pressure, eg. head up tilt.
2. Lowered arterial pressure - at systolic pressures <90mm Hg IOP is proportional to the blood pressure.
3. Hypocarbia by constricting choroidal vessels.
4. Intravenous induction agents (except ketamine).
5. Inhalational agents (the fall in IOP is proportional to the inspired concentration).
6. Non-depolarising muscle relaxants.
7. Reduction in aqueous volume, eg by acetazolamide which inhibits production.
8. Reduction in vitreous volume, eg by mannitol which exerts an osmotic effect.

A suitable technique for intraocular surgery in adults is as follows:

Premedication. Oral diazepam 0.1 - 0.2mg/kg. Heavy sedation with opiates is best avoided because of the dangers of respiratory depression and hypercarbia.

Induction: Thiopentone 4mg/kg

Suxamethonium 1mg/kg

Laryngoscopy. This should not be performed until the patient is fully paralysed in order to avoid gagging or coughing. Topical anaesthesia to the larynx and trachea with 4% lignocaine will reduce the incidence of coughing especially if the head is moved.

Maintenance. N₂O:O₂:halothane 0.5 - 1% (or equivalent concentration of other volatile agent). Vecuronium 0.1mg/kg administered before the effects of suxamethonium have worn off. IPPV to produce moderate hypocarbia.

Position. Head up tilt to reduce venous pressure

Monitoring. ECG, oximeter, capnograph and peripheral nerve stimulator should be used if available. In situations where full monitoring is not available it is probably safer to administer atropine or glycopyrrolate routinely with the

induction of anaesthesia to prevent the bradycardia which may occur during manipulation of the eye due to the oculocardiac reflex.

Reversal. Continue volatile agent until reversal is complete and spontaneous respiration is resumed using atropine or glycopyrrolate and neostigmine as required.

Extubation. This should be accomplished with the patient on their side. An anti-emetic may be administered to minimise the incidence of post operative vomiting.

Post Operative Analgesia. Morphine 0.1 mg/kg if required. No food or drink should be administered for 3 hours to reduce the possibility of aspiration of gastric contents.

If muscle relaxants are unavailable and the patient breathes spontaneously the depth of anaesthesia must be increased to prevent coughing or straining against the tube. This technique however carries the additional disadvantages of subsequent hypercarbia, hypotension and a prolonged recovery period. Some anaesthetists use a reinforced laryngeal mask with spontaneous respiration for some ophthalmic operations.

Penetrating Eye Injury

When the globe has been penetrated the IOP is reduced to atmospheric pressure. An increase in IOP during induction may cause expulsion of intraocular contents and permanent damage to the eye.

If the repair is carried out as an emergency procedure the patient must be assumed to have a full stomach and requires a rapid sequence induction. During pre-oxygenation care must be taken not to exert pressure on the eye by the face mask. Suxamethonium is theoretically contra-indicated as it causes a rise in IOP. The anaesthetist must however weigh the risk to the eye against the risk of aspiration of gastric contents.

If intubation is anticipated as being uneventful a large dose of a non-depolarising relaxant (eg vecuronium 0.15 mg/kg) may be substituted for suxamethonium and a modified rapid sequence induction performed. Care must be taken to allow time for full muscle paralysis to occur before laryngoscopy is attempted meanwhile, cricoid

pressure is maintained.

If, however, difficulties are anticipated with intubation suxamethonium should be used to provide the best intubating conditions as rapidly as possible despite the theoretical risk to the eye. In practice the risk is minimised by the prior administration of an induction agent which reduces IOP.

Once intubation has been achieved anaesthesia is conducted using the general principles described above.

Strabismus Surgery

During surgery for the correction of strabismus traction on the extra ocular muscles may cause sudden and profound bradycardia via the oculocardiac reflex mediated by the vagus nerve. This effect is also occasionally seen during other forms of eye surgery eg retinal detachment.

When this occurs the surgeon must be immediately alerted as the normal heart rate is generally restored when traction is released. If this does not occur an intravenous bolus of atropine 0.02 mg/kg may be required. It is important that the anaesthetist carefully monitors the heart rate throughout the operation, preferably using an audible warning device so that the surgeon is aware of changes in heart rate. Intravenous access must be assured and atropine drawn up and ready for immediate use. In paediatric patients with their increased vagal tone the prophylactic administration of atropine before the commencement of surgery is advisable.

Examination Under Anaesthesia

Although endotracheal intubation is required for most patients requiring general anaesthesia for eye surgery, examination of the eye in children can often be provided satisfactorily via a face mask. If the naso-lacrimal duct is to be irrigated steps should be taken to avoid respiratory obstruction due to laryngospasm. This can be achieved either by intubation or positioning the patient with a pillow under the shoulders to divert irrigation fluid away from the larynx.

Ketamine can also be used for examination of the eye but pre-medication with atropine is essential to prevent laryngospasm caused by excessive secretions.