LOCAL ANAESTHESIA AND THE EYE

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Eye surgery

The techniques of local anaesthesia are of crucial importance to the eye surgeon for, if need be, he can perform most of the operations in his repertoire with these methods; but the co-operation of an anaesthetist who fully understands the implications of these techniques (as well as having the usual skills of his specialty) contributes greatly to the care of patients with eye problems. Such co-operation means that the choice of anaesthesia can range from topical local block and neuroleptic agents to general anaesthesia. Proper team work should result in the ideal anaesthetic being chosen.

Local anaesthesia is popular with surgeons practising in those countries where eye disease is rampant and facilities for general anaesthesia are totally inadequate. The methods of achieving such anaesthesia may be learned quickly by relatively inexperienced auxiliaries, leaving the surgeon free to concentrate on the essentials of the operation. The hundreds of thousands who have had their sight restored in the eye camps held in the Indian sub-continent bear witness to the advantages of this approach.

There are staunch advocates of local anaesthesia even in those countries in which the anaesthetic services are well developed. These protagonists argue that many patients admitted to hospital for eye surgery are elderly and that general anaesthesia is often contraindicated, because of either cardiovascular or respiratory disease. They claim too, with justification, that they can operate on more patients in a given time than is possible under general anaesthesia and this is an important consideration when theatre time is short.

Local anaesthesia has its limitations, of course. It is usually inappropriate when children undergo surgery and there are many adults who cannot face the prospect of an operation being performed on their eye whilst they are conscious. General anaesthesia has the great advantage of ensuring a completely immobile eye, so necessary when surgery is carried out under the microscope—an increasingly common practice. In addition, the intraocular pressure may be reduced by a general anaesthetic, which helps lessen the risk of vitreous loss and other complications arising during intraocular surgery. And all but the most extrovert surgeons find teaching trainees much easier when the patient is asleep.

The following account, which is set out on a largely topographical basis, describes some of the commoner methods used to achieve anaesthesia, and indeed akinesia, by local techniques.

SEDATION

Patients awaiting an eye operation are likely to be anxious and adequate sedation is of prime importance. Such medication should properly be prescribed by an anaesthetist, who is best trained to appreciate the effects of the drugs used on the patient's vital functions. He is most likely to understand any interaction of the sedative with drugs either taken by the patient before operation or used during the operation. These may include not only the local anaesthetic itself but adjuvants, such as adrenaline, or solutions given either as drops or by intraocular injection, usually aimed at controlling the size of the pupil.

METHODS OF ANAESTHESIA

Lids

The removal of superficial skin lesions, such as papillomata or retention cysts, requires no more than local infiltration of an anaesthetic agent. Lignocaine (1% or 2% solution), with or without adrenaline 1 in 100 000 to minimize bleeding, is widely used. The use of adrenaline has its dangers in those who are hypertensive or taking monoamine oxidase inhibitors. The plunger of the syringe should be withdrawn at intervals during the course of the injection to detect if a blood vessel has been entered inadvertently. The addition of hyaluronidase promotes the dissemination of the local anaesthetic in the tissues and hastens the onset of the anaesthetic effect.

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Many procedures, such as those to correct malposition of the lids (e.g. ectropion or entropion) or the excision of an infiltrating lesion (e.g. basal cell carcinoma) require that the whole thickness of the lid be anaesthetized. This also applies when the lids are fused (tarsorrhaphy), which is necessary to achieve protection of the exposed cornea.

Figure 1 shows the points of exit of the branches of the trigeminal nerve which supply the lids and figure 2 illustrates the neurovascular plane in which they lie. If the lid alone is to be anaesthetized, this is most readily achieved by infiltrating a small amount of anaesthetic solution into the plane in which the nerves run—between the orbicularis oculi muscle and the tarsal plate. The area should then be gently massaged. When more extensive surgery, such as flap rotation or "Z-plasty", is envisaged, then it is preferable to block a specific nerve.

Most operations carried out on the lower lids and the cheek can be performed after blocking the infraorbital nerve at its exit from the infraorbital foramen. This lies 5 mm below the infraorbital margin, directly below the supraorbital notch (fig. 3). The extreme lateral part of the lower lid is supplied by the lacrimal nerve and local infiltration of this area is advisable. The extreme medial parts of the upper and lower lids are supplied by the supratrochlear nerve, and this can be blocked by infiltration at a point 3–4 mm below the junction of the upper and medial walls of the orbit (fig. 4). The remainder of the upper lid is supplied by the supraorbital and the supratrochlear nerves and these may be blocked at their appropriate exit points.

Surface of the globe
Anaesthesia of the cornea and bulbar conjunctiva may be necessary to allow proper examination of the damaged eye. Topical anaesthesia is also used before the removal of corneal foreign bodies and for minor surgery to the cornea or conjunctiva.

Several mild, short-acting anaesthetic agents are available which may be used for either brief examination or removal of superficial foreign bodies, for example proxymetacaine hydrochloride 0.5% (Ophthane) and oxybuprocaine (Benoxinate). However, for more extensive procedures, two agents have become established as being particularly useful; cocaine 4% and amethocaine 1%.

Cocaine produces vasoconstriction and is preferred for conjunctival operations. It has a mydriatic effect and is therefore contraindicated in patients predisposed to angle-closure glaucoma. The other major disadvantage is the drug’s effect on the corneal...
epithelium, which may become cloudy or even desquamate a few minutes after the instillation of the drops. The use of cocaine is therefore contraindicated in any surgery where a good view through

Intraocular operations

The achievement of anaesthesia for intraocular surgery is exacting, for several requirements must be satisfied.

Sedation. The patient must be sedated so that he lies still during the operation and does not cough or strain. Sudden movements when instruments are within the eye can be disastrous. Straining and coughing lead to engorgement of the veins in the orbit and hence an increase in intraocular pressure because the venous sinuses in the choroid become distended. This may result in prolapse of the iris and, more seriously, the vitreous when the eye is incised. If vitreous becomes trapped in the wound a fibrous reaction may develop which leads to distortion of the pupil and traction on the retina which may precipitate a detachment.

Sedation is usually achieved by the use of benzodiazepine drugs or opiates and these are frequently combined with an antiemetic to reduce the likelihood of vomiting in the period after operation.

Anaesthesia of the cornea and bulbar conjunctiva is achieved topically as described earlier.

the cornea is essential, as in retinal detachment surgery. Amethocaine, if used frequently, has a similar but lesser effect on the corneal epithelium. The disadvantage of amethocaine is that it may cause vascular dilatation and hence precipitate bleeding.

Once the cornea has been anaesthetized, the afferent limb of the protective blink reflex is lost, and the eye becomes vulnerable to accidental damage. It is therefore important to protect it from trauma by means of a pad firmly applied over the closed lid. The pad should be left in place for several hours, by which time corneal sensation will have been fully restored. If the pad is only loosely applied the lid may open beneath it and the cornea be abraded by the pad itself. It is the risk of such accidental damage and the toxicity to the corneal epithelium that preclude the repeated use of local anaesthetic drops in those painful but transient conditions such as corneal abrasions or when the cornea is damaged by ultraviolet light.

Intraocular anaesthesia. The iris is the most sensitive structure within the eye and it must be anaesthetized before any intraocular surgery is undertaken. This is achieved by giving a retrobulbar

![Fig. 3. Blocking the infraorbital nerve.](https://academic.oup.com/bja/article-abstract/52/7/689/257599/fig3)

![Fig. 4. Blocking the infratrochlear nerve.](https://academic.oup.com/bja/article-abstract/52/7/689/257599/fig4)
The pain fibres arising in the iris leave the globe posteriorly, in either the short ciliary nerves which run backwards to the ciliary ganglion (fig. 5) or the long ciliary nerves. The fibres entering the ganglion pass straight through it to form the sensory root which joins the naso-ciliary nerve. The long ciliary nerves, which pass close to the ganglion, also join the naso-ciliary nerve. Hence, the iris is conveniently anaesthetized by the infiltration of an anaesthetic solution around the ciliary ganglion.

The ganglion lies about 1 cm from the optic foramen, between the optic nerve and the lateral rectus muscle, within the muscle cone. It is reached by giving a retrobulbar injection, using a 4-cm long 25-gauge needle.

The patient is asked to look upwards and medially, thus drawing forward the fascial sheath running between the inferior and lateral rectus muscles. The needle is inserted through the skin at a point just above and medial to the junction of the floor and the lateral wall of the orbit (fig. 6). Alternatively, the lower lid may be drawn down and the injection given directly through the conjunctiva. The needle should be passed straight backwards for about 1 cm. The eye moves slightly as the needle pierces Tenon’s capsule (the fascia encompassing the globe and its associated muscles). The needle is then directed upwards and medially, towards the apex of the orbit, and inserted a further 2 cm. Its tip should then lie within the muscle cone, adjacent to the ciliary ganglion. Lignocaine 1 or 2 ml (or 2–3 ml if hyaluronidase has been added) is injected slowly.

The main complication of a retrobulbar injection is haemorrhage from one of the many small orbital veins being punctured. This causes immediate marked proptosis and the resulting venous engorgement increases the intraocular pressure. The operation must be postponed. Some surgeons try to lessen the risk of precipitating haemorrhage by slowly injecting a small amount of the anaesthetic as the needle is advanced, in the hope that any small blood vessels will be pushed away from the needle tip.

A beneficial side-effect of a retrobulbar injection is a slight decrease of the intraocular pressure, probably because of constriction of the posterior ciliary arteries.

_Akinesia_. Paralysis of both the facial and the extraocular muscles is necessary for safe intraocular surgery. Contraction of the orbicularis oculi causes the lids to press upon the eye and contraction of the extraocular muscles leads to distortion of the globe. Both these events cause an increase in intraocular pressure, should the eye be intact; if an incision has been made, this pressure can be dangerous.

**Fig. 5.** The ciliary ganglion (6) and the associated nerves. 1 = frontal nerve; 2 = infratrochlear nerve; 3 = lacrimal nerve; 4 = short ciliary nerves; 5 = long ciliary nerves; 6 = ciliary ganglion; 7 = ophthalmic nerve; 8 = sensory root of trigeminal nerve; 9 = nerve to inferior oblique; 10 = maxillary nerve; 11 = infraorbital nerve.

**Fig. 6.** Retrobulbar injection.
been made through the globe's outer coat its contents, including vitreous, may be expelled.

Akinesia of the orbicularis oculi can be achieved by the methods of O'Brien or Van Lint.

The course of the facial nerve is shown in figure 7. In O'Brien's method the condyle of the mandible is first identified with the finger by asking the patient to open and close his mouth. The needle is inserted through the skin at a point overlying the junction of the upper and middle thirds of the ramus of the mandible. The needle is passed directly down to periosteum, and withdrawn slightly, before the injection of 2–3 ml of anaesthetic solution. The area is then massaged. The effect of the injection is to block the temporo-facial branches of the facial nerve. This method has the potential disadvantage that any communicating branches from the mandibulo-facial trunk of the nerve, which join the temporo-facial trunk distal to the site of this injection, are inevitably missed.

Van Lint's method involves injecting anaesthetic solution across the zygomatic bone as it forms the lateral and inferior margins of the orbit (fig. 8). The needle is inserted 1 cm lateral to and below the outer canthus and the injection is made beneath the muscle fibres upwards towards the eyebrow. The needle is almost fully withdrawn and passed downwards and medially towards the infraorbital foramen and the tissues infiltrated. A total of 4 ml of anaesthetic solution is given. This method has the advantage of being more peripheral and therefore the consequence is that any distal communicating branches will be blocked. A possible disadvantage is bleeding into the lids. The resulting haematoma may cause pressure on the eye, with all the attendant problems.

Akinesia of the extraocular muscles is a fortunate consequence of the retrobulbar injection, because the motor nerves lie on the inner surfaces of the recti and are blocked by the anaesthetic within the muscle cone.

**Lachrymal system**

Surgery on the lachrymal drainage system is commonly undertaken either to restore patency or to eradicate infection. When the adult naso-lachrymal duct is obstructed, part of the medial wall of the orbit may be removed and the mucosa of the lachrymal sac anastomosed to that of the nasal cavity (dacryocystorhinostomy—DCR). Persistent sepsis of the system,
particularly in the elderly or infirm, may justify excision of the sac (dacryocystectomy).

Such surgery requires anaesthesia of the skin of the inner canthus, the medial part of the lower lid and the lacrimal canaliculi and contents of the lacrimal fossa. For DCR the nasal mucosa should be anaesthetized.

Skin anaesthesia is achieved by blocking the infra-trochlear and the infraorbital nerves as described earlier. The lacrimal fossa and the mucosa of the lateral wall of the nose are innervated by branches of the anterior ethmoidal nerve which can be blocked by an injection placed about 2 cm behind the orbital margin at the junction of the roof and medial wall. Further anaesthesia of the nasal mucosa may be provided by packing the nose with ribbon gauze soaked in a mixture of cocaine and adrenaline. Haemostasis is best achieved by packing 30 min before the operation.

Pain

Occasionally a patient presents with an extremely painful blind eye. This problem is less common than formerly thanks, in part, to the control of ocular inflammation with steroids and the introduction of drugs which control glaucoma. However, there are still patients whose ocular pathology cannot be controlled and whose eye becomes both blind and painful. In such cases a retrobulbar injection of alcohol, aimed at destroying the sensory nerves, may secure total relief from the pain and allow retention of the eye, which may still be cosmetically acceptable.

The technique of giving the injection has been described earlier, but it should be realized that the introduction of a concentrated solution of alcohol into the orbit is excruciatingly painful. It is therefore essential first to inject a small amount of anaesthetic, preferably a long-acting solution, such as bupivacaine. After the injection of the anaesthetic the needle can be left in position and after 2 or 3 min the syringe is changed and 1–2 ml of 80% or 90% alcohol is introduced. Should the pain not be completely eradicated the injection can be repeated a few weeks later.

Incidental corneal anaesthesia

The anaesthetic cornea is at risk irrespective of whether the anaesthesia has been induced intentionally or encountered incidentally. The corneae of all patients under general anaesthesia must be protected, as must those of other unconscious patients, some of whom will be under the care of the anaesthetist in an Intensive Care Unit. It is essential that the cornea be kept moist and, in the absence of blinking, which normally spreads a tear film with bacteriocidal properties over the surface of the cornea, prompt supportive measures are necessary. Drops of saline, liquid paraffin or artificial tears (Hypermellose) should be instilled frequently and antibiotic ointment (e.g. chloramphenicol) should be applied to lessen the risk of secondary infection.

A facial paralysis, such as that brought on by Bell’s palsy, may lead to the eye becoming exposed as a result of inadequate closure of the lids. The cornea is at particular risk if inadequate closure is associated with corneal anaesthesia, as may occur following excision of an acoustic neuroma when the integrity of both the facial and trigeminal nerves may be jeopardized. The exposed cornea can become infected, leading to permanent scarring, or even perforation, in a matter of hours. In such cases, when recovery of the palsy is judged likely to be either delayed or incomplete, a tarsorrhaphy should be performed in good time. The operation should be carried out meticulously, for without due attention to detail, lashes may be left lying against the cornea which remain undetected behind the fused lids. The price the patient has paid for a hastily performed operation only comes to light when the tarsorrhaphy is opened to reveal an opaque cornea beneath the parted lids.

Many operations upon the eye can be performed under local anaesthesia and it is usually individual circumstances that dictate whether this technique is used of choice. Although eye surgeons are trained to achieve anaesthesia by local means, the co-operation of an experienced anaesthetist contributes greatly to the range of methods available for ensuring that the operation is performed under ideal circumstances. Sight is precious and the anaesthetist can play a crucial role in both its restoration and preservation.

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