

# Regional anaesthesia for eye surgery

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## Abstract

Many ophthalmic procedures are conducted under a range of local anaesthetic techniques. These range from topical drops through to sharp needle blocks with local anaesthetic. The most commonly used block is the sub-Tenon block; it provides excellent operating conditions while reducing complications and risks.

**Keywords** Ophthalmic anaesthesia; regional anaesthesia; sub-Tenon block

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## Introduction

Since 1884 there have been local anaesthetic approaches for eye surgery. Local anaesthesia is now the main anaesthetic technique for eye surgery, cataract and vitreoretinal surgery,<sup>1</sup> although there is variation between centres. Local anaesthesia for eye surgery does not exclude the need for general anaesthesia and there will always be contraindications to regional anaesthetic as the sole technique. However, many patients who would be extremely high risk for general anaesthesia will be at significantly lower risk for regional anaesthesia, although the high-risk patient may still require intraoperative care from an anaesthetist.

Overall the patient having eye surgery is relatively low risk and most eye operations can be conducted in an ambulatory care setting.

## Anatomy

To safely conduct any local anaesthetic block you need to be aware of the relevant anatomy and this is especially true with regards to the orbit. The orbit contains many delicate structures which are at risk of damage: the globe, six muscle groups, blood vessels and nerves.

Movement of the globe is controlled by the four rectus muscles and two oblique muscles. They are orientated to form an incomplete cone which contains most of the nerves and vessels.

The optic nerve enters the orbit through the optic foramen of the skull and is surrounded by a meningeal sheath. Thus there is a risk of accidental injection into the cerebrospinal fluid (CSF).

Sensory innervation is via the ophthalmic (first) branch of the fifth cranial nerve (CN V). The autonomic sympathetic

innervation is via afferents from the stellate ganglion; the parasympathetic innervation is from the nucleus of the third cranial nerve (CN III).

The ophthalmic artery (a branch of the internal carotid artery) enters the orbit superomedially, and follows the optic nerve. It supplies blood to the whole orbit and orbital contents.

Tenon's capsule is a thin fascial sheath which surrounds the globe and is fused with the bulbar conjunctiva anteriorly and near the optic nerve posteriorly. Delivery of local anaesthetic may be into this *potential* space and thus there may be initial resistance to injection.

## Physiology

### Oculo-cardiac reflex

The oculocardiac reflex is a vagally mediated reflex with a range of triggers: traction of the extra-ocular muscles, direct pressure on the globe, retrobulbar block and ocular trauma.

It usually results in a sinus bradycardia but it may cause other rhythm abnormalities. Prevention or limitation may occur with the use of prophylactic anticholinergics. If it occurs the key management is usually removal of the trigger but there may be the need for further anticholinergics and rarely resuscitation.

## Preoperative management

Many preoperative assessment clinics are nurse led and delivered with support from anaesthetists and ophthalmologists.<sup>3</sup> Regional anaesthetic for eye surgery is overall of low risk despite many of the patients being elderly and having significant comorbidities. One of the crucial factors is that the patient must be able to lie flat and not move, so significant respiratory disease or movement disorders may be a contraindication to a regional technique.

### Anticoagulants and antiplatelet agents

The current practice is to continue anticoagulants and antiplatelet agents for patients undergoing cataract operations.<sup>2</sup> The balance of risk between haemorrhage and significant thrombotic events is such that we aim to maintain normal therapeutic levels. In more complex surgical cases a multidisciplinary approach should be taken to assess the risks of maintaining or stopping the agents.

### Fasting

For local anaesthetic alone the patients are not fasted. However if general anaesthesia is a potential, then normal fasting applies.

### Contraindications to regional anaesthesia

The absolute contraindications to local anaesthesia are patient refusal, patient lacking the capacity to consent, inability to cooperate, inability to communicate, inability to lie flat and still, infection around the orbit or eye and rarely local anaesthetic allergy.

The relative contraindications are usually surgical and include emergency surgery with a risk of globe rupture, prolonged or repeated surgery and others.

### Complications of local anaesthesia

- Retrobulbar haemorrhage (1–2% incidence).
- Globe penetration (<1% incidence).

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- Optic nerve damage (<1% incidence).
- Local anaesthetic toxicity (uncommon).
- Muscle palsies (uncommon).
- Chemosis (common).
- Corneal abrasion.

### Regional anaesthetic techniques (all blocks)

There are a range of local anaesthetic approaches and they can be delivered by the anaesthetist or ophthalmologist. The type and extent of surgery will help determine the choice of block. They may be conducted as sole anaesthetic or along with a general anaesthetic.

### Preparation and conduct of the block

The surgeon should have consented the patient and marked the side. With regards to the anaesthesia, the patient should have the block explained and verbal consent should be obtained before starting. All routine preoperative checks of equipment and drugs should be conducted.

The patient should lie supine, have IV access established (for sharp needle blocks only) and full monitoring applied. A Stop Before You Block pause should then occur.

Topical anaesthesia should be used initially to obtain globe surface anaesthesia. Iodine 5% is then applied to the conjunctiva, ensuring splashes do not enter the contralateral eye.

The procedure should be fully documented including any presence or absence of akinesia and any complications noted.

### Intraoperative

During any procedure under a regional technique, the patient has to lie still with a drape over their head. The drape is usually held by a support, often a right-angled bar. The patient should be monitored by a trained member of staff throughout the procedure, and oxygen should be administered either via nasal cannula or via the support used under the drape. This also helps to improve CO<sub>2</sub> removal from the area around the patient.

A member of the theatre team should hold the patient's hand. The patient can squeeze the team member's hand should they need to move, cough or speak. This will reduce the risk of movement at a crucial part of the procedure.

Sedation is possible and there is a theoretical benefit with a target-controlled infusion (TCI) of propofol at low dose.

### Sub-Tenon block

#### Overview

This block uses a blunt needle and thus avoids the blind placement of sharp needles.

A blunt curved needle is used to place the local anaesthetic into the sub-Tenon's space towards the rear of the globe. The injection of local anaesthetic provides both anaesthesia and often akinesia with a relatively low risk of the serious complications seen with sharp needle blocks. This is now the most commonly used block in the UK for both cataract and vitreoretinal surgery, and has high levels of patient satisfaction.<sup>4</sup>

#### Conduct of the block

- Routine checks and preparation as above.
- An eyelid speculum is inserted, holding the lids apart.

- The inferonasal quadrant is visualized by having the patient look up and out. Using non-toothed forceps the conjunctiva and Tenon's capsule should be pinched 5–7 mm from the limbus.
- This effectively forms a small 'tent' into which a small incision (2 mm or less) should be made using round-ended scissors. This should expose the white and shiny sclera below.
- The closed scissors are gently inserted into this hole and opened to create a small tunnel into the sub-Tenon's space and towards the back of the globe.
- A blunt, curved cannula (commonly 19G, 25 mm sub-Tenon's cannula) is passed slowly and gently into this passage, following the curve of the globe.
- The cannula is advanced in a curved movement following the globe. When the needle is inserted to a depth of 15–20 mm, the syringe will be almost vertical and in the correct position to inject.
- After aspiration, the local anaesthetic should be injected slowly and there may be initial resistance.
- A volume of between 3 and 5 ml of anaesthetic should be injected slowly, watching for chemosis (conjunctival oedema). There should be slight proptosis at the end.
- The cannula should then be removed and gentle pressure should be applied to the globe for a few minutes.

### Problems and complications

- Failure to see sclera – sub-Tenon's capsule not breached; redo the cut with scissors.
- Difficulty advancing needle – a gentle side to side motion of the cannula may resolve this. Subconjunctival or conjunctival swelling – applying pressure may aid resolution
- Haemorrhage – gentle pressure.

### Assessment of the block

Akinesia is a reliable indicator of effective block, although the absence of akinesia does not necessarily mean the block has failed.

### Retrobulbar block

#### Overview

A sharp needle is manoeuvred alongside and the behind the globe to deposit local anaesthetic at the back of the globe. It provides good anaesthesia with complete akinesia of the eye; there is an association with more serious complications.<sup>5</sup>

#### Conduct of the block

- Routine checks and preparation as above.
- With the patient looking straight ahead, a 24 mm 25G needle is inserted inferotemporally lateral to the lateral limbus either through the conjunctival reflection or percutaneously through the lower eyelid.
- The bevel of the needle should be facing the globe and the needle should be angled vertically backwards, parallel to the floor of the orbit until the equator of the globe is passed (10–15 mm depth measured from the anterior aspect of the globe).

- Once passed the equator of the globe the needle is angled slightly medially and upwards into the muscle cone behind the globe.
- After aspiration approximately 3–5 ml of local anaesthetic is injected.
- The needle should be removed and pressure applied to the globe.

### Problems and complications

Complications, although still rare, include:

- globe perforation
- retrobulbar haemorrhage – may require urgent surgical decompression to preserve sight.
- damage to the optic nerve or artery
- accidental administration of local anaesthetic into the CSF, which may lead to convulsions or cardiac arrest requiring resuscitation.

### Assessment of the block

Akinesia is assessed after 5 minutes and there may be the need for supplementary blocks.

### Peribulbar block

#### Overview

A sharp needle is manoeuvred alongside globe to deposit local anaesthetic alongside the globe. It provides good anaesthesia with complete akinesia of the eye,<sup>5</sup> however, is associated with a higher serious complication rate.

#### Conduct of the block

- Routine checks and preparation as above.
- With the patient looking straight ahead, a 16 mm 25G needle is inserted inferotemporally, lateral to the lateral limbus either through the conjunctival reflection or percutaneously.
- The needle should be angled vertically backwards, parallel to the floor of the orbit. If there is any bony contact the needle should be reangled upwards.
- The needle should remain within the peribulbar space and not advance as far as the posterior border of the globe.
- After aspiration, approximately 5–10 ml of local anaesthetic is injected.
- While injecting, observe for rapid conjunctival swelling. This indicates the needle is too superficial and needs to be advanced further.
- The needle is removed and pressure applied to the globe.

### Problems and complications

Complications, although still rare, include:

- globe perforation
- retrobulbar haemorrhage
- damage to the optic nerve or artery – although less likely.

### Assessment of the block

Akinesia is assessed after 5 minutes and there may be the need for supplementary blocks.

### Local infiltration

Suitable for oculoplastic procedures such as eyelid surgery. The skin around the operative site is infiltrated with local anaesthetic. This provides a limited area of anaesthesia, and carries a risk of subcutaneous haemorrhage. For this reason, solutions containing adrenaline are often used.

### Topical local anaesthetic

Topical local anaesthetic is appropriate for superficial surgery such as removal of foreign bodies or some cataracts.

### Local anaesthetic

#### Adjuncts

Hyaluronidase can be used to increase the speed of onset and improve the quality of the block. It is an enzyme which results in the hydrolysis of hyaluronic acid, thus improving spread of local anaesthetic through the tissue planes. 150 IU is a safe and effective dose.<sup>6</sup>

#### Choice of anaesthetic agent

Sole agents or combinations may be used. Lidocaine, bupivacaine and ropivacaine have all been used. The choice depends upon required speed of onset and duration of action. As a compromise a 50:50 mix of 2% lidocaine and 0.5% levobupivacaine is commonly used.

### Summary

Regional anaesthesia is widely used for ophthalmic surgery and is usually safe and well tolerated by patients. The choice of technique will depend upon the operator, patient and the operative requirements. ◆

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