Review Article

Ophthalmic Regional Block

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Abstract

Cataract surgery is the commonest ophthalmic surgical procedure and a local anaesthetic technique is usually preferred but the provision of anaesthesia in terms of skills and resources varies worldwide. Intraconal and extraconal blocks using needles are commonly used. The techniques are generally safe but although rare, serious sight- and life-threatening complications have occurred following the inappropriate placement of needles. Sub-Tenon's block was introduced as a safe alternative to needle techniques but complications have arisen following this block as well. Currently, there is no absolutely safe ophthalmic regional block. It is essential that those who are involved in the care of these patients have a thorough knowledge of the techniques used. This review article outlines the relevant anatomy, commonly used techniques and their safe performance and perioperative care.

Ann Acad Med Singapore 2006;35:158-67

Key words: Anaesthesia, Peribulbar, Regional ophthalmic anaesthesia, Retrobulbar, Sub-Tenon, Sub-Tenon's

Introduction

Patient comfort, safety and low complication rates are the essentials of local anaesthesia. The anaesthetic requirements for ophthalmic surgery are dictated by the nature of the proposed surgery, the surgeon's preference and the patient's wishes. Cataract surgery is the commonest ophthalmic surgical procedure and a local anaesthetic technique is usually preferred. The provision of ophthalmic regional anaesthesia for cataract surgery varies worldwide. These may be chosen to eliminate eye movement or not and both non-akinetic and akinetic methods are widely used.[1-3] Non-akinetic methods include topical,[4] subconjunctival,[5] deep fornix anaesthesia[6] and lidocaine gel.[7] Although akinesia is not essential for modern cataract surgery, some ophthalmic surgeons may prefer to operate on immobile eyes. A recent study suggests that patients also prefer an akinetic regional ophthalmic block.[8] Akinetic blocks using needle techniques such as intraconal, extraconal or combined intraconal and extraconal blocks are used in the USA and other countries.[1,9] Although rare, many serious complications have been reported following needle blocks[10] and this has led to the introduction of newer sub-Tenon's block as a safer alternative.[11-14]

The terminology used for regional orbital blocks is controversial.[15,16] A name based on the likely anatomical placement of the needle is accepted widely.[17] An intraconal (retrobulbar) block involves the injection of a local anaesthetic agent into the part of the orbital cavity (the muscle cone), behind the globe that is formed by 4 recti muscles and the superior and inferior oblique muscles. The classical extraconal (peribulbar) block was introduced in 1986 as a safer alternative to the retrobulbar block,[18] in which the needle tip remained outside the muscle cone. Unfortunately, these terms are used interchangeably in many published studies. A wide range of local anaesthetic injection techniques are in use, some of which may be described as retrobulbar by one clinician and peribulbar by another.[16] However, it is commonly believed that if there is a rapid onset of an akinetic block, it is usually an intraconal block and the needle tip is probably very close to the intracone area.[17] Computed tomography (CT) studies after intra- and extraconal injections of radio contrast material have demonstrated the existence of multiple communications between these 2 compartments, allowing injected material to diffuse from one to the other.[19] Indeed, this division is artificial because the globe, the extraocular

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muscles and the septal compartments appear to function as a single unit and there are no anatomical discrete divisions.[17] A combination of intraconal and extraconal blocks is described as combined retroperibulbar block.[20]

In sub-Tenon's block, local anaesthetic agent is injected under the Tenon's capsule.[17] This block is also known as parabulbar block,[21] pinpoint anaesthesia[22] and medial episcleral block.[23]

Relevant Anatomy

As with all regional anaesthetic techniques, knowledge of the anatomy of the orbit and its contents is essential to the safe practice of ophthalmic regional anaesthesia and many excellent textbooks on anatomy are available.[24,25] The orbit is an irregular four-sided pyramid with its apex pointing posteromedially and its base facing anteriorly. The annulus of Zinn, a fibrous ring arising from the superior orbital fissure, forms the apex. The base is formed by the surface of the cornea, the conjunctiva and the lids. Globe movements are controlled by the rectus muscles (inferior, lateral, medial and superior) and the oblique muscles (superior and inferior). The rectus muscles arise from the annulus of Zinn near the apex of the orbit and insert anterior to the equator of the globe, forming an incomplete cone. The distance from the inferior temporal orbital rim to the annulus measures 42 to 54 mm. Within the annulus and the muscle cone lie the optic nerve (II), the oculomotor nerves (III containing both superior and inferior branches), the abducent nerve (VI nerve), the nasociliary nerve (a branch of V nerve), the ciliary ganglion and vessels. The superior branch of oculomotor nerve supplies the superior rectus and the levator palpebrae muscles. The inferior branch of oculomotor nerve supplies the medial rectus, the inferior rectus, and the inferior oblique muscles. The abducens nerve supplies the lateral rectus. The trochlear nerve (IV nerve) runs outside and above the annulus, and supplies the superior oblique muscle (retained activity of this muscle is frequently observed as anaesthetic agents often fail to block this nerve). Corneal and perilimbal conjunctival and superonasal quadrant of the peripheral conjunctival sensations are mediated through the nasociliary nerve. The remainder of the peripheral conjunctival sensation is supplied through the lacrimal, frontal and infraorbital nerves coursing outside the muscle cone; hence, intraoperative pain may be experienced if these nerves are not blocked.

The fascial sheath (Tenon's capsule) is a thin membrane that envelops the globe and separates it from the orbital fat.[24] It thus forms a socket for the globe. The inner surface is smooth and shiny and is separated from the outer surface of the sclera by a potential space called the episcleral space. Crossing the space and attaching the fascial sheath to the sclera are numerous delicate bands of connective tissue (Fig. 1). Anteriorly, the fascial sheath is firmly attached to the sclera, about 3 to 5 mm posterior to the corneoscleral junction.

However, the description of Tenon's capsule does vary and one major textbook of anatomy[25] suggests that the space under the Tenon capsule is actually a lymph space and this follows the optic nerve and continues with subarachnoid space. Posteriorly, the sheath fuses with the meninges around the optic nerve and with the sclera around the exit of the optic nerve.

The tendons of all 6 extrinsic muscles of the eye pierce the sheath as they pass to their insertions on the globe. At the site of perforation the sheath is reflected along the tendons of these muscles to form, on each, a tubular sleeve. The superior oblique muscle sleeve extends as far as the trochlea and the inferior oblique muscle sleeve extends to the origin of the muscle. The tubular sleeves for the 4 recti muscles also have expansions. Those for medial and lateral recti are strong and are attached to the lacrimal and zygomatic bones and are called the medial and lateral check ligaments respectively. Thinner and less distinct expansions extend from the superior rectus tendon to that of the levator palpebrae superioris and from the inferior rectus to the inferior tarsal plate. The inferior part of the fascial sheath is thickened and is continuous medially and laterally with the medial and lateral check ligaments.

Assessment and Preparation

Preoperative preparation and assessment vary worldwide. In the UK, the Joint Colleges Working Party Report[26] recommended that patients are not fasted but fasting policies vary considerably.[27] Complication rates as a result of starvation or aspiration in ophthalmic regional anaesthesia are unknown and dangers remain if a patient vomits whilst undergoing any form of anaesthesia and surgery. According to published guidelines and reported evidence,[26,28] routine investigation of patients undergoing cataract surgery is not essential because it improves neither the health nor the outcome of surgery, but tests can be done to improve the general health of the patient if required.

The preoperative assessment should always include a specific enquiry about bleeding disorders and related drugs. There is an increased risk of haemorrhage and this requires that a clotting profile is available (and recorded) prior to injection. Patients receiving anticoagulants are advised to continue their medication.[29] Clotting results should be within the recommended therapeutic range.[29,30] Currently there is no recommendation for patients receiving antiplatelet agents.[30] Procedures under topical, subconjunctival, sub-Tenon's or shallow peribulbar blocks are recommended.[29]

There are a number of risk factors that predispose the globe to needle penetration. The presence of a long eye, staphyloma or enophthalmos, faulty technique, a lack of appreciation of risk factors, an uncooperative patient and the use of unnecessarily long needles are some of the contributing causes.[10] Patients presenting with axial myopia have greater risk of globe puncture compared with patients with normal axial length and carry a risk rate of one perforation for every 140 needle blocks performed in eyes with an axial length greater than 26 mm.[31] A precise axial length measurement is usually available for intraocular lens dioptre power calculation before cataract surgery. If the block is performed for other surgery and the axial length measurement is not known, close attention to the dioptre power of patients spectacles or contact lenses may provide valuable clues to globe dimension. In the presence of high myopia, a classical peribulbar block[32] or a single medial peribulbar injection is advocated.[33] Similar caution will apply where there is a pre-existing scleral buckle from an earlier retinal operative procedure.[32]

Once the decision is made to operate, the anaesthetic and surgical procedures are explained to the patients to enable informed consent. All monitoring and anaesthetic equipment in the operating environments should be fully functional.[26] Blood pressure, oxygen saturation and ECG leads are connected and baseline recordings are obtained.[26] Although the insertion of an intravenous line has been questioned for topical or sub-Tenon's injections,[34] an intravenous line must be inserted before embarking on a needle block.[26] The presence of a secure intravenous line remains good clinical practice.[17]

Akinetic Needle Technique

The Atkinson's or classical retrobulbar block[35] involves raising a skin wheal with local anaesthetic and insertion of needle through the skin at the junction of medial 2/3rd and lateral 1/3rd of the lower orbital margin. Two to 3 mL of local anaesthetic is injected deep into the orbit very close to major structures behind the globe while the patient is asked to look upwards and inwards. A separate 7th nerve block is required.[35] This block is performed by depositing local anaesthetic at some point along the distribution of the nerve from its emergence from the base of the skull at the stylomastoid foramen to its terminal branches. The block is very painful and many complications, which include difficulty in swallowing and breathing difficulty and other complications related to vagus, glossopharyngeal, phrenic and spinal accessory nerve block, have occurred.[10,17] When hyaluronidase is admixed with anaesthetic agent, injected into the orbit in higher volume and used in combination with orbital decompression devices, effective spread from the orbit through the orbital septum occurs to achieve eyelid akinesia without resorting to the painful percutaneous 7th nerve block.[10]

Many complications have occurred following classical retrobulbar block.[20] The classical retrobulbar block has now been superseded by a more modern approach to retrobulbar and peribulbar blocks.[36]

Measures to reduce pain during injection are essential. Topical local anaesthetic drops are instilled to obtain surface anaesthesia. A dilute local injection is also helpful before the injection of concentrated local anaesthetic agent.[37] Dilute local solution is prepared by adding 2 mL of concentrated local anaesthetic agent, for instance 2% lidocaine, to 13 mL of balanced salt solution (BSS).[37] 1.5 to 2 mL of this dilute solution is injected through the conjunctiva under the inferior tarsal plate in the inferotemporal quadrant.[37]

In the modern retrobulbar block,[36] a 25-G, 31-mm long needle is inserted through the conjunctiva or skin in the inferotemporal quadrant as far laterally as possible below the lateral rectus muscle. The initial direction of the needle is tangential to the globe, then pass below the globe and, once past the equator as gauged by axial length of the globe, is allowed to go upwards and inwards to enter the central space just behind the globe.[36] The globe is continuously observed during the needle placement. Four to 5 mL of local anaesthetic agent is injected.

In the modern peribulbar block,[36] the injection is deliberately made outside the cone. A 25-G, 31-mm long needle is inserted through the conjunctiva as far laterally as possible in the inferotemporal quadrant. Once the needle is under the globe, it is not directed upward and inward, but is directed along the orbital floor. Five mL of local anaesthetic agent is injected. Many patients require a supplementary injection.

A medial peribulbar block is usually performed to supplement inferotemporal retrobulbar or peribulbar injection, particularly when akinesia is not adequate.[36] A 25- or 27-G needle is inserted in the blind pit between the caruncle and the medial canthus to a depth of 15 to 20 mm. Three to 5 mL of local anaesthetic agent is usually injected. Some authorities use the medial peribulbar as a primary injection technique for anaesthesia, particularly in patients with longer axial lengths.[33]

Needle Selection for Akinetic Block

The needle length is a very important consideration in the safe conduct of regional ophthalmic anaesthesia. Historically, a needle measuring 38 mm has been used but anatomical studies of cadaver skulls have shown that this traditional 38-mm needle could impale the optic nerve.[38] The authors measured the distance between the inferior

orbital rim and the apex in 120 skulls. The distance varied from 42 to 54 mm. The ciliary ganglion was found consistently to lie 7 mm in front of the apex, hence the ciliary ganglion is 35 mm from the inferior orbital rim in a shallow orbit. In another study, Birch et al[39] demonstrated, using ultrasound localisation, that all the needles (38 mm long) were placed closer to the posterior aspect of the globe. In some patients, the needle shaft was actually seen to indent the globe. Therefore, patients with shallow orbit are at a greater risk with needles longer than 35 mm and using shorter needles should reduce the risk of damage to vital structures behind the globe. For intraconal and extraconal injections, shorter (25 mm) needles are recommended, though some authors claim excellent results with 16-mm needles.[15]

A great deal of controversy surrounds the bevel and tip of the needle. The sharp narrow-gauge needles (25 to 31 gauges) reduce the discomfort on insertion[40] at the expense of a reduced tactile feedback with a theoretically higher risk of failing to recognise a globe perforation. Conversely, traditional teaching favoured the use of blunt or dull needles with the supposed advantages that blood vessels were pushed rather than traumatised and tissue planes could be more accurately defined[41] but these are more likely to cause greater damage when misplaced.[42] Blunt-tipped, as opposed to steep bevel cutting needles, have been shown to require more force to penetrate the globe, but translation of this into a reduction in globe perforation has not been demonstrated.[42]

The illustrative photograph of the traditional Atkinson's needle entry point is through the skin at the junction of the medial 2/3rd and lateral 1/3rd of the inferior orbital rim.[35] This was not the description in his text but has been accepted as such by most practitioners. The needle is directed towards the orbital apex and the patient is asked to look upwards and inwards. Unsold and colleagues[43] demonstrated, with CT scans of cadavers, that when a 35-mm needle is placed as above, the needle is in close proximity to the optic nerve and ophthalmic artery. In addition, tangential puncture of the optic nerve sheath can occur, leading to injection of anaesthetic agent into the subarachnoid space, resulting in brainstem anaesthesia.[44] Indeed, 2 cases of optic nerve trauma leading to catastrophic loss of vision have been reported using Atkinson's entry point.[45] If the eye is fixed in a primary gaze position and the needle length is reduced to 31 mm and directed toward an imaginary point behind the macula rather than aiming for the orbit, the catastrophic morbidity may be reduced.[20]

The authors akinetic needle technique consists of a 2-injection retrobulbar / peribulbar sequence. This is preceded by a dilute painless local injection as previously described[37] using a 27-G, 1-cm long sharp needle, inserted into the lower fornix previously rendered anaesthetic with topical local anaesthetic eye drops, under the inferior tarsal plate in the inferotemporal quadrant (Fig. 2). A 27-G, 2-cm sharp needle (Fig. 3) is inserted at the junction of lateral and inferior orbital margins (Fig. 4) with eye fixed in the neutral gaze position. Once the needle has passed the equator of the globe, it is directed upward and inward (Fig. 5) remaining tangential to the globe. Four to 5 mL of local anaesthetic is injected slowly after negative test aspiration. If complete akinesia is required, a medial peribulbar injection is made using the same needle with the eye fixed in the neutral gaze. The injection is made between the caruncle and the medial canthus and passing directly backwards parallel to the medial orbital wall to a depth of 1 to 1.5 cm (Fig. 6) and 3 to 4 mL of local anaesthetic is injected. A gentle pressure on globe with eyelids closed is applied for a few minutes.

Complications of Needle Block

There are many complications of needle blocks, ranging from simple to serious, that have been reported in many reviews.[10,46,47] The complications may be limited to the orbit or may be systemic. Orbital complications include failure of the block, corneal abrasion, chemosis, conjunctival haemorrhage, vessel damage leading to retrobulbar haemorrhage, globe perforation, globe penetration, optic nerve damage and extraocular muscle damage. Systemic complications, such as local anaesthetic agent toxicity, brainstem anaesthesia and cardio-respiratory arrest, may be due to intravenous or intrathecal injections or the spread or misplacement of drug in the orbit during or immediately after injection.[20]

Sub-Tenon's Block

This block was re-introduced into the clinical practice as a simple, safe and effective technique because of continuing concerns over the rare but serious complications of sharp needle blocks. The block is a modification of the original idea of Turnbull[48] and has been popularised by Mein and Woodcock,[11] Hansen et al,[12] Stevens,[13] Greenbaum[21] and others.[23] The technique involves gaining access to the sub-Tenon's space, the insertion of a blunt cannula and the administration of local anaesthetic agent into the sub-Tenon's space, resulting in subsequent anaesthesia.[13]

Injection of local anaesthetic agent under the Tenon capsule blocks sensation from the eye by action on the short ciliary nerves as they pass through the Tenon capsule to the globe. Akinesia is obtained by direct blockade of anterior motor nerve fibres as they enter the extraocular muscles. Vision may be affected by direct action on the optic nerve as the anaesthetic solution diffuses along its anterior portion. Ripart et al,[14] Winder et al[49] and Kumar and McNeela[50] have demonstrated that the injected local anaesthetic

surrounds the optic nerve and diffuses into the retrobulbar space.

Sub-Tenon's Technique

The sub-Tenon's technique involves obtaining surface anaesthesia, instillation of antiseptic, surgical access to the sub-Tenon's space, insertion of a blunt cannula and the subsequent administration of local anaesthetic agent into the sub-Tenon's space.[51,52] The anatomical basis of different sub-Tenon's blocks is similar but they differ in how sub-Tenon's space is accessed, type of cannula and local anaesthetic agent used.

Effective surface anaesthesia is the key to the success of sub-Tenon's block. Topical anaesthetic agents vary in their formulation and some contain preservatives and antibacterial substances. Preservative-free preparations in single-dose containers are usually preferred. They produce stinging on initial application in most patients. Surface anaesthesia can be achieved either by instilling topical agents such as amethocaine, proxymetacaine or benoxinate on the conjunctiva and cornea or by the application of a cotton bud soaked with topical agent in the area of dissection.[13,51,52]

There are reports of orbital swelling following injections[53,54] and some believe it to be infective in origin. There is a UK recommendation that 5% povidone iodine eye drops should be instilled[55] before embarking on the block. Importantly, 10% povidone iodine has been shown to be toxic to the cornea[56,57] and is not recommended for instillation into the eye.

Although sub-Tenon's space can be accessed from all 4 quadrants,[52] the inferonasal quadrant is the most commonly reported site of access in the published studies as the placement of cannula in this quadrant allows good fluid distribution superiorly while avoiding the area of access for surgery and damage to the vortex veins. The patient is asked to look upwards and outwards. Under sterile conditions, the conjunctiva and Tenon capsule are gripped with non-toothed forceps, 5 to 10 mm away from the limbus (Fig. 7). A small incision is made through these layers with scissors to expose the white area and the sub-Tenon cannula is inserted following the globe (Fig. 8).

Cannulae for Sub-Tenon's Block

Many different sub-Tenon cannulae are available. They are made of either metal or plastic. One of the most commonly used commercial cannulae (Fig. 9) is made of metal, 19-G, 2.54-cm long and curved with a blunt end.[52] There are other commercial and non-commercial cannulae and they vary in lengths and gauges. These include the Southampton cannula,[13] mid sub-Tenon cannula,[58] anterior cannula,[21] Rous cannula[59] and an ultrashort cannula.[60] Prolonged anaesthesia and analgesia are obtained by inserting a catheter in the sub-Tenon's space.[61] The choice of cannula depends on the availability and the preference of the clinician. The volume of local anaesthetic agent for sub-Tenon's block varies from 1.5 to 11 mL[21,62] but 3 to 5 mL is common.[63-65]

Sub-Tenon's block is a versatile and effective technique.[52] Its use has been advocated primarily for cataract surgery but is also effective for viteroretinal surgery,[66] panretinal photocoagulation,[67] trabeculectomy,[68] strabismus surgery,[69] optic nerve sheath fenestration[70] and the delivery of drugs.[71] This technique is also increasingly favoured in patients who are on anticoagulants, aspirin and non-steroidal anti-inflammatory drugs (NSAIDs).[29]

Complications of Sub-Tenon's Block

Sub-Tenon's block was introduced as a very safe and alternative technique to needle block. Over the years, a large number of complications both minor and major have been reported.[51,52] Minor complications such as pain during injection, chemosis, conjunctival haemorrhage and leakage of local anaesthetic are common[72] but the incidence of these complications varies in published studies.[73] Akinesia is variable and volume-dependent.[64] Most patients develop akinesia with 4 to 5mL of local anaesthetic agent but the superior oblique and eyelid muscles may remain active.[64,72] Major complications include orbital and retrobulbar haemorrhage[74] rectus muscle paresis and trauma,[75] globe perforation,[76,77] the central spread of local anaesthetic,[77] orbital cellulitis[53,54] and others.[78-80] Most of these complications have occurred following the use of a 2.54-cm metal cannula.[52] Smaller or flexible cannulae appear to be safer but the incidence of minor complications increases.[64,72]

Pharmacological Considerations during Ophthalmic Regional Block

Local Anaesthetic Agent

The ideal agent for ophthalmic block should be safe, painless to inject and produce a rapid onset of dense motor and sensory block, the duration of which must be sufficient for surgery yet not excessively prolonged.[36] The speed of onset is partially determined by the properties of the anaesthetic, but more directly by the proximity to the nerves.[81] All the modern, high-potency local anaesthetic agents are suitable for ophthalmic blocks and numerous studies have shown little difference in the quality of anaesthesia, analgesia and akinesia.[28]

Adjuvants

Vasoconstrictors: Vasoconstrictors (epinephrine and felypressin) are commonly mixed with local anaesthetic

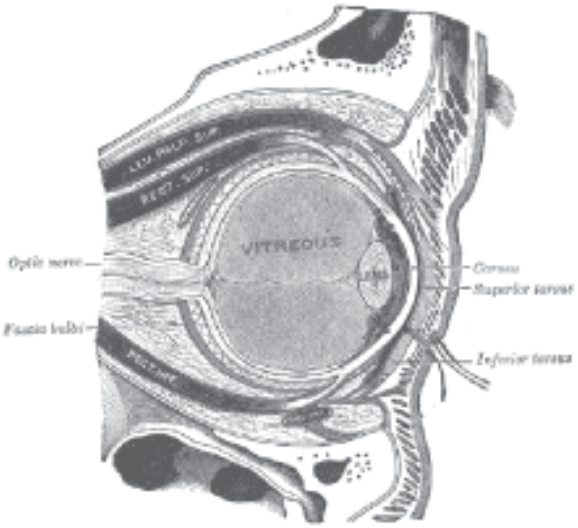

Fig. 1. Schematic diagram showing Tenon's capsule with connective tissue bands traversing sub-Tenon's space (reprinted with kind permission from www.bartleby.com).

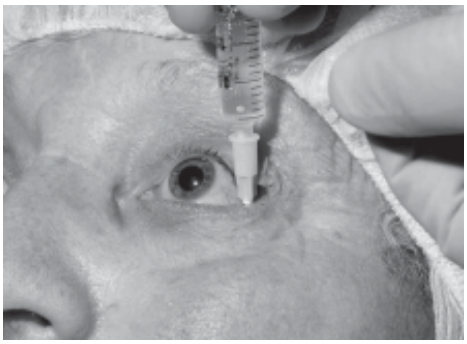

Fig. 2. The direction of needle for dilute painless local injection.

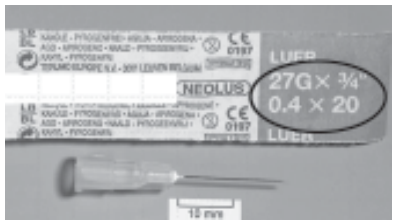

Fig. 3. Needle for main inferotemporal injection (27 gauge, 2 cm long).

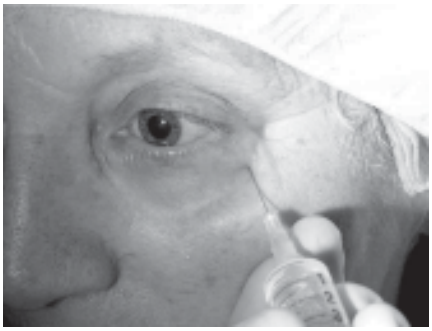

Fig. 4. Insertion point and direction of needle for extreme inferolateral intraconal injection.

Fig. 5. Final position of needle after intraconal needle placement.

Fig. 6. Direction and placement of needle for medial peribulbar injection.

Fig. 7. Globe position and inferonasal direction using forceps and scissors during sub-Tenon's block (the patient is asked to look upwards and outwards).

Fig. 8. A sub-Tenon cannula is shown inserted through the dissected area.

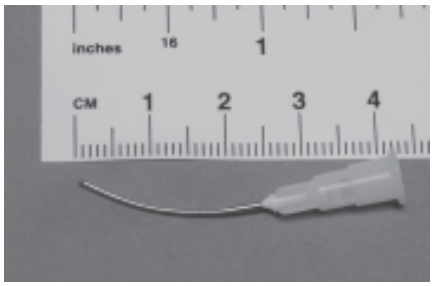

Fig. 9. Posterior sub-Tenon's metal cannula 19 gauge (2.54 cm length).

solution to increase the intensity and duration of block, and minimise bleeding from small vessels.[81] Absorption of local anaesthetic is reduced, thus avoiding high concentrations of local anaesthetic in the plasma. Epinephrine is commonly mixed with the local anaesthetic agent to prolong the duration and intensity of the block. A concentration of 1:200,000 has no systemic effect.[36] However, epinephrine may cause vasoconstriction of the ophthalmic artery, compromising the retinal circulation. The use of epinephrine-containing solutions should also be avoided in elderly patients suffering from cerebrovascular and cardiovascular diseases.[36] Phacoemulsification cataract

extraction is usually of short duration; hence the duration of block achieved by lidocaine without epinephrine usually suffices.

Hyaluronidase: Hyaluronidase is an enzyme, which reversibly liquefies the interstitial barrier between cells by depolymerisation of hyaluronic acid to a tetrasaccharide, thereby enhancing the diffusion of molecules through tissue planes.[82] It is available as a powder readily soluble in local anaesthetic solution. Hyaluronidase has been shown to improve the effectiveness and the quality of needle as well as sub-Tenon's block[83,84] but its use remains controversial.[85] The amount of hyaluronidase used in published studies varies from 5 to150 IU/mL. The UK data sheet[86] limits the concentration to 15 IU/mL. Orbital swelling due to rare allergic reactions[87] or excessive doses of hyaluronidase[54] and orbital pseudotumour[88] has been reported. Excellent blocks can be achieved without hyaluronidase [89] but there are reports of muscle dysfunction when it is not used during needle block.[90]

pH Alteration: Commercial preparation of lidocaine and bupivacaine are acidic solutions in which the basic local anaesthetic exists predominantly in the charged ionic form.[81] It is only the nonionised form of the agent that traverses the lipid membrane of the nerve to produce the conduction block. At higher pH values, a greater proportion of local anaesthetic molecules exist in the nonionised form, allowing more rapid influx into the neuronal cells.[81] Alkalinisation has been shown to decrease the onset time and prolong the duration of effect after needle block[91] but no such benefit is seen during sub-Tenon's block.[89]

Others: The addition of muscle relaxants,[92,93] clonidine[94] and other chemicals are known to increase the onset and potency of orbital block but their use is neither routine nor recommended.

Sedation and Ophthalmic Regional Blocks

Sedation is commonly used during topical anaesthesia.[2] Selected patients, in whom explanation and reassurance have proved inadequate, may benefit from sedation. Short-acting benzodiazepines, opioids and small doses of intravenous anaesthetic induction agents are favoured but the dosage must be minimal. The routine use of sedation is discouraged[26] because of an increased incidence of adverse intraoperative events.[95,96] It is essential that when sedation is administered, a means of providing supplementation oxygen is available.[26] Equipment and skills to manage any life-threatening events must be immediately accessible.

Intraocular Pressure (IOP) and Ophthalmic Regional Blocks

Changes in intraocular pressure after retrobulbar and peribulbar injections are controversial but IOP is generally reported to increase immediately after injection.[97-100] Prior reduction of IOP is associated with fewer operative complications, notably shallowing of the anterior chamber and vitreous loss during large-incision extracapsular cataract extractions. These complications are less likely to happen during modern small-incision phacoemulsification procedure as the tendency for the anterior chamber to collapse is reduced. Any rise in IOP may have other serious consequences in patients with glaucoma and patients with advanced visual field loss. IOP is not seen to increase after sub-Tenon's block.[101-103]

Retained Visual Sensations During Ophthalmic Regional Blocks

Many patients experience intraoperative visual sensations that include light, colours, movements and instruments during surgery under all forms of local ophthalmic anaesthesia.[104] Although the majority of patients feel comfortable with the visual sensations they experience, a small proportion find the experience unpleasant or frightening. Therefore, patients receiving orbital blocks should receive preoperative advice as this may alleviate an unpleasant experience.[104]

Intraoperative Care and Monitoring

The patient should be comfortable and soft pads are placed under the pressure areas. All patients undergoing major eye surgery under local anaesthesia should be monitored with pulse oximetry, ECG, non-invasive blood pressure measurement and the maintenance of verbal contact.[26] Patients should receive an oxygen-enriched breathing atmosphere to prevent hypoxia and at a flow rate enough to prevent re-breathing and the ensuing hypercarbia once draped. ECG and pulse oximetry should be continued. Once the patient is under the drapes, verbal and tactile contacts are maintained.[26]

Advantages and Disadvantages of Different Techniques

There are conflicting reports on the relative effectiveness of akinetic blocks. The evidence indicates that peribulbar and retrobulbar anaesthesia produce equally good akinesia and equivalent pain control during cataract surgery.[28] There is insufficient evidence in the literature to make a definite statement concerning the relative effectiveness of sub-Tenon's block in producing akinesia when compared with peribulbar or retrobulbar block. However, individual studies reveal different and sometimes contradictory conclusions.[28] With regard to pain control, there were similar disagreements between studies. However, overall there was moderate evidence that sub-Tenon's block produced better pain

control than retrobulbar and peribulbar block. Finally, there was weak evidence that sub-Tenon's block produces better pain control than topical anaesthesia.

Choice of Technique

There are numerous studies illustrating the diversity of preference for anaesthetic technique by surgeons. Similar diversity occurs in reports of patient preference. However, a recent article by Friedman et al[8] indicates that 72% of patients preferred block anaesthesia to topical anaesthesia. Ruschen et al[105] also supported this view, with patients reporting higher satisfaction scores with sub-Tenon's block over topical anaesthesia alone. The choice of which technique to use will always depend on a balance between the patient's wishes, the operative needs of the surgeon, the skills of the anaesthetist and the place where such surgery is being performed.

Conclusion

Eye blocks provide excellent anaesthesia for ophthalmic surgery and success rates are high. Satisfactory anaesthesia and akinesia can be obtained with both needle and cannula. Although rare, orbital injections may cause severe local and systemic complications. Knowledge of orbital anatomy and training are essential for the practice of safe orbital regional anaesthesia.

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