

Sub-Tenon's anaesthesia: complications and their prevention

CM Kumar¹, H Eid² and C Dodds²

Abstract

The advent of a new technique that is considered much safer than previously established one leads to its rapid adoption. This usually leads to the identification of previously unreported complications of the new technique, and a re-assessment of its position in clinical care, which is precisely the state of play with the sub-Tenon's block. The sub-Tenon's block was introduced into the clinical practice in early 1990. A systematic recent search of subject headings such as complications of sub-Tenon's block, subtenon, orbital block, orbital block complications, and orbital anaesthesia was performed in Medline, EMBASE, and Cochrane database. Indeed there are complications of sub-Tenon's block published as case reports and the exact incidence of these complications is not known. Management and preventive measures of these complications are described. Although the sub-Tenon's block appears to be relatively safer than needle-based blocks but a proper prospective, randomized, double-blind controlled trial is essential for scientific proof that sub-Tenon's block is better than needle-based blocks.

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Introduction

The majority of ophthalmic surgical procedures in adults are performed under local anaesthesia but technique, choice, and preferences vary depending on surgical procedure, surgeon, and patients.^{1,2} Cataract extraction with lens implant is the most frequently performed surgery. Some

surgeons perform this surgery in selected patients under topical anaesthesia but complicated cataract and other procedures may require intraconal (retrobulbar), extraconal (peribulbar), and sub-Tenon's blocks, which provide akinesia as well as anaesthesia.^{3–7}

One or more minor complications occur in 4.3% of 38 058 all local ophthalmic blocks.⁵ Serious sight- and life-threatening events occurred in 25 eyes (0.066%), undergoing needle or sub-Tenon's blocks but minor complications were 2.3 times more common with sub-Tenon's blocks. The needle blocks had a 2.5-fold increased risk of serious sight- and life-threatening complications (Table 1)^{8–14} and their popularity has declined.

The sub-Tenon's was introduced as a simple, safe, and effective block in the early 1990s.^{15–18} In the sub-Tenon's block, a careful dissection is performed, usually in the inferonasal quadrant, to gain access to the space under the Tenon's capsule, and then a blunt sub-Tenon's cannula is inserted and local anaesthetic agent of choice is injected.^{15–17} A variety of sub-Tenon's cannulae^{19–23} are available but a 2.54 cm long, blunt, and curved posterior metal sub-Tenon's cannula described by Stevens¹⁶ is the most commonly used. This block has become popular in many countries including the United Kingdom and a recent study indicated that >87.8% members of the British Ophthalmic Anaesthesia Society use this technique in their routine practice.²⁴ The sub-Tenon's block is probably popular because it provides good akinesia,²⁵ better intraoperative analgesia, and operating conditions compared with needle blocks and a 50% reduction in posterior capsular tear/vitreous loss compared with topical anaesthesia.²⁶

Although performance of a sub-Tenon's block requires some dexterity in the handling of surgical instruments but most practitioners develop competence after about 60 blocks.^{27,28} The sub-Tenon's block is used for cataract

¹Department of Anaesthesia, Khoo Teck Puat Hospital, Singapore

²The James Cook University Hospital, Middlesbrough, UK

Correspondence: CM Kumar, Department of Anaesthesia, Khoo Teck Puat Hospital, 90 Yishun Central, Singapore 768828, Singapore
 Tel: +65 6602 2317;
 Fax: +65 6602 3648.
 E-mail: chandra.kumar2406@gmail.com

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Table 1 Major complications of needle blocks (modified from Kumar and Dowd)¹⁴

Complications	Mechanism	Risk factors	Incidence	Prevention	Treatment
Inadvertent subarachnoid anaesthesia (Brain-stem anaesthesia)	Subject to debate but spread through optic nerve sheath or through the orbital foramina	Placement of long needle into the apex	0.3–0.8% (retrobulbar) Unknown (peribulbar)	Avoid using long needle	Extensive cardiorespiratory support
Ocular perforation	Direct needle entry into the globe through sclera	Placement of needle angled towards the apex	3 : 4000 (retrobulbar block) 1 : 16 224 (peribulbar block)	Attention to anatomy and appropriate technique	Immediate ophthalmic opinion
Retrobulbar haemorrhage	Damage to arterial or venous blood vessels behind the globe	Elderly receiving, steroids, NSAID, aspirin	0.1–3%	Limit insertion of needle <31 mm in the relatively avascular area	Immediate oculocompression, ophthalmic opinion and decompression surgery if necessary
Globe ischaemia	Interruption of blood flow	Prolonged oculocompression	Unknown	Use pressure limiting oculocompression device	Ophthalmic opinion
Optic nerve atrophy	Direct damage to nerve, central retinal artery, or secondary to haemorrhage		Unknown	Careful needle placement	Ophthalmic opinion
Damage to the motor nerve of the inferior rectus and inferior oblique muscles	Direct trauma to the nerve	Insertion of needle at the junction of medial 2/3rd and lateral 1/3rd of inferior orbital margin	Unknown	Careful needle placement avoiding the nerve	Ophthalmic opinion
Prolonged extraocular muscle malfunction	Prolonged exposure of fine muscle fibres, injection of local anaesthetic agent into the muscle	May be associated with non-use of hyaluronidase	Unknown	Proper placement of needle	Ophthalmic opinion
Orbital swelling	Infection Excessive dose of hyaluronidase	Poor technique	Unknown	Aseptic technique Use of recommended dose of hyaluronidase	Antibiotics, steroids ophthalmic opinion

surgery, strabismus surgery, vitreoretinal surgery, optic nerve fenestration, delivery of drugs around the globe, and postoperative pain relief (Table 2).^{29,30}

Although the technique is considered relatively safe and its popularity is increased, case reports of minor as well as sight- and life-threatening complications have been reported. We performed a systematic search of the Medline, EMBASE, and Cochrane databases till October 2010. The combinations of the following medical subject headings: orbital anaesthesia, eye blocks, cataract, vitreoretinal surgery, strabismus surgery, subtenon, sub-Tenon's, complications of orbital block, and complications of orbital anaesthesia were searched. References and citations were excluded if they were non-English language. Most complications were reported as case reports and a meta-analysis was not feasible. This article reviews major sight- and life-threatening complications of sub-Tenon's block (Table 3), their possible aetiology, risk factors, prevention, and management.

Minor complications

Minor complications such as pain, chemosis, and subconjunctival haemorrhage are not sight threatening and although they occur with fairly high frequency they do not usually interfere with surgery.

Pain

The injection of a local anaesthetic solution can produce a mild stinging or burning sensation and can also cause a feeling of pressure because of widening and stretching of the potential sub-Tenon's space.³⁰

The incidence of pain during sub-Tenon's injection with posterior metal cannula is reported in up to 44% of patients.¹⁶ Pain scores on a visual analogue scale

(0 = no pain, 10 = worst imaginable) have been reported as high as 5 and smaller cannulae appear to offer a marginal benefit.³¹ In the Auckland Hospital study³² of 6000 patients who received sub-Tenon's block, the incidence of pain during injection was 32 with 7% of patients experiencing more than mild discomfort, 7% of patients also complained of some discomfort during surgery. The surgeon and patient acceptability rate was 98.8%.

Pain on injection can be reduced by good surface anaesthesia, gentle insertion of the cannula, and slow injection. As with all regional anaesthetic techniques, there must be continuous explanation and reassurance to the patient according to the guidelines published by The Royal College Anaesthetists and the Royal College of Ophthalmologists in 2001.³³ The common practice of warming the local anaesthetic solution before sub-Tenon's block was not found to decrease pain experienced during injection.³⁴ The range of ophthalmic operations that can be safely managed using a sub-Tenon's block is usually associated with a minimal need for postoperative analgesics.³⁵

Chemosis

Chemosis is a swelling or ballooning of the conjunctiva and signifies spread of the local anaesthetic anteriorly from the sub-Tenon's space during injection or an incorrect injection into the subconjunctival space rather than the sub-Tenon's space.

The incidence of chemosis with posterior metal cannula is 23%¹⁵ and increases to 100%³¹ with shorter cannulae. Chemosis is more likely to occur if dissection of the Tenon's capsule is inadequate, or if a large volume of local anaesthetic is injected. Chemosis may be confined to the site of injection or extend to other quadrants.³¹ It does not usually interfere with cataract surgery but can compromise the operative field especially during glaucoma surgery.

Careful dissection and applying gentle pressure on the globe after sub-Tenon's block may reduce the swelling and limit its expansion.³⁰

Subconjunctival haemorrhage

Subconjunctival haemorrhage is usually due to the tearing of small blood vessels during conjunctival or Tenon capsule dissection. The haemorrhage is usually limited to the area of dissection but can spread to other quadrants.³⁶

A red looking eye may also be due to conjunctival vasodilatation following drug instillation. The incidence of red eye following sub-Tenon's block varies from 7.4–100%,^{31,32} being higher with shorter cannulae.

Table 2 Limitations and relative contraindications of sub-Tenon's block (modified from Kumar and Dodds)³⁰

Limitations

- Previous sub-Tenon's block in the same quadrant
- Previous extensive vitreo-retinal surgery
- Previous repeated strabismus surgery
- Eye trauma
- Infection to the orbit

Relative contraindications

- Severe ocular pemphigoid
- Surgery requiring complete akinesia (viscacanostomy)
- Surgery where chemosis and subconjunctival haemorrhage may compromise the outcome of surgery (glaucoma filtration surgery)

Table 3 Sight- and life-threatening complications of sub-Tenon's block

<i>Complications</i>	<i>Possible mechanism</i>	<i>Risk factors</i>	<i>Incidence</i>	<i>Prevention</i>	<i>Treatment</i>
Brain stem anaesthesia	Injection into the optic nerve sheath Unintentional perforation of Tenon's capsule and spread of LA to CNS through one of the orbital foramen	Deep posterior injection	Unknown	Adhere to basic anatomy, use shorter sub-Tenon's cannulae	Extensive cardiorespiratory support
Globe penetration	Improper dissection	Inexperienced user, poor technique, previous surgery	Unknown	Careful use of technique and adhere to basic anatomy	Immediate senior ophthalmic opinion
Intraorbital, orbital and/or retrobulbar haemorrhage	Trauma to blood vessel Rupture of sclerotic blood vessel	Patients receiving aspirin or clopidogrel Inappropriate technique	Unknown	Adhere to anatomy	Immediate oculocompression, ophthalmologic opinion, and decompression surgery
Retinal ischaemia	Increase in IOP Retrobulbar haemorrhage Compression of blood vessel	High volume of LA Glaucoma Compromised circulation to retinal artery	Unknown	Void deep posterior injection	Ophthalmic opinion
Optic nerve damage	Direct trauma Optic neuropathy	Posterior injection High concentration of LA	Unknown	Avoid deep posterior injection, use recommended dose of appropriate LA	Ophthalmic opinion
Rectus muscle dysfunction	Direct trauma to muscle Injection of local anaesthetic into the muscle Prolonged exposure of rectus muscle fibres with local anaesthetic agent	Not known	Unknown	Proper placement of cannula Adhere to anatomy Avoid forceful injection	Ophthalmic opinion
Orbital swelling	Infection Excessive dose of hyaluronidase	Poor technique	Unknown	Aseptic technique, use recommended dose of hyaluronidase	Antibiotics, steroids, and ophthalmic opinion

The lower incidence reported could be due to the exclusion of patients who had red looking eyes because of conjunctival injection or the subjective assessment. An objective method to assess conjunctival haemorrhage using comparison of photographs has been proposed³⁷ but may not be clinically feasible.

Patients taking antiplatelet agents, such as aspirin and clopidogrel, appear to have a higher incidence of subconjunctival haemorrhage, although this is not statistically significant.³⁸ The current recommendation is to continue anticoagulant medications and maintain the international normalized ratio within the appropriate therapeutic range before ophthalmic surgery.^{39,40} Continuation of aspirin did not cause difficulty in stopping the bleeding in any individual case and discontinuation of the medication had no effect on the intraoperative course or postoperative outcome.⁴¹ In the Auckland Hospital series, surgery was abandoned in 1 of the 6000 patients because of a large subconjunctival haemorrhage.³² However, this was not sight threatening and the patient was not taking any anticoagulant medication.

Subconjunctival haemorrhage may be minimized by careful dissection, which reduces the damage to fine vessels. Gentle pressure and application of vasoconstrictor soaked cotton buds may limit the spread of haemorrhage.¹⁴ Localized conjunctival cautery under microscopic control by ophthalmologists before tissue dissection may significantly reduce the frequency of subconjunctival haemorrhage.⁴² However, no such benefit was obtained when cautery was used by the anaesthetists.⁴³ The incidence of this common minor complication is unpredictable and all patients receiving sub-Tenon's block should be informed that the eye might look red in the immediate postoperative period.

Major life- and sight-threatening complications

Brain stem anaesthesia

Two cases of possible brain stem anaesthesia after sub-Tenon's block have been reported. The exact aetiology of spread of local anaesthetic agent to the central nervous system is not very well understood. Although the mechanism in these cases is not clear but direct spread of local anaesthetic into the subarachnoid space may have been the cause of brain stem anaesthesia. Rüschen *et al*⁴⁴ suggested that local anaesthetic could have crossed the optic nerve dural sheath through a perforation that occurred during dissection of the sub-Tenon's space with the tip of the Westcott scissors. Kumar and Dodds³⁰ offer alternative explanations. According to a textbook of anatomy,⁴⁵ the space under the Tenon's capsule is a lymph space, and this follows the

optic nerve and continues with the subarachnoid space. Accidental injection of local anaesthetic agent into this part of the posterior sub-Tenon's space can then enter the subarachnoid space through the optic nerve sheath. Unintentional perforation of the Tenon's capsule during injection, subsequent deposition of local anaesthetic into the intraconal space and spread to the central nervous system through an orbital foramen is another possibility.³⁰

Symptoms and signs of brain stem anaesthesia range from drowsiness, confusion, and or loss of verbal contact, to cranial nerve palsies, convulsions, respiratory depression, and cardiac arrest. Rüschen *et al*⁴⁴ reported a patient who became unresponsive to verbal command for nearly 3 h after a sub-Tenon's block. Fortunately respiration and cardiovascular parameters were stable during the operation and immediate post recovery period. The patient made a full recovery with no neurological deficits. Quantock and Goswami⁴⁶ described a patient who developed a generalized tonic-clonic seizure and refractory ventricular fibrillation one minute after sub-Tenon's block injection. Subsequent resuscitation was unsuccessful. Post-mortem examination revealed severe coronary artery disease and the mortality was considered primarily cardiac in origin; however, the possibility of brainstem anaesthesia could not be ruled out.

Immediate availability of trained personnel who can maintain airway and oxygenation is essential. These patients may require careful intravenous fluid therapy and vasopressor agents.

Globe perforation

Three cases of globe perforation have been reported, two identified at the time of the performance of the block and one 5 weeks later.

Frieman and Friedberg⁴⁷ reported an episode of globe perforation that occurred in a patient with scleral scarring resulting from previous retinal detachment surgery. Incisions were made with sharp scissors to relieve the adhesions but the surgeon continued to advance the scissors more posteriorly until he suddenly felt a dramatic decline in resistance because of globe perforation. Prolonged management of this perforation was required but no adverse visual sequelae were reported. Another case of globe perforation was reported which occurred when a metal sub-Tenon's cannula entered the globe through the sclera.⁴⁸

A case of delayed scleral perforation was reported from the United Kingdom⁴⁴ where the sub-Tenon's block was performed by the operating surgeon immediately before the start of cataract surgery. Three ml of 0.5% bupivacaine was used for the sub-Tenon's block. The

patient felt discomfort during the latter part of the operation and was squeezing her eye. This was described as ineffective sub-Tenon's block, which made the operation increasingly difficult. A posterior capsular tear occurred requiring a complex anterior vitrectomy. Five weeks later on routine follow-up, an inferonasal scar attributed to a cannula entry was identified. This case highlights the importance of waiting to achieve an effective block particularly when drugs with a relatively slow onset of action are used.

An urgent ophthalmological opinion must be sought as immediate surgery may limit the damage.

Orbital and/or retrobulbar haemorrhage

Cases of intraocular, orbital, and retrobulbar haemorrhages of unknown aetiology have been reported. Rüschen *et al*⁴⁴ reported two patients who developed hyphaema after the administration of sub-Tenon's block before surgery. Ultrasound examination showed posterior vitreous detachment. Neither patient had the known risk factors for hyphaema, and in both, sub-Tenon's block was followed by ocular massage. Ocular massage with fingers is sometimes performed to aid the spread of the local anaesthetic or reduce oedema formation although a compression device such as the Honan's balloon is more commonly used. However, pressure generated by digital massage can produce a peak intraocular pressure (IOP) of up to 400 mm Hg, with considerable globe distortion and shearing forces on the ciliary arteries.⁴⁹

There have been three published case reports of orbital and/or retrobulbar haemorrhage occurring between administration of the anaesthetic block and the start of the procedure.⁵⁰⁻⁵² There was no visible source of bleeding in one patient⁵¹ and one other patient was on regular aspirin and clopidogrel.⁵²

The causes of intraorbital, orbital, and/or retrobulbar haemorrhage are not clear but direct trauma to blood vessels by the cannula cannot be ruled out. The temporal vortex vein reflects on to the inner surface of the Tenon's capsule posterior to the insertion of the inferior rectus muscle.⁴⁵ The inferonasal quadrant has no such vein loop on the inner Tenon's capsule. However, it is possible that the long metal sub-Tenon's cannula was inserted too far posteriorly. This, coupled with anatomical variations or slight inferior displacement of the cannula during injection, might have led to rupture of the vein and a subsequent retrobulbar haemorrhage. Displacement and rupture of a sclerotic blood vessel because of infusion of fluid behind the orbit was another possibility.⁵¹

A retrobulbar haemorrhage should be suspected when the globe becomes proptosed over a period of a few minutes. Lid swelling and conjunctival blood vessel

engorgement occur. IOP should be determined which is dramatically increased and the retinal circulation should be checked.

Treatment if necessary is directed towards reducing compartment pressure, thus reducing IOP and minimizing the effects on retinal circulation. Immediate oculocompression can be helpful in limiting the severity and extent of haemorrhage. The ophthalmologist should be consulted immediately to evaluate the degree of haemorrhage and for further interventions.

Retinal ischaemia

Closures of the central retinal vessels have been reported with^{53,54} or without retrobulbar haemorrhage.⁵⁵ Two cases of transient central retinal artery occlusion and another case of permanent loss of vision have been reported after sub-Tenon's block.⁵⁶ One patient in Ruschen *et al* series⁴⁴ suffered from irreversible visual loss of elusive aetiology and the possibility of a central retinal artery occlusion could not be ruled out. This patient gave a history of transient blindness 6 months earlier presumably caused by arterial spasm and this was considered to be a predisposing factor to the arterial occlusion following sub-Tenon's block. Recently, another episode of retinal arterial occlusion associated with sub-Tenon's block has been reported.⁵⁷

The exact cause of the above complication following sub-Tenon's block is unknown. It could presumably result from an increase in IOP exceeding the mean arterial pressure in the ophthalmic or central retinal artery, or because of increased IOP, which may interfere with the small vessels supplying the optic nerve.⁵⁷ However, the sub-Tenon's block does not appear to be associated with a significant increase in the IOP.⁵⁸ The manipulation of the globe may compromise the retinal perfusion because of spikes in IOP. All orbital blocks including sub-Tenon's cause a marked decrease in pulsatile ocular blood flow, persisting at least for 10 min after the injection.^{59,60} It is hypothesized that the decrease in ocular blood flow is the result of vasoconstriction caused by the high local concentration of the local anaesthetic drug.⁶⁰ Inhibition of endothelium-dependent relaxation of the ciliary arteries or anaesthetic blockade of the vasodilator nerves are other possible explanation for vasoconstriction.⁶¹

Although the risk of retinal ischaemia after local anaesthetic injection is very small but it deserves consideration in patients with compromised ocular circulation or significant glaucomatous optic neuropathy.

Signs and symptoms of retinal artery occlusions are usually late. Retinal arterial occlusion is an ophthalmic emergency and prompt treatment is essential. Nonspecific methods to increase blood flow and dislodge

emboli include digital massage, intravenous acetazolamide, and methylprednisolone. Additional measures include paracentesis of aqueous humour to decrease IOP acutely. Pan-retinal photocoagulation with an argon laser may be effective in early stages.

Optic nerve damage

There has been one case report of a patient who developed total blindness after cataract extraction possibly owing to optic neuropathy resulting from direct trauma by the tip of the sub-Tenon's cannula.⁶² The investigators demonstrated, on cadaveric eyes, that the tip of the metal sub-Tenon's cannula (22–26 mm long) could reach the optic nerve when the cannula was advanced along the sclera in the inferonasal quadrant. The use of 4% lidocaine causing neurotoxicity might be another possibility.

Rectus muscle dysfunction

There have been several published reports of diplopia associated with sub-Tenon's block and the inferior rectus is the most commonly affected muscle.

Jaycock *et al*⁶³ described three cases of persistent inferior rectus muscle restriction after sub-Tenon's block provided via the inferonasal quadrant. The investigators believed that direct trauma to the muscle with haematoma formation occurred at the time of the sub-Tenon's block with subsequent contracture of the affected muscle. All patients suffered from immediate peri-orbital bruising. Two of these patients received a local anaesthetic mixture of lidocaine 4% and bupivacaine 0.75%, which might have contributed to myotoxicity. Three more cases of inferior rectus muscle restriction were reported by Adams *et al*.⁶⁴ Similarly, Merino *et al*⁶⁵ reported eight patients who developed restrictive strabismus after sub-Tenon's block. Strabismus surgery was required in four cases. Lignocaine 5% was the anaesthetic agent used for the sub-Tenon's block.

Spierer and Schwalb⁶⁶ reported transient diplopia resulting from superior oblique muscle paresis after cataract surgery. A sub-Tenon's block was performed in the superotemporal quadrant using a metal cannula that was advanced to its fullest extent along the sclera. Spontaneous recovery ensued (within one month).

Muscle dysfunction after sub-Tenon's block may result from direct trauma to the muscle with either the scissors or trauma by the rigid metal cannula^{63,64} or from direct myotoxicity of the local anaesthetic solution. Conventional local anaesthetic concentrations such as 2% lignocaine, 0.75% bupivacaine, levobupivacaine, or 1% ropivacaine are in common use. Higher

concentrations may be neurotoxic as well as myotoxic and should be avoided. Inflammation or infection introduced into the sub-Tenon's space leading to adhesion formation may be another mechanism of muscle injury.⁶⁴

Muscle injury may not be the only cause of diplopia after cataract surgery. The prolonged disruption of binocular vision and the abrupt change in the sensory situation after the cataract operation with lens implantation may lead to strabismus or deterioration of a pre-existing strabismus.⁶⁴ Evaluation of binocular vision and eye movements before cataract operation may be helpful in diagnosis and management of diplopia after surgery.

Care is required during dissection and insertion of metal cannula during the block. Once diagnosed, the case should be treated by strabismus surgeon for corrective surgery.

Orbital swelling

Several cases of proptosis developing within the first few days after surgery under sub-Tenon's block have been reported.^{67–73}

Possible mechanisms included infection, hyaluronidase-induced orbital inflammation, or reaction to anaesthetic agents. None of the patients had appropriate tests for allergic reactions in the reported cases. At the time these complications were reported, instillation of conjunctival povidone iodine was not applied before sub-Tenon's block, as the common practice then was to apply povidone iodine only after sub-Tenon's block and before surgery. Some of these patients had high doses of hyaluronidase 500–1500 IU added to the injected local anaesthetic.⁷¹

The severity of the manifestations varied and most patients were afebrile with normal white blood cell count. Oral and systemic antibiotics with or without steroid resolved the problems. One patient received an oral antihistamine. The orbital swellings resolved within 2–4 weeks in all cases. Only two cases of orbital swelling had clinical picture of infection associated with fever, purulent discharge, and positive cultures. The first patient presented with a catastrophic endophthalmitis and orbital cellulitis that resulted in loss of vision, following uncomplicated cataract surgery under sub-Tenon's block.⁶⁷ In the second case, orbital cellulitis developed in an immunologically compromised patient who presented with inferonasal corneal perforation.⁷⁰ The patient had undergone a corneal gluing procedure under sub-Tenon's block. The orbital cellulitis resolved after intravenous antibiotics.

The safety of providing sub-Tenon's block in the presence of active corneal ulceration and altered

conjunctival flora is not known. If sub-Tenon's block is required, extreme caution is necessary. Corneal gluing can be performed under topical anaesthesia and sub-Tenon's block should be avoided.

Hyaluronidase-induced orbital inflammation (which has also been reported after needle blocks) should be considered when a patient presents with a rapid onset of orbital swelling, especially in the presence of previous exposure to hyaluronidase.⁷⁴ Hyaluronidase-associated orbital inflammation may predispose the eye to infection.⁷³

Sub-Tenon's block, is a 'no-touch' technique and routine aseptic precautions should be practised. It does involve a significant breach of the conjunctiva that could potentially serve as an access for pathogens into the orbital cavity. Instillation of specially formulated povidone iodine 5% into the conjunctival sac before injection is recommended before opening up the conjunctiva.⁷⁵ Excessive dose of hyaluronidase should be avoided and must not exceed > 15 IU/ml.⁷⁶

Early recognition and treatment of postoperative orbital inflammation by steroids and appropriate antibiotics may prevent potentially serious visual consequences.

Other non-sight and non-life threatening

Eye lashes^{77,78} and intact subconjunctival insect entrapment⁷⁹ after sub-Tenon's block have been described. A large conjunctival incision that is sited too anteriorly can rarely create a potential entry site for unwanted foreign bodies may also be associated with inward folding of a conjunctival flap resulting in inclusion cyst formation.⁸⁰

Care should be taken when administering a sub-Tenon's block to ensure that the conjunctival incision is small and sited correctly. Vigilance is needed in patients reporting a persistent foreign body sensation or eye redness following sub-Tenon's block.

Other untoward medical events that may occur during sub-Tenon's block

Serious systemic adverse events may occur during anaesthesia and surgery, which are not related to sub-Tenon's block. Five patients in the Auckland study³² had panic attacks or cardiovascular compromise and five other patients required therapeutic interventions for cardiovascular events that occurred during or shortly after sub-Tenon's block.

Routine intraoperative monitoring and vigilance is required to diagnose these events so that appropriate treatment can be instituted immediately.

The ways forward

Sub-Tenon's block has now been associated with most of the commonly described complications, which are associated with needle blocks but the incidence and nature of these complications appear to be less frequent. The sub-Tenon's block is accepted as a safer alternative.³² A recent large UK survey found a lower rate of reported serious complications with sub-Tenon's block compared with retrobulbar and peribulbar techniques.⁵ Although the reasons for some of the complications are not clear but most sight- and life-threatening complications appear to be related to inappropriate or poor technique. Although the type of cannula used was not always specified in the reported cases but it appeared that all the complications occurred while the rigid metal posterior cannula was used. It is surmised, although not proven, that a shorter, less rigid or flexible cannula, and lower volume of local anaesthetic agent can improve the safety profile of sub-Tenon's block.⁸¹

Conclusion

The sub-Tenon's block appears to be relatively safer than needle-based blocks but is not without complications and a proper prospective, randomized, double-blind controlled trial is essential for scientific proof. A thorough knowledge of orbital anatomy, attention to the technique, awareness of possible complications, and preventive measures are essential if this technique is to be used safely.

Conflict of interest

The authors declare no conflict of interest.

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