

# Sub-Tenon block: an anaesthetist approach

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## Abstract

Due to an obvious increase in the number of the elderly, the spectrum of ophthalmic surgery has changed, with a higher proportion of cataract operations. Additionally, a surge in cosmetic lens implant surgery is under way. Meeting their similar surgical needs and those of the case flow alike, sub-Tenon anaesthesia has evolved as a reliable and safe technique. Having been performed until recently by surgeons only, it is now being adopted by anaesthetic departments as well. It is in this context that the sub-Tenon block (a technical term largely preferred) is considered in this paper, with a special emphasis on the practical aspects. The structure of this presentation and the selection of the reviewed literature derive from the recent involvement of the author in about 1,500 cases of cosmetic eye surgery.

**Keywords:** cataract extraction surgery, sub-Tenon anaesthesia, cosmetic lens implant

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## Introduction

Since day case facilities have expanded and less invasive surgery has developed, an increasing number of eye operations are nowadays performed under regional anaesthesia. Consequently, the anaesthetic approach has also progressed, in its turn, towards optimisation [1, 2].

After over a century of 'sharp instrument' (peri- and retrobulbar) anaesthesia, quoted as causing possible serious and even life threatening complications, globe perforation, orbital haemorrhage, optic nerve damage and subarachnoid diffusion [3, 4], a new, safer version has emerged over the last two decades, the sub-Tenon block [5].

Also described as parabolbar [6], pinpoint [7] and medial episcleral [8] and making an old idea [9] current, the sub-Tenon block consists of instilling anaesthetic solution into the potential lamellar space between the sclera and the Tenon's capsule. Suitable in principle for a variety of surgical eye procedures, it is today the anaesthetic technique of choice for cataract extraction.

## Anaesthesia-related anatomy

The sub-Tenon's capsule is a fascial layer of elastic connective tissue surrounding the globe and separating it from the orbital fat. It fuses anteriorly to the sclera

about 0.5 cm lateral to the corneoscleral junction (limbus) while posteriorly it extends in all directions around the globe, the muscle sheaths and the meninge of the optical nerve [10].

The space between this capsule and sclera is firmly closed around the limbus, separated by delicate bands and, at the globe equator, by the muscle insertions and appears to be fenestrated posteriorly.

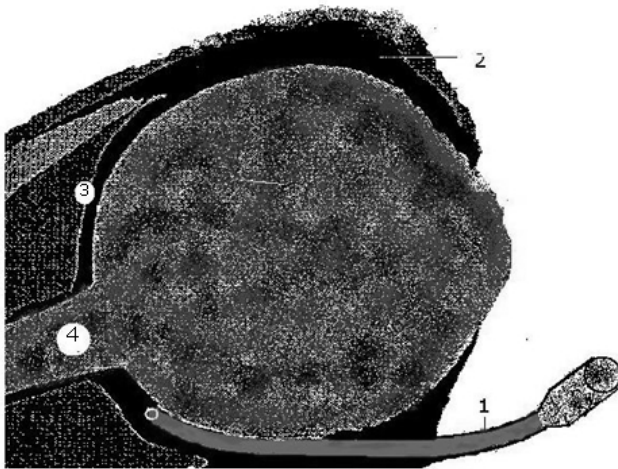
Between the orbit apex and muscular cone there are many nervous structures of high anaesthetic significance like the oculomotor, abducent, naso-ciliary nerves and the naso-ciliary ganglion.

Potential or lymphatic in type [11], the space between the sclera and the Tenon's capsule has proved to be a practical approach for ophthalmic anaesthesia due to the easy anterior access and favourable posterior anatomic details.

Instilled gently and progressively into the sub-Tenon space, the anaesthetic solution [12, 13]:

- transforms it from a potential to a real space (fig. 1), bathing the ciliary nerves and providing a sensory block of the globe and paralysis of the ciliary muscles, with mydriasis,
- diffuses into the retro bulbar cone along the external ocular muscles inserting on the globe equator as well as their motor nerves, providing the degree of hypokinesia achieved,
- passes also through the capsule posterior fenestrae to the surrounding fat and even periorbital tissues with their nervous fibres, explaining the eyelid hypotonia and ptosis which occur.

In case of higher injecting pressure and, particularly, volume, the anaesthetic solution may reach the sub-arachnoidian space with its subsequent dangers.



1 – plastic cannula, 2 – space occupied by anaesthetic solution, 3 – sub-Tenon's capsule, 4 – optic nerve

**Fig. 1.** Anaesthetic solution diffused in the sub-Tenon space (inspired from [21])

### Patient assessment and preparations

There is a large variety of policies, each unit having its own [14]. Patients needing cataract extraction as much as those for cosmetic lens implant are, in principle, day surgery cases. However, for reasons deriving from the special needs of such surgery, patients with shortage of breath, cough and gastric reflux as well as those unable to lie flat are not suitable for having the operation done under a local anaesthesia. Also inappropriate are cases with allergies to local anaesthetics and those not cooperative.

Once a patient is accepted as a day case, the following aspects have to be further considered:

- Fasting is not compulsory but any proximal ingurgitation is discouraged as nausea is not unusual during eye operations.
- An appropriate meal is, on the contrary, encouraged in diet controlled diabetic patients while an insulin dependent one should have the usual dose of medication given.
- Aspirin and clopidogrel are compatible with the kind of anaesthesia and surgery under discussion.
- A true hypocoagulation is accepted as long as it is in a therapeutical range; one postpones a case having an INR higher than 3.5 as well as a prosthetic valve one with accidental values below 1.5. Marginal cases have to be discussed with the relevant surgeon and a collective decision taken.
- Well controlled atrial fibrillation is also accepted but a destabilisation of the rate can occur.

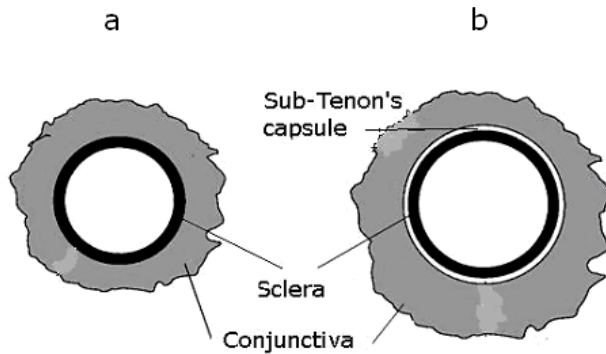
Before the patient signs the consent form, every effort is made to explain in an accessible language the most important problems of significance: position on the table, duration of the procedure, the need for an i.v. access and possible shortcomings such as discomfort, slight pain, conjunctival haemorrhage. Sedation should also be discussed as an option, either by request or by indication. The site of operation must be clearly marked and the chosen sign obsessively rechecked on the route.

### Performing the block

The block is usually performed in the anaesthetic room, supine, on a transferable theatre table, with an i.v. access secured, sedation achieved or at least under way and basic monitoring (O<sub>2</sub> saturation, BP and ECG) taking place. Good lighting is essential but magnification is not actually necessary. A theatre practitioner should always be present and standard theatre equipment operational.

The components of a sub-Tenon block are:

1. Anaesthesia of the cornea and conjunctiva is easily obtained topically with either amethocaine 1%, tetracaine 1% or proximetacaine 0.5%. The drops work quickly and, apart from the very first one, are very well tolerated.
2. For the disinfection of the eye surface, drops of aqueous 5% iodine are placed beneath the lower eyelid.
3. To avoid blinking and improve access, an eyelid speculum is inserted.
4. There are more steps in helping to get the anaesthetic solution to the right place:
  - Asking the patient to look out and up (a mark on the ceiling or the nearest wall could be of help in maintaining the line of gaze) the infero-nasal quadrant is well exposed.
  - Using blunt and non-toothed forceps, a small tent of conjunctiva is raised 0.5-1.0 cm from the limbus, as such, making a small (a couple of millimetres) incision with a pair of spring ophthalmologic scissors, the underlying Tenon's capsule will be met (Fig 2) and, so, cut.
  - The absolute proof of this is the image of the white marble like sclera below. Detecting this endpoint of dissection comes with experience.
5. To instil the anaesthetic solution into the sub-Tenon space, more facilities have been sequentially used: a straight metal (Southampton) [5], a curved metal [15] or a soft plastic cannula [16], the latter one – in different versions – becoming more and more popular. Attached to a 2 or 5 ml syringe, it is intro-



a – immediately next to limbus, b – 0.5-1.0 cm from limbus

Fig. 2. Eye frontal sections

duced through the conjunctival tunnel, gently slid along the contour of the globe maintaining close contact of its tip with the sclera, until the posterior segment is reached; the total distance is about 2 cm. If when advancing, the cannula meets resistance (fibrous band or muscular insertion) it should be cautiously withdrawn and redirected.

6. The instillation itself should be gentle, step by step, in a manner to minimize reflux and allow good diffusion. Depending of these factors, 2.5-4 ml are usually used. A slight proptosis, a not more than reasonable conjunctival swelling around the access tunnel and a progressive mydriasis are good signs of an effective instillation.
7. It takes in general a couple of minutes to accomplish the block. At this point, the cannula is withdrawn altogether, the speculum removed, the eye closed and a uniform, gentle, pressure exerted for another couple of minutes.

An ideal sub-Tenon block consists of:

1. hypotonia of the eyelids, ptosis,
2. analgesia of the eye surface,
3. mydriasis,
4. akinesia,
5. painless manoeuvring of the globe.

It goes without saying that this is not always completely achieved, but one usually manages to obtain a good enough quality of block, of a nature to meet the most common clinical needs.

To gauge its level, the eye concerned is re-examined minute by minute and the developing features of anaesthesia are recorded. It takes usually 10-15 min to achieve the desired picture. If after about 10 min the level of anaesthesia is not satisfactory, the eyelid speculum is reinserted and, via the same breach, the cannula is reintroduced and another 2 ml of anaesthetic solution instilled. Some operators leave the cannula in place for a while, with the syringe disconnected, in order to have it *in situ* if a supplement becomes necessary. The block lasts nearly two hours, being from this

viewpoint extremely reliable for a surgical procedure like that under discussion.

#### Composition of the anaesthetic mixture

Lignocaine 2%, alone or mixed with an equal volume of bupivacaine 0.5 or 0.75%, 2-5 ml, is used.

Hyaluronidase is usually added to promote the rate of diffusion; its concentration varies but 15 u/ml is that officially recommended [17]. A vasoconstrictor is rarely added while warming and increasing the alkalinity of the solution have been tried without being proven as beneficial.

#### Auxiliary medication

Sedation is optional; favoured by many patients, it must not interfere with the required degree of cooperation. Given by titration, 2-3 mg of midazolam is enough in most cases.

The inhibitory oculocardiac reflex is rare in cataract and cataract related surgery. A preemptive administration of atropine is to be considered in cases with vagotonic or betablocker bradycardia.

As cataract patients are in the large majority old and always have a comorbidity, they may benefit from intraoperative oxygenotherapy, a flow of 3-5 l/min.

#### Complications

##### Minor

1. A *slight pain* during the instillation is not rare, but never a real problem. Preoperative explanations, a good surface anaesthesia, a gentle technique and an encouraging conversation are, together, a norm of good practice.
2. An *overspill* of anaesthetic solution during the instillation is commonly observed; if large, it suggests an insufficient dissection.
3. Some *chemosis* always occurs around the conjunctival breach. Even if large, it does not usually interfere with the surgical needs. The cause could consist of too high a pressure of instillation, too large a volume of solution or mainly an inadequate dissection of the Tenon's capsule – circumstance when the anaesthetic solution does not actually reach the sub-Tenon space.
4. A small *conjunctival haemorrhage* is quite frequent and fully acceptable [18]. Attempts are made to make a reasonably tiny incision in a less vascular area; however, such a one is not always easily to be found. If gentle pressure has no effect, one has to appeal for haemostasis to diathermy.

##### Significant

Although rare, they represent a cause for concern and every effort has to be made to prevent them. These include:

1. *Diplopia*, consequent to damage of the muscle insertions under the path of the instilling cannula.
2. *Orbital and retrobulbar hemorrhage*.

3. *Scleral perforation*, particularly in cases with previous scleral procedures. It is expected that the use of the soft plastic version of cannula reduce such complications.
4. *Optic neuropathy, choroidal and retinal vascular occlusion* are, fortunately, very rare. Their mechanism is rather obscure and a previous, known or hidden, pathology often exists.
5. By far, the most dangerous reported accident is a *cardiorespiratory collapse* [19], always due to a spread of the anaesthetic agent to the subarachnoid space, acting on the brainstem structures.

## Conclusion

For the surgical needs of cataract extraction, the sub-Tenon block proves to be a reliable and low risk profile anaesthetic technique. It is highly suitable for day case surgical settings and, nowadays, largely accepted by both the surgeons and anaesthetists.

Becoming acquainted with the equipment necessary to undertake the procedure safely, the latter could consistently contribute to solving the increasing theatre case load represented by the ongoing high demand of cosmetic lens implant [20].

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## Blocul sub-Tenon: punctul de vedere al anestezistului

### Rezumat

În cadrul reducerii gradului de agresivitate a tehnicilor operatorii și a sporirii procentajului de chirurgie ambulatorie, anestezia a parcurs și ea, la rândul ei, un program de optimizare și adaptare la realitățile terenului. Unul din domeniile chirurgicale ce a beneficiat cel mai mult din acest concept este cel al oftalmologiei. Ca urmare a prelungirii vârstei medii de viață și, drept consecință, a creșterii numărului de vârstnici, operațiile de cataractă s-au înmulțit în ultimii ani apreciabil. Aceștia li s-a alăturat în practica ambulatorie implantul cosmetic de cristalin – o operație foarte asemănătoare celei de extracție a cataractei. Ambelor categorii li se potrivește din toate punctele de vedere anestezia locoregională; în cadrul acesteia, blocul sub-Tenon și-a câștigat repede un loc binemeritat. Relativ simplu din punct de vedere tehnic, acest procedeu anestezic este asimilat și de secțiile de anestezie ale unităților spitalicești de profil. Blocul sub-Tenon este descris în detaliu în prezentul material pe baza experienței autorului în rezolvarea a aproximativ 1500 de cazuri de chirurgie oftalmologică cosmetică.

**Cuvinte cheie:** operație de extracție de cataractă, anestezie sub-Tenon, implant cosmetic de cristalin