SHORT REPORT

Transconjunctival approach to peribulbar block

Lindsay A McGrath[1,2]
Christopher P Bradshaw[3,4]

[1]University of Queensland, School of Medicine, Brisbane, Qld, Australia; [2]City Eye Centre, Brisbane, Qld, Australia; [3]Royal Brisbane and Women's Hospital, Department of Anesthetics, Brisbane, Qld, Australia; [4]Queensland Eye Hospital, Brisbane, Qld, Australia

Abstract: As increasing numbers of anesthetists perform eye block anesthesia, thorough understandings of peribulbar injection techniques are important for safe practice. There is uncertainty in the literature regarding the optimum needle length, entry point, volume of injectate, and use of single vs double-injection techniques. A modified technique of peribulbar block anesthesia is presented, which offers increased safety, simplicity, low cost, and little change to instrumentation.
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Introduction

Since the discovery of cocaine as an effective topical ocular anesthetic in 1884 by Koller[1], eye surgery has been commonly performed under local anesthesia. But it was not until almost midway through the 20th century that better anesthetic agents were available and the retrobulbar technique of anesthesia became more widely accepted. Retrobulbar anesthesia is classically injected through the skin at the inferotemporal margin of the orbit.[2] The needle is first directed straight back, away from the eyeball, until the point is beyond the globe. Typically, the needle is inserted to a depth of 25 to 35 mm and the injection made into the muscle cone.[2] Peribulbar anesthetic is administered percutaneously or perconjunctivally and advanced up to 25 mm, to the equator of the globe. Compared with retrobulbar techniques, peribulbar anesthesia takes longer to establish and requires larger volumes of local anesthetic but avoids the intraconal space and consequently, has fewer complications, and provides better patient comfort and operating conditions.[3,4]

The peribulbar block was first described by Davis and Mandel in 1986.[5] Large series of peribulbar blocks given by anesthetists in the United States and Canada in the early 1990s were reported, with a low incidence of complications.[3] However, reports of globe perforations, incomplete anesthesia, and excessive increases in intraocular pressures, due to poor injection technique or injection volume, continue to circulate.[3]

A new and safer approach to the peribulbar eye block is presented here, which should lessen the potential for globe perforation by the peribulbar block needle. The adaptations to the peribulbar block technique are useful for the ophthalmologist and anesthetist alike, in the delivery of safe and effective ocular anesthesia and akinesia.

Injection technique

Informed consent for the anesthetic was obtained from the patient, and the operative eye was dilated with atropine 1%, cyclopentolate 1%, and tropicamide 1% (in the case of cataract or

Correspondence: Lindsay A McGrath
City Eye Centre, 10/135 Wickham Terrace, Brisbane Qld 4000, Australia
Tel +61 4 11 279 378
Email lindsay.mcg@gmail.com

vitreoretinal surgery). The patient who was photographed gave full consent for the clinical images to be published.

The patient was placed in a 15-degree head-up position in order to reduce the potential for hemorrhage caused by the block needle, and topical oxybuprocaine 0.5% (Minims, Bausch & Lomb, Surrey, UK) drops were instilled into the conjunctival sac. A peripheral intravenous line was inserted, and standard monitors were applied. Conscious sedation, in the form of titrated doses of 25 mcg of fentanyl citrate with 1 mg of midazolam hydrochloride, was administered to provide a brief period of sedation and amnesia during puncture. The end point was to keep the patient sedated but arousable during injection. The eye was prepared with a 5% povidone iodine solution. A 10 mL luer-lock syringe (Terumo Medical Corporation, Somerset, NJ, USA) was used to avoid the risk of needle disengagement inherent in the use of a slip lock syringe, due to the high resistance of the 25-gauge needle during injection. A mixture containing 5 mL lignocaine 2% (Xylocaine, AstraZeneca Pty Ltd, NSW, Australia), 5 mL ropivacaine 1% (Naropin, AstraZeneca Pty Ltd, NSW, Australia), and 10–15 U in 1 mL of hyaluronidase (Hyalase, CP Pharmaceuticals Ltd, Wrexham, UK) was prepared.

This block has been used successfully for anesthesia prior to cataract, glaucoma, corneal, and vitreoretinal surgery. Where the block was performed prior to cataract surgery, the intraocular lens size was checked to gain an indication of globe length. A lower intraocular lens size correlates with myopia and hence longer globe length. Particular care was taken when a lens of power less than 22.0 D was used, as reports suggest a 30-fold increased risk of perforation in eyes with axial lengths of 26 mm or longer.[6]

A 25-gauge, 25 mm bevel disposable needle (Terumo Medical Corporation, Somerset NJ, USA) was used. The lower lid was everted, and the 25-gauge needle was inserted by the perconjunctival route, at the junction of the middle and lateral third of the inferior orbital rim, with the eye in the neutral position (Figure 1). The needle was directed towards the floor of the orbit. Care was taken to ensure that the needle was withdrawn slightly off the floor prior to injection, to avoid injection under the periosteum. During the insertion process, the globe was gently elevated superiorly with the index and middle fingers of the nondominant hand in an attempt to push the globe away from the needle (Figure 2). This pressure also aimed to push the injectate posteriorly behind the globe. After gentle negative aspiration, the local anesthetic solution was injected at a slow and steady rate until the upper lid dropped to cover the whole of the cornea (Figure 3).

A total of 10–12 mL of local anesthetic solution was usually required for complete ptosis. During injection, the needle was directed more posteriorly while the fingers of the nondominant hand and the increasing intraorbital pressure pushed the globe superiorly.

Proptosis, ptosis, and chemosis were identified, and motor block confirmed an effective sensory block (Figure 4). If severe or atypical pain was encountered during the injection, further sedation was given intravenously without withdrawing the block needle. The patient was asked to look left, then right to observe free motility and exclude globe perforation. In this way, as the pain settled, the block could be continued. Prior to continuing, the eye was also palpated to estimate the intraocular pressure digitally, as increased intraocular pressure could herald intraocular injection of the anesthetic.

If the anesthetic was judged to be insufficient at 5 minutes, a further injection of 5 mL of anesthetic was injected medial to the caruncle. For cataract extraction surgery, an eye weight (iwait™; Oryx Medical Pty Ltd, Maylands WA, Australia) was placed on the eye, where the block was performed, for 3 minutes postinjection. In this way, the intraocular pressure was reduced prior to surgery.

Figure 1 The needle is inserted inferotemporally by the perconjunctival route, with the eye in the neutral position.

Figure 2 As the anesthetic solution is injected, the globe is gently elevated superiorly by the fingers of the nondominant hand.

Figure 3 Adequate injection volume can be determined by the presence of ptosis completely covering the cornea.

Discussion

Perconjunctival peribulbar anesthesia by an inferior injection is a well-accepted technique for ocular regional anaesthesia.[3] We have presented small technique modifications to improve anesthesia and reduce complications. This technique has been carried out in our facility for over 5 years, in over 4000 eyes, with no reports of globe perforation to date.

Although the medial approach has been described as a safe and effective first-line approach for peribulbar blockade, we find the inferotemporal approach gives a more reliable and successful block. Peribulbar blocks via both the inferomedial and inferotemporal approaches offer optimum access to the orbital apex and tissue compartment that envelopes the superior, inferior, and medial muscle groups. Magnetic resonance imaging (MRI) studies have also shown the inferior orbital compartments to be relatively avascular, offering additional safety.[7] The inferotemporal approach offers more physical space between the globe and the orbital walls, providing safer access away from the extraocular muscles compared with a medial or off-centered ("two thirds/one third") inferotemporal approach.[8]

Figure 4 The needle is withdrawn, and the eye is seen to be proptosed, with complete ptosis.

There is some concern reported in the literature that needle lengths longer than 16 mm may be unsafe for use in peribulbar blockade.[9] Despite this, we find the 25 mm length to be more useful for deep injection of the anesthetic agent and for ensuring adequate spread from the extraconal to intraconal space. Peribulbar block anesthesia utilizes the tissue compartment principle, in which a needle is inserted into a compartment, and the injected local anesthetic spreads by virtue of its pressure and volume, throughout the compartment.[10] Needle length failed to correlate with related complications, such as optic nerve damage, and subconjunctival or retrobulbar hemorrhage, in a large multicenter study of 33,363 blocks.[4] Further, an analysis of 16,224 blocks reported a 25 mm needle length as safe, with few sight-related complications.[3]

While external ocular compression techniques have been shown to increase intraocular pressure[11], the technique of superior ballottement of the globe does not seem to increase the rate of intraocular pressure-related complications. Riad described the application of digital pressure around the needle hub to prevent displacement and posterosuperior spread of injectate.[6] The slight upward pressure we propose further improves the success rate of the blocks and minimizes traumatic complications. The relationship between injection volume and intraocular pressure rise has been shown to be clinically irrelevant.[12,13] The risks of increased intraocular pressure after a block include deficient retinal perfusion or ischemic compression of the optic nerve. These complications have only been described in cases where the intraocular pressure exceeds that of the arterial blood pressure for greater than 1 hour.[13] This is an extremely rare occurrence in the context of peribulbar anesthesia, and the risk is reduced further reduced by globe compression postblock.[2,13] Additionally, globe compression reduces the risk of retrobulbar hemorrhage and assists with the diffusion of local anesthetic.

A wide range of anesthetic volumes have been trialed in studies of peribulbar anesthesia.[13] It has been shown, however, that the volume of anesthetic has little correlation with the akinesia score but that the correct volume can be titrated until total upper eyelid drop is achieved to determine the success of the block in an individual patient.[12] Frow et al suggested that injecting by titration until total upper eyelid drop may reduce the inherent risks of excessive volume, while ensuring the administration of adequate volumes to achieve akinesia in those with larger orbits.[12] Local anesthetic injected into the extraconal space has a longer way to spread into the cone in order to block all the nerves responsible for sensory, motor, and autonomic innervation of the eyeball. Increased spread requires an increased volume of injectate, a theory that has been supported in other work.[10] Our technique typically requires 12 mL of local anesthetic.

In contrast to retrobulbar blockade, during peribulbar blockade, the injected anesthetics must spread from the extraconal to intraconal space to provide adequate anesthesia and akinesia of the globe. Therefore, as mentioned previously, a higher volume of injectate or multiple injections may be required.[10] Reinjection rates ranging from 4%–28% have been reported for adequate peribulbar anaesthesia.[10] Although a second injection is required in some cases, a third top up is generally unfavorable due to risk of anesthetic toxicity and the finite volume that can be safely accommodated within the restrictions of the bony orbit. Our technique of keeping the needle in situ during episodes of pain is useful to avoid multiple puncture sites and increased risk of traumatic complications (after intraocular injection is excluded). However, Hamilton reminds clinicians that unduly deep sedation at the time of orbital anesthetic injection must be avoided, as this may counter patients acting as their own monitor ie, being conscious enough to report pain.[8]

Anesthetists, for reasons of safety and efficacy, often favor the sub-Tenon's approach to ocular anesthesia. This approach, however, requires an incision in the bulbar conjunctiva in order to gain access to the sub-Tenon's space. This can create problems in surgeries such as pterygium excision with autoconjunctival graft and trabeculectomy, where an intact conjunctiva is required. Some vitreoretinal surgeons also prefer not to disturb the conjunctiva overlying potential port sites. In these cases, it is useful to have an alternative block such as the peribulbar, which creates no visible bruising, bulbar conjunctival damage, or subconjunctival hemorrhage.

The modifications to the peribulbar block described herein include a downward angled needle insertion, using the orbital floor as a guide; superior ballottement of the globe to allow more potential extraconal space and posterosuperior spread of the injectate; and the persistence of needle placement during episodes of pain, managed by increased doses of intravenous analgesia. The techniques previously described, such as the use of total upper eyelid drop as an end point marker and single injection inferotemporal approach, were confirmed to be safe and effective.[12] The peribulbar approach requires less training, equipment, and hence, expense than a sub-Tenon's approach. Further prospective studies of these technique modifications are required to further highlight the improved safety and efficacy.

Peribulbar injection via a perconjunctival approach has the advantages of reducing skin hematoma formation – improving cosmesis postoperatively and potentially reducing the infection risk (due to the closed space compared with percutaneous injection). Administration of topical anesthesia to the conjunctival sac reduces the pain with injection as the needle passes through the mucous membrane, further enhancing patient satisfaction. Our inferior perconjunctival injection technique with globe ballottement is a simple and safe alternative approach for ocular regional anesthesia. The advantages include a needle path less subject to misdirection, tactile assessment and control of orbital volume, and a single-injection technique.

Disclosure

The authors report no conflicts of interest in this work.

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