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Complications of local anaesthesia for ophthalmic surgery

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Complications of local anaesthesia for ophthalmic surgery may result from the agents used or the block technique itself and, although relatively rare, range from the trivial to the devastating, which may threaten sight or even life.

Complications of the agents

Topical local anaesthetic agents frequently sting, and are occasionally associated with temporary clouding of the cornea, making surgery more difficult [38]. This clouding was most often seen with cocaine and is much less common with amethocaine or oxybuprocaine. Corneal anaesthesia necessitates protection,of the eye by ensuring that it is closed and protected by a pad.

SYSTEMIC COMPLICATIONS

Systemic complications may be caused by local anaesthetic toxicity associated with overdose or intravascular injection, and allergic or vasovagal reactions. These are not considered further in this review.

Systemic toxicity may also follow injection of local anaesthetic into the cerebrospinal fluid within a cuff of dura around the optic nerve or intra-arterial injection of anaesthetic solution with retrograde flow. Symptoms and signs include confusion, convulsions, unconsciousness and respiratory or cardiac arrest [13].

Systemic complications may also follow overdose or intravascular injection of adrenaline, which is often added to reduce local anaesthetic absorption and to improve and extend the duration of the block. Hyaluronidase is usually added to improve onset and quality of block, but may rarely cause allergic reactions [46].

Complications of the techniques

Preoperative assessment and preparation must not be neglected as they are most important in providing safe conditions for local anaesthetic injections. Establishing rapport with the patient, which reduces anxiety and stress thereby lowering arterial pressure, and the use of painless local anaesthetic techniques, reduce the need for sedation.

SUBCONJUNCTIVAL OEDEMA (CHEMOSIS)

Chemosis more frequently follows large volume peribulbar injections than retrobulbar injections, but usually resolves with the use of pressure reducing devices and does not cause intraoperative or postoperative problems [7].

BRUISING (ECCHYMOSIS)

Insertion of a needle through the skin or conjunctiva may be followed by bruising [44], which may be very disfiguring. Injection should be made through the conjunctiva rather than the skin wherever possible, as it is less painful and the chance of skin bruising is reduced.

RETROBULBAR HAEMORRHAGE

Retrobulbar haemorrhage is a serious complication which may occur in 0.1–1.7 % of patients [5, 11, 18, 29], and vascular or haematological disease may be a predisposing factor. It is more likely in the elderly, and in those receiving steroids, aspirin or other non-steroidal anti-inflammatory drugs, and anticoagulants. There is a body of opinion that supports the use of eye blocks in patients who are receiving anticoagulants within the therapeutic range and who consider that the risk of haemorrhagic complications is less than the risk of systemic problems if the anticoagulants are stopped [15, 17, 27].

Retrobulbar haemorrhage is manifest by increasing proptosis with tight eyelids, subconjunctival and periorbital haemorrhage, and a dramatic increase in intraorbital pressure. Even normal retrobulbar injections have been shown to reduce ophthalmic artery pulse pressure [20], so clearly retrobulbar haemorrhage may lead to retinal artery compression because of mechanical tamponade or increased intraocular pressure. Central retinal artery pulsations should be monitored and if there are signs of impending retinal artery occlusion, urgent decompressive surgery or an anterior chamber paracentesis may be required to prevent permanent loss of vision.

It is usually prudent to postpone surgery, but occasionally the application of pressure reducing devices may be successful in reducing intraocular pressure and surgery may be allowed to proceed [5].

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Key words

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GLOBE PENETRATION OR PERFORATION

The insertion of a needle into (penetration) or through the globe (perforation) are rare complications which are more likely to occur in myopic eyes which are longer but also thinner [12, 35]. The length of the globe should be known as part of the preparation for lens implant surgery, and globes longer than 26 mm are particularly at risk. Patients who have had or are presenting for retinal detachment surgery or for surgery of short-sightedness are likely to have long eyes [35].

Perforation may occur with both peribulbar and retrobulbar blocks [10]. In one study it was noted that 12 of 23 referred perforations followed retrobulbar injections and the other 11 followed peribulbar injections [19]. It is more likely when there is poor patient co-operation or difficult access to the conjunctival fornix, and may occur whether the block is performed by an ophthalmologist or non-ophthalmologist [14, 19]. It is essential that anyone performing regional anaesthesia for the eye should have extensive knowledge of orbital anatomy and be fully aware of the risks of globe perforation. The incidence described in the literature varies from 0 in 2000 peribulbar blocks [6], to 1 in 12 000 of a series of peribulbar and retrobulbar blocks [18], 3 in 4000 retrobulbar blocks [35], and 1 in 16 224 peribulbar blocks [7].

A diagnosis of perforation may be made by pain at the time the block is performed, sudden loss of vision, hypotonia, a poor red reflex or vitreous haemorrhage [40]. When suspected or diagnosed it must be discussed with the surgeon who should advise on further management, and decide if the operation should proceed.

Penetration or perforation may be avoided by knowledge of orbital anatomy and the length of the globe, initial tangential needle insertion, not going "up and in" until the needle tip is clearly past the globe equator, aiming for the inferior portion of the superior orbital fissure rather than the orbital apex [21], and a sensitive touch with the needle.

AMAUROSIS

Peribulbar injections of local anaesthetic do not lead to temporary loss of vision, whereas retrobulbar injections cause this as a consequence of the optic nerve becoming blocked [1, 6]. Patients should be warned of the possibility of loss of light perception, especially if a block is being performed on the only functioning eye, and reassured that even if light perception is retained, it does not imply that the block is not effective and that they should not be worried by the microscope light or movements that they might see.

OPTIC NERVE ATROPHY

Optic atrophy and retinal vascular occlusion may be caused by direct damage to the optic nerve or central retinal artery, injection into the optic nerve sheath or haemorrhage within the nerve sheath [23, 25, 29, 33, 43]. It may follow retrobulbar haemorrhage, with or without acute retinal vascular occlusion [12]. These complications may lead to partial or complete visual loss. They may be related to or incidental to the technique and have even followed surgery under general anaesthesia. The mechanism may involve shut-down of retinal mini-vessels in the optic nerve. There is no evidence that the use of adrenaline in standard vasoconstrictor concentrations has any adverse effect on retinal circulation.

PENETRATION OF THE OPTIC NERVE SHEATH

The optic nerve has a complete dural cuff all the way to the sclera, and injection into this cuff leads to subarachnoid spread of the agent directly to the central nervous system [9, 22]. There is little doubt that the use of the up and in position of the globe rotates the optic nerve down and out and towards the inferotemporal needle [24, 45]. All injections should be made with the globe in the primary gaze position so that the optic nerve remains in its normal position behind the globe.

A variety of symptoms and signs may follow, including drowsiness, vomiting, contralateral blindness caused by reflux of the drug to the optic chiasm [2] or an air bubble in the sheath [3], convulsions, respiratory depression or arrest [39], neurological deficit, and even cardiac arrest [37]. These symptoms usually appear within about 8 min, although one case was described in which the onset was immediate, suggesting injection via the ophthalmic artery [28], and another in which it was delayed for 40 min [42]. It is likely that there are other routes of central spread of local anaesthetic, including spread from the posterior orbit in the fat outside the dural sheath.

The incidence of central nervous system involvement in a series of 6000 retrobulbar blocks was 1 in 375, with 1 in 700 being described as life threatening [31]. In another series, the incidence was similar at 3 per 1000 [18]. Because of these risks, the patient should be observed carefully and monitored after the introduction of local anaesthetic and also during surgery. Resuscitation equipment and personnel trained to use it effectively must be available.

OCULOCARDIAC REFLEX

An established local anaesthetic block ablates the oculocardiac reflex by providing afferent block of the reflex pathway, but the institution of the block and especially rapid distension of the tissues by volume or haemorrhage might provoke it occasionally. This is another reason why the patient must be monitored carefully.

MYOTOXICITY

Extraocular muscle palsies have been described [18, 36]. They most frequently affect the inferior rectus muscle [8, 16, 32], but occasionally there may be palsies of the superior oblique, the medial rectus with nasal injection, superior rectus or levator palpebrae superioris following superior injection or

as a consequence of surgery. They usually recover but occasionally corrective strabismus surgery is required.

The highest concentrations of local anaesthetic should not be used as these have been shown to be myotoxic [4, 34], and direct injection into the muscles is avoided by use of suitable sites for needle insertion such as the inferotemporal, nasal and superotemporal.

COMPLICATIONS OF FACIAL NERVE BLOCK

Facial nerve block is rarely used now that the orbicularis oculi can be blocked easily from within the orbit, especially by injections into the nasal compartment. Facial nerve block is often painful and associated with bruising. Block of the main trunk at its exit from the stylomastoid foramen leads to full hemifacial palsy and the local anaesthetic may spread to the vagus, glossopharyngeal or spinal accessory nerves, leading to dysphagia or respiratory difficulty. Cases of prolonged facial paralysis have been described in the past.

Conclusions

There is a substantial body of opinion, supported by several studies, indicating that the peribulbar technique is effective and safer than retrobulbar injection, as the needles do not enter the retrobulbar space. This is anatomically close to the posterior surface of the globe and optic foramen which contains the optic nerve with its dural sheath and central retinal artery and vein [30, 41, 47, 48]. Certainly the most recent multicentre report of over 16 000 peribulbar blocks showed a very low complication rate [7]. Similarly it is often stated that blunt needles are safer than sharp needles [26, 29]. However, most of the complications, and particularly severe haemorrhage and globe perforation, have been described after both methods and with both types of needle tip. It is generally agreed that the incidence of complications is reduced if short needles are used. Needles longer than 3 cm should never be used, and the needle need not be inserted more than 2.5 cm using any of the techniques. This avoids injections at the apex of the orbit where the most vulnerable structures such as the largest vessels and the optic nerve are more likely to be encountered.

There is an urgent need for a well planned, prospective, double-blind, randomized study or a detailed audit of the complications of the different techniques to resolve these important issues.

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