



Regional anesthesia of the eye, orbit, and periocular skin

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Abstract Advances in ophthalmic surgery, together with achieving greater patient safety, have changed the requirements of regional anaesthesia of the eye, orbit, and periocular skin. Patient comfort, safety, and low complication rates are essentials of regional anesthesia, which includes invasive procedures that generate intraoperative and postoperative analgesia, as well as akinesia. We present the currently used local anesthesia (topical and subcutaneous infiltration of local anesthetics) and regional anesthetic techniques in ophthalmic procedures, describing the techniques, advantages, disadvantages, and complications in ophthalmic regional blocks, as well as some educational measures to implement them to reduce the risk of ocular complications. Currently, there is no absolutely safe ophthalmic regional block, and the anesthetic modality should be assessed on a patient and surgeon basis.

Local anesthesia is the reversible loss of sensation in certain area of the body to minimize pain and obtain patient comfort. It can be achieved through topical application or injection of anesthetic agents that block the nerve impulses to that tissue.

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Topical anesthesia

Topical and intracameral anesthesia are the most common anesthetic methods used in ocular surgeries. Topical anesthesia, a procedure that involves the administration of local anesthetic on the eyeball, can be supplemented by injecting intracameral lidocaine 1% (0.1–0.5 mL) into the anterior chamber through the corneal incision (paracentesis).

This provides good pupil dilation without needing any topical mydriatic agents.¹

Intradermal or subcutaneous anesthesia

An adequate preoperative assessment of the eye and periocular region is essential to obtain optimal surgical results. Skin quality, dyschromias, neoplasms, and actinic damage should be evaluated, because these issues can influence the surgical result.² Periocular cosmetic surgery can usually be done

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on an outpatient basis under local anesthesia. Although oral sedation improves safety and efficacy in aesthetic facial surgery, some procedures, like blepharoptosis surgery, are best accomplished without any systemic sedation.³ Local anesthetics are usually injected to infiltrate the soft tissue operative sites. The surgeon should always pull back on the syringe before injecting to avoid inadvertent intravascular injection and use doses with the best safety profiles, starting with the lowest, depending on the patient's age, weight, and comorbidities. A generous amount of anesthetic can be injected into the surrounding area. After intradermal or subcutaneous injection, their onset of action is almost immediate.

The main local anesthetic agents, amides and esters, inactivate local sensory nerves. Lidocaine is the most commonly used due to the highly predictable onset, duration of action, and low toxicity. The maximum recommended dose is 3 to 4 mg/kg and 7 mg/kg if epinephrine (adrenaline) is added.⁴ The addition of a vasoconstrictor agent such as epinephrine doubles the duration of action. As a result, lidocaine with epinephrine lasts approximately 2 to 4 hours, compared with 30 to 60 minutes for lidocaine alone; moreover, epinephrine enhances hemostasis and prevents the rate of systemic absorption from the subcutaneous tissues, reducing the probability of systemic adverse effects and increasing the analgesia duration. Surgical visualization is improved due to the decreased blood flow, and a reduced amount of electrocautery is required.

Adverse effects of local anesthetics

Severe side effects of local anesthetics should be considered. They rarely occur but may be due to systemic absorption, local tissue toxicity, allergic reactions, and drug-specific effects.

Systemic toxicity of local anesthetics

Symptoms of systemic toxicity of include nausea, confusion, difficulty in breathing, arterial hypotension, bradycardia, light-headedness, confusion, and so on. This toxicity is often related to the potential hazard of an accidental intravascular injection and results from elevated plasma concentrations of these drugs. Severe adverse effects should not occur if well-tolerated doses of local anesthetic are used, taking the utmost care not to inject any of it directly into the bloodstream. Less commonly, systemic toxicity is in relation with its absorption from injected tissue. The importance of systemic absorption depends on the anesthetic dose, the precise place of injection, and the association of a vasoconstrictor drug in the local anesthetic mixture.

Local side effects

Local side effects, such as bruising and a temporary sensation of stinging or burning, are common. Local anesthesia administered via injection may cause swelling, temporary impaired movement of the affected area, and

bleeding. Occasionally, the injection site may become infected; however, the probability of severe bleeding and infection is low, especially with proper precautions. Local anesthesia may also take a longer time than expected.

Allergic reactions to local anesthetics

Adverse reactions to local anesthetics (mainly the esters) are not infrequent, but a real allergy is very rare. It is usually due to sensitivity to their metabolite, para-aminobenzoic acid (PABA), and does not result in cross-allergy to amides. Due to this, amides can be used as alternatives in those patients. Nonallergic reactions may resemble some kind of allergy in their manifestations. In some cases, skin tests and provocative challenge may be necessary to establish a diagnosis of allergy. There are also cases of allergy to the preservatives in local anesthetics. In any case, despite the common use of anesthetic agents, allergic reactions are infrequent, representing less than 1% of all adverse reactions to local anesthesia.⁴

Regional anesthesia

Regional anesthesia or field block covers a larger area of the subcutaneous tissue or involves peripheral nerves. Regional anesthesia includes invasive procedures that generate intraoperative and postoperative analgesia as well as akinesia.⁵ They facilitate the surgical work and decrease the oculocardiac reflex, which is caused by manipulation of the globe and traction on the extraocular muscles.⁶ The anesthesia administration phase in ophthalmic regional block is associated with minimal discomfort; thus, regional anesthesia is popular in many practices worldwide for cataract, glaucoma, and vitreoretinal surgery.⁷

Patient comfort, tolerability, and low complication rates are essentials of regional anesthesia. It has been associated with lower perioperative morbidity, lower costs, and better patient comfort compared with general anesthesia for ophthalmic surgery.

Orbital anatomy

To provide effective local anesthesia it is important to understand a number of aspects on periorbital anatomy, such as the orbital muscle cone region (Figure 1). This compartment is determined by the four rectus muscles that originate with the Zinn annular ligament, which is inserted into the orbital apex. These four muscles are also inserted above the eyeball. Within this area, there are neurovascular structures that could be at risk of injury. Tenon capsule is an important anatomic structure and represents an incomplete fascial layer of connective tissue that anteriorly fuses with the conjunctiva and extends posteriorly. Tenon capsule is a thin membrane that envelops the globe and

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