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ANESTHESIA FOR OPHTHALMIC SURGERY: PERIOPERATIVE CONSIDERATIONS

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ABSTRACT The use of anesthesia during ophthalmic surgery is crucial for ensuring patient comfort and safety. Different types of ophthalmic surgeries require different types of anesthesia techniques. Cataract surgery is the most performed ophthalmic surgery and is typically performed under local anesthesia with sedation, while glaucoma surgery can be performed using local or general anesthesia depending on the complexity of the procedure. The use of local anesthesia can reduce intraocular pressure (IOP) and is associated with fewer postoperative complications compared to general anesthesia. Three ophthalmic reflexes, the oculocardiac, oculorespiratory, and oculoemetic reflexes, should be recognized by the anesthesiologist. Appropriate prophylaxis and treatment of postoperative nausea and vomiting are essential for patients undergoing ophthalmic surgery.

KEYWORDS : anesthesia, ophthalmic surgery, intraocular pressure.

INTRODUCTION

Anesthesia is a critical component of surgical procedures, including those performed in the field of ophthalmology. The use of anesthesia during eye surgery is crucial for ensuring patient comfort and safety, as well as for facilitating the surgical process itself. Ophthalmic procedures can be particularly challenging due to the delicate nature of the eye and the potential risks associated with even minor surgical interventions. Additionally, patients undergoing eye surgery often require precise control of their movements and reactions during the procedure, further highlighting the importance of effective anesthesia. This article will explore the different types of anesthesia used in ophthalmic surgery, including topical, local, and general anesthesia. We will discuss the benefits and drawbacks of each approach, as well as the factors that influence the selection of anesthetic techniques for individual patients. Additionally, we will examine the various medications and techniques used to manage pain and reduce inflammation following eye surgery, highlighting the importance of post-operative care in achieving successful surgical outcomes. (1,2).

METHODS

The review would be based on a thorough search of the relevant literature using electronic databases such as PubMed, Embase, and Cochrane Library. The search terms would be focused on anesthesia for ophthalmic surgery and would include terms such as topical anesthesia, local anesthesia, general anesthesia, sedation, and pain management. The data extraction process would involve the extraction of data related to the study design, sample size, anesthesia techniques used, and outcomes. The extracted data would be summarized and synthesized to provide an overview of the current evidence on anesthesia for ophthalmic surgery.

Types of surgery

The use of anesthesia during ophthalmic surgery is critical for ensuring patient comfort and safety. Different types of ophthalmic surgeries require different types of anesthesia techniques. The most common types of ophthalmic surgeries include cataract surgery, glaucoma surgery, corneal surgery, vitreoretinal surgery, and oculoplastic surgery (3).

Cataract surgery is the most commonly performed ophthalmic surgery and is typically performed under local anesthesia with sedation. Glaucoma surgery can be performed using local or general anesthesia depending on the complexity of the procedure. Corneal surgery can be performed under local anesthesia with topical or regional anesthesia, while vitreoretinal surgery is typically performed under general anesthesia due to the complexity of the procedure. Oculoplastic surgery can be performed under local anesthesia with sedation or general anesthesia depending on the nature and extent of the surgery (3,4).

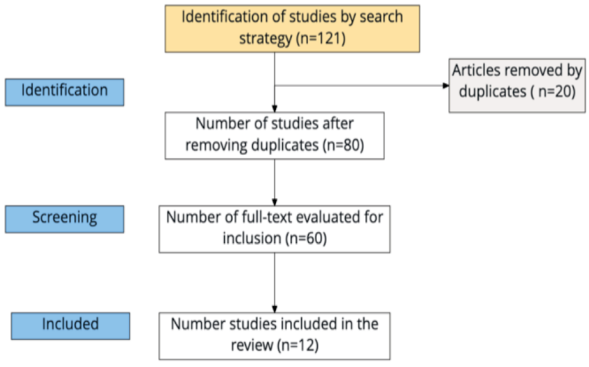

Figure 1. PRISMA.

Intraocular Pressure

IOP is the fluid pressure within the eye and is maintained by a delicate balance between aqueous humor production and outflow. Aqueous humor is produced by the ciliary body and flows through the pupil to drain out of the eye through the trabecular meshwork and uveoscleral pathways. The normal range for IOP is 10-20 mmHg (5).

IOP is an important consideration in ophthalmic surgery because it can affect the success of the surgery and the postoperative outcomes. High IOP during surgery can increase the risk of bleeding, make it more difficult for the surgeon to visualize the surgical site, and increase the risk of complications, such as postoperative hypotony and retinal detachment. Anesthesia can affect IOP in various ways, depending on the type of anesthesia used. General anesthesia has been shown to increase IOP due to several factors, including the effects of anesthetic agents on the autonomic nervous system and the use of positive pressure ventilation. On the other hand, local anesthesia has been shown to decrease IOP, possibly due to its effects on the ciliary body, which reduces aqueous humor production (5,6).

Surgery can also affect IOP due to various factors, such as the use of surgical instruments and manipulation of the eye. Surgical instruments can cause mechanical trauma to the eye, leading to an increase in IOP. Manipulation of the eye can also lead to an increase in IOP due to the compression of the globe and obstruction of aqueous humor outflow. There are several strategies for minimizing IOP changes during ophthalmic

surgery. The use of local anesthesia can reduce IOP, and it is associated with fewer postoperative complications compared to general anesthesia. Additionally, the use of hypotensive anesthesia, which involves reducing the patient's blood pressure during surgery, can also reduce IOP. However, hypotensive anesthesia should be used with caution, as it may cause hypoperfusion of vital organs and increase the risk of postoperative complications (6).

Ophthalmic reflexes

Ophthalmic reflexes are important considerations for anesthesiologists caring for patients undergoing ophthalmic surgery. There are three ophthalmic reflexes that should be recognized by the anesthesiologist: the oculocardiac reflex (OCR), the oculorespiratory reflex (ORR), and the oculoemetic reflex (OER) (7).

The OCR is elicited by pressure or torsion on the extraocular muscles, transmitting afferent impulses through the ophthalmic division of the trigeminal nerve. This reflex is mediated by the vagus nerve and may manifest as sinus bradycardia, ectopy, and sinus arrest. Death secondary to the OCR in otherwise healthy children has been described. Therefore, a thorough understanding of the OCR, including prophylaxis and therapy, is essential for anesthesiologists caring for ophthalmic patients (7,8).

The ORR has also been recognized for nearly a century, but it is less often appreciated with the use of controlled ventilation. Pressure on the extraocular muscles may result in tachypnea or respiratory arrest through a postulated connection between the trigeminal nerve, the pneumotaxic center of the pons, and the medullary respiratory centers. This reflex is not inhibited by the use of atropine or glycopyrrolate. A review of the ORR and its potential for causing hypercapnia and hypoxia has led some investigators to recommend controlled ventilation during strabismus surgery. However, this recommendation remains controversial, and further studies are needed to determine the optimal anesthetic management for ophthalmic surgery (8,9).

The OER is more theoretic than the other two reflexes, but it may explain the high incidence of nausea and emesis after strabismus surgery. This reflex is elicited by pressure on the extraocular muscles, transmitting afferent impulses through the ophthalmic division of the trigeminal nerve. An association between the OCR and the OER has been demonstrated, such that patients who exhibit the OCR intraoperatively are 2.6 times more likely to experience postoperative vomiting than those without OCR manifestations. Anticholinergic therapy does not decrease the incidence of postoperative nausea and vomiting. Therefore, appropriate prophylaxis and treatment of PONV are essential for patients undergoing ophthalmic surgery. In addition to the ophthalmic reflexes, anesthesiologists must consider the physiology of the eye and the effects of anesthesia and surgery on intraocular pressure (IOP). The IOP is the pressure within the eye, and it is maintained by a delicate balance between the production and drainage of aqueous humor. The IOP can be affected by several factors, including body position, respiratory status, and anesthesia (9).

The supine position is commonly used for ophthalmic surgery, as it allows for optimal exposure of the eye. However, the supine position can also increase the IOP due to increased venous pressure in the eye. Therefore, measures to decrease venous pressure, such as elevating the head or using a headrest, should be considered. Similarly, positive pressure ventilation during anesthesia can also increase the IOP, particularly in patients with compromised outflow of aqueous humor. Therefore, ventilation should be adjusted to maintain normocapnia while minimizing positive pressure. The use of local anesthesia for ophthalmic surgery can also affect the IOP. Topical anesthesia can cause a transient increase in IOP, which may not be significant in healthy eyes. However, in eyes with compromised outflow, such as those with glaucoma, this increase in IOP can be significant and should be monitored closely. Regional anesthesia, such as retrobulbar or peribulbar blocks, can also cause an increase in IOP due to the injection of anesthetic solution (10).

Ophthalmology Medications and their Systemic Effects

There are various medications utilized by ophthalmologists during outpatient and perioperative settings that have significant anesthetic effects. The ophthalmic agents have both favorable and unfavorable impacts that may be more prominent and threatening in pediatric patients due to higher systemic absorption or dosing concerning body weight and pharmacologic compartment. Therefore, the anesthesiologist must be well-versed with each medication used in the perioperative period and pay attention to the total dose administered and the potential for adverse effects. Cyclopentolate, Tropicamide, Atropine, Homatropine, and Scopolamine are Cycloplegic medications that paralyze accommodation. They act as a muscarinic antagonist, and their side effects include gastrointestinal disturbance, atropine-like toxicity, and inhibition of plasma cholinesterase. Scopolamine, not commonly used for diagnostic cycloplegia and mydriasis and the treatment of iridocyclitis, has the potential to increase intraocular pressure. Therefore, IV or IM scopolamine as premedication should not be used in a patient with glaucoma (10,11).

Phenylephrine is an -agonist used for maximal mydriasis and vasoconstriction without cycloplegia. The potential side effects of Phenylephrine include hypertension, tachycardia or reflex bradycardia, pulmonary edema, cardiac arrhythmia, cardiac arrest, and subarachnoid hemorrhage. Hydroxyamphetamine is a sympathomimetic used in combination with tropicamide for differentiating preganglionic and postganglionic lesions producing Horner syndrome. Cocaine is an ester local anesthetic with vasoconstrictive properties, used as a Mydriatic medication. Its side effects include tachycardia, hypertension, dysrhythmias, hyperthermia, and seizures (11).

Pilocarpine is Glaucoma Agent (Direct-Acting Cholinergics) medications that produce miosis and a decrease in intraocular pressure. Pilocarpine is used for chronic and acute angle-closure glaucoma, and its side effects include gastrointestinal disturbance, diaphoresis, and brow pain (12).

CONCLUSION

Anesthesiologists must consider the unique anesthesia requirements for each type of ophthalmic surgery to ensure patient safety and comfort. Intraocular pressure (IOP) is a crucial factor that can affect surgical outcomes and postoperative complications. Different anesthesia techniques can impact IOP, with local anesthesia decreasing and general anesthesia increasing it. Ophthalmic reflexes such as the OCR, ORR, and OER should also be recognized and managed appropriately.

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