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A CONCEPTUAL REVIEW ARTICLE ON COMPARISON BETWEEN PERIBULBAR AND RETROBULBAR ANAESTHESIA IN OPHTHALMIC SURGERY

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Abstract: Ophthalmic surgery is one of the most commonly performed procedures requiring anesthesia, with both local and general techniques available. Local ocular anesthesia is preferred for most intraocular surgeries due to its safety profile and the needfor patient cooperation. Common methods include topical, sub-tenon's, peribulbar, and retrobulbar anesthesia, applied across procedures such as cataract, corneal, glaucoma, vitreoretinal, and strabismus surgeries. Peribulbar anesthesia involves injection outside the muscle cone and is widely used as an alternative to retrobulbar block. While retrobulbar anesthesia provides rapid analgesia and akinesia with smaller drug volumes, it carries higher risks, including scleral perforation and oculocardiac reflex stimulation. Peribulbar anesthesia aims to achieve comparable surgical conditions with a potentially improved safety profile.

Keywords: peribulbar, Retrobulbar,Extraconal ,Intraconal,Anesthesia,Lignocaine2%,Bupivacaine0.5%

INTRODUCTION

Ophthalmic surgery is among the most frequently performed surgical procedures requiring anaesthesia in developed countries and serves as an important model for understanding effective anaesthetic practice, particularly the use of local and regional nerve blocks. A wide range of anaesthetic techniques—including local, regional, and general anaesthesia—are employed in ophthalmology, with local anaesthesia being preferred for most procedures due to shorter operative times and reduced systemic risks. Common ophthalmic surgeries such as cataract extraction, corneal transplantation, glaucoma surgery, vitreoretinal procedures, and strabismus correction are routinely performed under local anaesthesia using topical, sub-Tenon's, peribulbar, or retrobulbar techniques. The primary objectives of ophthalmic anaesthesia are to ensure adequate pain control, patient cooperation, and ocular akinesia to provide optimal surgical conditions while minimizing intraoperative complications. Successful administration requires a thorough understanding of ocular anatomy and physiology, as local anaesthetic agents act on sensory nerves, extraocular muscles, and the ciliary ganglion within close proximity to the optic nerve. Peribulbar and topical techniques are most commonly used, often employing a combination of lignocaine, bupivacaine, and hyaluronidase. Despite their effectiveness, these techniques carry potential risks, including ocular, neurological, and rare systemic complications, underscoring the need for precision and expertise in ophthalmic anaesthesia.

MATERIAL AND METHOD

All literature related to ocular anaesthesia, peribulbar and retrobulbar anaesthesia, anaesthetic drugs from various authentic books, various research paper and web search etc.

AIM AND OBJECTIVE

AIM:

To study comparison between between retrobulbar and peribulbar anaesthesia in occular surgeries.

OBJECTIVES:

1) Comparative study between retrobulbar and peribulbar anaesthesia
2)To study the action of anaesthetic drugs in retrobulbar and peribulbar anaesthesia.

REVIEW OF RETROBULBAR AND PERIBULBAR ANAESTHESIA

The term "retrobulbar" is derived from two components:

1)Retro: The prefix retro derived from Latin word meaning backward. It is commonly used in medical to indicate something located behi & It is commonly used in medical terminology to indicate something located behind.

2) Bulbar: This comes from the Latin word bulbus, meaning "bulb" or "globe." In the context of ophthalmology, "bulbar" refers to the eyeball or the globe of the eye.

The term "peribulbar" is derived from two components.

1)Peri: A prefix of Greek origin, meaning "around" or "surrounding." It is commonly used in medical terminology to indicate something located around or near a specific structure.

2)Bulbar: This comes from the Latin word bulbus, meaning "bulb" or "globe." In the context of ophthalmology, "bulbar" refers to the eyeball or the globe of the eye.

Anatomy

Orbit

- Paired bony cavities at the front of the skull housing the eyeballs and associated structures
- Truncated pyramidal shape; adult orbital volume ≈ 30 mL
- Medial walls are parallel; lateral walls are perpendicular

Globe

- Spherical structure suspended in the anterosuperior orbit; volume ≈ 7 mL
- Composed of three tunics: fibrous (cornea, sclera), vascular (iris, ciliary body, choroid), and neural (retina)
- Axial length ≈ 24 mm (longer in myopia, shorter in hypermetropia)
- Sclera is thinnest at the equator and muscle insertion site
- Myopic eyes may have posterior staphyloma, increasing perforation risk**.**

Anterior and Posterior Segments

- Posterior segment contains vitreous, retina, macula, and optic nerve root
- Anterior segment includes anterior and posterior chambers separated by the iris

Extraocular Muscles

- Four rectus and two oblique muscles control eye movement
- Rectus muscles arise from the annulus of Zinn and form the retrobulbar cone
- Optic nerve passes through this cone

Intraorbital Compartments

Three spaces: intraocular, intraconal, and extraconalNo true membrane separates intraconal and extraconal spaces Large-volume peribulbar blocks can achieve anesthesia similar to retrobulbar blocks

Innervation of the Orbit

Sensory supply mainly from ophthalmic nerve (V1)via frontal and nasociliary branches
Infraorbital nerve (V2) supplies the orbital floor

Motor control: oculomotor (III), trochlear (IV), and abducens (VI) nerves

Anatomical Quadrant

Globe divided into eight quadrants using three perpendicular planes
Orbital quadrants: superonasal, superotemporal, inferonasal, inferotemporal
Inferotemporal quadrant is least vascular andpreferred for nerve blocks.

INDICATIONS

1.Cataract surgery
2.Retinal surgery
3.Glaucoma surgery
4.Strabismus surgery
5.Pterygium surgery
6.Corneal surgery
7.Orbital surgery

CONTRAINDICATIONS

1. Allergy to Anaesthetic Agents
2.Orbital or eyelid infection
3. Uncontrolled Bleeding Disorders
4. Severe Trauma
5. Severe Orbital Anatomy Abnormalities

1) Preparation:

1) Patient Positioning: The patient is positioned supine, with the head slightly tilted backward and the eye to be anaesthetized in the upward position. This position helps expose the lower eyelid and facilitates the procedure.

2) Sterilization: The skin around the eye, including the eyelid and periorbital region, is cleaned and sterilized using an antiseptic solution, such as iodine or chlorhexidine, to reduce the risk of infection

RETROBULBAR BLOCK

Retrobulbar block, now sparingly used, was introduced by Herman Knapp in 1884. It is administered by injecting 2 mL of anaesthetic solution (2% xylocaine with added hyaluronidase
5 IU/mL and with or without adrenaline one in one lac) into the muscle cone behind the eyeball (Fig. 26.3A). It is usual to give the injection through the inferior fornix or the skin of outer part of lower lid with the eye in primary gaze (Fig. 26.4A). The needle is first directed straight backwards then slightly upwards and inwards towards the apex of the orbit, up to a depth of 2.5 to 3 cm.

Retrobulbar block anaesthetizes the ciliary nerves, ciliary ganglion and third and sixth cranial nerves thus producing globe akinesia, anaesthesia and analgesia. The superior oblique muscle is not usually paralyzed as the fourth cranial nerve is outside the muscle cone.

COMPLICATIONS

1.Retrobulbar Haemorrhage
2.Globe perforation
3.Optic nerve injury
4.Extraocular muscle palsies

PERIBULBAR ANAESTHESIA

This technique described in 1986 by Davis and Mandel has almost replaced the time-tested combination of retrobulbar and facial blocks, because of its fewer complications and by obviating the need for a separate facial block.

Technique, primarily involves the injection of 6 to 7 mL of local anaesthetic solution in the peripheral space of the orbit (Fig. 26.3B), from where it diffuses into the muscle cone and lids; leading to globe and orbicularis akinesia and anaesthesia.

Classically, the peribulbar block is administered by two injections; first through the upper lid (at the junction of medial one-third and lateral two-thirds) and second through the lower lid (at the junction of lateral one-third and medial two-thirds) (Fig. 26.4B).

After injection digital orbital compression or message is applied for 10 to 15 minutes.

Injection of Anaesthetic:

1. Anaesthetic agents: A mixture of 2% lignocaine and 0.5–0.75% bupivacaine with or without hyaluronidase (25 IU/mL) is commonly used. The mixture provides both rapid onset and prolonged duration of anaesthesia.

Anaesthetic Drugs

1. Lignocaine (Lidocaine)

• Action: Lignocaine is a local anaesthetic that works by blocking sodium channels in nerve cells, preventing the propagation of nerve impulses. This results in loss of sensation in the area where the drug is applied.

• Onset and Duration: It has a rapid onset (within 2-5 minutes) and provides a moderate duration of anaesthesia (30-60 minutes), making it effective for short to medium-duration procedures.

2. Bupivacaine

•Action: Bupivacaine is a long-acting local anaesthetic that also blocks sodium channels in nerve cells, preventing nerve impulse conduction and providing analgesia and akinesia (muscle paralysis).

•Onset and Duration: It has a slower onset (5-10 minutes) but provides a longer duration of action (up to 4-8 hours). This makes it useful for procedures that require prolonged anaesthesia.

3.Hyaluronidase

• Action: Hyaluronidase is an enzyme that breaks down hyaluronic acid, a major component of the extracellular matrix. By degrading the hyaluronic acid, it increases tissue permeability, allowing for a faster spread of local anaesthetic agents and improving the overall effectiveness of the block.

• Use: It is often added to local anaesthetic mixtures to enhance the diffusion of the anaesthetic agents, facilitating a more uniform and quicker anaesthesia.

4. Adrenaline (Epinephrine)

• Action: Adrenaline is a vasoconstrictor that works by stimulating alpha-adrenergic receptors, causing the blood vessels to constrict. This reduces local blood flow, decreasing the absorption of the anaesthetic into the bloodstream and prolonging its action at the injection site.

•Use: While not always used in peribulbar blocks, adrenaline is sometimes added to local anaesthetics (such as lignocaine or bupivacaine) to extend the duration of anaesthesia and reduce bleeding during surgery. Caution is needed when used in the orbit due to the potential for increased intraocular pressure.

Comparative Table: Retrobulbar vs Peribulbar Anaesthesia

Feature	**Retrobulbar Anaesthesia**	**Peribulbar Anaesthesia**
Injection Site	Inside muscle cone (intraconal)	Outside muscle cone (extraconal)
Needle Length	Longer needle (31-38mm)	Shorter needle (25-31mm)
Drug volume	2-4ml	5-10ml
Onset of Action	Rapid	Rapid
Akinesia	Excellent	Good
Analgesia	Dense	Adequate
Safety	Less Safe	Safer
Complications	Optic Nerve Injury, Globe Perforation, Retrobulbar haemorrhage.	Lower complications
Technical skills	More expertise required	Easier technique
Patients Comfort	Less	Better
Need for Additional Block	Less common	May be required

DISCUSSION

Effective anesthesia is crucial for ensuring safe and comfortable intraocular surgeries. Over the years, techniques have evolved from performing surgeries without anesthesia to utilizing modern methods such as topical or regional anesthesia. Currently, the majority of cataract surgeries are conducted under local anesthesia, while general anesthesia is used only in select cases. But regional anaesthesia like Retrobulbar and Peribulbar anaesthesia are commonly used in most of the ocular procedures. Peribulbar anaesthesia is extraconal anaesthesia most widely used than retrobulbar. A mixture of 5 ml bupivacaine 0.75%, 5 ml lignocaine 2% with or without 1:200,000 adrenaline, and with or without 150 units of hyaluronidase is prepared in a 10 ml syringe.there are higher chances of complications in retrobulbar anaesthesia than Peribulbar anaesthesia.It is clear that serious complications can occur from all techniques of eye blocks. Before attempting to perform any regional orbital block, it is essential to learn the anatomy of orbital structures and the safe block technique. Dissection of a human cadaver orbit, when available.

CONCLUSION

Peribulbar anesthesia is a widely used and effective regional anesthetic technique for a variety of ocular surgeries. It provides reliable sensory anesthesia, akinesia (paralysis of eye muscles), and intraoperative comfort while avoiding the risks associated with general anesthesia but limitations in complex cases.
Compared to retrobulbar anesthesia, it has a safer profile with a lower risk of severe complications, making it particularly suitable for elderly and systemically compromised patients. However, its success depends on the expertise of the practitioner and proper patient selection.

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