Recent trends in regional ophthalmic anesthesia

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Abstract

Most ophthalmic surgical procedures are now performed under a local anesthetic technique but the provision of anesthesia in terms of skills and resources varies worldwide.

In this essay, we review the current practice and recent development of the different ophthalmic regional anesthetic techniques with special emphasis on risk\benefit profile,etiology,risk factors,treatment,safe performance and prevention of complications that ranges from trivile to life-threatening (crisis).

(Key words: Eye blocks, ophthalmic anesthesia, regional anesthesia complications, retrobulbar, peribulbar, sub-Tenon's)

DEDICATION TO

MY MOTHER AND MY FAMILY

ALL MY LOVE AND THANKFULNESS FOR THEIR HELP AND SUPPORT TO ACHIEVE THIS WORK .

GOD BLESS US.

Contents

►Chapter (1)

Anatomy……..…….…...3

►Chapter (2)

Assessment and Preparation……..……11

►Chapter (3)

Sedation for Ophthalmic Procedures……...….20

►Chapter (4)

Pharmacology of Regional Anesthetic ……..……32

►Chapter (5)

Ophthalmic Regional Anesthetic Techniques……41

►Chapter (6)

Complications of Ophthalmic Regional Anesthesia…….59

►Chapter (7)

Achievement of Adequate and Safe Blocks……..…75

► References……79

List of Figures

►**Figure 1:** The bony orbit is formed by seven bones conjoined together**.** …….....3

►**Figure 2:** The lateral orbital rim is set back in line with the globe equator…….... 4

►**Figure 3:** Globe in primary gaze ……..8

►**Figure 4:** The Ciliary ganglion in relation with other structures of the eye …….9

►**Figure 5:** Pathways in the Ciliary Ganglion……...10

►**Figure 6 :** Retrobulbar (intraconal) block and schematic representation of the intraorbital muscle cone ……..…….…… 43

►**Figure 7 :** Peribulbar (extraconal) block and schematic representation of the intraorbital muscle cone ……..……..46

►**Figure 8 :** Direction and Placement of Needle for Medial Peribulbar Injection……..……..47

►**Figure 9:** Globe position and inferonasal direction using forceps and scissors during sub-Tenon's block...……...49

►**Figure 10:** A sub-Tenon cannula is shown inserted through the dissected area ……..……49

►**Figure 11:** Posterior sub-Tenon's metal cannula 19 gauge (2.54 cm length)……..50

►**Figure 12**: Classic Van Lint technique……..…….52

►**Figure 13:** O'Brien technique for facial nerve block. ……53

►**Figure 14:** Areas covered by regional anaesthesia blocks……..54

►**Figure 15:** Supraorbital nerve block ……...……...54

►**Figure 16**: Supratrochlear nerve block… ……...……... 55

►**Figure 17:** Infraorbital nerve block…….. …….55

►**Figure 18**: Base of the brain & the path that anesthetic agents might follow……...63

►**Figure 19 -A**: needle inserted in the intraconal compartment (retrobulbar block)……...71

►**Figure 19 -B**: needle inserted in the extraconal compartment (peribulbar block)…..……...71

List of Tables

► **Table 1:** Classification of local anesthetic agents…….....32

► **Table 2:** Retrobulbar block……...…….....45

► **Table 3:**Peribulbar block…….……..47

► **Table 4:** Sub-Tenon's block……..50

List of Abbreviations

AAG : Alpha (1)-Acid Glycoprotein

CNS : Central Nervous System

CO_2 : Carbon dioxide

COPD : Chronic Obstructive Pulmonary Disease

CPR : Cardiopulmonary Resuscitation

DCR : Dacrocystorhinostomy

DTFNBA : Deep Topical Fornix Nerve Block Anaesthesia

GABA : Gamma-Amino Butyric Acid

IM : Intramuscular

INR : International Normalized Ratio

IOP : Intraocular pressure

IV : Intravenous

$NaHCO_3$: Sodium Bicarbonate

NSAIDs : Non-Steroidal Anti-Inflammatory Drugs

O_2 : Oxygen

OCR : Oculocardiac Reflex

Introduction

The use of ophthalmic regional anesthesia is gaining widespread day after day. Most eye operations can be performed under local anesthesia. Patient comfort, safety and low complication rates are the essentials of local anesthesia. The choice of which technique to use will always depend on a balance between the patient's medical conditions, cooperation, age and mental status bearing in mind that the large scale of patients with vision problems are the elder group. These elderly patients frequently have major diseases and problems that can disrupt a smooth procedure.

Many techniques are used nowadays for local ophthalmic anaesthesia namely, peribulbar, intraconal, periconal, combined intraconal-periconal, sub-conjunctival, sub-tenon and topical corneoconjuctival blocks. The provision of regional anesthesia for ophthalmic surgery especially cataract and anterior segment surgeries varies worldwide. They may be chosen to eliminate or preserve eye movement and both *non-akinetic* and *akinetic* methods are commonly used. In posterior segment and vitroretinal surgeries the use of local anesthetic techniques is recently growing wider as well.

Serious sight-and life-threatening complications have occurred following the local anesthetic techniques while less invasive than general anaesthesia, local anaesthesia is not without possible complications.

Complications of local anaesthesia for ophthalmic surgeries are directly related to most of the local anaesthetic agents used or the block technique itself.

In this review we will discuss anatomy of the globe, patient's selection for regional anaesthesia, preoperative patients' preparation and perioperative monitoring, the commonly used local anaesthetic techniques and drugs used in ophthalmic surgery,factors affecting achievement of adequate block, postoperative care and complications of ophthalmic regional anesthesia that ranges from trivial to life threatening.

Anatomy

As with all anesthetic techniques, thorough knowledge of the anatomy is essential. Anatomy of the orbit and its nerve supply is necessary to the safe practice of ophthalmic regional anesthesia. (1)

This chapter will cover the following points:

1- Anatomy of the Bony Orbit.

2- Extra-Ocular Muscles.

3- Motor and Sensory Nerve Supply.

4-Blood Supply

5- Orbital Fat.

6- Conjunctiva.

7- Tenon's Capsule.

8- Applied Anatomy.

1- Anatomy Of The Bony Orbit

- The eyes lie within two bony orbits, located on either side of the root of the nose. Each orbit is pear-shaped, with the optic nerve representing the stem. Seven bones conjoin to form the orbital structure (Fig. 1); frontal, zygomatic, maxillary, ethmoidal, sphenoid, lacrimal and palatine bone.(1)

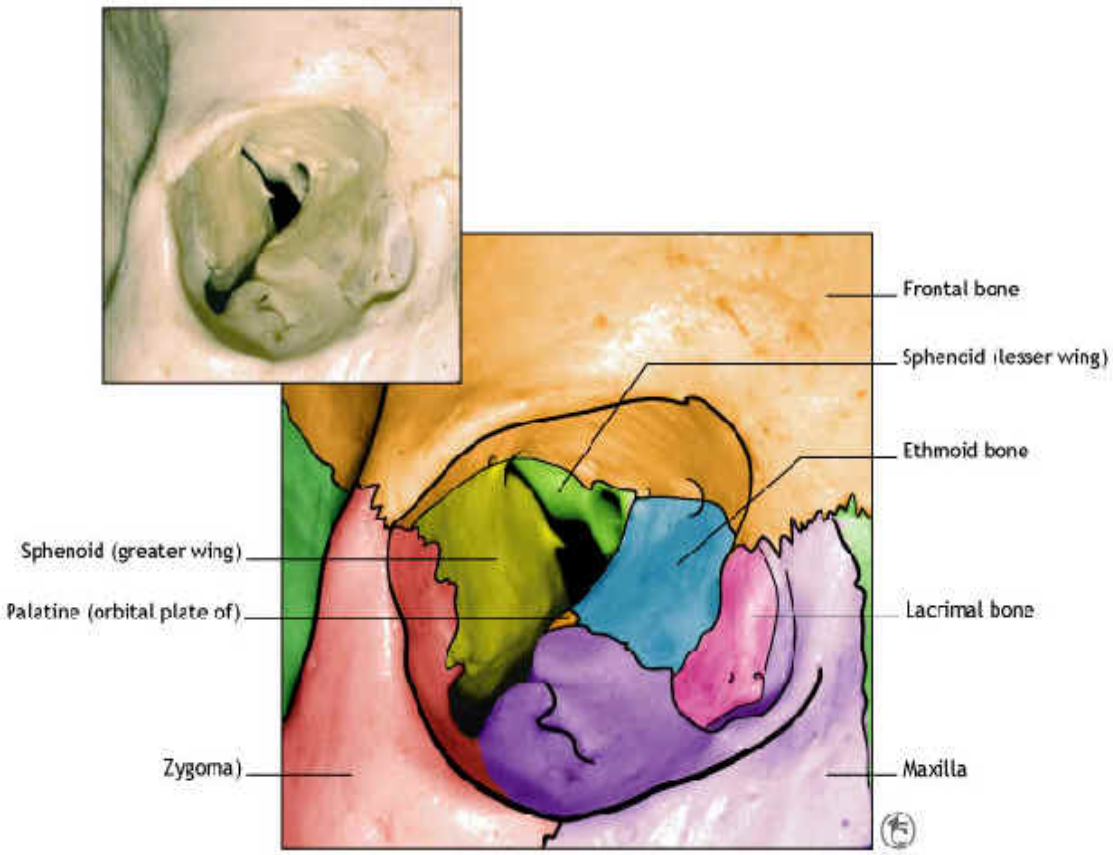

Fig. 1 –The bony orbit is formed by seven bones conjoined together. [1]

***Beard C,Quickert MH.Anatomy of the orbit**

The apex lies near the medial end of superior orbital fissure and contains the optic canal which communicates with middle cranial fossa.

The roof (superior wall) is formed by the orbital plate of the frontal bone and the lesser wing of sphenoid. The orbital surface presents medially by trochlear fovea and laterally by lacrimal fossa.

The floor (inferior wall) is formed by the orbital surface of maxilla, the orbital surface of zygomatic bone and the orbital process of palatine bone. Medially near the orbital margin is located the groove for nasolacrimal duct. Near the middle of the floor, located infraorbital groove, which leads to the infraorbital foramen. The floor is separated from the lateral wall by inferior orbital fissure, which connects the orbit to pterygopalatine and infratemporal fossa.

The medial wall is formed by the frontal process of maxilla, lacrimal bone, orbital plate of ethmoid and a small part of the body of the sphenoid.

The Lateral wall is formed by the orbital process of zygomatic and the orbital plate of greater wing of sphenoid. The bones meet at the zygomaticosphenoid

suture. The lateral wall is the thickest wall of the orbit. The optic foramen, which contains the optic nerve and the large ophthalmic artery, is at the nasal side of the apex (2).

The volume of the adult orbit is 30 ml³; whereas that of an average sized globe is 6.5 ml³. The typical dimensions at the rim are 35 mm vertically and 40 mm horizontally. The depth of the orbit from the inferior orbital rim to the optic foramen ranges from 42 to 54 mm [3]. The lateral orbital rim is set back 12 to 18 mm behind the cornea, allowing exposure of the globe to its equator (Fig. 2).

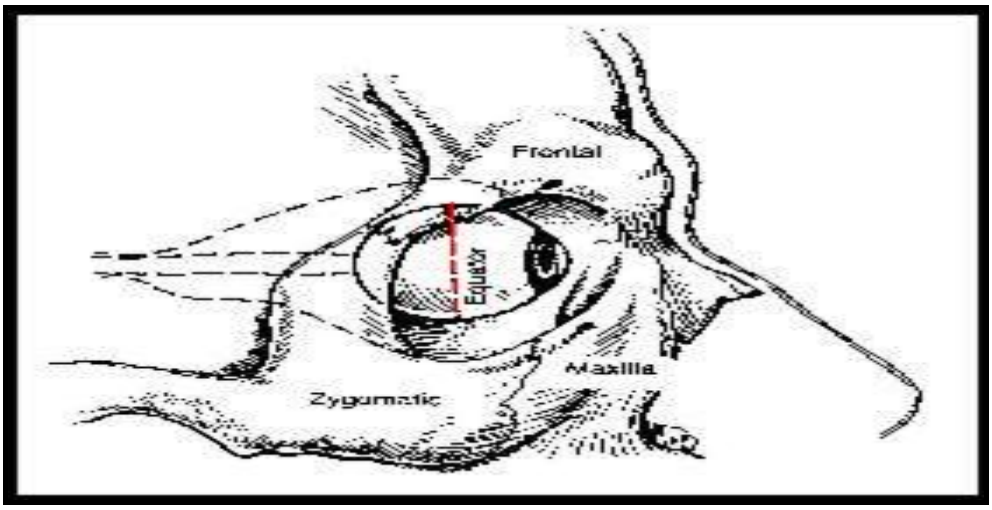

Fig. 2-The lateral orbital rim is set back in line with the globe equator. [2]

*** Bron AJ, Tripathi RC. Anatomy of the eye & orbit**

The orbital septum

A thin sheet of connective tissue called the orbital septum encircles the orbit as an extension of the periosteum of the roof and the floor of the orbit. It also attaches to the anterior surface of the levator muscle. Posterior to the orbital septum is the orbital fat. In both the upper and lower eyelids, the orbital septum attaches to the apponeurosis. The orbital septum thus provides a barrier to anterior or posterior extravasation of blood or the spread of inflammation.[4]

2-Extraocular Muscles

Each orbit contains 6 extraocular muscles that function together to move the eye: 4 recti muscles (superior, inferior, lateral, medial) and 2 oblique muscles (superior, inferior). The levator palpebrae muscle elevates the upper lid. The actions of each extraocular muscle are as follows:

- Medial rectus : Converging of eye globe
- Lateral rectus : Diverging
- Superior rectus : Elevation, adduction and intorsion
- Inferior rectus : Depression, adduction and extorsion
- Inferior oblique : Extorsion, elevation and abduction
- Superior oblique : Intorsion, depression, abduction

3-Motor And Sensory Nerve Supply

Motor Nerve Supply of the Extra-Ocular Muscles

There are three cranial nerves that supply motor function to the extra-ocular muscles; the oculo-motor cranial nerve, the trochlear cranial nerve, and the abducent cranial nerve. The latter two nerves supply one muscle each, the superior oblique and the lateral rectus, respectively. The oculo-motor nerve innervates the remaining four extra-ocular muscles, plus the levator palpebrae superioris and carries parasympathetic fibers designed for the sphincter muscle of the iris and the ciliary muscle. The motor nerves to the four recti muscles and the inferior oblique access their respective muscle bellies from within the muscle cone, whereas the trochlear nerve remains outside the cone and enters its muscle, the superior oblique at its supero-lateral edge. This anatomical

difference explains the delayed onset of akinesia following small volume intra-conal local anesthetic injection.[5]

The motor nerve supply to the extraocular muscles is easy to remember using the pseudoformula LR6(SO4)3 - lateral rectus by the sixth (abducent) cranial nerve, superior oblique by the fourth (trochlear) and the remainder by branches of the third (oculomotor) nerve.[5]

Sensory Nerve Supply:

Corneal and perilimbal conjuctival and superonasal quadrant of the peripheral conjunctival sensations are mediated through the nasociliary nerve from ophthalmic nerve. The remainder of the peripheral conjunctival sensation is supplied through the lacrimal(from ophthalmic), frontal(from ophthalmic) and infraorbital(the extension of maxillary nerve) nerves coursing outside the muscle cone; hence, intraoperative pain may be experienced if these nerves are not blocked. [5]

4-Blood Supply

Blood Supply to the Extraocular Muscles

The inferior and superior muscular branches of ophthalmic artery, lacrimal artery, and infraorbital artery supply the extraocular muscles.

Orbital Blood vessels:

The orbit receives its blood supply from the anterior and posterior ciliary arteries. The posterior ciliary vessels originate from the ophthalmic artery and supply the whole uveal tract, the sclera, the margin of the cornea and the major arterial circle of ciliary body via perforating scleral vessels.[6]