Ain Shams University
Faculty of Medicine
Department of Anesthesia
&. Intensive Care

Current Anesthetic Trends in Ophthalmic Surgery

Essay

Submitted for Partial Fulfilment of Master Degree in Anesthesiology

By

Mourad Maher Ali Shanab
M.B., B.Ch.

Under Supervision of

Prof. Dr. Ayman Mokhtar Kamaly
Professor of Anesthesiology & Intensive Care
Faculty of Medicine - Ain Shams University

Dr. Azza Atef Abd El-Alim
Assistant professor of Anesthesiology & Intensive Care
Faculty of Medicine - Ain Shams University

Dr.Mahmoud Hassan Mohammed
Lecturer of Anesthesiology & Intensive Care
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
2009

Acknowledgement

First of all, all gratitude is due to Allah for blessing this work until it has reached its end, as a part of his generous help throughout my life.

I would like to express my deepest gratitude to Prof. Dr. Ayman Mokhtar Kamaly, Professor of Anesthesiology and Intensive Care, Faculty of Medicine- Ain Shams University, for giving me the great support and encouragement throughout the whole work.

Also,it is my great pleasure to express my deep gratitude to Dr. Azza Atef Abd El-Alim, Assistant Professor of Anesthesiology and Intensive Care, Faculty of Medicine- Ain Shams University, for the effort and time she spent.

Also, I would like to express my deepest gratitude to Dr. Mahmoud Hassan Mohammed, Lecture of Anesthesiology and Intensive Care, Faculty of Medicine- Ain Shams University, for his close supervision, his science advice and for the great effort he has done throughout the whole work.

Contents

Abbreviations

AAG	Alpha acid glycoprotein
ACC	American college of cardiology
AHA	American heart association
C_3F_9	Perfluoropropane
CG	Ciliary ganglion
CHF	Congestive heart failure
CNS	Central nervous system
CO_2	Carbon dioxide
COPD	Chronic obstructive pulmonary disease
DCR	Dacrocystorhinostomy
DTFNBA	Deep topical fornix nerve block anesthesia
ECG	Electro-cardiography
EEG	Electro-encephalography
EMLA	Eutectic mixture of local anesthetic
EOM	Extraocular muscle
ERV	Expiratory reserve volume
ETT	Endotracheal tube
EUA	Examination under anesthesia
Fe++	Ferrous Iron
Fe+++	Ferric Iron
FRC	Functional residual capacity
g	Gram
GFR	Glomerular filtration rate
GG	Gasserian ganglion
IO	Inferior oblique
IOL	Intra ocular length
IOP	Intra ocular pressure
IPPV	Intermittent positive pressure ventilation
IR	Inferior rectus
IV	Intravenous
Kg	Kilogram
LCN	Long ciliary nerve
LMA	Laryngeal mask airway
LR	Lateral rectus
LV	Left Ventricular
M3	Muscarinic receptors
MAO	Monoamine oxidase

mg	Milligram
MI	Myocardial infarction
ml	Milliliter
MR	Medial rectus
N_2O	Nitrous oxide
$NaHCO_4$	Sodium bicarbonate
NPO	Nil per os
NSAIDs	Non-steroidal anti-inflammatory drugs
OCR	Oculo-cardiac reflex
P_aCO_2	Partial pressure of carbon dioxide
P_aO_2	Partial pressure of oxygen
PBA	Peribulbar anesthesia
PK	Perforating keratoplasty
PONV	Postoperative nausea and vomiting
RV	Residual volume
SA	Sino auricular
SBE	Sub acute bacterial endocarditis
SBP	Systemic blood pressure
SCH	Supra choroidal hemorrhage
SCN	Short ciliary nerve
SF_6	Sulfur hexafluoride
SO	Superior oblique
SR	Superior rectus
SVR	Systemic vascular resistance
TLC	Total lung capacity
V	Vagus nerve
VC	Vital capacity
X	Trigeminal nerve
µg	Microgram

List of Figures

List of Tables

Introduction

General anesthesia for eye surgery presents a number of special considerations for the anesthesiologist. Patients are frequently at the extremes of age and in the case of the elderly concomitant medical conditions are not uncommon, particularly diabetes, ischemic heart diseases and hypertension ***(Kumar, 2007).***

Anesthetic requirements for ophthalmic surgery are dictated primarily by patient's clinical condition, the nature of the proposed surgery, the surgeon's preference and the patient's wishes ***(Kumar, 2007).***

Although regional anesthesia is suitable for most ophthalmic operations, general anesthesia is still commonly used worldwide especially for prolonged surgical procedures and regional anesthesia is often reserved for those patients who are unfit for general anesthesia. However, this pattern is currently changing where regional anesthesia becomes a real alternative for general anesthesia during ophthalmic surgery especially with the recent trends towards day-care surgery ***(Aleman, 1995).***

Eye blocks provide excellent anesthesia for ophthalmic surgery and success rates are high. Satisfactory anesthesia and akinesia can be obtained with both needle and cannula ***(Kumar, 2007).***

Although rare, orbital injections may cause severe local and systemic complications. Knowledge of orbital anatomy and training are essential for the practice of safe orbital regional anesthesia ***(Kumar, 2007).***

Although retrobulbar and peribulbar regional anesthetic techniques are used (by both anesthesiologists and ophthalmologists) in various types of eye surgery, topical anesthesia of the conjunctiva and cornea, followed—as needed—by sub-Tenon's block, is now common in routine cataract surgery. Because of the risk of life-threatening complications in ophthalmic regional anesthesia, the services of an anesthesiologist must be available and training of anesthesia residents in ophthalmic regional anesthesia is highly recommended ***(Kallio and Rosenberg, 2005).***

Formerly, the term "local-standby" described the anesthesiologist's role in these cases. However, this term has been replaced by "monitored anesthesia care" since the anesthesiologist should be continually monitoring the patient during surgery and not just "standing by***"(Burroughs, et al, 2003)*****.**

<u>**Review Article**</u>

Current Anesthetic Trends in Ophthalmic Surgery

Essay

Submitted for Partial Fulfilment of Master Degree inAnesthesiology

By

Mourad Maher Ali Shanab

M.B., B.Ch.

Under Supervision of

Prof. Dr. Ayman Mokhtar Kamaly

Professor of Anesthesiology & Intensive Care

Faculty of Medicine - Ain Shams University

Dr. Azza Atef Abd El-Alim

Assistant professor of Anesthesiology & Intensive Care

Faculty of Medicine - Ain Shams University

Dr.Mahmoud Hassan Mohammed

Lecturer of Anesthesiology & Intensive Care

Faculty of Medicine - Ain Shams University

Basic knowledge of the anatomy of the orbit and its contents is necessary for the successful performance of anesthesia for ophthalmic surgery (1).

Skilled administration of either local or general anesthesia contributes directly to the successful outcome of the surgery. Close cooperation and clear understanding between surgeon and anesthesiologist are essential. Risks and benefits must be assessed carefully and the anesthetic technique selected accordingly. Ophthalmic surgery can be classified into subspecialties and intraocular or extraocular procedures may be performed each has different anesthetic requirements (2).

Patients who present for eye surgery are frequently at the extreme ends of age. Both neonatal and geriatric anesthesia present special problems (2).

Although regional anesthesia is suitable for most ophthalmic operations, general anesthesia is still commonly used worldwide especially for prolonged surgical procedures and regional anesthesia is often reserved for those patients who are unfit for general anesthesia. However, this pattern is currently changing where regional anesthesia becomes a real alternative for general anesthesia during ophthalmic surgery especially with the recent trends towards day-care surgery (3).

To conduct safe regional anesthesia, preoperative evaluation of the patient’s mental status is extremely important. The patient should be alert, cooperative, and comfortable and must accept the idea of being awake during surgery. In addition to the mental status, the ability of the patient to lie supine without dyspnea, persistent cough, discomfort, or pain should also be carefully evaluated. Anesthesiologists are the best personnel to handle any possible systemic complications that may arise after the administration of ophthalmic blocks. Additionally, the availability of long-acting local anesthetics, which provide adequate surgical anesthesia as well as prolonged, postoperative analgesia, has eliminated the need for postoperative narcotics and their associated potential for respiratory depression, nausea, and vomiting (4).

Regional anesthesia is commonly used for ophthalmic surgery. Various Ophthalmic surgeries require a potent motor blockade (akinesia) of the eyeball and eyelids. Retrobulbar anesthesia was the only technique used for many years since the late 1800s, but became more widely used in the 1940s, (5).

In an attempt to reduce some of the complications of retrobulbar anesthesia, peribulbar anesthesia was introduced in the 1960s However; peribulbar anesthesia has some limitations (6).

Intraconal and extraconal blocks using needles are commonly used. The techniques are generally safe but although rare, serious sight- and life-threatening complications have occurred following the inappropriate placement of needles. Sub-Tenon’s block was introduced as a safe alternative to needle techniques but complications have arisen following this block as well. Currently, there is no absolutely safe ophthalmic regional block. It is essential that those who are involved in the care of these patients have a thorough knowledge of the techniques used (7).

References

1-Varvinski AM, Eltringham R (1996), Anesthesia for ophthalmic surgery, *Update in anesthesia*, issue 6, article 3.

2- Aitkenhead AR, Rowbotham DJ, Smith G (2001). Anesthesia for ophthalmic surgery. In: Aitkenhead AR, Rowbotham DJ, Smith G, eds. *Textbook of anesthesia*. 4^{th} ed. London, New York, Oxford, Philadelphia, Sydney, Toronto: Churchill Livingstone. pp. 594-605.

3- Aleman CE (1995). Significant developments in local anesthesia. In: Boyd BF(ed). *Highlights of Ophthalmology*, New York Arcata Book. pp. 23-65.

4- Prithviraj P (2003). Regional Anesthesia Options in Surgical Specialties. In: Prithviraj P ed., *Textbook of regional anesthesia*. New York, Edinburgh, London, Melbourne, Tokyo: Churchill Livingstone. pp. 512-77.

5- Ripart J, Lefrant JY, Vivien B, Charavel P, Fabbro-Peray P, Jaussaud A, et al (2000), Ophthalmic regional anesthesia: medial canthus episcleral (subtenon) anesthesia is more efficient than peribulbar anesthesia: a doubleblind randomized study, *Anesthesiology*, vol. 92, PP.1278-85.

6- Edge R, Navon S (1999), Scleral perforation during retrobulbar and peribulbar anesthesia: risk factor and outcome in 50,000 consecutive injections, *J Cataract Refract Surg*, vol. 25, PP. 1237–44.

7- Kumar CM, Dodds C (2006), Ophthalmic Regional Block, *Ann Acad Med Singapore*, vol. 35, PP. 158-67.

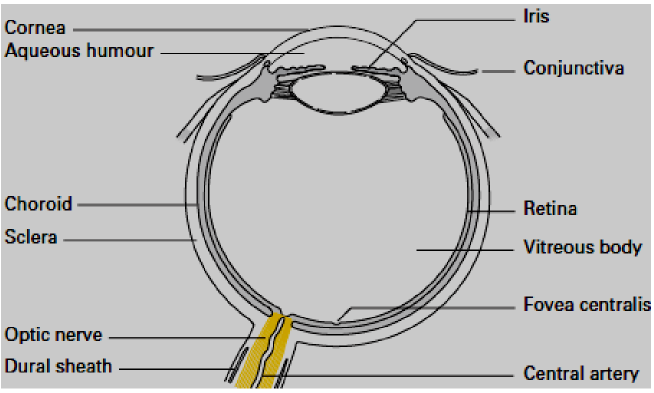
Anesthetic Ophthalmic Anatomical Considerations

Basic knowledge of the anatomy of the orbit and its contents is necessary for the successful performance of anesthesia for ophthalmic surgery (***Varvinski and Eltringham, 1996).***

(1) The Eyeball.

Position of the eyeball:

The eyeball is situated in the anterior part of the orbital cavity, closer to the roof than to the floor and nearer to the lateral than to the medial wall. The orbital margins have a fairly constant relationship to the eyeball. A vertically straight line applied to the superior and inferior orbital margins passes in contact with the cornea or slightly anterior to it, a horizontally straight line applied to the lateral and medial margins reveals that about one-third of the eyeball lies anterior to it. The anteroposterior diameter of the eye measures about 24 mm, the vertical diameter is about 23 mm, and horizontal diameter is 23.5 mm The eyeball comprises three concentric layers, an outer fibrous layer (the cornea and sclera), a middle vascular layer (the iris, ciliary body and choroid) and an inner neural layer (the retina)***(Wrong, 1991).***



-Figure (1): Horizontal section in the eye ***(Ellis et al, 2004).***

Intraocular contents consist of the following:

Aqueous humour in the anterior chamber (space lined by the cornea, iris, and pupil) and the posterior chamber (space behind the iris and in front of the vitreous), the crystalline lens, and the vitreous humour (space behind the lens and in front of the retina)(Figure 1). The optic nerve pierces the globe just above and 3 mm medial to the posterior pole. The nerve has a diameter of 1.5 mm and an intraorbital length of about 30 mm ***(Bruce, 1992).***

(2) The orbit

The orbit is a four sided bony pyramid cavity with its base forming the orbital opening and its apex placed posteromedialy. It has a total volume of about 30 ml. The medial wall of each orbit is in the sagittal plane of the head and parallel to the contralateral medial orbital wall. The angle between the lateral walls of the two orbits is approximately 90 degree and the angle between the lateral and medial walls of each orbit is approximately 45 degree (Figure 2). It should be noted that the apex including the optic foramen is in the same sagittal plane as the medial orbital wall ***(Varvinski and Eltringham, 1996).***

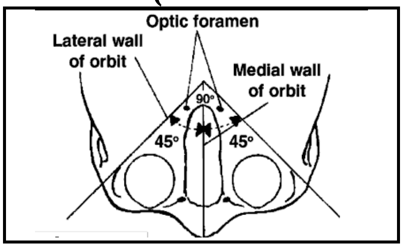


Figure (2): Diagrammatic representation of the angles of the lateral and medial walls of the orbits in transverse section ***(Varvinski and Eltringham, 1996).***

At the apex is the optic foramen, transmitting the optic nerve, and ophthalmic artery, and the superior and inferior orbital fissures transmitting the other nerves and vessels. The depth of the orbit from the inferior orbital rim to the apex ranges from 42 to 55 mm. this has important implications when injections are made in to the orbit. The deeper the injection the narrower is the space, and the greater the