Sub-Tenon's anesthesia as a well tolerated and effective procedure for ophthalmic surgery

Essay
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LIST OFABBREVIATIONS

AAGBI	Association of Anesthetists of Great Britain & Ireland
ACEI	Angiotensin-converting enzyme inhibitors
ACF	Anterior cranial fossa
CG	Ciliary ganglion
CHF	Congestive heart failure
CNS	Central nervous system
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CO_2	Carbon dioxide
COPD	Chronic obstructive pulmonary disease
DCR	Dacrocystorhinostomy
ECG	Electro-cardiography
EOM	Extraocular muscles
ETT	Endotracheal tube
EUA	Examination under anesthesia
g	Gram
IM	Intra muscular
IO	Inferior oblique
IOL	Intra ocular length
IOP	Intra ocular pressure
IPPV	Intermittent positive pressure ventilation
IR	Inferior rectus
ISAS	Iowa satisfaction with anesthesia scale
IV	Intravenous
JCAHO	Joint Commission on Accreditation of Healthcare Organizations

K	Potassium
Kg	Kilogram
LA	Local anesthetic
LCN	Long ciliary nerve
LMA	Laryngeal mask airway
LR	Lateral rectus
MAOI	Monoamine oxidase inhibitors
MCF	Middle cranial fossa
mg	Milligram
ml	Milliliter
mm	Millimeter
MR	Medial rectus
N_2O	Nitrous oxide
Na	Sodium
$NaHCO_4$	Sodium bicarbonate
NPO	Nil per os
NSAIDs	Non-steroidal anti-inflammatory drugs
OAA/S	Observer's Assessment of Alertness/Sedation Scale
OASS	Ocular anesthetic scoring system
OCR	Oculo-cardiac reflex
PABA	Para-aminobenzoic acid
P_aCO_2	Partial pressure of carbon dioxide
P_aO_2	Partial pressure of oxygen
PBA	Peribulbar anesthesia
pH	Power of hydrogen or Pondus Hydrogenii
pKa	Acid dissoition constant

PPRF	Paramedian pontine reticular formation
PONV	Postoperative nausea and vomiting
RBA	Retrobulbar anesthesia
SBP	Systemic blood pressure
SCH	Supra choroidal hemorrhage
SCN	Short ciliary nerve
SO	Superior oblique
SR	Superior rectus
STLA	Sub-Tenon’s local anesthesia
SVR	Systemic vascular resistance
UMSS	University of Michigan Sedation Scale
VSRS	Vancouver Sedative Recovery Scale
µg	Microgram

LIST OF FIGURES

Practice of eye surgery has expanded and ophthalmic regional anesthesia has gone hand in hand to cope with that expansion of the field of eye surgery ***(Bacon, 2006)***

Eye anesthesia can be local or general, depending on the procedure and the specifics of the patient's case. During the development of a surgical plan, the surgeon, patient, and anesthesiologist will discuss the anesthesia options and decide on the best fit for the patient and the case ***(McGoldrick and Foldes, 2006)***.

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 ***(McGoldrick and Gayer, 2006)***.

The properties of an ideal local anesthetic technique for ophthalmic surgery include globe anesthesia, akinesia, absence of external pressure on the globe, minimal injectante volume and absence of serious complications ***(Guise, 2003)***.

Today various methods of local anesthesia are in use including retrobulbar anesthesia (RBA), peribulbar anesthesia (PBA), and sub-tenon’s local anesthesia (STLA). The retrobulbar technique is associated with several uncommon but potentially serious complications such as scleral perforation, retrobulbar hemorrhage, brainstem anesthesia and optic nerve damage. The peribulbar technique offers some advantages over retrobulbar block. A large injectant volume, however, is required and the risk of sclera perforation is still present. These complications arise because of trauma produced by passing a sharp needle blindly into the retrobulbar space ***(Kumar and Dowd, 2008)***.

In 1990 Stevens and others described the technique of passing a blunt probe into the subtenon’s capsule by blunt dissection. It is not a new technique since it was described as early as 1884 by Turnbull. It was found that Sub-Tenon’s local anaesthesia is a simple, safe and atraumatic technique. Its benefits are numerous and it can be proposed as a good alternative to peribulbar or retrobulbar anesthesia in anterior and posterior segment eye surgery ***(Kumar et al, 2005)***.

In this review we will discuss anatomy of the orbital cavity and the globe which are necessary for the successful performance of local anesthesia for ophthalmic surgeries as well as physiological considerations during regional eye blocks. also pharmacological considerations of drugs used during regional eye blocks as local anesthetics regarding their pharmacodynamic and pharmacokinetic properties, additive drugs used within local anesthetics and drugs used during sedation at performing eye blocks. Preoperative patients' preparation and perioperative monitoring, the commonly used local anesthetic techniques for drug delivery and complications of ophthalmic regional anesthesia that ranges from trivial to life threatening complications are also discussed, focusing mainly on advantages of sub-tenon's local anesthesia over other types of ophthalmic local anesthesia.

PART 1: ANATOMICAL CONSIDERATIONS FOR OPHTHALMIC REGIONAL ANESTHESIA

With all regional anesthetic techniques, knowledge of the anatomy of the orbit and its contents is essential to the safe practice of ophthalmic regional anesthesia. The following shows important anatomical considerations during performing regional eye blocks ***(Kumar and Dowd, 2008)***

ANATOMY OF THE ORBITAL CAVITY

The orbit is simply a cavity or socket in the skull. It is the main bony frame that functions to protect, support, and maximize function of the eye. The orbit is a cavity shaped as a quadrilateral four-sided pyramid with its base in plane with the orbital rim anteriorly and its apex directed postero-medially ***(Kumar and Dowd, 2008)***.

(A) BOUNDARIES OF THE ORBITAL CAVITY

Seven main bones conjoin to form the orbital structure; the maxillary, frontal, zygomatic, ethmoid, sphenoid, palatine, and lacrimal bones. These bones Form together the following boundaries of each orbital cavity:

I: The orbital roof: It is triangular in shape. Formed mainly of the orbital process of the frontal bone and the lesser wing of sphenoid posteriorly, where the optic foramen is formed at the orbital apex ***(Johnson, 1996)***.

II: <u>The orbital floor:</u> It is the shortest orbital boundary. Formed by three bones: The orbital plate of the maxilla mainly, the orbital plate of the zygomatic bone anteriorly and the orbital plate of the palatine bone posteriorly ***(Johnson, 1996)***.

III: <u>The Medial wall of the orbit</u>: It is quadrangular in shape Formed by the frontal process of the maxilla, the lacrimal bone inferiorly, small part of the body of sphenoid, and centrally the thin (0.2-0.4 mm only) lamina papyracea (i.e. translucent and paper-like appearance) of the ethmoid ***(Johnson, 1996)***.

IV: <u>The lateral wall of the orbit</u>: It is formed by the greater wing of sphenoid and the zygomatic bone anteriorly. It is separated from the roof by the superior orbital fissure and from the floor by the inferior orbital fiisure ***(Johnson, 1996)***.

(B) RELATIONS OF THE ORBITAL CAVITY

<u>Superior</u> to the roof of the orbit, the frontal air sinus is located anteriorly and the rest is related to the anterior cranial fossa (ACF) containing the frontal lobe of the cerebral hemisphere and its covering meninges. ***<u>Inferior</u>*** to the floor of the orbit is the maxillary air sinus (antrum). Also the infraorbital nerve and blood vessels lie within the infraorbital canal are seen below the inferior orbital rim. ***<u>Laterally,</u>*** the orbit is related to the temporal fossa in its anterior portion and the middle cranial fossa (MCF) containing the temporal lobe of the cerebral hemisphere and its investing meninges posteriorly. ***Medially***, the orbital wall is related to the nasal cavity anteriorly, the ethmoid air sinus in the middle part and the sphenoid air sinus posteriorly ***(Johnson, 1996)***.

(C) ANATOMICAL POSITION AND DIMENSIONS

The orbits are aligned so that the medial wall of each orbit is in the sagital section and are parallel to each other. The lateral walls are nearly perpendicular to each other (i.e. angle measured between them is approximately 90 degrees). The arc from medial to lateral wall in each orbit is approximately 45°. As a result lines dropped through a central anterior-to-posterior axis of each orbit bisect nearly at a 45° angle, making the orbital axis to run from behind forwards laterally and slightly downwards. The average dimensions of the orbit are as follows ***(Smerdon, 2000)***:

- Height of orbital margin: 40 mm
- Width of orbital margin: 35 mm
- Depth of orbit: 40-55 mm
- Interorbital distance: 25 mm
- Volume of orbit: 30 cm^3 (7ml of which is occupied by the globe and its muscular cone with the remainder composed of loose connective tissue)