Local Anaesthesia In Ophthalmic Surgery

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Local anaesthesia is currently preferred for many ophthalmic surgeries as it is associated with reduced morbidity and mortality, early patient mobilization, improved patient satisfaction and reduced hospital stay when compared with general anaesthesia. 90% of all ophthalmic surgeries can be done under local anaesthesia. Local anaesthesia can be administered topically or by orbital injections.

A) Topical anaesthesia: It is becoming increasingly popular for phacoemulsification surgery although many other procedures may also be performed topically.

Procedures that can be done under topical anaesthesia in a suitable patient:

- Application of surgical scrubs Povidone 2.5%-10%
- Tonometry
- Excision of superficial conjunctival lesions such as cysts and naevi
- Removal of foreign bodies
- Removal of sutures
- Debridement of corneal epithelium
- Corneal scrapings/biopsy in infective keratitis
- Removal of pterygia and Conjunctival autografts
- Refractive surgery
- ECCE and phacoemulsification

Although topical anaesthesia is an extremely simple technique, it may add to the complexities of surgery as operating conditions may be more challenging and it demands understanding and increased cooperation from the patient. The demands on the surgeon and the patient limit the use of topical anaesthesia to relatively short procedures. It achieves anaesthesia of cornea, conjunctiva and anterior sclera. It does not anaesthetize eye lids, posterior sclera, extraocular muscles and intraocular structures.

Pre-assessment: Careful patient selection is essential if topical anaesthesia is to be used safely and effectively. Patient need to be co-operative and not unduly anxious. A good surgeon-patient relationship and communication facilitates the procedure. Patient must be able to lie still and be comfortable in the supine position.

Perioperative care: Patient should be counselled well and consent obtained for surgery under topical anaesthesia. Communication with the patient while operating is a surgical skill that has to be acquired. Application of local anaesthetic drops should start 20-30 minutes before surgery. Different regimes are described but in general two or three drops are instilled every five minutes. Sufficient absorption should occur over this period to render the surface of the eye anaesthetized. As the cornea is avascular, once absorbed the local anaesthetic remains for approximately half an hour. Additional drops can be given at any stage during the operation if discomfort is experienced. The brightness of the microscope light source should be lowered to reduce photophobia and limit patient distress.

- Topical anaesthetic application alone produces detectable levels of local anaesthetic agent in the anterior chamber and provides good analgesia. However certain manoeuvres such as iris manipulation, IOP fluctuations and insertion of intraocular lens can be uncomfortable. Any discomfort is better tolerated if
the patient is fully informed preoperatively. Because visual function is maintained during surgery, the patient may be more aware of the operative procedures and some patients find this stressful and often request sedation. Short acting intravenous drugs such as midazolam are popular choices although premedication with oral benzodiazepines may be just as effective.

**Choice of topical drops** :- Amides preferred over ester preparations. There is no consensus on which topical local anaesthetic eye drop provides the best analgesia. Tetracaine 0.50 %, Amethocaine, Proparacaine 0.50 %, Lignocaine 1-4 %, and Bupivacaine 0.50-0.75 % have all been used successfully. Availability may determine the clinicians choice but it is essential that the preparation is preservative free. Small sponge soaked with the drops can be kept in the inferior and superior fornix or a ring saturated with drops can be placed in the paralimbal region to maintain corneal clarity.

**Intra cameral injection** :- To improve analgesia, the local anaesthetic can be injected intraoperatively into the anterior chamber of the eye. The “intracameral” injection produces superior analgesia improving comfort and co-operation. The drug should be preservative free as Benzalkonium chloride is toxic to corneal endothelium. 0.5 ml of lignocaine 1 % is the most popular solution used. There is no difference in anaesthetic effect between bupivacaine 0.50 % and lidocaine 1 % but the possibility of damage to corneal endothelium occurs with bupivacaine. Anaesthetic solution is washed out by injection of viscoelastic material after 15-30 seconds.

**Anaesthetic result** :- Patient satisfaction with intraoperative analgesia after topical anaesthesia appears comparable to that of orbital injection techniques. Surgically related complication rates under topical anaesthesia are similar to conventional orbital blocks. However without akinesia an inexperienced surgeon may experience some difficulty with capsulorrhexis and phacoemulsification. On the other hand the lack of akinesia may be used by the surgeon to his advantage as the patient can be asked to consciously fix or alter their gaze during the operation.

- In the event the patient becomes distressed or the procedure becomes complicated or lengthened, a subtenon block can be administered to provide a retrobulbar analgesia with akinesia.

**Post operative care** :- Topical anaesthesia does not cause unwanted postoperative ptosis, or diplopia, nor does it affect the secretion of tears. As the protective mechanism of the eye is preserved it is not essential that the eye be patched. The rapid return of visual function facilitates an early discharge from the hospital.

**B) Orbital injections**

**Advantages** :-
- Attains anaesthesia of conjunctiva, sclera, cornea, intraocular structures and extraocular structures
- Extraocular movements are greatly eliminated
- Superior rectus suture can be used
- No restriction to the extent of intraocular manipulation

**Disadvantages** :-
- Pain & anxiety of injection
- Post operative patching of the eye is necessary

<table>
<thead>
<tr>
<th>Advantages of Topical Anaesthesia</th>
<th>Disadvantages of Topical Anaesthesia</th>
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<tbody>
<tr>
<td>1. Absence of pain of injection</td>
<td>1. No intraocular anaesthesia</td>
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<td>2. No complications of injection</td>
<td>2. Iris manipulation painful</td>
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<td>3. No temporary visual loss</td>
<td>3. Discomfort on IOL insertion &amp; IOP fluctuation</td>
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<td>4. No need to patch after surgery</td>
<td>4. Anxiety due to full awareness of surgery</td>
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<td>5. Day care procedure</td>
<td>5. No akinesia</td>
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<td>6. No lignocaine toxicity</td>
<td>6. SR suture painful / oculocardiac reflex</td>
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<td>7. No ptosis</td>
<td>7. Photophobia due to microscope light</td>
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<td>8. If on anti coagulants can be contd</td>
<td>8. Difficulty to manage complications</td>
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<td>9. No diplopia</td>
<td>9. suited for short procedures only</td>
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<td>10. No systemic side effects</td>
<td>10. SPK, corneal haze</td>
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<td>11. Needs very co-operative patient</td>
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<td>12. Aware of pressure and discomfort of speculum</td>
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<td>13. May need sedation</td>
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Complications like retrobulbar haemorrhage, Globe perforation, and optic nerve injury

**Anaesthetic agent:** A mixture of 5ml of 0.50 % bupivacaine plus 5ml of 2 % xylocaine with 1,200,000 adrenaline and 75 units of of hyaluronidase (one vial / ampoule is 150 units). One ampoule of hyaluronidase can be mixed in two bottles of xylocaine. Lignocaine provides early action. Bupivacaine prolongs the efficacy. Hyaluronidase permits diffusion into orbit. Adrenaline decreases the absorption and there by prolongs the duration of anaesthesia and reduce bleeding during surgery and also prevents surge in plasma levels. Adrenaline is contraindicated in patients with hypertension, cardiovascular disease and cerebrovascular disease.

**Routes of administration**

1) Peribulbar injection
2) Parabulbar injection
3) Retrobulbar injection

Peribulbar injection :- Also known as extraconal anaesthesia as the tip of the needle is outside the muscle cone. This technique is as effective as retrobulbar block and has almost replaced Retrobulbar block (Fig. 1a & b).

Procedure- The patient in supine position is asked to look straight ahead in primary position. 24-25mm long 23-26 gauge needle can be used. The needle can be inserted either transconjunctivally or trans cutaneously at the junction of middle 2/3rd and lateral 1/3rd of lower lid. The needle is held perpendicular to the orbital margin and advanced adjacent and parallel to orbital floor for about 2.5 cm. After gentle aspiration of syringe to alleviate possible entry of needle into a blood vessel, 5ml of anaesthetic agent is injected into the lateral adipose tissue of the orbit. Injected solution diffuses into the superior, nasal and inferior compartments of the posterior orbit while inferior sulcus of the lower lid is kept compressed by the surgeons fingers. Filling up of the superior lid furrow and drooping of the upper lid are early signs of the block coming into action.

Ocular compression is applied for few minutes. Then just medial to medial canthus same needle is inserted to a depth of 2.5 cm and a further 3 ml is injected. Alternatively second injection may be given just interomedial to supra orbital notch but is likely to cause more complications. Anaesthesia & analgesia begin in 5 minutes and is maximum in 15 minutes time. Supplementary injections may be necessary inferiorly for persisting inferolateral movements and superiorly to block superior and medial movements.

**Do’s and Do not’s & Tips for a good block**

- Use primary gaze position or down & out
- Avoid medial gaze as it rotates the optic nerve to injection site
- Bevel of the needle towards the globe
- Align the needle tangential to the globe
- Use fine sharp needle
- Select an avascular site
- Needle inserted perpendicular to orbital margin and parallel to floor of orbit
- Have a sound anatomic knowledge
- Avoid extraocular muscles
- If sclera is touched eyeball turns downwards
- Always maintain verbal contact with patient
- Measure axial length and extra caution applied in long myopic eyes

**Parabulbar anaesthesia / sub tenons block / pin point anaesthesia**

Anaesthetic agent is injected into posterior subtenon space bathing the nerves and muscles within the cone. A mixture of 2.5 ml of Xylocaine 2 % and 2.5 ml of bupivacaine 0.5 % is flushed into the sub tenon space.
by a blunt cannula after dissecting the conjunctiva under topical anaesthesia half way between inferior limbus and fornix. All four quadrants can be used but the infero nasal quadrant is preferred. This quadrant allows good fluid distribution superiorly while avoiding the area for surgery and damage to the vortex veins. Short ciliary nerves are blocked as they pass from the sub tenon space to the globe causing loss of sensation.

Advantages & disadvantages :- Parabulbar anaesthesia completely avoids vascular and optic nerve injury. It requires only low volumes of the drug. It provides better anaesthesia to iris and anterior segment. But it causes more postoperative morbidity in the form of chemosis and subconjunctival haemorrhage.

Complications :-

Retrobulbar anaesthesia / Intraconal anaesthesia

Technique :- A 31 mm long 25 gauge needle is inserted through the conjunctiva or skin in the infero temporal quadrant at the junction of lateral 1/3rd and medial 2/3rd of inferior orbital margin. The needle is directed posteriorly, upward and medially towards the lower edge of the superior orbital fissure at the apex of the orbit or towards midway between occiput and opposite mastoid process. The needle enters the central space just behind the globe. As the needle pierces the intermuscular septum between the lateral rectus and inferior rectus muscles, the feel is altered. Globe is continuously observed during the needle placement. A volume of 2-4 ml is injected after aspiration. Ocular compression enhances the effect dramatically (Fig. 3).

Retrobulbar haemorrhage – More common in very old patients with fragile vessels, patients with vascular and haematological disease, coagulation failure, and those on drug therapy with aspirin, NSAIDS, steroids and anti coagulants. Retrobulbar haemorrhage manifests as ecchymoses, periorbital haemorrhage, subconjunctival haemorrhage, proptosis and raised IOP. Proptosis, visual acuity, pupils, pain, IOP and arterial patency needs to be monitored in the acute phase of severe orbital haemorrhage. Surgery has to be postponed.

Globe perforation :- Perforation is seen in myopic eyes longer than 26 mm especially those with posterior staphyloma. Poor patient co-operation, jerky movements of head, eye and face can cause perforation.

Optic nerve damage :- The tip of the needle may pierce the optic nerve and cause optic nerve damage leading to optic atrophy (Fig. 4).

Vascular occlusion

Myotoxicity - Extra ocular muscle palsies causing diplopia and ptosis

Combined retro peribulbar block :-

Multiple communications between extraconal and intraconal compartments have been demonstrated by CT studies using radio contrast material. Thus the injected material diffuses from one to the other. This division into extraconal, intraconal components is artificial, because the globe, extraocular muscles and the septal compartments function as a unit. and there are no anatomically discrete divisions. A combined intraconal and extraconal block may be effective when repeated peribulbar fails to take effect.
Facial nerve block:-
Orbicularis spasm affecting intraocular surgery can be alleviated by blocking the facial nerve. Facial nerve may be blocked at various sites

Van Lint block- Terminal branches to orbicularis muscle are blocked at the lateral orbital margin and along the superior and inferior orbital margin.

O’Brien block- facial nerve is blocked as it crosses the condyle of the mandible 2mm below the tragus of the ear.

Atkinson block – Facial nerve blocked midway between stylomastoid foramen and orbicularis oculi.

Spaeth block – nerve is blocked before it divides after emerging from the stylomastoid foramen.

Systemic complications of local anaesthetic agents
Systemic complications may be due to overdose or accidental intravascular injection or due to allergy to the drug or the preservative. Accidental injection can occur into CSF through the duramater around the optic nerve.

Safe dose of Local anesthetic
1. Xylocaine 2% without adrenaline – 3mg / kg (maximum 10 ml )
2. Xylocaine with adrenaline - 7 mg / kg (maximum 20 ml)
3. Bupivacaine with or without adrenaline - 2mg /kg (maximum 25 ml)

How to minimize toxic effects
1. Low volume at the rate of 1ml /10 second
2. Low concentration of the drug
3. Mix different LA drugs like Xylocaine & bupivacaine
4. Use adrenaline as adjuvant if not contraindicated
5. Increase threshold to local anesthetics by premedicating with diazepam or midazolam

Signs and symptoms of toxicity
There is no strict correlation between blood levels and toxic symptoms

a) Pre excitation phase
Circumoral or tongue numbness (earliest feature)
Light headedness, delirium, tinnitus
Visual disturbances – nystagmus, diplopia, amaurosis

b) Excitation phase
Muscular twitching and convulsions aggravated by hypoxia and acidosis

c) Depressive phase
Bradycardia, hypotension, arrhythmias especially with bupivacaine
Respiratory depression and cardiopulmonary arrest
Bupivacaine is more cardiotoxic even with moderate dose and difficult to revert even with cardioversion

Management of Systemic complication
1. IV cannula should be placed in all patients for any possible emergency
2. Ventilatory support with oxygen – Ambu bag, Boyles apparatus or ventilator
3. Ringer lactate drip if BP is low
4. Thiopentone 50-100mg, Diazepam 5-10 mg or Midazolam 1-2 mg if convulsions are present

(Midazolam is five times more potent than diazepam. Has fast onset and short action, fast and complete recovery with no hang over and amnesia. Usual dose is 0.03 – 0.05 mg / kg .The usual dose administered is 1-2 mg IV. May be repeated after half hour. In extremes of age the safe dose is 1mg.)

Oculocardiac reflex – Oculo cardiac reflex is a complication which can occur during block or surgery due to traction on extraocular muscles or pressure on the globe. It may manifest as bradycardia, bigeminy, ectopic beats, nodal rhythm, a.v block, arrhythmias, or periods of asystole. It most commonly occurs during
muscle surgery, RD surgery and enucleation. Oculo
cardiac reflex may occur after retrobulbar block or
retrobulbar haemorrhage. Retrobulbar block may block
the reflex. But it itself has the risk to induce it.

**Management**: No treatment needed if reflex
manifests as bradycardia or infrequent ectopic beats
with the BP remaining stable. Cessation of surgery is
indicated if arrythmias become significant. Surgery may
be resumed after a brief pause as oculocardiac reflex
fatigue easily. Usually there is little or no activity after
a brief pause in surgical stimuli. In severe cases
oculocardiac reflex is managed with anticholinergic
drugs like atropine or glycopyrolate. Prolonged tachy
dysarrythmias may result with large doses of atropine.
So caution should be exercised in giving large dose of
atropine in the management of oculocardiac reflex.

**Anaesthetic support in OT**

Qualified anaesthesiologist should be available in all
ophthalmic theatres to meet any emergency during
block or surgery. Full anaesthetic back up including
emergency medicine tray, Oxygen, pulse oxymeter,
cardiac monitor, Boyles apparatus, defibrillator and
ventilator should be made available in the OT. Operating
in an OT with out full life support measures will be
suicidal in these days of consumerism. The
ophthalmologist should be trained in intubation and
other resuscitative techniques.

**Conclusion**

Although ophthalmic surgery under local anaesthesia
is a relatively safe technique compared to general
anesthesia, one should undertake surgery only
with the assistance and support of the anaesthesiologist.
Atleast the anaesthetist should be available on call.
It is mandatory to equip the theatre with life
support measures and life saving anaesthetic
equipments. It is preferable that all ophthalmic
surgeons undergo training in emergency resuscitative
measures.