Good anesthesia is essential for the performance of safe intraocular surgery. Anesthesia for cataract surgery today aims at creating a comfortable environment for the patient and the surgeon during surgery and a quick recovery of function without inherent added risks. We have moved a full circle from the ancient days of ‘no-anesthesia’ couching, to Koller’s topical cocaine, through general anesthesia, Knapp’s local anesthesia and now to topical and no-anesthesia phacoemulsification.

Today, most surgeons throughout the world use local anesthesia for cataract surgery, though topical anesthesia is gaining popularity. General anesthesia has a limited role, mainly in cases in which local or topical anesthesia cannot be used.

Local Anesthetics in use

**Lidocaine hydrochloride**- available as a 2% and 4% solution for injection and topical use. Has a quick onset of action, but the duration is relatively short. The action can be prolonged by the addition of epinephrine.

**Bupivacaine hydrochloride** - has a higher lipid solubility and protein binding, and therefore is more potent and has a longer duration of action than lidocaine. It offers excellent postoperative analgesia as well.

A common practice is to use combinations of the above. The most common combination is a 1:1 mixture of 2% lignocaine with 0.5 or 0.75% bupivacaine.

**ANATOMY**

The ciliary ganglion, a parasympathetic ganglion, lies approximately 1 cm from the posterior boundary of the orbit between the lateral surface of the optic nerve and the ophthalmic artery. Parasympathetic fibers originating in the oculomotor nerve and postganglionic fibers supply the ciliary body and pupillary sphincter muscles.
The nasociliary nerve, a branch of the ophthalmic nerve, supplies sensory innervation of the cornea, iris, and ciliary body by way of the short ciliary nerves (these short ciliary nerves are 6-10 small filaments that run with the ciliary arteries).

Retrobulbar block is aimed at blocking the ciliary ganglion, ciliary nerves, and cranial nerves II, III and VI. Cranial nerve IV is not affected since it lies outside the muscle cone. When the block is performed, the local anesthetic is delivered within the muscle cone itself. During a peribulbar injection, however, the injection is outside the muscle cone and spreads by way of diffusion to block the orbital nerves, including the IV nerve.

RETROBULBAR ANESTHESIA

Retrobulbar block can provide adequate anesthesia, akinesia and control of intraocular pressure as well as postoperative analgesia

Technique of Retrobulbar Block

In the adult, the distance to the ciliary ganglion from the skin is about 3.5cm. Most commonly, a 25 gauge, 1 ½ inches long (35 mm) needle is used to reduce the risk of passage beyond the ciliary ganglion. Advancement too far can result in puncture of the vessels in the apex of the orbit. The inferolateral margin of the orbit is palpated and a skin wheal is made. The patient is asked to look straight ahead. The injection is at the junction of the lateral and middle thirds of the inferior orbital rim. The needle is advanced slowly, bevel facing the sclera, to penetrate retrobulbar fat and the intermuscular septum. If resistance is felt, the needle may be in muscle, optic nerve or the sclera and it should be withdrawn and redirected. Advance to 35 mm (depth of the needle). Inject approximately 1-2 cc of local anesthetic at this depth and then another 1cc of local anesthetic while withdrawing the needle. Lids are closed and firm pressure and massage are given.
over the orbit over a piece of folded gauze. In less then 5 min there is anesthesia of eyeball and in a little longer time akinesia of the extraocular muscles.

**PERIBULBAR ANESTHESIA**

In 1985, Davis & Mandel reported the use of peribulbar anesthesia. Kelman was known to have first performed this technique (unpublished) in 1970. Anesthetic solution is deposited within the orbit but does not enter the muscle cone, therefore offering a measure of safety.

**Technique of peribulbar block**

5 ml bupivacaine 0.75% and 5 ml lignocaine 2% with 1:200000 adrenaline and 150 units of hyaluronidase (mixed to aid diffusion within the orbital tissue) are drawn into a 10 ml syringe. Superior & inferior injections of 5 ml each are given with a 3/4 inch, 24-26G needle. Inferior injection is given at the junction of the outer one third & inner two third of the lower orbital rim. Superior injection is given usually nasally just above the medial canthus. The superior injection may be avoided till the time the inferior injection takes effect (3-5 min), to judge the necessity for the additional injection. If good akinesia is attained by the inferior injection, there is no need for the superior injection. Gently press on the lower lid between the orbital margin and the globe to feel the inferior orbital notch and with the other hand progressively inject 5 ml of anesthetic solution starting just under the skin, progressively to just behind the equator of the globe. 1 ml is injected in the lid, about 2-3 ml in the region of the equator & 1-2 ml just posterior. The same procedure may be repeated for the upper injection if required. Fullness of the upper lid points to an increase in the orbital volume and correct site of injection. 10-20 minutes of intermittent ocular compression is applied after the injection.

**COMPLICATIONS OF REGIONAL BLOCKS:**

**Retrobulbar Hemorrhage:** This is the most common complication seen and is due to inadvertent puncture of vessels within the retrobulbar space. It is evidenced by the
simultaneous appearance of an excellent motor block of the globe, closing of the upper lid, proptosis and a palpable increase in intraocular pressure. Subconjunctival blood and eyelid ecchymosis may be seen as the hemorrhage extends anteriorly. Retrobulbar hemorrhage can lead to other complications such as central retinal artery occlusion and stimulation of the oculocardiac reflex. Many are, however, minimal or even subclinical. On a rare occasion, surgery may be continued. However, it is usually considered best to postpone surgery for 2-4 days after hemorrhage because of the risk of repeat hemorrhage, and the difficulty encountered due to operating with a positive orbital and vitreous pressure.

**Oculocardiac Reflex:** Bradycardia, junctional rhythm, or asystole can occur secondary to traction on the eye and ocular muscles. This is called the oculocardiac reflex (OCR). With cataract surgery, this can occur several hours later in the event of an expanding hemorrhage. Thus, the patient should be closely monitored for several hours following a hemorrhage. If the OCR develops, surgical stimulation should stop and intravenous atropine is the treatment of choice (0.007 mg/kg). If the OCR develops, surgical stimulation should stop and intravenous atropine is the treatment of choice (0.007 mg/kg). An anesthetist’s assistance must be sought in this eventuality. Better knowledge and aggressive treatment has decreased serious morbidity from this reflex from 1 in 3,500 to less than 1 in 100,000.

**Central Retinal Artery Occlusion:** This can result from a retrobulbar hemorrhage and may result in total loss of vision if not treated. If retrobulbar hemorrhage occurs, the patient's intraocular pressure and central retinal artery pulsations should be monitored. If external pressure on the globe is high enough to result in compression of the retinal arteries, then the surgeon should perform a deep lateral canthotomy or an anterior chamber paracentesis to decompress the orbit. This complication can also occur if the dura is penetrated and the local anesthetic is injected into the subarachnoid space.

**Puncture of the Globe:** Use of a blunted needle in retobulbar anesthesia is common in an attempt to reduce this complication. However, this complication can still occur, with peribulbar anesthesia too, and is more likely in patients with severely myopic eye ("long eye"), operated retinal detachment with scleral buckling and
Penetration of the Optic Nerve: Direct injury to the nerve, injection into the nerve sheath with compression ischemia and intramural sheath hemorrhage can result in optic atrophy and loss of vision even without retrobulbar hemorrhage.

Inadvertent Brain Stem Anesthesia: Accidental injection into the CSF can occur during the block due to perforation of the meningeal sheaths that surround the optic nerve. The patient may experience disorientation, amaurosis fugax, aphasia, hemiplegia, unconsciousness, convulsions, and respiratory or cardiac arrest a few minutes after the injection. Direct intravascular injection via the optic nerve sheath or local anesthesia carried by the ophthalmic and internal carotid artery by retrograde flow to the thalamus and midbrain can also present the same way. This situation requires prompt recognition and treatment (including airway control, respiratory support, possible cardiac intervention, etc.). hence a patient should never be left unattended after the block.

Epinephrine Toxicity: In patients with hypertension, angina, or arrhythmias, epinephrine should be avoided. Injection of a total of 0.05 mg (10 cc of 1:200,000) of epinephrine does not contribute significantly to problems in these patients. However, careful monitoring and consultation with an anesthetist is warranted.

Other Complications: Allergic reactions may occur to the ester-type local anesthetics. Blocks usually last 2 to 3 hours. If the block wears off before surgery is complete, supplementation of the block may be risky when the eyeball is open. The volume of injected fluid, edema, or hemorrhage may distort original anatomy and make surgery difficult.
**Advantages of peribulbar block over retrobulbar block**

Safer than retrobulbar anesthesia due to:

1. Less chances of retrobulbar haemorrhage
2. Perforation of eye or injury to the optic nerve.
3. The potential for intraocular or intradural injection is decreased because the anesthetic is deposited outside the muscle cone.

**Disadvantages of peribulbar block**

1. Akinesia of the extra-ocular muscle may be less complete.
2. Greater volume required, more time required to achieve satisfactory block.

**TOPICAL ANESTHESIA**

Two applications of proparcaine or four percent lidocaine hydrochloride drops are given to the eye to be operated. In a small minority of patients, intravenous sedation may be necessary to reduce anxiety & improve cooperation. Xylocaine jelly 2% is also used. The gel is applied 3 to 5 minutes prior to surgery and washed away on the operating table. A modified technique consists of combining topical anesthesia with 0.5 ml of 1% lidocaine (preservative – free) injected through the side port incision after evacuation of aqueous.

**Advantage**

Topical anesthesia avoids the potential complications associated with retrobulbar & peribulbar injection. Rapid visual rehabilitation that occurs just after the procedure is also gratifying to the patients.

**Limitations**

Topical anesthesia requires a cooperative patient. Patient co-operation during biometry or tonometry is a good indicator of the appropriateness of the patient for surgery under topical anesthesia. It should be avoided in patients with small pupils & very dense cataracts, and when expected surgical time is long. It should be kept as an option for phacoemulsification only, and after achieving sufficient expertise to be able to manage critical situations with skill. Care must be taken during the use of pointed or sharp instruments to immobilize the globe with the second instrument during surgery, during capsulorrhexis and IOL insertion.
PARALYSIS OF THE ORBICULARIS OCULI - FACIAL NERVE BLOCK

To prevent a raise in the intraocular pressure due to the squeezing action of the eyelids during cataract extraction, a temporary paralysis of the orbicularis muscle is essential.

Anatomy

The facial nerve passes from the stylomastoid foramen into the substance of the parotid gland, and 5-7 mm behind the ramus of the mandible. It divides into two divisions: temporofacial and cervicofacial

The temporofacial division which supplies orbicularis oculi muscle lies on the neck of the condyle.

Orbicularis oculi akinesia is effected by one of the following methods.

**O’Brien’s method** aims at blocking the facial nerve at the proximal trunk. The condyloid process of the mandible is palpated just in front of the tragus of the ear by asking the patient to open and close his or her mouth. The process is felt to slip forward under the finger during this movement. At the site of injection the skin is partially anesthetized by raising an intradermal wheal with the local anesthetic. A 5ml syringe with a 24 G needle 1inch in length is used. The needle should pass straight down to the periosteum; 2-3 ml local anesthetic solution is injected, and after withdrawing the needle firm pressure and local massage are applied. Paralysis of the orbicularis occurs within 7 minutes.

**Van Lint method** : Facial nerve is blocked in the region of the terminal branches of the facial nerve. An intradermal wheal of local anesthetic is raised at a point about 1 cm below and behind the lateral canthus. A needle, 5 cm in length, is passed through the wheal down to the periosteum of the zygomatic bone. The needle is then
passed upward towards the temporal fossa and 4 ml are injected along the track while withdrawing. Without totally withdrawing the needle, it is turned forward medially and downwards towards the infraorbital foramen to inject 2 ml, and lastly downwards and backwards along the lower margin of zygoma for 2.5 cm with 3 ml being injected along the tract. Few ml. are injected beneath the skin at the junction of lateral wall with the floor of the orbit and into the upper lid above the lateral canthus. Pressure is then exerted over the injected area to distribute the solution and reduce swelling. After waiting for 5-7 minutes, akinesia is tested by holding the eyelid open with a small swab on a holder and asking the patient to close his eyelids.

**Atkinson method:** Injection is given along the inferior edge of the zygomatic bone and then upward across the zygomatic arch toward the top of the ear. The injection is begun at the inferior edge of the zygomatic bone at a point slightly posterior to a vertical line drawn from the lateral margin of the orbit. A 1.5 inch, 23 gauge needle with a rounded point is used to inject the anesthetic mixture as it advances close to the bone and then across the zygomatic arch to just in front of the top of the ear. About 3 ml are injected.

**Nadbath Ellis method:** Injection is made in the area of the facial nerve as it emerges from the stylomastoid foramen and enters the parotid gland.