"COMPARITIVE STUDY OF TOPICAL, SUBTENON'S AND PERIBULBAR ANAESTHESIA IN PHACOEMULSIFICATION"

By

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In partial fulfillment
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MASTER OF SURGERY
IN
OPHTHALMOLOGY

Under the Guidance of
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LIST OF ABBREVIATIONS USED

Sl. No.	*Abbreviation*	*Full form*
1.	ICCE	Intra Capsular Cataract Extraction
2.	ECCE	Extra Capslar Cataract Extraction
3.	MSICS	Manual Small Incision Cataract Surgery
4.	PCIOL	Posterior Chamber Intra Ocular Lens
5.	GA	General Anaesthesia
6.	ST	Subtenon's
7.	PB	Peribulbar
8.	RB	Retrobulbar
9.	IOP	Intra Ocular Pressure
10.	CNS	Central Nervous System
11.	CVS	Cardiovascular System
12.	TRU	Turbidity Reducing Units
13.	IU	International Units
14.	SCH	Sub Conjunctival Haemorrhage
15.	G	Gauge
16.	BSCVA	Best Spectacle Corrected Visual Acuity
17.	ANOVA	Analysis Of Variance

ABSTRACT

BACKGROUND

Retrobulbar anaesthesia, due to its serious complications was replaced with peribulbar anaesthesia. But that also did not eliminate serious complications totally. Recently other methods like subtenon's anaesthesia with a blunt canula is expected to have less complications while topical anaesthesia is expected to have minimal complications.

OBJECTIVES

1. To study the effect of anaesthetic drugs and patient's and surgeon's comfort used in topical, subtenon's and peribulbar anaesthesia in phacoemulsification.
2. To study the intra and post operative complications and visual outcome of phacoemulsification using topical, subtenon's and peribulbar anaesthesia.

METHODS

Study of 150 patients who underwent phacoemulsification was done, of which 50 underwent surgery by topical anaesthesia, 50 by subtenon's anaesthesia and 50 by peribulbar anaesthesia. The efficacy and safety of the three methods of anaesthesia in phacomulsification with respect to pain (during administration, intraoperative and postoperative), akinesia, lid movements and complications were compared.

RESULTS

Pain scores during administration of anaesthesia and 6 hours post surgery were significantly lower(P<0.001**) for topical compared to subtenon's and peribulbar groups. Per operative pain scores were comparable(P=0.304) between the three groups. Akinesia was also comparable between the groups(P=0.304). Lid movements were significantly high(P<0.001**) in topical group compared to subtenon's and peribulbar. Visual acuity was comparable among groups.

CONCLUSION

Topical anaesthesia is an effective and reliable method for phacoemulsification with many benefits over subtenon's and peribulbar anaesthesia and a high level of patient satisfaction. However patients who are not suitable for topical anaesthesia should be considered for subtenon's rather than peribulbar anaesthesia.

KEYWORDS

Phacoemulsification, topical, subtenon's, peribulbar, anaesthesia.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF CHARTS

LIST OF FIGURES

LIST OF PHOTOGRAPHS

INTRODUCTION

There are 37 million blind people in the world today, the majority of whom live in developing countries. Approximately 9 million Indians are blind from cataract with another 1.8–3.8 million going blind from cataract every year. Ophthalmologists and program planners have been able to effectively increase cataract surgical output from a low of 1.2 million surgeries in 1992 to a high of 4.8 million surgeries in 2006 with intraocular lenses (IOLs) used in 90% of cases.

Keeping pace with the law of nature, procedures of cataract surgery have also evolved with time. After Intra Capsular Cataract Extraction (ICCE), Extra Capsular Cataract Extraction (ECCE) and Manual Small Incision Cataract Surgery (MSICS), the technique of phacoemulsification was developed to enable ophthalmologists to extract cataracts through the smallest possible incision using an ultrasound or laser probe, to break the lens without damaging the lens capsule. Today it has become the preferred technique for cataract removal. No sutures are required as incision is self-healing.

Retrobulbar anaesthesia was commonly used for cataract extraction. Rare but serious complications like retrobulbar hemorrhage, globe perforation, optic nerve injury have led many ophthalmologists to replace retrobulbar anaesthesia with peribulbar anaesthesia. However peribulbar anaesthesia does not eliminate serious complications totally, although these probably occur less frequently. Even with a two injection technique, it has sometimes an excessive rate of imperfect block and pain.

In recent years there has been a move, towards other methods like subtenon's anaesthesia and topical anaesthesia. Subtenon's anaesthesia with a blunt canula will have less complication. Topical anaesthesia is expected to have minimal complications.

We are conducting this prospective study to evaluate the efficacy and safety of topical, subtenon's and peribulbar anaesthesia in phacoemulsification in terms of patient's comfort (pain during administration of anaesthesia, during surgery and 6 hours after surgery), surgeon's comfort (akinesia and lid squeezing), complications (intra and post operative) and visual outcome in our set up.

OBJECTIVES OF STUDY:

1. To study the effect (onset and duration) of anaesthetic drugs and patient's and surgeon's comfort (pain during administration of anaesthesia, intra operative pain, post operative pain, akinesia and lid squeezing) used in topical, subtenon's and peribulbar anaesthesia in phacoemulsification.

2. To study the intra and post operative complications of phacoemulsification using topical, subtenon's and peribulbar anaesthesia.

3. To study the visual outcome of phacoemulsification using topical, subtenon's and peribulbar anaesthesia.

REVIEW OF LITERATURE:-

Written history of cataract spans over 20 centuries. An African's and an Arabic oculist translated into Latin cataracta meaning; something poured underneath something the WATERFALL.[1][2]

Early surgeons, performing couching had no idea of pushing something behind the pupil was the human lens. In 16th century Atoine Jan and Michel Pierre identified from autopsy specimen that the cataract was truly the crystalline lens itself.[1][3]

The written proof of couching came from Susruta an Indian surgeon.[1][4]

Daviel performed extracapsular extraction from inferior limbus in sitting position.[1][5]

Pierre Francos shifted incision to the upper limbus while sitting on head side of patient.The pharmacological mydriasis and planned iridectomy was introduced by Carl Himly.[1][6]

The next breakthrough came in intracapsular surgery with the development of chemical zonulysis using an enzyme α chymotrysin.[1][7]

Aphakic correction with contact lens started established from 1940. Harold Ridley implanted first synthetic lens on November 29, 1949.[1][8]

First feeling of intact supports for IOL was urged by Cornelius Binkhorst.[1]

Kelman introduced his phacoemulsifier in 1967 but many intracapsular surgeons were not convinced.[1][9]

After that Robert Sinskey and John sheets were more popular in small incision ultrasonic surgery.[1][10]

Howard Gimbel introduced capsulorhexis first time.[1][11]

Small incision closing sutures introduced by John Shepherd and later by Howard Fine.[1][12]

Kelman performed phacoemulsification into anterior chamber and D. Calvard, Kratz T performed phacoemulsification into the papillary plane.[1][13]

Endocapsular phacoemulsification was introduced by Shepherd.[1][14]

The technique of phacoemulsification was developed to enable ophthalmologists to extract cataracts through the smallest possible incision using an ultrasound or laser probe, to break the lenses without damaging the lens capsule. Today it has become the preferred technique for cataract removal. No sutures are required as incision is self-healing.[15][16]

There are several local anaesthetic techniques available for cataract surgery including retrobulbar (intraconal),[17][18] peribulbar (extraconal),[17][19] subtenon's,[17][20][21] subconjunctival[17][22] and topical anaesthesia.[17][23]

Retrobulbar anaesthesia (RB) used to be performed for cataract surgery for many years. This was associated with some rare but serious complications such as: globe perforation, brain stem anaesthesia, post operative strabismus, retrobulbar haematoma and optic nerve injury. This has led to get this procedure replaced with peribulbar anaesthesia (PB).[24][25] Although complications with peribulbar anaesthesia are much less compared with retrobulbar anaesthesia, serious complications were reported.[24][26][27][28]

Peribulbar injection of anaesthetic agents has been used for more than a century in cataract surgery and various modifications have been devised over the last two decades.[29]

Retrobulbar anesthesia was first described in 1884 when Hermann Knapp used a Cocaine injection posterior to the globe to perform an enucleation. It provides akinesia of the extraocular muscles by blocking cranial nerves III, IV, and VI and anesthesia of the conjunctiva, cornea, and uvea by blocking the ciliary nerves. Due to complications of retrobulbar block it has been progressively replaced by PB anesthesia first described by Davis & Mandel in 1986.[30][31] In PB

anesthesia, anesthetic solution is delivered by a relatively short and sharp needle outside the muscle cone[30][32] farther the globe, optic nerve, dural sheaths and optic foramen.[30][33] Some patients find the injection painful and frightening. Recently there has been renewed interest in subtenon's (ST) anaesthesia[30][20][34] first described as early as 1884 by Turnbull.[30][35] Subtenon technique is efficient, simple, easy to learn, reproducible and has low rate of complications.[30][36] In this anesthetic agent is delivered into subtenon space by a blunt canula, topical anesthesia is used prior to infiltration making it almost pain-free. Complete akinesia is rare and this is sometimes limiting[30][37] however the addition of hyaluronidase significantly improves the quality of motor blockade achieved with ST[30][38] Hyaluronidase is added to anaesthetize a greater area with the same amount and concentration of anaesthetic agent, and to reduce the induction time. Hyaluronidase, an enzyme, catalyses the depolymerization of hyaluronic acid to a tetrasaccharide and potentially increases diffusion of local anesthetic through tissue planes. The analgesic effect of ST anesthesia is dose dependant and 3ml is the optimal dose.[30][39] Topical anesthesia (TA) is in extremely wide use nowadays for intraocular surgery.[30][40]

Topical anaesthesia is not new. In 1984, Knapp described the use of cocaine eye drops.[41][42]

Fichman[17][23] first described a novel technique, topical anesthesia, which is not only free from all of the above complications but is also well tolerated by the patients. Since its introduction, topical anesthesia has become increasingly popular, as indicated by the annual survey of the practice styles and preferences of members of the American Society of Cataract and Refractive Surgery. There have been several reports of its safety and efficacy.[17][43-47]

Topical anaesthesia eliminates the risks of retrobulbar and peribulbar anaesthesia and has several other benefits like:

The return of vision is more rapid, it is less costly, patients can have surgery without discontinuation of systemic anticoagulants or aspirin and there is more patient satisfaction.[41][40]

The main disadvantage of topical anaesthesia is lack of akinesia which can make surgery technically difficult. But with good patient selection, proper counseling and patient cooperation this problem can be avoided. During capsulorrhexis, the patient should be asked to particularly keep the eyes still. However during phacoemulsification and irrigation and aspiration, the instruments placed in the main tunnel and side port incisions immobilize the eye. It is best to slightly lower the bottle height while inserting the phaco tip because this can cause less stretch on zonules due to posterior lens migration. This might cause pain as ciliary body is not anesthetized. The surgeon should avoid touching iris, especially during IOL implantation. This can be achieved by having widely dilated pupil. As patients with topical anaesthesia are more sensitive to IOP elevation after surgery, careful and complete viscoelastic removal is necessary. Pain killers and acetazolamide tablet after surgery would minimize pain and maintain IOP. Up till now we have mostly been able to achieve these goals with good patient satisfaction. The key to successful cataract surgery with topical anaesthesia is surgeon-patient communication. Patients with hearing or language problems or dementia are poor candidates.[41]

HISTORY OF EVOLUTION OF OPHTHALMIC ANAESTHESIA

Proper anaesthetic management is an integral part of any successful eye surgery. Before the discovery of ether, most operative procedures presented a serious challenge. Couching of crystalline lens to cure cataract was performed more than a thousand years ago, although surgeons at that time had only primitive anaesthetic and analgesic agents to ease patient's misery. Over the years, various agents made from roots, barks, herbs, seeds and flowers have been applied to surgical field, but few of these substances proved adequate to produce relaxation or relieve pain. Under such circumstances, it is difficult to imagine how extra ocular procedures, let alone intra ocular procedures, such as lens extraction, could be performed. Fortunately, over the last century, the search for surgical adjuncts to achieve anaesthesia and analgesia has produced many advances, easing the ordeal of surgery for both the patient and the surgeon.

EARLY FORMS OF ANAESTHESIA

The poppy

The chinese probably were the first to exploit the narcotic effect of opium to perform various operative procedures a thousand years ago. In the third century AD, a chinese physician, Hua Toa, used hashish (cannabis indica) to render patients unconscious. This practice was also used by the Egyptians and Arabians.

Hyoscyamus

A group of refrigants called hyoscymus were well known as narcotics in the medical literature of first century AD. The cooling effect of medication provided anaesthesia.

When mixed with wine, the herb mandragora produced potent effects, including inebriation and anaesthesia. Dioscorides used the extract of mandragora as a general anaesthetic during surgical couching.

Alcohol

Alcohol was frequently given to patients before orthopaedic operations, such as reduction and fixation of dislocations and fractures. Large quantities of alcohol were necessary; however, to produce a satisfactory anaesthetic and analgesic effect, and patients often become lethargic and stuporous before the surgery could be performed.

Acupuncture

Acupuncture has been used for centuries to produce a local anaesthetic effect. Almost 2000 years ago, the Chinese developed acupuncture as an analgesic for the treatment of headaches, toothaches, joint pain and various kinds of abdominal pain.

Others

Asphyxia produced by strangulation or compression of the carotid vessels in the neck was used for temporary relief while a surgical procedure was performed. Another, somewhat barbaric, method of anaesthesia involved causing a cerebral concussion by a blow to the head, resulting in sufficient loss of consciousness to allow the surgeon to proceed.

Egyptians used material derived from the crocodile, which they applied to the patients' skin to produce local anaesthesia. Other topical agents tried over the years were generally abandoned because of inadequate pain relief. Hypothermis was also used extensively by the Egyptians. Intensely cold sponges, applied directly to the nerve root, decreased oxygen consumption,

lowered the metabolic rate, and slowed nerve impulse conduction, thereby achieving both an anaesthetic and an analgesic effect.

Nitrous Oxide and Ether:

Davy first described the use of nitrous oxide in surgery in 1800, but the report was not much noted. In 1884, Dr. Horace Wells,[48] a dentist, accidentally rediscovered its effect and used it to perform dental extractions.

Ether was first used in a neck tumour removal operation by Crawford W. Long in Jefferson,[48]Georgia in 1842. Because the medical community was slow to accept this radical idea, however, Long was forced to abandon it. William T. Morton,[48] a second-year medical student at Harvard medical school, first demonstrated successful surgery under ether at Massachusets General Hospital. Because Morton was the first to successfully publicize the use of ether, he is generally accredited with its discovery. Long's first use of ether as an anaesthetic has been memorialized by a statue citing is precedence in Statuary Hall in Washington, DC.

The introduction of nitrous oxide and ether began the era of anaesthesiology as a medical specialty. Thereafter, as more specialized and sophisticated monitoring techniques and anaesthetics were developed, many complex and difficult operations became possible.

Cocaine:

In 1885, Gadecke[49] extracted the alkaloid, erythroxyline, from coca leaves, the drug was isolated and named cocaine by Albert Nielmann.[49] The mydriatic action of cocaine was first appreciated by Von Anrep in 1879. Carl Koller,[49] who immigrated to the United States from Bohemia, discovered that cocaine could produce complete anaesthesia of the cornea and conjunctiva and reported its use in ophthalmic surgery in 1884. Because of the excellent

analgesia produced by cocaine, he found that all ophthalmic surgeries could be performed under local anaesthetic provided that the patient was able to co-operate and remain motionless.

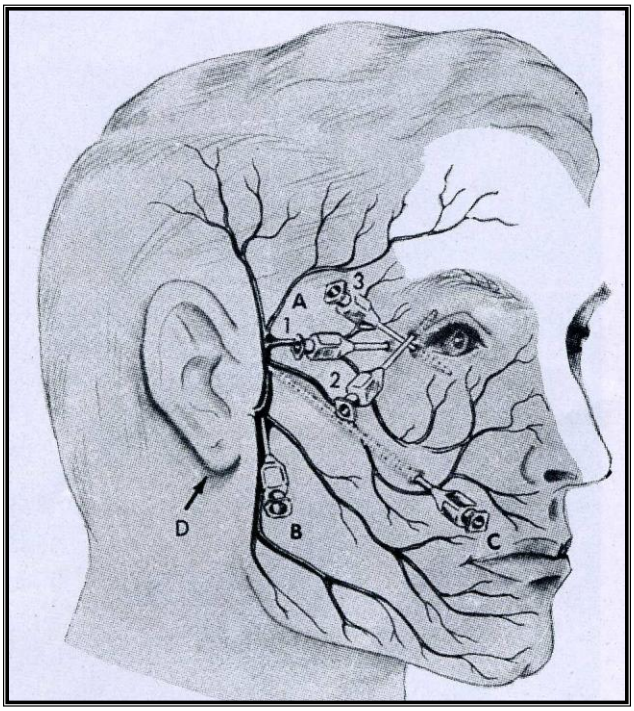
Regional Anaesthesia

Regional anaesthesia include:

- Facial and Retrobulbar
- Peribulbar
- Subtenon's
- Topical

In 1884, Carl Koller,[49] a young Austrian resident in ophthalmology, discovered the local anaesthetic properties of cocaine. With topical application of 5 % cocaine to the cornea and conjunctiva, he accomplished successful cataract extraction, noting the need for more extensive anaesthesia if iris were to be rendered insensitive. He carried out globe enucleation with 5 % cocaine injected within the muscle cone. Epinephrine and procaine were discovered in 1901 and 1905 respectively, and safer blocks became possible. Van Lint[50] in 1914 introduced his classical facial nerve block technique; here akinesia is obtained by infiltrating anaesthetic agent in the region of the terminal branches of the facial nerve. O'Brien akinesia obtains a paresis of the orbicularis muscle by blocking the facial nerve at the proximal trunk. Atkinson published many articles on regional anaesthesia for ophthalmic surgery from 1934 to 1964. Injection is made along the inferior edge of the zygomatic bone and then upwards across the zygomatic arch towards the top of the ear. Nadbath-Ellis akinesia involves an injection in the area of the facial nerve as it emerges from the stylomastoid foramen and enters the parotid gland.

Figure 1 - Facial Nerve Blocks



A- Van Lint, B- O'Brien, C-Atkinson, D- Nadbath Ellis

Current Techniques:

Until very recently, the regional anaesthesia requirements for cataract extraction surgery included globe akinesia. Rubin[51] recently listed five aims of quality regional anaesthesia for ocular surgery.

-To make sure that block procedure is carried out painlessly so that the patient maintains absolute confidence.

-To ensure globe and conjunctival anaesthesia.

-To achieve maximal akinesia of the globe, including paralysis of the four rectus muscles and the two oblique muscles, as well as the orbicularis oculi and levator palpebrae superioris.

- To ensue low pressure within the orbit and globe

- To avoid local or systemic complications

Retrobulbar Anaesthesia

Retrobulbar anaesthesia was first described in1884 by Knapp,[52] who injected 4 % cocaine for ocular anaesthesia prior to enucleation surgery. The modern technique was described in 1934 by Atkinson.[53] Retrobulbar injection was performed using a 22 or 23 G needles which were about 3.5 to 3.7 cm long, having a blunt tip. The patient is directed to look upward and nasally so as to move the inferior oblique and the fascia between the lateral and inferior rectus muscles forward and upward out of the way of the needle. The needle was directed straight back, well away from the eye ball, towards the apex of orbit and inserted to a depth of 2.5 to 3.5 cm and injection made in the muscle cone. The point of inserting the needle tip being just above the inferior margin at the junction of the outer one third and medial two third.

A safer method of retrobulbar injection is to ask the patient to look slightly downwards and outwards, based on the CT findings of Unsold[54] et al. In this position, the tip of needle is less likely to damage the optic nerve and posterior ciliary arteries.

Havener WH,[55] as suggested by Swan KC, advocated that the anaesthetic should be injected in the anterior retrobulbar space. The region just behind the globe is relatively avascular. The vessels of the apex of the orbit are larger and more fixed in position and cannot be readily displaced by a needle. They are much more readily pierced than the more anterior vessels. This is the reason retrobulbar haemorrhage is more frequent after deep injections.

The retrobulbar injection can also be performed through inferior cul-de-sac. James P. Gills described a procedure for performing a retrobulbar block and akinesia with one injection. With this technique, paralysis of the orbicularis oculi muscle occurs with the retrobulbar block.

Jeffrey G.Straus in 1988, developed a new retrobulbar needle and injection technique to decrease the risk of most complications associated with conventional needles and techniques. The needle is curved as it extends from its hub, but it has a straight terminal position. This is a 25 G, 38 mm needle with an Atkinson tip.

Advantages of retrobulbar injection:[56]

1) Quick action.
2) Less volume of anaesthetic required.
3) Widely used in eye camp surgeries.

Complications and drawbacks of retrobulbar injection[57]

1) Bruising (ecchymosis)
2) Retrobulbar haemmorhage
3) Globe penetration or perforation.
4) Amaurosis.
5) Perforation of optic nerve.
6) Needle perforation of optic nerve sheath.
7) Myotoxicity.
8) Brain stem anaesthesia.
9) Occulocardiac reflex

10) Central retinal artery occlusion.

11) Suprachoroidal haemorrhage.

12) Adjuvant facial block necessary.

13) The action is not uniform and sustained for long time.

Peribulbar Anaesthesia

Peribulbar anaesthesia has been used since the late 1960's; however it was not formally described until March of 1986 by Davis and Mandel.[58] Various modifications have subsequently been described by Bloomberg[59] and others. Their studies have reported excellent anaesthesia without complications in large number of patients undergoing cataract surgery when peribulbar techniques were used.

In January 1989, Weiss and Diechman[60] reported a study of a comparison between retrobulbar and peribulbar anaesthesian for cataract surgery. They found that the efficacy of peribulbar anaesthesia appears to be comparable to that of retrobulbar anaesthesia. However, a significant increase in chemosis was found with peribulbar anaesthesia.

The commonly used technique was that of Weis, here the technique was quite similar to retrobulbar, except that a 25 G 1.6 cm needle was used and the needle was introduced at the junction of the medial two third and lateral one third and directed exactly as that of retrobulbar. The hub of the needle indented the skin, aspiration was done to check if needle was in any vessel, if not, the local anaesthetic was injected approximately 5-7 ml. Pressure was applied with a Honan balloon for 10 minutes at 30 mm Hg lid and globe akinesia was checked for. If this was not satisfactory a supplementary injection was given at the supratrochlear notch.

Advantages of peribulbar injection[61]

1) Gives uniform action and sustains for longer duration
2) It is safer than retrobulbar injection
3) Less incidence of retrobulbar haemmorhage

Complications and drawbacks of peribulbar anaesthesia

1) The necessity of multiple intraorbital injections
2) The requirement of two to four times volume of anaesthetic used with retrobulbar anaesthesia.
3) Delayed onset of anaesthesia and akinesia
4) Requires hyaluronidase for diffusion of the anaesthetic solution in the orbit.
5) Requires application of pinky bal or similar pressure applying mechanism and constant monitoring of the same for 20 minutes
6) Ill monitored pressure over eye ball may lead to central artery occlusion
7) Globe perforation
8) Long term ptosis
9) Cannot be given in ruptured globe, dislocated or subluxated lens
10) Acquired Browns syndrome

RECENT INNOVATIONS IN REGIONAL ANAESTHESIA FOR OPHTHALMIC PROCEDURE:

Ongoing reports of the rare but serious complications of intraconal (retrobulbar) anaesthesia stimulated the concept of alternative non akinetic methds of regional anaesthesia for cataract extraction surgery. The techniques published subsequently fall into three groups; subconjunctival (perilimbal), injection of local anaesthetic by needle or cannula within Tenon's capsule and solely topical corneoconjunctival anaesthesia.

Subconjunctival (perilimbal) injection of local anaesthesia: Articles published in 1990 and 1991 advocated (with careful selection of patients) subconjunctival injection of local anaesthetics in small volume near the superior limbus, mainly for anterior segment surgery. The subconjunctival method allows exposure to the greater risks associated with performing intraocular surgery in the presence of extra ocular muscle activity. Globe perforation associated with the technique has been reported.

Sub-Tenon's Block:

Anaesthesia for cataract surgery produced by injecting small volumes of local anaesthetic beneath Tenon's capsule was first described by Swan in 1956. He indicated that the sub-tenon's method produced better iris and anterior segment anaesthesia than did sub conjunctival injection.

The injection technique involved insertion of blunt cannula into subtenon space after surgical dissection of sub- Tenons space. The degree of abolition of extra ocular muscle involvement is proportional to the volume of injectant.

Procedure:

The patient should be assessed for anaesthesia in the standard manner. Inability to comply with the anaesthetists instructions as, for example, as a result of deafness or mental incapacity, inability to lie flat, allergy to local anaesthetics, lack of i.v. acess or excessive uncontrollable anxiety are absolute contra indications to sub-tenon's anaesthesia. The procedure should be explained to the patient to allay anxiety and assist the anaesthetist in carrying out the block.

The injection is made on a supine patient. The conjunctiva is anaesthetized with topical anaesthetic solution. An eye lid speculum is inserted at this point to improve access. Throughout the procedure patient is asked to look up and outwards to expose the inferonasal quadrant. A small tent of conjunctiva is raised with a pair of non toothed forceps approximately midway between the limbus of the eye and the visible angle of the inferonasal portion of the conjunctiva. A small incision is made in the tented conjunctiva with a pair of ophthalmic scissors. The closed scissors are introduced through the aperture created and a tunnel is fashioned over the bare sclera by blunt dissection through tenon's capsule. A curved blunt irrigating cannula is then inserted with the syringe of anaesthetic solution attached. Stevens' described a metal cannula designed for this purpose.[62] The cannula is introduced along the contour of the globe and gentle contact of its tip is maintained with the sclera. Occasionally resistance to the needle is felt around the equator where a fibrous band can form as the ocular muscles broach the capsule. This is usually easily overcome by gentle pressure.

To reduce the risk of trauma to soft tissues, flexible cannula have been used.[63][64][65] They have two potential problems: the precise site of injection may be unpredictable, and with an anterior injection the volume administered could be limited by the swelling of the conjunctiva.

For anterior segment procedures, where absolute akinesis may not be required, these factors are unlikely to be significant.

Normally little resistance is found to injection. If resistance is felt, withdrawal and re-insertion of the needle using gentle pressure of the tip against the globe to ensure entry into correct tissue plane will help. Slight proptosis of the eye ball is normal after a correctly sited injection. There may be slight leakage of solution from the tunneled point of entry of cannula into the conjunctiva. If ballooning of the conjunctiva occurs, solution may be in the incorrect tissue plane. After removal of the cannula, pressure is applied by massaging the globe.

Common pitfalls are related to positioning of the conjunctival incision and the confirmation of dissection down to sclera. The incision must be made at a sufficient distance from the limbus to avoid the oblique insertion of tenon's capsule into sclera. A distance of 7- 10 mm from the limbus is acceptable. Detecting the end point of dissection comes with experience. The sclera has a different, more fibrous and whiter appearance than either the capsule, or continuation of the fascial layer of the extra ocular muscles. Good illumination is very important for this difference to be apparent. While some ophthalmologists may prefer to use magnification, the procedure is normally performed satisfactorily with the naked eye.

Extra care should be taken in myopic patients. They have longer and thinner globes, and there is an increased risk of scleral perforation. The technique is relatively contraindicated where there is a history of scleral disease with possible scarring and friability of the sclera. Previous retinal detachment surgery can be associated with scleral buckles and adhesions, which may hinder dissection and spread of anaesthetic solution, and increase the risk of globe perforation in the quadrant dissected.

Recent reports suggest that the use of subtenon's block is becoming more wide spread among anaesthetists and ophthalmological surgeons.[66] It has been suggested that it has more acceptable risk profile than traditional ophthalmic anaesthesia.[67]

Advantages of Sub-Tenon's anaesthesia

1) As this method requires blunt cannula there is no prick pain at the time of giving anaesthesia.
2) Patient is unware of receiving any injection.
3) Small amount or volume of anaesthetic solution is required
4) No need of pinky ball, only digital massage is sufficient.
5) Quick action within five minutes.
6) No risk of retrobulbar haemorrhage, globe perforation, optic nerve damage, and other complications associated with retrobulbar and peribulbar injection.
7) Intraocular pressure is not much raised even immediately after giving the anaesthesia and good hypotony is achieved thereafter.
8) The degree of abolition of extraocular muscle movement is proportional to the volume of injectant
9) Also good for retinal surgeries, and squint surgeries.

Complications or drawbacks of subtenon anaesthesia

1) Increased incidence of conjunctival chemosis and subconjunctival haemorrhage.
2) Theoretically, there is a potential for damaging one of the vortex veins.
3) Should be avoided in patients receiving anticoagulant medication.

4) Abolition of orbicularis action is proportional to the volume of injectant (with hyaluronidase).

An incision into the conjunctiva and underlying fascia is made and a theoretical risk of providing a route of infection is possible, though any ocular surgery would normally have antibiotic cover by topical treatment which would also provide cover for this small incision. Theoretically, rigid metal cannula can perforate a staphylomatous myopic eyes but disastrous if occurred.

TOPICAL ANAESTHESIA

The most recent step in the evolution of regional anaesthesia for catraract extraction has been the introduction of solely topical corneoconjunctival anaesthesia. The method is best for lens removal by phacoemulsification with foldable PCIOL implantation through a clear corneal incision of 4 mm width or less. Anaesthesia was achieved with amethocaine 1% (four drops) instilled over a 30 minute interval pre operatively and prilocaine 2% injected subconjunctivally at the incision site immediately before surgery.[68] Topical anaesthesia for phacoemulsification cataract surgery has several advantages compared with regional anaesthesia. Firstly, it eliminates the risk of damage to the globe or orbital contents associated with retrobulbar and, less commonly, peribulbar injections.[69-74] Secondly, it allows rapid visual rehabilitation following surgery with the potential for good vision in the immediate post operative period.[75][76] Thirdly there is no post operative ptosis or diplopia.[76] Retention of full ocular motility may also be advantageous during surgery by improving surgical access.[77-80] Finally topical anaesthesia can increase the time and cost efficiency of surgery because of reduced anaesthetic requirements

Sedative drugs are avoided or used minimally to allow retention of patient cooperation. The most appropriate topical agents are lidocaine 4 % and bupivacaine 0.75 %.

TOPICAL ANAESTHESIA WITH 4% INTRA CAMERAL LIGNOCAINE

Phacoemulsification can be performed under topical anaesthesia with or without intracameral lignocaine, which makes the surgery patient friendly, without compromising the outcome. Lignocaine 4 % drops were instilled in the conjunctival sac 5 minutes before the surgery. Once fully draped, the eye speculum was inserted and then, 4% lignocaine was generously poured on the exposed ocular surface. After waiting for about one minute, the surgery was started. The entry into the anterior chamber was followed by intracameral injection of diluted 2% lignocaine solution, either commercially available preservative free or regular 2 % lignocaine injection diluted to 0.5 % with Ringers Lactate solution.[81] This concentration is safe for corneal endothelium and provides adequate anaesthesia to uveal tissue for pain free surgery.[82-85] Lignocaine gel has been shown to be an effective[86][87] and possibly, a superior[88][89] substitute to lignocaine drops. This method also shares the same advantages of only topical anaesthesia.

General anaesthesia:

If GA is selected, the chief requirements are akinesia of globe and eyelids and ocular hypotony to protect against extrusion of intraocular contents. Following a smooth induction, in which stimulation from laryngoscopy and tracheal intubation is avoided, a deep level of anaesthesia is maintained until the wound has been closed. A nondepolarising muscle relaxant is administered with neuromuscular monitoring to ensure 90 % twitch suppression while the eye is open. For effective reduction of IOP during general anaesthesia, controlled ventilation with end

tidal carbon-di-oxide monitoring is used to produce moderate hypocapnea. Intra operative use of antiemetics reduces the incidence of post operative nausea and vomiting. When the surgery is completed, spontaneous ventilation is established with the patient still deeply anaesthetized. Coughing initiated by tracheal intubation can be prevented by prior administration of intravenous lidocaine.

Most eye disease in children is of a congenital nature, with a high association of other congenital malformations. A paediatric consultation is recommended as part of the preoperative assessment.

PHARMACOLOGY OF LOCAL ANAESTHETICS AND THEIR CLINICAL SIGNIFICANCE

INTRODUCTION:

Any agent which, when applied to nervous tissue, which prevents conduction of the nerve impulse in any part of the neurone, can be classified as local anesthetic. In fact all true anaesthetics only produce a reversible depression of conduction. Further they are commonly used to produce of loss of pain with or without loss of touch and other local sensation or nervous control and therefore the term local analgesic is better than local anaesthetic.

The acceptability of an anaesthetic technique depends on its clinical success rate and its safety. In the field of regional anaesthesia these two factors are occasionally diametrically opposed, but so is the danger of toxic side effects. Thus within the context of the desirable criteria of rapid onset and appropriate duration, preference must be given to the substances with lowest toxicity.

PHARMACOLOGY:

The various local analgesics in use today vary in toxicity, potency and duration of action. They are the water soluble salts of lipid soluble substances which vary widely in their chemical composition.

THE MAIN GROUP INCLUDE

a) **Cocaine:** Naturally occurring alkaloid, first isolated in1860 and the first local analgesic to be used.

b) **P- Amino Benzoic Acid Derivatives:** A large group of compounds including procaine, amethocaine, benzamine and butcaine.

c) Other synthetic agents, among which must be considered lignocaine which is aminocyclamide, cinchocaine, aminoline acid derivative certain aromatic alcohols, such as benzyl alcohols, which are sometimes used as surface active local analgesics, and local analgesics of low solubility, such as benzocaine and butyl aminobenzoate used mainly as dusting powders. Many of these drugs have marked chemical resemblance to P- aminobenzoic acid group of drugs.

Many antihistamines, especially certain of the phenothiazines also have local analgesic properties but are unsuitable for use as they are irritant to tissues.

Prolonged or permanent analgesia can be produced by protoplasmic poisons, such as quinidine, alcohol, phenol and chlorocresol. These need to be applied close to the nerve. Conduction in nerves can also be blocked by pressure and by low temperature. These techniques are not suitable for operative procedures.

Type of agents

ESTERS	**AMINO ACIDS**
1. Cocaine	1) Lignocaine
2. Procaine	2) Bupivacaine
3. Amethocaine	3) Etidocaine
	4) Cinchocaine
	5) Bilocaine

Lignocaine Hydrochloride: Chemical name: 2 diethyl amino aceto -2, 6- xylidine hydrochloride

Pharmacology: Lignocaine is an amino acyclamide and a derivative of acetanilide. It is an effective local analgesic of slightly greater toxicity in 0.5 % solution than procaine, less toxic in weaker solution, but about one and a half times as toxic in a 2 % solution. Its action is more rapid, more intense and lasts longer.

When administered locally it has a tendency to cause vasodilatation and this is normally counteracted by the addition of a vasoconstrictor. It has a potent analgesic action on mucus surfaces when applied topically. It produces general analgesia when given intravenously, which lasts longer than that of procaine less than 10 % excreted in the urine and less than 7% excreted into the bile.

The majority is broken down in the liver to monoethylglycine xylidine, and than hydrolyzed by liver amidases to 2, 6 xylidine and 4 hydroxy – 2, 6 xylidine. Glycine xylidine is also formed. The rate of metabolism is doubled by pre treatment with phenobarbitone.

Dose:

a) Nerve blocks: 2 % solution.

Max. dose is 100 ml (500 mg) with adrenaline.

Max. dose is 40 ml (200 mg) without adrenaline.

b) Surface analgesia:

2 % solution max. 8 ml

4 % solution max. 4 ml

Precautions:

They are stable in the presence of acids and alkalis and can be autoclaved repeatedly.

2) Bupivacaine hydrochloride:

Chemical name:

butyl-2 piperdyl forma – 2 -6 xylidine hydrochloride.

Pharmacology:

Bupivacaine is a long acting local anaesthetic of the amide type. The choice of two strengths of solutions of 0.25 % or 0.5 % makes it possible to vary the degree of motor block. Both its potency and toxicity are approximately 4 times than those of lignocaine, so that its therapeutic ratio is similar. It does however, has a longer duration of action up to 6 hours. General systemic effects are similar to those of other local analgesics. No local toxic effects on nerves or surrounding tissues have been reported.

Dose: Plain solutions of 0.75 %, 0.5 % and 0.25 % are available.

Max Dose: Not more than 50 mg (2 mg/kg body wt) in a 70 kg healthy adult (30 ml of 0.5 %) should be given at one time or in any 4 hour period.

Max. recommended dose / day is 400 mg.

Side effects and precautions: Serious side effects are rare but may occur in connection with relative or absolute over dosage.

Relative over dosage: Occurs when it is accidentally injected into an artery. In these circumstances CNS symptoms, with or without convulsions, occur even after doses that would normally be considered harmless**.**

Absolute Overdosage: Leads above all to CNS and CVS side effects. CNS side effects may occur after accidental intravenous injection and take the form of anxiety, feeling of intoxication, auditory changes, numbness of tongue and lips, double vision, dizziness, articulation difficulties, pressure over chest and forehead and muscular fasciculations. These effects may be regarded as

toxic prodromal symptoms and their occurrence during injection should lead to immediate discontinuation of the injection.

Continued influence on CNS leads to loss of consciousness, convulsions and ultimately to repiratory paralaysis.

Cardiovascular side effects are normally a late complication. A very rapid intravenous bolus injection may, however, lead to such high concentration of drug in coronary vessels and that myocardial depression and even cardiac arrest may happen. The circulatory effect may then be the only symptoms or be followed by CNS side effects. Myocardial depression may even be the first sign of intoxication. It should be noted that central blockade per se often leads to sympathetic blockade and hence hypotension and bradycardia. Adequate resuscitation equipment must be available whenever local anaesthesia is administered.

Treatment of side effects/ overdosage: Serious side effects should be treated immediately, according to the toxic symptoms profile. General convulsions should be treated with oxygen and artificial respiration. Hyperventilation helps to reduce the toxicity.

Small doses of a short acting barbiturate (thiopentone 50-150 mg) or diazepam (5-10 mg) may be given intravenously repeating as necessary. Alternatively suxamethonium and artificial respiration are helpful. Circulatory failure should be treated with oxygen, raising foot of the bed, sympathomimetics and plasma expanders. Circulatory arrest should be treated with cardiac massage.

HYALURONIDASE:

It is an enzyme available in the powder form in ampoules containing 1500 IU or Turbidity reducing units each. It is prepared commercially from mammalian testis tissues. It is reconstituted just before use and after reconstitution it should be used within 2 hours. This

enzyme is used in this study. It acts on Hyaluronic acid, which is a cement substance of the tissue. Hyaluronic acid was isolated in 1929 by Meyer and Palmer. Duran and Reynal proposed a spreading factor in the spread of tissue infection. Duthie and Chan demonstrated enzyme which liquefied tissue cement Hyaluronic acid and explained the mechanism of spreading factor propsed by Duran and Reynal. Hyaluronidase acts by depolymerising hyaluronic acid by hydrolysis. Hyaluronic acid is a glycosaminoglycan consisting of repeating disaccharide units composed of glutamic acid and sodium acetyl glycosamine linked together by 1-3 glucosidic bond.

It is measured in turbidity reducing units. One TRU reduces the turbidity of a 0.2 mg of hyluronic acid suspension in serum to that of a 0.1 mg of suspension.

Its enzymatic action is reversible and hyaluronic acid reforms within 24-48 hours completely. Enzyme is a protein like substance and gets inactivated by pepsin, trypsin and alcohol. It is water soluble and also in dilute acids. It has no toxicity and no allergy or antigenicity. But in high doses especially when given with anaesthetic agents it may produce some allergic reaction at the site of injection. Hyaluronidase does not increase the capillary permeability as capillaries do not contain hyaluronic acid. Each mg contains about 300 turbidity reducing units.

General uses:

1) In obstetrics, used to reduce the duration of labour by giving intracervically and also given at the site of episiotomy, also used to prevent post partum haemorrhage along with ergometrine
2) In anaesthesia- given along with local anaesthetic to facilitate the spread of local anaesthetic.
3) It is given intraneurally to relieve pain in lepra reaction

To facilitate rapid absorption of relatively large quantities of fluids in infants when they are being given by technique of hypodermolysis

1) To facilitate rapid absorption of substances in radiography when they are given by intra muscular routes.
2) Also used to promote the absorption of blood and fluid in traumatic or post operative oedema, haematoma and along with local anaesthetics.
3) Used intravenously as a sedation in infants, suffering from convulsions.
4) Also used to cause resolution of early keloids and in sprain of ligaments of ankle.

PRECAUTIONS WHILE USAGE

1) Should not be used in and around an infected area.
2) Malignancy is also considered a relative contra indication.

USES IN OPHTHALMOLOGY

1) Used along with local anesthetic in retrobulbar injection. 6-10 units per ml of local anaesthetic area used. It increases the spread of agent rapidly and block sets in rapidly and increases the effectiveness of agent by 40 %. But duration of action of anaesthetics agent is reduced, to counter act this, epinephrine is added which causes vasoconstriction and delays the absorption of agent. Epinephrine also reduces the allergy caused by hyaluronidase which occurs when given along with anaesthetics.

Orbicularis paralysis sets in a minute when given by Van lint technique and sets within 3 minutes with 2-5 ml of retrobulbar injection.

2) Used in blepharoplasty- given underneath the skin of lid 30 minutes before surgery.

3) When given subconjunctivally along with agents like steroids help in rapid absorption.

4) Helps in rapid absorption of sub conjunctival haemorrhages and disappearance of black eyes.

APPLIED ANATOMY RELATED

Surgical spaces in the orbit

The orbit is divided into a number of spaces. From the surgical point of view, four spaces can be described in the orbit.

Figure 2- Bones of the orbit

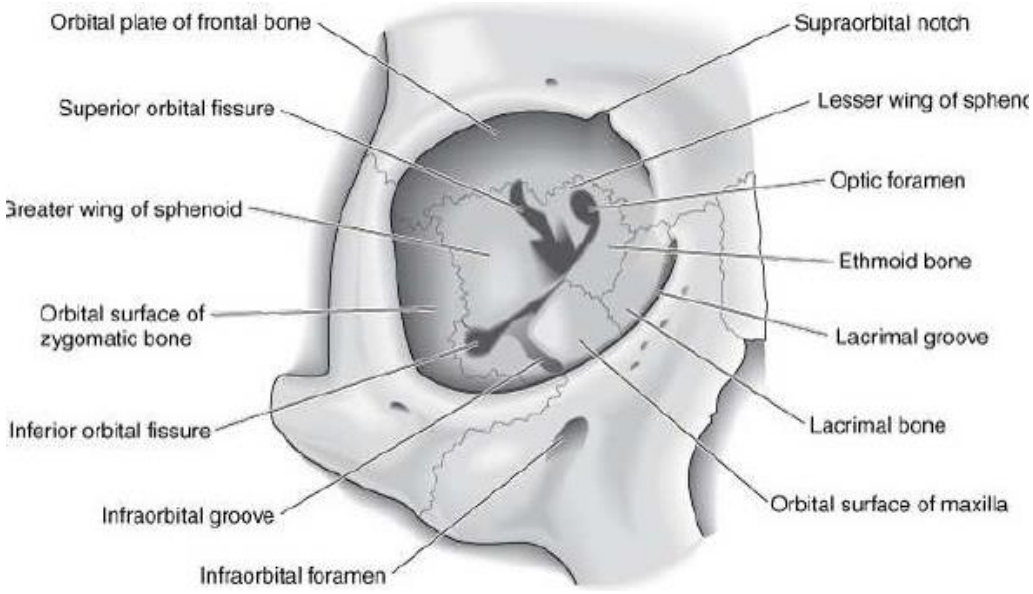
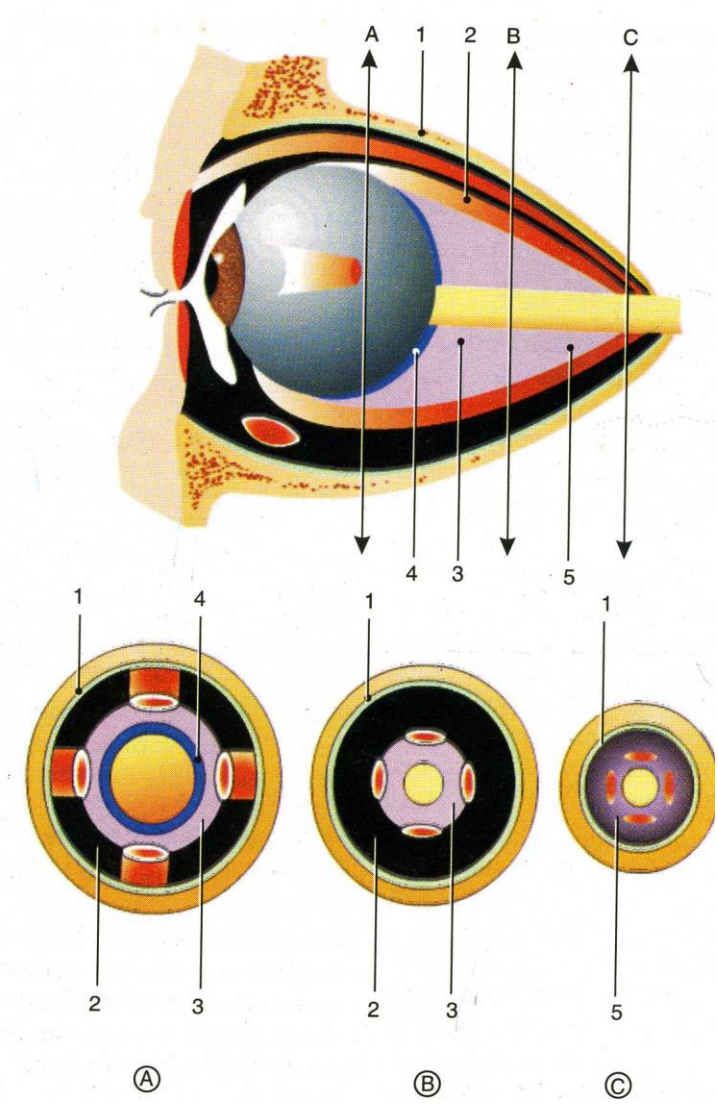


Figure 3 - Surgical spaces in the orbit



1- Subperiosteal space, 2- Peripheral space, 3- Central space, 4- Tenon's space, 5- peripheral and central spaces merged with each other at the orbital apex

1) Subperiosteal space

This is a potential space between orbital bones and the periorbita, limited anteriorly by the strong adhesions of periorbita to orbital rim.

2) **Peripheral orbital space (Anterior space)**

This space is bounded peripherally by peri orbita, internally by the four extra ocular muscles with their inter muscular septa and anteriorly by the septum orbitale (including tarsal plates and tarsal ligaments). Posteriorly, it merges with the central space.

Contents of this space are peripheral orbit fat. Superior oblique. Inferior oblique and levator palpebrae superioris muscle. Lacrimal, Frontal, trochlear.anterior ethmoidal and posterior ethmoidal nerves, superior and inferior ophthalmic veins, lacrimal gland and half of the lacrimal sac.

3) **Central space:**

It is also called muscular cone or posterior or retrobulbar space. This space is bounded anteriorly by Tenons capsule lining the back of the eye and peripherally by the extra ocular rectus muscle and their intermuscular septa (in the anterior part). In the posterior part, where inter muscular septa are imperceptible, this space becomes continuous with the peripheral orbit space. Contents of the central space include optic nerve and its meninges, superior and inferior divisions of oculomotor nerve. Abducent nerve, nasociliary nerve, ciliary ganglion, ophthalmic artery, superior ophthalmic vein and the central orbit fat.

4) Subtenon's space

It is a potential space around the eye ball between the sclera and tenon's capsule.

In the preceding paragraphs the surgical spaces have been described using classical nomenclature. However, some alternative terms are also used. At the apex of the orbit, the peripheral (anterior) and central (posterior) spaces merge with each other to form a single space. Hence it will be more appropriate to divide the orbit into following five surgical spaces.

Subperiosteal space

Anterior (peripheral) space extending posteriorly upto the posterior limit of the intermuscular membrane.

Posterior (central) space, also extending posteriorly up to the posterior limit of intermuscular membrane.

Apical space, bounded peripherally by periorbita; anteriorly becoming continuous with the anterior (peripheral) and posterior (central) spaces, at the level of posterior limit of intermuscular membrane and ending posteriorly at the apex of the orbit.

Subtenons space

ORBICULARIS OCULI

Orbicularis oculi is the palpebral sphincter. It is an elliptical sheet extending from the lids, where it surrounds the palpebral fissure, to the brow, temple and cheek. It consists of two main parts- Palpebral part

Orbital part

Palpebral part:

The palpebral part of orbicularis oculi is central and confined to the lids. It consists of muscle fibres and may divide into pre tarsal and pre septal strata, which are joined by thinnest parts of the muscle, at the superior and inferior palpebral sulci.

It diverges from the medial palpebral ligament and neighbouring bone and curves across the lids in a series of half ellipses, which interlace beyond the lateral canthus as the lateral palpebral raphe.

Orbital part:

The orbital part has a curved orgin from the upper orbital margin medial to the supra orbital notch, the maxillary process of the frontal bone and the frontal process of maxilla from the medial palpebral ligament, and from the lower orbital margin medial to the infra orbital foramen. This attachment is musculotendinous and discontinous. Peripheral fibres sweep across the orbital margin in eccentric loops, the more central ones forming almost complete rings.

Relations:

The palpebral part has areolar tissue but not fat on both aspects. Anteriorly, this separates it from the skin, posteriorly, the sub muscular areolar tissue separates it from the tarsal plates and palpebral fascia, containing main vessels, nerves and fibres of the levator. This part is adherent to dermis at the medial and lateral canthi. Fibres of the levator pass through it to the skin.

The orbital part spreads above on the fore head (contributing to the structure of the eye brow and covering corrugator super cilli), laterally on the temple (covering the anterior part of the temporal fascia) and below on the cheek (overlapping the zygomatic bone and elevator muscles of upper lip and nostril). Anteriorly it is separated from the skin by a layer of fat, to which it is adherent, and thus to skin.

A third part of the orbicularis oculi is a recognizable entity, the pars lacrimalis (tensor tarsi), often named Horners muscle, is a thin layer attached behind the lacrimal crest and the lacrimal fascia. Passing anteriorly, it divides into two slips around the canaliculi and blends with the pre tarsal and ciliary parts of orbicularis oculi on both lids.

ACTIONS:

The palpebral part closes the lids gently, as in blinking, which is often involuntary and frequently without obvious stimulus. Reflex blinking is stimulated by visible threats and loud noises. Voluntary blinking, to clarify vision or to break eye contact, also occurs. Reflex blinking is stimulated by drying of cornea. It spreads tear fluid, and the pars lacrimalis helps to empty the sac.

The orbital part closes the lids firmly, and draws the skin of the fore head, temple and cheek medially, which form radial furrows around the lateral canthus. The muscle also contracts during short but powerful expiration, as in crying, coughing, blowing of the nose, sneezing and excessive laughter. Contraction of the orbital part depresses the eye brow to reduce excessive light from above, the relaxed palpebral part allowing the lids to remain open.

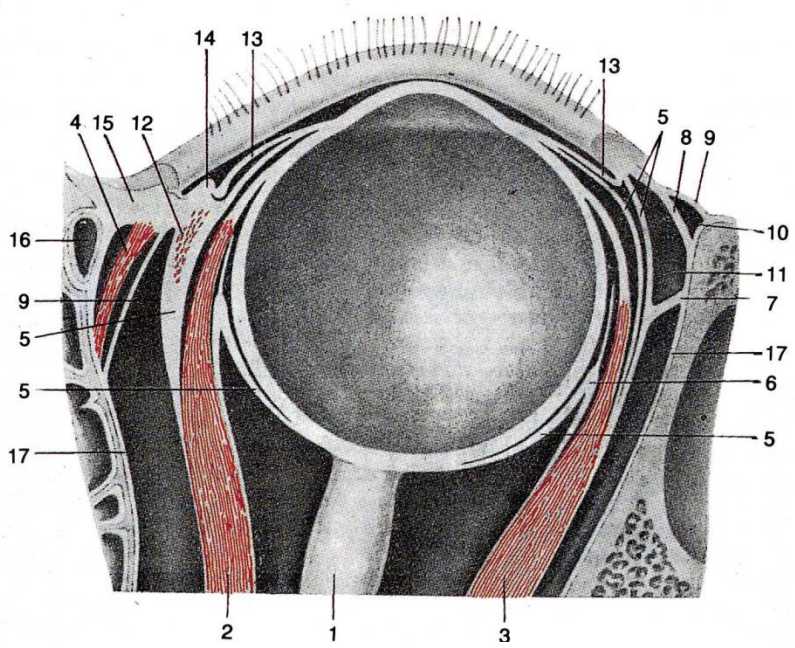
The palpebral part is opposed by levator palpebral superiors, the orbital by occipitofrontalis.

NERVE SUPPLY:

Orbicularis oculi is innervated by the facial nerve, through its temporal and zygomatic branches which enter the muscle from its lateral side and deep aspect. Several temporal branches ascend across the zygoma and pass above the lateral canthus to supply the upper half of orbicularis, assisted by upper zygomatic branches, the lower of which cross the zygomatic bone to reach its lower part.

THE OCULAR FASCIA

Figure-4 – Ocular Fascia



1- Optic nerve, 2- Medial rectus, 3- Lateral rectus, 4- Horner's muscle, 5 & 6- Fascis bulbi, 7- Lateral check ligament 8-Aponeurosis of levator 9- Septum Orbitale 10- Superior recess 11- Recess for lacrimal gland, 12- Medial capsulopalpebral muscle, 13- Bulbar conjunctiva, 14- Caruncle, 15-Medial Palpebral ligament, 16- Lacrimal sac, 17- Periorbita

Tenons capsule (Fascia bulbi): is a thin membrane of somewhat elastic fibres, enveloping the globe from the limbus to the optic nerve. Its inner surface is well defined and in close contact with the sclera.

Anteriorly, it is firmly attached to the sclera around the limbus and between the two there is a serous interstice. Separation of the layers is however difficult. There is limited movement between tenons capsule and sclera. Such movements are impeded by fibrous attachments and by those structures which penetrate the capsule and tend to make it adhere to sclera. Between the

capsule and the duramater of the optic nerve, there are fibrous connections. So the capsule really amounts to a continuation of the duramater around the eye ball.

The posterior surface of the fascia bulbi is in contact with orbital part, from which it is separated with difficuty.

Anteriorly the fascia bulbi becomes thinner, and merges gradually into the sub conjunctival connective tissue and in operations for exposing the ocular muscles can be demonstrated separately from this membrane.

Beneath the eye, Tenons capsule is thicker, acting as a suspensory (hammock like) supporting band. This is known as suspensory ligament of Lockwood. The capsule also provides sheaths of connective tissue around the extraocular muscles from where they pass through. These envelope vary in length in different muscles, attaching themselves to the muscle fascia and extending strong branch to nearby structures.

The lateral rectus sends a connecting band to the orbital tubercle and a similar connection goes from the medial rectus to the lacrimal bone. To some extent these substantial bands limit or oppose the ocular rotations and are called as check ligaments

Through the tenons capsule pass the following:

The optic nerve

The ciliary nerves

The ciliary arteries

The vortex veins

The tendons of extra ocular muscles

The band of fibres from the superior rectus is fastened to the levator muscle of the upper eye lid, which assists in coordinating movements of two muscles. So when the superior rectus elevates the eye, the upper lids tend to be raised.

From the inferior rectus fibrous tissue extends forwards over the inferior oblique muscles as far as the lower lid, to fasten into the tarsal plate. Because fibres penetrate up to 2 mm, the lower lid adjusts its position when the eye looks down.

Each tendon of the appropriate muscles make a connection with the conjunctival fornix, so the conjunctiva is stretched as eye rotates. Fatty tissue occupies the space within the orbit. The consistency and connective tissues content of this material differs from place to place and it is organized in patches with in connective tissue coverings. Between individual external muscles of the eye, there are fatty and membranous connections, divided into central and peripheral parts. But these are less prominent towards the orbital apex. The eye itself and other orbital structures enjoy a yielding and flexible environment on account of this fatty material.

Tenons space delivery allows potential diffusion of solution throughout this compartment and solution may also diffuse back into the orbit, reaching the intraconal central region. There is no clear cut compartmentalization into central (retrobulbar) region and peripheral space outside the muscle cone. Solution may then diffuse extensively between the compartments if sufficient time is allowed and may be facilitated by the use of hyalouronidase.

To eliminate pain sensation for the globe, pain fibres leaving from the eye must be blocked and to further achieve akinesia, the extraocular muscle nerve supply should also inhibited. Ocular pain sensation is mediated by the long sensory root of ciliary ganglion. These fibres pass through the ganglion and provide sensation from the cornea, iris and ciliary body. The ciliary ganglion is situated posteriorly in the orbit approximately 1 cm anterior to the optic foramen

between the optic nerve and the lateral rectus muscle within the muscle cone. It is separated from the lateral rectus muscle by loose fat and is close to the ophthalmic artery. Posterior diffusion of local anaesthetic solution may directly block the ganglion, or blockade of muscle function may occur by solution affecting nerves passing more anteriorly. The differential temporal decrease in muscle function, with those muscles closest to the site of solution delivery, medial and inferior rectus being lost first, suggests that a direct block upon anterior nerve fibres may be occurring

The extraocular muscles are supplied by cranial nerves III, IV and VI. To achieve akinesia, motor fibres with in these nerves have to be inhibited at some level in their path. Superior rectus is supplied by the superior division of the oculomotor nerve entering the inner surface of the muscle at the junction of its middle and posterior thirds. Inferior rectus, medial rectus and inferior oblique are supplied by the inferior division of the oculomotor nerve entering the inner surface of the muscles at the junction of middle and posterior thirds. Lateral rectus is supplied on its inner aspect by the abducens nerve just behind its middle. Only superior oblique is supplied superiorly at its lateral border by the trochlear nerve, the most anterior branch being at the junction of posterior and middle thirds. All extraocular muscles except superior oblique are thus supplied by the nerve entering on the inner surface. The presence of superior oblique function after effective blockade of all other extra ocular muscle activity provides further evidence that a direct action upon nerve fibres in the retrobulbar compartment is the mechanism of action, to what degree the anaesthetic solution affects the ciliary ganglion is undetermined.

Differences between peribulbar and subtenon's anaesthesia can be explained anatomically. Peribulbar anaesthesia has been used for years, but its success rate is still insufficient. Wong[90] et al stated that peribulbar anaesthesia utilizes the tissue compartment principle in which a needle is inserted into a compartment and the local anaesthetic injected spreads by virtue of its pressure

and volume throughout the compartment. The target structures to be blocked are a number of small sensory and motor nerves dispersed throughout the corpus adiposum of the orbit, especially in the intraconal space. After sub tenon anaesthesia, local anaesthetic must spread from extraconal space into intraconal space.[91][92] Because the corpus adenosum of the orbit is separated into multiple compartments by a small network of septa, the spread of local anaesthetic is sometimes heterogenous and incomplete.[91-93] This irregular spreading accounts for imperfect blockade in up to 50% of patients in some series[94][95] or for the need for multiple injections or very high volumes in peribulbar anaesthesia.

The subtenon's space is a virtual space that allows the rotation movements of the eye ball in the connective tissues of the orbit. It is adherence free and therefore injectable. Subtenon space is limited by the sclera and the fascial sheath of the orbit. It has been hypothesized that subtenon anaesthesia acts by spreading the local anaesthetic through the fascial sheath of the eye ball from the episcleral space to the intra conal space.[95-96] Another hypothesis that explains subtenon's anaesthesia effectiveness is that the cannula introduced into the episcleral space pierces the fascial sheath of the eyeball from the episcleral space to the retrobulbar space. Another hypothesis that explains sub tenon's anaesthesia effectiveness is that the cannula introduced into the episcleral space pierces the fascial sheath of the eyeball to enter the intraconal space. The ciliary nerves, responsible for the sensory innervation of the globe, pass through the episcleral space and are bathed by any anaesthetic solution injected into the space, resulting in a good sensory blockade of the eye ball. It has been confirmed that spread of local anaesthetic is guided by the fascial sheath of the orbit into the episcleral space all around the eye ball. Sub tenon anaesthesia is often performed using a surgical approach to the fascial sheath of the eye ball. Some needle techniques also have been presented. In most of these reports, the volume of the

local anaesthetics injected into the episcleral space is less than 4 ml. This may account for incomplete motor blockade in many cases, especially with regard to lid akinesia, with the need for an additional facial nerve block. The fascial sheath of the eyeball extends to the sheaths of the rectus muscles. This anatomic disposition may explain that a high volume of local anaesthetic is guided preferentially to those muscle sheaths to provide akinesia of eyelids.

METHODOLOGY

MATERIALS AND METHODS

This prospective study was conducted between December 2010 and July 2012 at R.L. Jalappa Hospital and Research Center, Sri Devaraj Urs Medical College, Kolar. Patients who had attended the outpatient department of Department of Ophthalmology formed the subjects for the study. During the above mentioned period 150 randomly selected patients fulfilling the criteria framed, were included for the study. They were randomly divided into Group A (n=50) who underwent phacoemulsification under topical anaesthesia, Group B (n=50) who underwent phacoemulsification under subtenon's anaesthesia and Group C (n=50) who underwent phacoemulsification under peribulbar anaesthesia After the procedure the effect of the drugs, patient's and surgeon's comfort (in terms of pain, akinesia and lid movements) and intra and post operative complications of the three methods of anaesthesia in phacoemulsification were compared.

INCLUSION CRITERA:

1. Immature cortical cataract.
2. Posterior subcapsular cataract.
3. Nuclear sclerosis grade I, II and III.

EXCLUSION CRITERIA:

1. Nuclear sclerosis grade IV.
2. Pseudoexfoliation.

3. Previous ocular surgery.
4. Nystagmus.
5. Co-existing ocular pathology.
6. Hearing impairment.
7. Speech disorder.
8. Orthopnea.
9. Extreme anxiety.
10. Mental retardation.
11. Irreversible blindness in the contralateral eye.

PRE-OPERATIVE EVALUATION

All the patients were admitted one day prior to the surgery. All these patients underwent, the following pre-operative evaluation and complete eye examination including a full history of any previous ocular disease or surgery, examination by both direct & indirect ophthalmoscopy, visual acuity recording by Snellens charts, Applanation tonometry and detailed slit lamp examination.

General physical and systemic examination including cardiovascular system and Respiratory system examination, blood pressure recording and blood sugar evaluation was done.

Written informed consent was taken from all the patients.

PRE OPERATIVE PREPARATION

Pre operatively all patients were on oral Tab Ciprofloxacin 500mg twice daily. Ciprofloxacin (0.3%) eye drops was instilled hourly one day prior to surgery. The pupil was dilated with Tropicamide with Phenylephrine 1% drops along with Flurbiprofen 0.03% drops, used 3 times in

one hour for two hours before surgery. Sensitivity to local anaesthetics was tested with lignocaine test dose.

All surgeries were done by a single experienced surgeon. A 2.8mm clear corneal incision, continuous curvilinear capsulorrhexis, bimanual endocapsular phacoemulsification and bimanual aspiration of cortical lens material was followed implantation of foldable acrylic IOL (intra ocular lens).

PROCEDURES

PROCEDURE FOR TOPICAL ANAESTHESIA

The topical group (Group A-50) received proparacaine hydrochloride 0.5% drops in the conjuctival sac 5 times in 10 minutes prior to surgery. Final dose was administered after patient has been draped and just prior to the initial clear corneal incision.

PROCEDURE FOR SUB TENON'S ANAESTHESIA

The injection was made on a supine patient. The conjunctiva was anaesthetized with topical anaesthetic solution (4% xylocaine). An eye lid speculum was inserted at this point to improve access. Throughout the procedure patient was asked to look up and outwards to expose the inferonasal quadrant. A small tent of conjunctiva was raised with a pair of non toothed forceps approximately midway between the limbus of the eye and the visible angle of the inferonasal portion of the conjunctiva. A small incision was made in the tented conjunctiva about 5-7 mm from the limbus with a pair of ophthalmic scissors. The closed scissors were introduced through the aperture created and a tunnel was fashioned through the bare sclera by blunt dissection through tenon's capsule. A curved blunt irrigating cannula (19 G, 25 mm) was then inserted with the syringe of anaesthetic solution(2ml of 2% xylocaine with adrenaline mixed with 1 ml of 0.5% bupivacaine) attached. The cannula was introduced along the contour of the globe and

gentle contact of its tip was maintained with the sclera. Occasionally resistance to the needle is felt around the equator where a fibrous band can form as the ocular muscles broach the capsule. This was usually easily overcome by gentle pressure. The cannula was then reintroduced and guided along a path following the contour of the globe until the tip was past the posterior of the equator of the globe. Slow delivery of 2 ml of local anaesthetic was then performed.

Figure - 5 Incision of conjunctiva and formation of tent

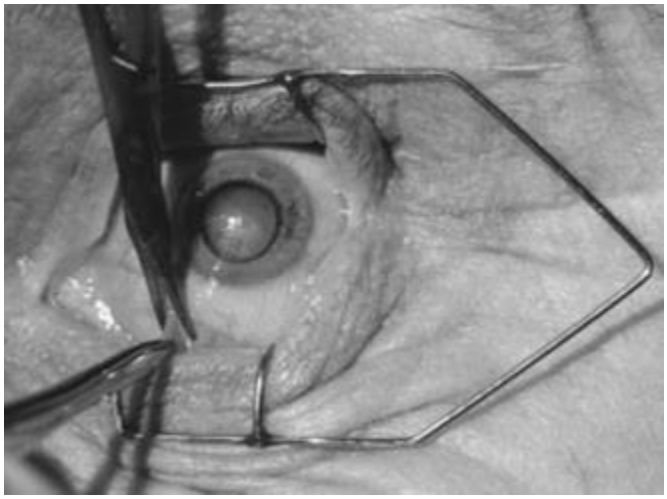


FIGURE 6- Dissection of tenon's capsule

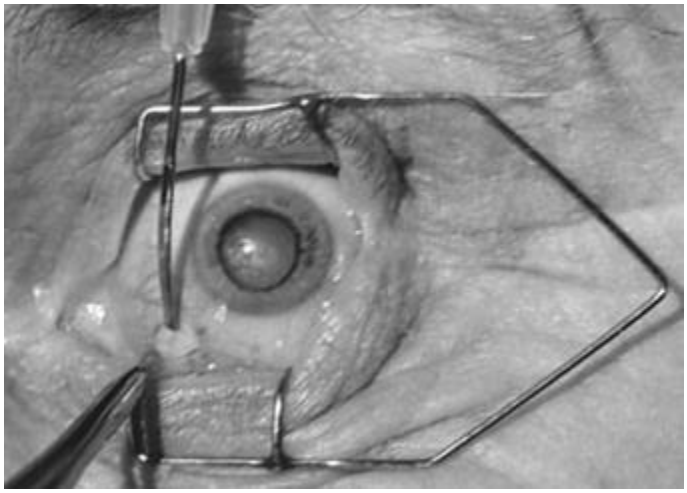
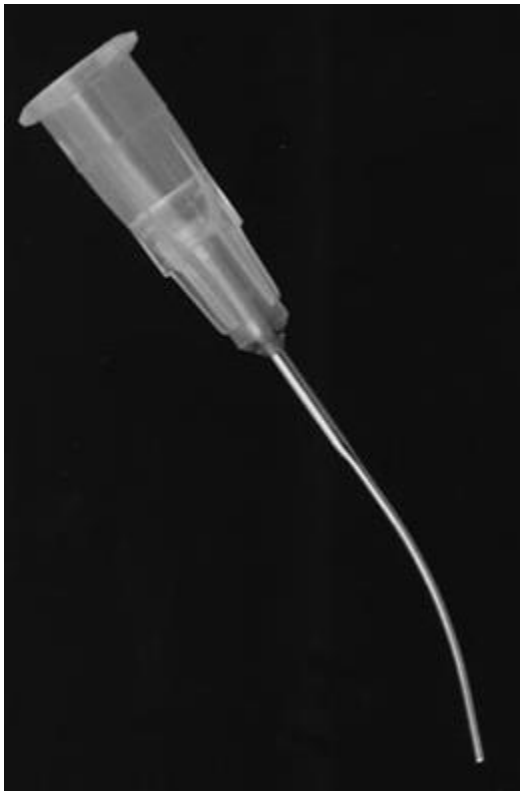


Figure - 7 Visitec curved sub-tenon's cannula



PROCEDURE FOR PERIBULBAR ANAESTHESIA

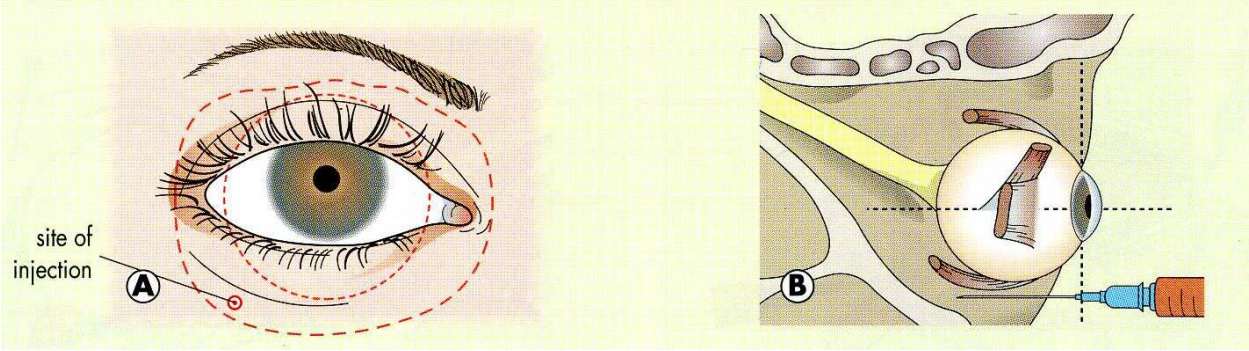
Peribulbar anaesthesia was given by the following method.

1) **Inferotemporal injection**

The injection was made on a supine patient. With the globe in primary gaze initial injection was given at the inferotemporal orbital margin midway between the lateral canthus and the lateral limbus. The 25 G, 25 mm needle attached to a syringe containing anaesthetic mixture (4ml of 2% xylocaine with adrenaline and 3 ml of 0.5% bupivacaine) was then advanced parallel to the orbital floor and injected at a depth of about 2.5 cm from the inferior orbital rim. This area contains the neurovascular bundle to the inferior oblique and the belly of the inferior rectus

which are potentially at risk for needle perforation. After 3 minutes, the amount of akinesia was assessed.

Figure -8- Inferotemporal Injection in Peribulbar Anaesthesia



4) Superonasal injection

The superior nasal quadrant is less safe to pass the needle (25 G, 25 mm). Its use should be discouraged. The needle can be introduced through the upper eyelid at about 2 mm below and medial to the supraorbital notch or lateral and inferior to the supraorbital notch. It is advanced in a sagittal plane under the roof of the orbit 3-5 ml of anesthetic solution is injected. The needle hub should just touch the skin; if the skin is indented this can increase the incidence of injury of the important structures located deeply in this orbital quadrant (optic nerve). The use of a (25 G, 15mm) needle is also recommended.. This should be used only as a supplementary block in order to achieve full akinesia if it is required by the surgeon.

Ocular compression

After local anesthetic injection, Honan's ball (an ocular compression device) was applied for 10-20 min. In addition to softening the globe, compression also helps to spread the anesthetic solution posteriorly, decrease conjunctival oedema and promote akinesia. In conditions when

impairment of blood flow to the retina and optic nerve can take place such as in glaucoma and retinal surgery, it has been recommended to maintain ocular perfusion and refrain from using continuous compression. If it is necessary, intermittent digital pressure is applied.

GRADING OF PAIN

Table 1-Grading of pain (during anaesthesia, intra operative and post operative)

Grade 0	No pain.
Grade 1	No pain, slight sensation
Grade 2	Slight pain
Grade 3	Moderate pain
Grade 4	Intense pain

GRADING OF AKINESIA DURING SURGERY

Akinesia was scored on a scale designed to measure ocular movements in each quadrant.

Table 2- Grading of eye movements

Grade 0	No movement
Grade 1	Mild movements
Grade 2	Moderate movements
Grade 3	Severe movements

GRADING OF LID MOVEMENTS DURING SURGERY.

Table 3- Grading of lid movements

Grade 0	Little or no lid squeezing.
Grade 1	Moderate or ill sustained squeezing throughout.
Grade 2	Instantaneous and sustained squeezing

ANALYSIS OF RESULTS

Effect of anaesthetic drugs (onset and duration), patient's comfort (in terms of pain, akinesia and lid movements) and intra operative complications were noted. Also, post operative complications and best spectacle corrected visual acuity (BSCVA) were noted in all the three groups.

Descriptive statistical analysis has been carried out in the present study. Significance was assessed at 5 % level of significance. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Statistical analysis was done using SPSS software 15.

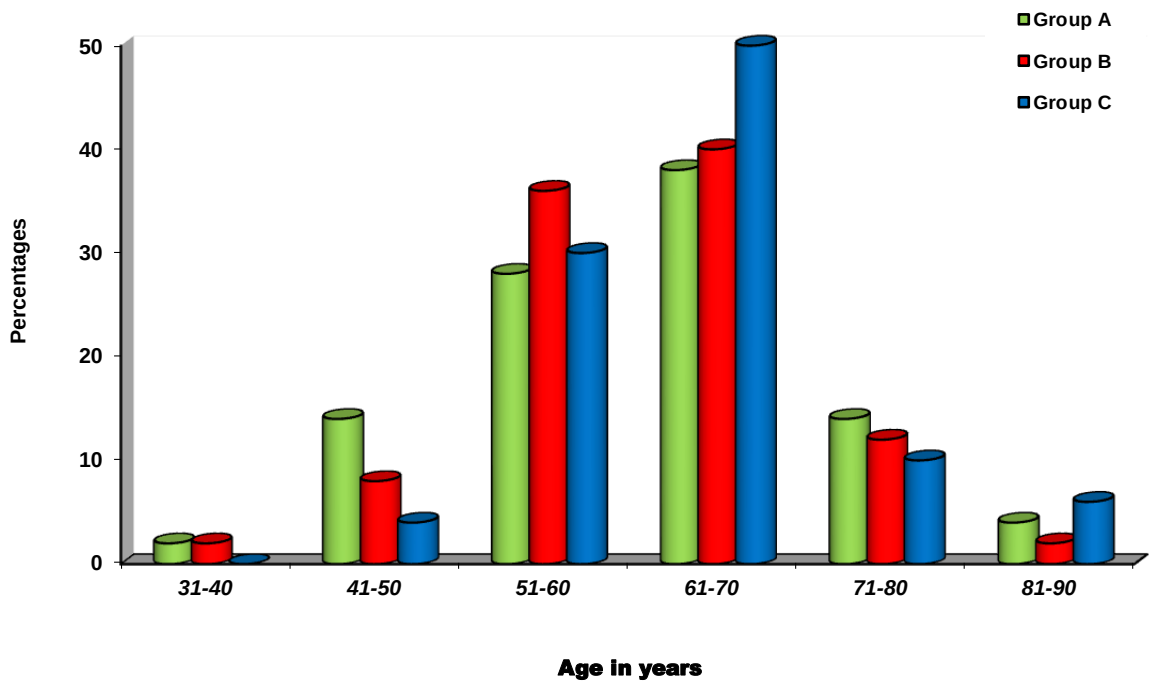
OBSERVATION AND RESULTS

TABLE 4: AGE DISTRIBUTION OF PATIENTS STUDIED

Age in years	Group A		Group B		Group C	
	No	%	No	%	No	%
31-40	1	2.0	1	2.0	0	0.0
41-50	7	14.0	4	8.0	2	4.0
51-60	14	28.0	18	36.0	15	30.0
61-70	19	38.0	20	40.0	25	50.0
71-80	7	14.0	6	12.0	5	10.0
81-90	2	4.0	1	2.0	3	6.0
Total	50	100.0	50	100.0	50	100.0
Mean ±SD	62.12±10.05		62.94±8.86		64.88±8.03	

Samples are age matched with P = 0.294

CHART 1: BAR CHART SHOWING AGE DISTRIBUTION



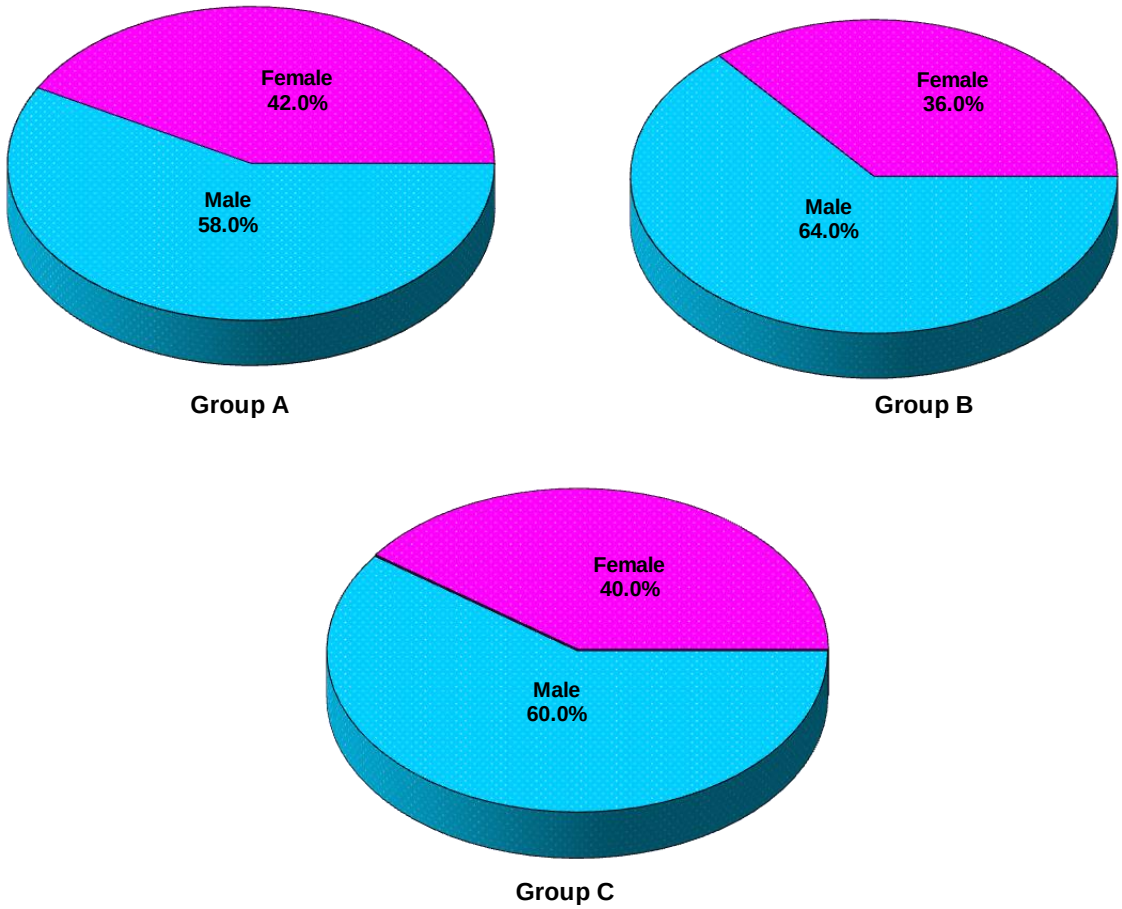
In our study in topical group (group A) there were a total of 50 patients. Out of these 50 patients, 1 (2%) was aged between 31-40 years, 7 (14%) were aged between 41-50 years, 14 (28%) were aged between 51-60 years, 19 (38%) were aged between 61-70 years, 7 (14%) were aged between 71-80 years, and 2 (4%) were between 81-90 years. In the subtenon's group (group B), out of total 50 patients, 1 (2%) was aged between 31-40 years, 4 (8%) were aged between 41-50 years, 18 (36%) were aged aged between 51-60 years, 20 (40%) were aged between 61-70 years, 6 (12%) were aged between 71-80 years and 1(2%) was aged between 81-90 years. Out of the 50 patients in peribulbar group (group C), no patients were there aged between 31-40 years, 2 (4%) were aged between 41-50 years, 15 (30%) were aged between 51-60 years, 25 (50%) were aged between 61-70 years, 5 (10%) were aged between 71-80 years and 3 (6%) were aged between 81-90 years.

TABLE 5: GENDER DISTRIBUTION OF PATIENTS STUDIED

Gender	Group A		Group B		Group C	
	No	%	No	%	No	%
Male	29	58.0	32	64.0	30	60.0
Female	21	42.0	18	36.0	20	40.0
Total	50	100.0	50	100.0	50	100.0

Samples are gender matched with p=0.822

CHART 2: PIE DIAGRAM SHOWING GENDER DISTRIBUTION

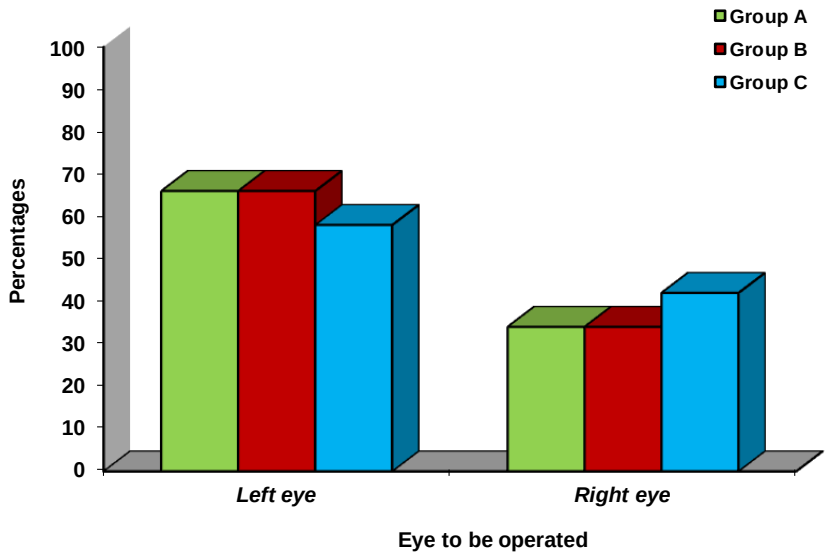


In our study, in group A (topical group), out of total 50 patients, 29 patients (58%) were male and 21 patients (42%) were female. Out of total 50 patients in group B (subtenon's group), 32 patients (64%) were male and 18 patients (36%) were female. In group C (peribulbar group), out of total 50 patients, 30 patients (60%) were male and 20 patients (40%) were female.

TABLE 6: EYE TO BE OPERATED

Eye to be operated	Group A		Group B		Group C	
	No	%	No	%	No	%
Left eye	33	66.0	33	66.0	29	58.0
Right eye	17	34.0	17	34.0	21	42.0
Total	50	100.0	50	100.0	50	100.0

CHART 3: BAR CHART SHOWING LATERALITY OF EYE TO BE OPERATED



In Group A (topical) and Group B (subtenon's), 33 left eyes (66%) were operated and 17 right eyes (34%) were operated. In Group C (peribulbar), 29 left eyes (58%) were operated and 21 right eyes (42%) were operated.

TABLE 7: ONSET AND DURATION OF ANAESTHETIC DRUGS

Group A		Group B		Group C	
Onset of action	Duration of action	Onset of action	Duration of action	Onset of action	Duration of action
Instanteneous	15-20mins	10mins	20-30mins	15-20mins	45-50mins

In Group A, onset of action of drugs was instantaneous for all the 50 patients and the effect persisted for 15-20 minutes for all the 50 patients. In Group B, onset of action of drugs was 10 minutes for all the 50 patients while the effect of the drugs lasted for 20-30 minutes for all the 50 patients. In Group C, onset of action of drugs was 15-20 minutes from the time of administration for all 50 patients and effect of the anaesthesia lasted for 45-50 minutes for all the 50 patients.

TABLE 8: COMPARISON OF PAIN DURING ANESTHESIA (GRADE) IN THREE GROUPS OF PATIENTS STUDIED

The status of pain (as per grading system) in the 50 subjects during the administration of anaesthesia is given below

Pain during anesthesia (Grade)	**Group A**		**Group B**		**Group C**	
	No	**%**	**No**	**%**	**No**	**%**
Nil	50	100.0	25	50.0	0	0.0
1-2	0	0.0	23	46.0	20	40.0
3-4	0	0.0	2	4.0	30	60.0
Total	50	100.0	50	100.0	50	100.0
Mean ±SD	0.00±0.00		0.78±0.95		2.82±1.04	

Pain during anesthesia is significantly more in Group C (mean=2.82) compared to Group B (mean=0.78) , is significantly low in Group A(mean=0.0) with P<0.001**

In group A, no patients felt any pain during administration of anaesthesia. In group B, 25 patients (50%) did not feel any pain during administration of anaesthesia, 23 patients (46%) felt pain of grade 1-2 and 2 patients (4%) felt pain of grade 3-4. In group C, 20 patients (40%) felt pain of grade 1-2 and 30 patients (60%) felt pain of grade 3-4 during administration of anaesthesia. Pain scores during administration of anaesthesia were found to be significantly high in peribulbar group and significantly low in topical group compared to subtenon's group (P<0.001**) with the mean pain scores being 0.0, 0.78 and 2.82 in topical, subtenon's and peribulbar groups respectively.

CHART 4: BAR CHART SHOWING COMPARISON OF PAIN DURING ADMINISTRATION OF ANAESTHESIA (GRADE)

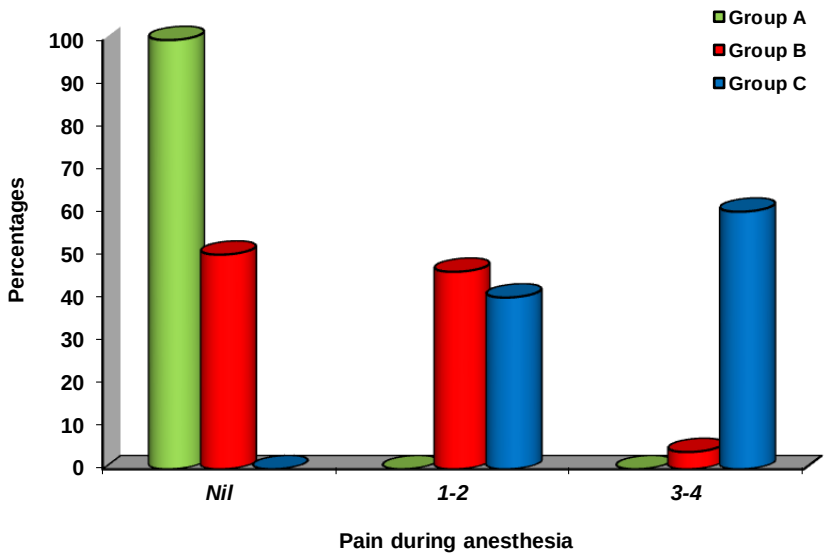


TABLE 9: COMPARISON OF PAIN DURING SURGERY IN THREE GROUPS OF PATIENTS

The status of pain (as per grading system) in the 50 subjects during the surgery is given below

Pain during Surgery	Group A		Group B		Group C	
	No	%	No	%	No	%
Nil	42	84.0	47	94.0	45	90.0
1-2	8	16.0	3	6.0	1	2.0
3-4	0	0.0	0	0.0	4	8.0
Total	50	100.0	50	100.0	50	100.0
Mean ±SD	0.20±0.49		0.12±0.47		0.32±0.99	

Distribution of pain during surgery was comparable in three groups of patients with P=0.304

In group A, 42 patients (84%) did not experience any pain during surgery, while 8 patients (16%) complained of pain of grade 1-2 but nobody experienced any pain of grade 3-4. In group B, 47 patients (94%) did not experience any pain during the surgery, 3 patients (6%) experienced pain of grade 1-2 while nobody experienced pain of grade 3-4. In group C, 45 patients (90%) did not feel any pain during surgery, 1 patient (2%) experienced pain of grade 1-2 and 4 patients (8%) experienced pain of grade 3-4. The overall pain scores during surgery were comparable in all the groups (P=0.304); the mean scores being 0.20, 0.12 and 0.32 in topical, subtenon's and peribulbar groups respectively. There was no statistically significant difference between any of the groups (P=0.304).

CHART 5: COMPARISON OF PAIN DURING SURGERY IN THREE GROUPS OF PATIENTS

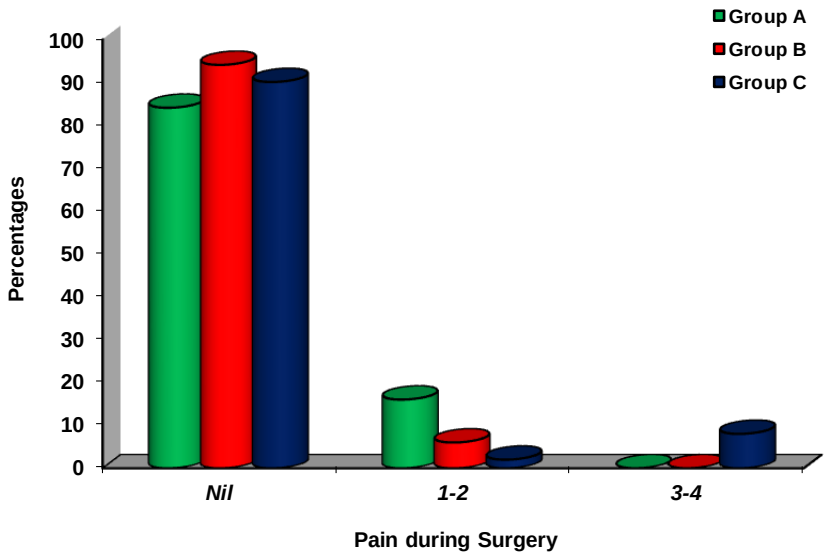


TABLE 10: COMPARISON OF PAIN 6 HOURS AFTER SURGERY (GRADE) IN THREE GROUPS OF PATIENTS

The status of pain (as per grading system) in the 50 subjects 6 hours after surgery is given below

Pain 6 hours after surgery	**Group A**		**Group B**		**Group C**	
	No	**%**	**No**	**%**	**No**	**%**
Nil	46	92.0	47	94.0	25	50.0
1-2	4	8.0	3	6.0	20	40.0
3-4	0	0.0	0	0.0	5	10.0
Total	50	100.0	50	100.0	50	100.0
Mean ±SD	0.08±0.27		0.12±0.47		0.94±1.15	

Pain felt 6 hours after surgery was significantly more in Group C with P<0.001**

In group A, 46 patients (92%) did not experience any pain 6 hours after surgery, 4 patients (8%) experienced pain of grades 1-2, while no patients experienced pain of grade 3-4. In group B, 47 patients (94%) did not experience any pain 6 hours after surgery, 3 patients (6%) experienced pain of grade 1-2 and no patients experienced pain of grade 3-4. In group C, 25 patients (50%) did not experience any pain 6 hours after surgery, 20 patients (40%) complained of pain of grade 1-2 while 5 patients (10%) complained of pain of grade 3-4. The pain scores 6 hours after surgery were found to be significantly high in peribulbar group (P<0.001**) compared to topical and subtenon's group; the mean pain scores being 0.08, 0.12 and 0.94 in topical, subtenon's and peribulbar groups respectively.

CHART 6: COMPARISON OF PAIN 6 HOURS AFTER SURGERY (GRADE) IN THREE GROUPS OF PATIENTS

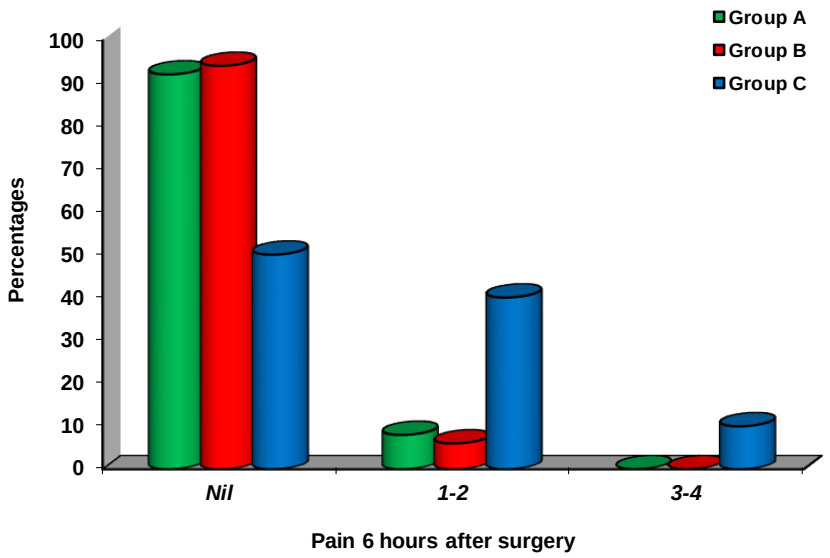


TABLE 11: COMPARISON OF AKINESIA (GRADE) IN THREE GROUPS OF PATIENTS

The status of akinesia (as per grading system) in the 100 subjects during the intra-operative period is given below

Eye Movements	Group A		Group B		Group C	
	No	%	No	%	No	%
No	0	0.0	42	84.0	46	92.0
Yes	50	100.0	8	16.0	4	8.0
• Grade 1	-	-	4	8.0	2	4.0
• Grade 2	-	-	2	4.0	2	4.0
• Grade 3	-	-	2	4.0	0	0.0
Total	50	100.0	50	100.0	50	100.0

Presence of eye movements is more in Group A compared to Group B and Group C but not statistically significant (P=0.304).

In group A, all the 50 patients had eye movements during the surgery. In group B, 42 patients (84%) did not have any eye movements during surgery, 8 patients (16%) had eye movements of which 4 patients (8%) had eye movements of grade 1, 2 patients (4%) had eye movements of grade 2 and another 2 patients (4%) had eye movements of grade 3. In group C, 46 patients (92%) did not have any eye movements during the surgery, 4 patients (8%) had eye movements of which 2 patients (4%) had eye movements of grade 1 and another 2 patients (4%) had eye movements of grade 2 while no patients had eye movements of grade 3. Though eye movements was more in topical group (P=0.304) compared to subtenon's and perbulbar, it was not statistically significant.

CHART 7: COMPARISON OF EYE MOVEMENTS IN THREE GROUPS OF PATIENTS

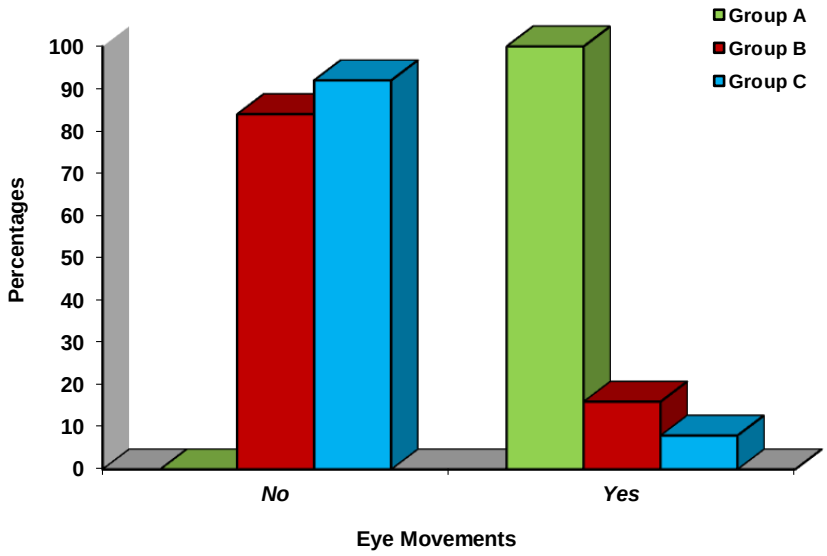


TABLE 12: COMPARISON OF LID MOVEMENT OF PATIENTS STUDIED

LID movement	Group A		Group B		Group C	
	No	%	No	%	No	%
Absent	0	0.0	41	82.0	48	96.0
Present	50	100.0	9	18.0	2	4.0
Total	50	100.0	50	100.0	50	100.0

Presence of LID movement is statistically more in group A compared to Group B and Group C with P<0.001**

In group A, all the 50 patients (100%) had lid movements during the surgery. In group B, 41 patients (82%) did not have lid movements during surgery while 9 patients (18%) had lid movements. In group C, 48 patients (96%) did not have lid movements during the surgery, while 2 patients (4%) had lid movements. Comparing the three groups, squeezing of the lids (P<0.001**) was significantly more commonly noted in the topical group.

CHART 8: COMPARISON OF LID MOVEMENT OF PATIENTS STUDIED

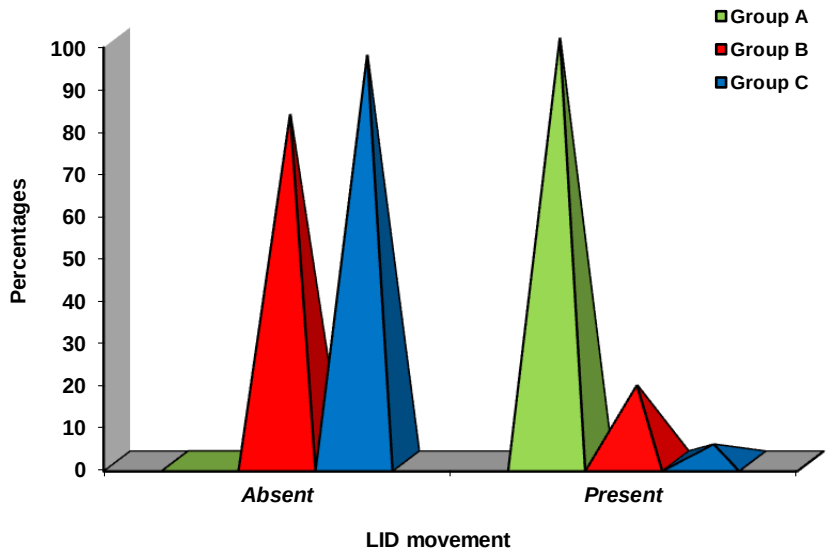


TABLE 13: AN EVALUATION OF CHEMOSIS IN THREE GROUPS OF PATIENTS STUDIED

Chemosis	Initial	1 day	1 week	1 month	3 months	6 months	% change
Group A							
• Nil	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	-
• Present	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-
Group B							
• Nil	39(78%)	44(88%)	50(100%)	50(100%)	50(100%)	50(100%)	+22.0
• Present	11(22%)	6(12%)	0(0%)	0(0%)	0(0%)	0(0%)	-22.0
Group C							
• Nil	45(90%)	47(94%)	50(100%)	50(100%)	50(100%)	50(100%)	+10.0
• Present	5(10%)	3(6%)	0(0%)	0(0%)	0(0%)	0(0%)	-10.0
P value	**<0.001****	**0.042***	1.000	1.000	1.000	1.000	-

In group A, no patients had chemosis. In group B, 11 patients (22%) developed chemosis following anaesthesia and 39 patients (78%) did not have chemosis. On 1st post operative day, 6 patients (12%) had chemosis and 44 patients (88%) did not have chemosis. By 1 week follow up, no patients had chemosis. In group C, 5 patients (10%) developed chemosis following anaesthesia and 45 patients (90%) did not have chemosis. On 1st post operative day, 3 patients (6%) had chemosis and 47 patients (94%) did not have chemosis. By 1 week follow up, no patient had chemosis. Chemosis (P<0.001**) was significantly more in subtenon's and peribulbar group compared to topical group.

CHART 9: EVALUATION OF CHEMOSIS IN THREE GROUPS OF PATIENTS STUDIED

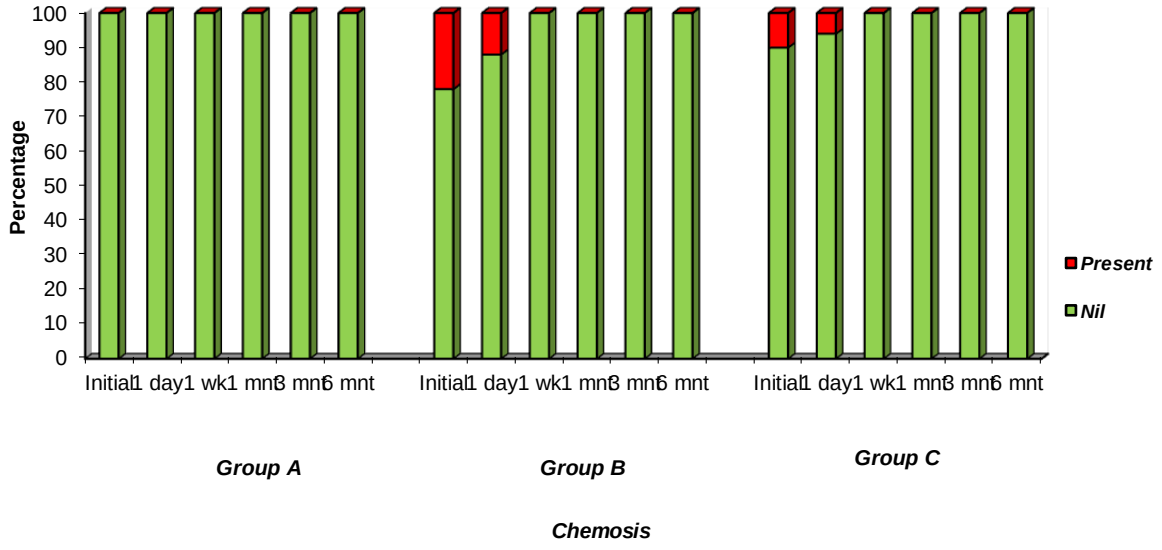


TABLE 14: AN EVALUATION OF SCH IN THREE GROUPS OF PATIENTS STUDIED

SCH	Initial	1 day	1 week	1 month	3 months	6 months	% change
Group A							
• Nil	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	-
• Present	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-
Group B							
• Nil	42(84%)	42(84%)	46(92%)	50(100%)	50(100%)	50(100%)	+16.0
• Present	8(16%)	8(16%)	4(8%)	0(0%)	0(0%)	0(0%)	-16.0
Group C							
• Nil	46(92%)	46(92%)	48(96%)	50(100%)	50(100%)	50(100%)	+8.0
• Present	4(8%)	4(8%)	2(4%)	0(0%)	0(0%)	0(0%)	-8.0
P value	**0.007****	**0.007****	0.166	1.000	1.000	1.000	-

In group A, no patients had SCH. In group B, 8 patients (16%) developed SCH following anaesthesia while 42 patients (84%) did not have any SCH. On 1st post operative day, 8 patients (16%) had SCH and 42 patients (84%) did not have SCH. On 1 week post operative follow up, 4 patients (8%) had SCH while 46 patients (92%) did not have SCH. On 1 month post operative follow up, no patients had any SCH. In group C, 4 patients (8%) developed SCH following anaesthesia while 46 patients (92%) did not have SCH. On 1st post operative day, 4 patients (8%) had SCH and 46 patients (92%) did not have SCH. On 1 week post operative follow up, 2 patients (4%) had SCH and 48 patients (96%) did not have SCH. On 1 month post operative follow up, no patients had any SCH. SCH (P=0.007**) was significantly more in subtenon's and peribulbar group compared to topical group.

CHART 10: EVALUATION OF SCH IN THREE GROUPS OF PATIENTS STUDIED

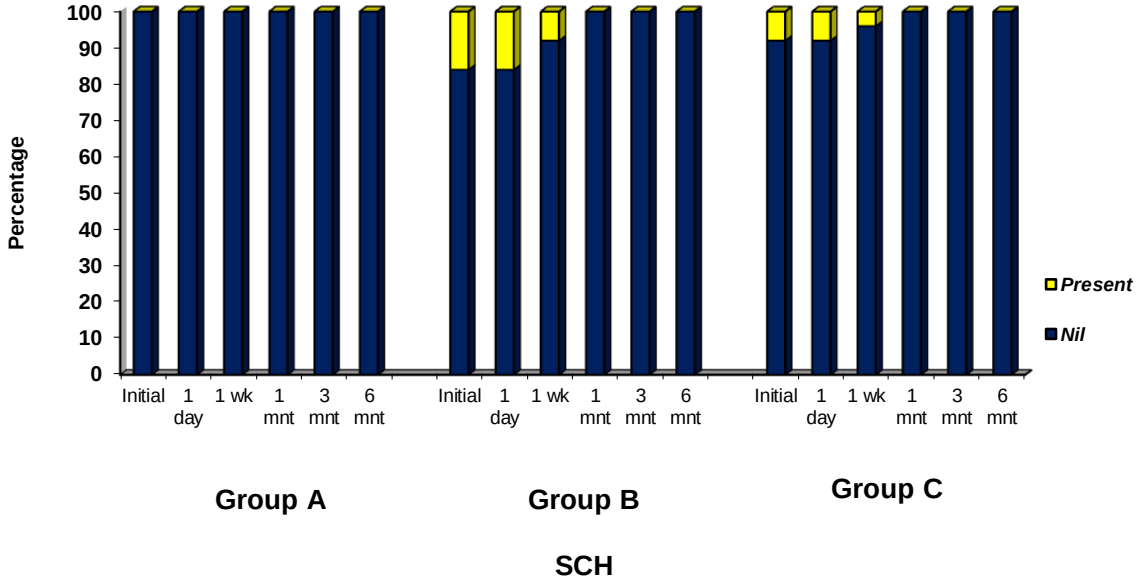


TABLE 15: AN EVALUATION OF ECCHYMOSIS IN THREE GROUPS OF PATIENTS STUDIED

Ecchymosis	Initial	1 day	1 week	1 month	3 months	6 months	% change
Group A							
• Nil	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	-
• Present	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-
Group B							
• Nil	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	-
• Present	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-
Group C							
• Nil	46(92%)	46(92%)	46(92%)	50(100%)	50(100%)	50(100%)	+8.0
• Present	4(8%)	4(8%)	4(8%)	0(0%)	0(0%)	0(0%)	-8.0
P value	**0.034***	**0.034***	**0.034***	1.000	1.000	1.000	-

In group A and B, no patients had ecchymosis. In group C, 4 patients (8%) developed ecchymosis following anaesthesia while 46 patients (92%) had no ecchymosis. On 1st post operative day, 4 patients (8%) had ecchymosis and 46 patients (92%) did not have ecchymosis. On 1 week post operative follow up, 4 patients (8%) had ecchymosis and 46 patients (92%) had no ecchymosis. On 1 month post operative follow up, no patient had ecchymosis. Ecchymosis (P=0.034*) was found to be significantly more in peribulbar group compared to topical and subtenon's group.

CHART 11: EVALUATION OF ECCHYMOSIS IN THREE GROUPS OF PATIENTS STUDIED

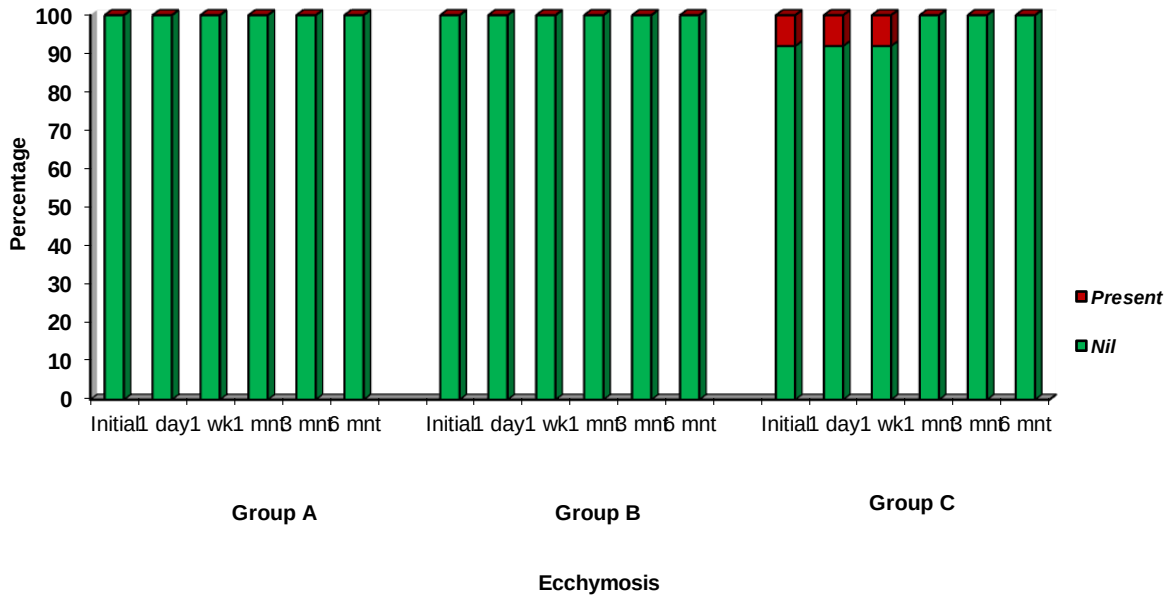


TABLE 16: AN EVALUATION OF PTOSIS IN THREE GROUPS OF PATIENTS STUDIED

Ptosis	Initial	1 day	1 week	1 month	3 months	6 months	% change
Group A							
• Nil	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	-
• Present	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-
Group B							
• Nil	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	50(100%)	-
• Present	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	-
Group C							
• Nil	46(92%)	46(92%)	46(92%)	50(100%)	50(100%)	50(100%)	+8.0
• Present	4(8%)	4(8%)	4(8%)	0(0%)	0(0%)	0(0%)	-8.0
P value	**0.034***	**0.034***	**0.034***	1.000	1.000	1.000	-

In group A and B, no patient had ptosis. In group C, 4 patients (8%) developed ptosis following anaesthesia while 46 patients (92%) had no ptosis. On 1st post operative day, 4 patients (8%) had ptosis and 46 patients (92%) did not have ptosis. On 1 week post operative follow up, 4 patients (8%) had ptosis and 46 patients (92%) had no ptosis. On 1 month post operative follow up, no patient had ptosis. Ptosis (P=0.034*) was found to be significantly more in peribulbar group compared to topical and subtenon's group.

CHART 12: EVALUATION OF PTOSIS IN THREE GROUPS OF PATIENTS STUDIED

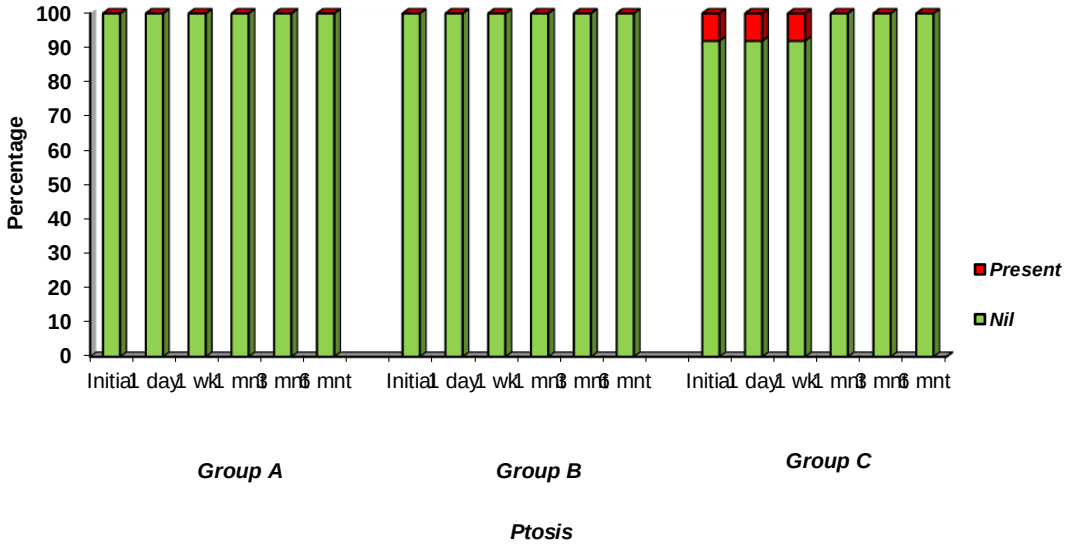


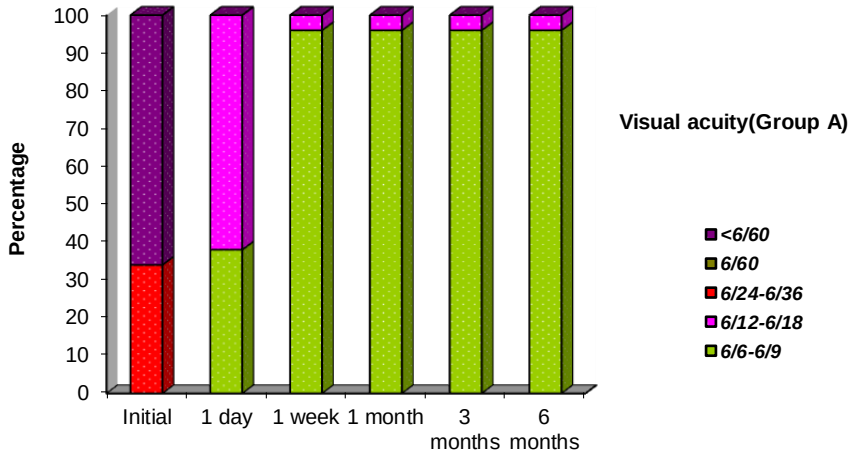
TABLE 17: EVALUATION OF VISUAL ACUITY OF PATIENTS STUDIED IN THREE GROUPS

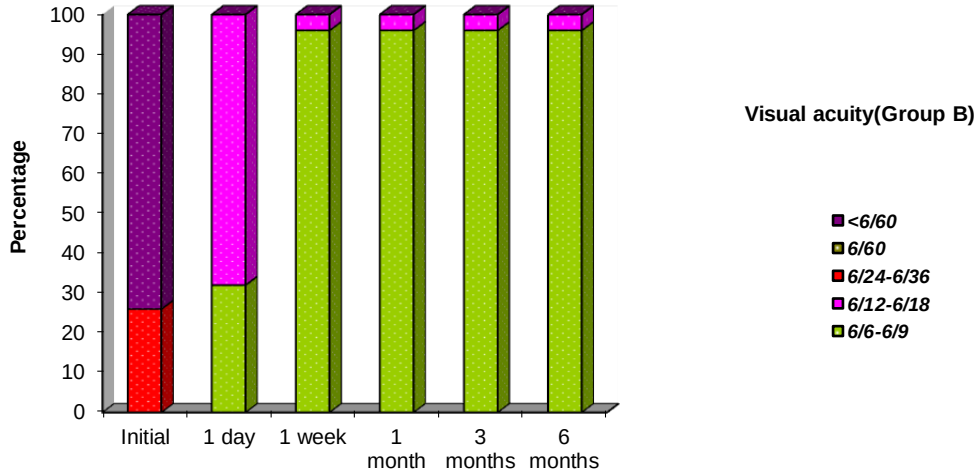
Visual activity	Initial	1 day	1 week	1 month	3 months	6 months
Group A						
• 6/6-6/9	-	19(38%)	48(96%)	48(96%)	48(96%)	48(96%)
• 6/12-6/18	-	31(62%)	2(4%)	2(4%)	2(4%)	2(4%)
• 6/24-6/36	17(34%)	-	-	-	-	-
• 6/60	-	-	-	-	-	-
• <6/60	33(66%)	-	-	-	-	-
Group B						
• 6/6-6/9	-	16(32%)	48(96%)	48(96%)	48(96%)	48(96%)
• 6/12-6/18	-	34(68%)	2(4%)	2(4%)	2(4%)	2(4%)
• 6/24-6/36	13(26%)	-	-	-	-	-
• 6/60	-	-	-	-	-	-
• <6/60	37(74%)	-	-	-	-	-
Group C						
• 6/6-6/9	-	17(34%)	48(96%)	48(96%)	48(96%)	48(96%)
• 6/12-6/18	-	33(66%)	2(4%)	2(4%)	2(4%)	2(4%)
• 6/24-6/36	14(28%)	-	-	-	-	-
• 6/60	-	-	-	-	-	-
• <6/60	36(72%)	-	-	-	-	-
P value	0.729	0.866	1.000	1.000	1.000	1.000

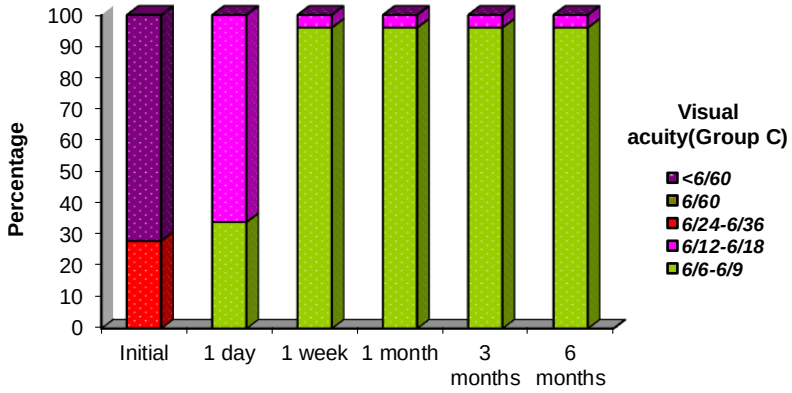
Before surgery, in group A, 17 patients (34%) had visual acuity between 6/24-6/36 and 33 patients (66%) had visual acuity <6/60. On 1st post operative day, 19 patients (38%) had vision between 6/6-6/9 and 31 patients (62%) had vision between 6/12-6/18. On 1 week follow up after surgery, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between

6/12-6/18. On 1month post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 3 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 6 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. Before surgery, in group B, 13 patients (26%) had visual acuity between 6/24-6/36 and 37 patients (74%) had visual acuity <6/60. On 1st post operative day, 16 patients (32%) had vision between 6/6-6/9 and 34 patients (68%) had vision between 6/12-6/18. On 1 week follow up after surgery, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 1month post operative follow up, 48 patients (96%) had vision between 6/6-6-9 and 2 patients (4%) had vision between 6/12-6/18. On 3 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 6 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. Before surgery, in group C, 14 patients (28%) had visual acuity between 6/24-6/36 and 36 patients (72%) had visual acuity <6/60. On 1st post operative day, 17 patients (34%) had vision between 6/6-6/9 and 33 patients (66%) had vision between 6/12-6/18. On 1 week follow up after surgery, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 1month post operative follow up, 48 patients (96%) had vision between 6/6-6-9 and 2 patients (4%) had vision between 6/12-6/18. On 3 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 6 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. Visual acuity post surgery was comparable between the three groups with P value of 0.866 on first post op day and P value of 1.000 from first post op week onwards.

CHART 13: EVALUATION OF VISUAL ACUITY OF PATIENTS STUDIED IN THREE GROUPS







DISCUSSION

In our study of the 150 patients included, 50 cases were randomly allocated to each of the three groups.

As shown in **Table 4,** in our study in topical group (group A) there were a total of 50 patients. Out of these 50 patients, 1 (2%) was aged between 31-40 years, 7 (14%) were aged between 41-50 years, 14 (28%) were aged between 51-60 years, 19 (38%) were aged between 61-70 years, 7 (14%) were aged between 71-80 years, and 2 (4%) were between 81-90 years. In the subtenon's group (group B), out of total 50 patients, 1 (2%) was aged between 31-40 years, 4 (8%) were aged between 41-50 years, 18 (36%) were aged aged between 51-60 years, 20 (40%) were aged between 61-70 years, 6 (12%) were aged between 71-80 years and 1(2%) was aged between 81-90 years. Out of the 50 patients in peribulbar group (group C), no patients were there aged between 31-40 years, 2 (4%) were aged between 41-50 years, 15 (30%) were aged between 51-60 years, 25 (50%) were aged between 61-70 years, 5 (10%) were aged between 71-80 years and 3 (6%) were aged between 81-90 years. Samples were age matched (P = 0.294).

As shown in **Table 5,** in our study, in group A (topical group), out of total 50 patients, 29 patients (58%) were male and 21 patients (42%) were female. Out of total 50 patients in group B (subtenon's group), 32 patients (64%) were male and 18 patients (36%) were female. In group C (peribulbar group), out of total 50 patients, 30 patients (60%) were male and 20 patients (40%) were female. Samples were gender matched (P=0.822).

As shown in **Table 6,** in our study, in Group A (topical) and Group B (subtenon's), 33 left eyes (66%) were operated and 17 right eyes (34%) were operated. In Group C (peribulbar), 29 left eyes (58%) were operated and 21 right eyes (42%) were operated.

All patients were assessed on effect of anaesthetic drugs (onset and duration), patient's comfort (in terms of pain, akinesia and lid movements) and intra operative and post operative complications (in terms of chemosis, SCH, ecchymosis and ptosis).

As shown in **Table 7**, in our study, in Group A, onset of action of drugs was instantaneous for all the 50 patients (100%) and the effect persisted for 15-20 minutes for all the 50 patients (100%). In Group B, onset of action of drugs was 10 minutes for all the 50 patients (100%) while the effect of the drugs lasted for 20-30 minutes for all the 50 patients (100%). In Group C, onset of action of drugs was 15-20 minutes from the time of administration for all 50 patients (100%) and effect of the anaesthesia lasted for 45-50 minutes for all the 50 patients (100%).

As shown in **Table 8**, in our study, in group A, no patients felt any pain during administration of anaesthesia. In group B, 25 patients (50%) did not feel any pain during administration of anaesthesia, 23 patients (46%) felt pain of grade 1-2 and 2 patients (4%) felt pain of grade 3-4. In group C, 20 patients (40%) felt pain of grade 1-2 and 30 patients (60%) felt pain of grade 3-4 during administration of anaesthesia. Pain scores during administration of anaesthesia were found to be significantly high in peribulbar group and significantly low in topical group compared to subtenon's group ($P<0.001^{**}$) with the mean pain scores being 0.0, 0.78 and 2.82 in topical, subtenon's and peribulbar groups respectively. In topical anaesthesia group as only eye drops were instilled prior to surgery, so no patient experienced any pain during administration of anaesthesia.

In a study by Zafirakis P et al[97], eighty-one percent of patients who received topical anesthesia and 8% of patients who received sub-Tenon anesthesia reported no pain during delivery of the anesthetic agent. The mean pain score was 0.19 ± 0.39 (SD) in the topical group and 1.35 ± 0.63 in the sub-Tenon group. The difference between groups was statistically significant (P < 0.001**).

As shown in **Table 9**, in our study, in group A, 42 patients (84%) did not experience any pain during surgery, while 8 patients (16%) complained of pain of grade 1-2 but nobody experienced any pain of grade 3-4. In group B, 47 patients (94%) did not experience any pain during the surgery, 3 patients (6%) experienced pain of grade 1-2 while nobody experienced pain of grade 3-4. In group C, 45 patients (90%) did not feel any pain during surgery, 1 patient (2%) experienced pain of grade 1-2 and 4 patients (8%) experienced pain of grade 3-4. The overall pain scores during surgery were comparable in all the groups (P=0.304); the mean scores being 0.20, 0.12 and 0.32 in topical, subtenon's and peribulbar groups respectively. There was no statistically significant difference between any of the groups (P=0.304).

In a study by Badar- ud-din Athar Naeem et al[41], 52% of patients in peribulbar group and 46% in topical group did not feel any pain. Mild pain was felt by 40% patients in peribulbar group and 45% of topical group. 6% patients of periocular and 5% patients of topical anaesthesia group had moderate pain. Severe pain was felt by only 2% patients of peribulbar group and 4% of topical group. There was no statistically significant difference between any of the groups (P = 0.323).

In a study by Ayyaz Hussain Awan et al[30], 32 patients in subtenon's group and 12 patients in peribulbar group did not experience any pain or discomfort during surgery, 14 patients in

subtenon's group and 22 patients in peribulbar group experienced slight discomfort but no pain, 3 patients in subtenon's group and 12 patients in peribulbar group had slight pain and 1 patient in subtenon's group and 4 in peribulbar group had moderate intensity of pain during surgery. Pain sensation during surgery was significantly less (P=0.001**) in subtenon's group compared to peribulbar group.

In the study by Zafirakis P et al[97], seventy-two percent of patients in the topical anesthesia group and 86% in the sub-Tenon anesthesia group reported no pain or slight discomfort during surgery (mean score 1.13 ± 1.57 and 0.57 ± 1.28, respectively) (P < 0.001**).

As shown in **Table 10,** in our study, in group A, 46 patients (92%) did not experience any pain 6 hours after surgery, 4 patients (8%) experienced pain of grades 1-2, while no patients experienced pain of grade 3-4. In group B, 47 patients (94%) did not experience any pain 6 hours after surgery, 3 patients (6%) experienced pain of grade 1-2 and no patients experienced pain of grade 3-4. In group C, 25 patients (50%) did not experience any pain 6 hours after surgery, 20 patients (40%) complained of pain of grade 1-2 while 5 patients (10%) complained of pain of grade 3-4. The pain scores 6 hours after surgery were found to be significantly high in peribulbar group (P<0.001**) compared to topical and subtenon's group; the mean pain scores being 0.08, 0.12 and 0.94 in topical, subtenon's and peribulbar groups respectively. The patients complained of pain 6 hours post operatively in peribulbar group mainly due to the periocular anaesthetic injection

In the study conducted by Srinivasan S et al[98], post operative pain was significantly high (P= 0.0009**) in topical group compared to subtenon's group.

In the study conducted by Zafirakis P et al[97], ninety percent of topical anesthesia patients and 100% of sub-Tenon anesthesia patients reported no pain or slight discomfort postoperatively (mean score 0.80 ± 0.93 and 0.12 ± 036, respectively) (P < 0.001**).

As shown in **Table 11,** in our study, in group A, all the 50 patients had eye movements during the surgery. In group B, 42 patients (84%) did not have any eye movements during surgery, 8 patients (16%) had eye movements of which 4 patients (8%) had eye movements of grade 1, 2 patients (4%) had eye movements of grade 2 and another 2 patients (4%) had eye movements of grade 3. In group C, 46 patients (92%) did not have any eye movements during the surgery, 4 patients (8%) had eye movements of which 2 patients (4%) had eye movements of grade 1 and another 2 patients (4%) had eye movements of grade 2 while no patients had eye movements of grade 3. Though eye movements was more in topical group (P=0.304) compared to subtenon's and perbulbar, it was not statistically significant.

In the study conducted by Zafirakis P et al[97], eye movements were significantly (P<0.001**) more commonly noted in subtenon's group compared to topical group.

In the study conducted by Badar- ud-din Athar Naeem et al[41], eye movements were significantly (P<0.005**) more commonly noted in topical group compared to peribulbar group.

As shown in **Table 12,** in our study, in group A, all the 50 patients (100%) had lid movements during the surgery. In group B, 41 patients (82%) did not have lid movements during surgery while 9 patients (18%) had lid movements. In group C, 48 patients (96%) did not have lid movements during the surgery, while 2 patients (4%) had lid movements. Comparing the

three groups, squeezing of the lids (P<0.001**) was significantly more commonly noted in the topical group.

The main disadvantage of topical anaesthesia is lack of akinesia and presence of lid movements which can make surgery technically difficult. But with good patient selection, proper counseling and patient cooperation this problem can be avoided. During capsulorrhexis, the patient should be asked to particularly keep the eyes still. However during phacoemulsification and irrigation and aspiration, the instruments placed in the main tunnel and side port incisions immobilize the eye. It is best to slightly lower the bottle height while inserting the phaco tip because this can cause less stretch on zonules due to posterior lens migration. This might cause pain as ciliary body is not anesthetized. The surgeon should avoid touching iris, especially during IOL implantation. This can be achieved by having widely dilated pupil. The key to successful cataract surgery with topical anaesthesia is surgeon-patient communication. Patients with hearing or language problems or dementia are poor candidates [41].

Although ocular movements were not significantly high (P=0.304) in topical group compared to subtenon's and peribulbar group in our study, squeezing of lids in topical group was significantly high (P<0.001**) compared to peribulbar and subtenon's group but was not a problem for experienced surgeons and especially when patient was also co-operative.

As shown in **Table 13,** in our study, in group A, no patients had chemosis. In group B, 11 patients (22%) developed chemosis following anaesthesia and 39 patients (78%) did not have chemosis. On 1st post operative day, 6 patients (12%) had chemosis and 44 patients (88%) did not have chemosis. By 1 week follow up, no patients had chemosis. In group C, 5 patients (10%) developed chemosis following anaesthesia and 45 patients (90%) did not have chemosis. On 1st

post operative day, 3 patients (6%) had chemosis and 47 patients (94%) did not have chemosis. By 1 week follow up, no patient had chemosis. Chemosis (P<0.001**) was significantly more in subtenon's and peribulbar group compared to topical group.

As shown in **Table 14,** in our study, in group A, no patients had SCH. In group B, 8 patients (16%) developed SCH following anaesthesia while 42 patients (84%) did not have any SCH. On 1st post operative day, 8 patients (16%) had SCH and 42 patients (84%) did not have SCH. On 1 week post operative follow up, 4 patients (8%) had SCH while 46 patients (92%) did not have SCH. On 1 month post operative follow up, no patients had any SCH. In group C, 4 patients (8%) developed SCH following anaesthesia while 46 patients (92%) did not have SCH. On 1st post operative day, 4 patients (8%) had SCH and 46 patients (92%) did not have SCH. On 1 week post operative follow up, 2 patients (4%) had SCH and 48 patients (96%) did not have SCH. On 1 month post operative follow up, no patients had any SCH. Sub conjunctival haemorrhage (P=0.007**) was significantly more in subtenon's and peribulbar group compared to topical group.

As shown in **Table 15,** in our study, in group A and B, no patients had ecchymosis. In group C, 4 patients (8%) developed ecchymosis following anaesthesia while 46 patients (92%) had no ecchymosis. On 1st post operative day, 4 patients (8%) had ecchymosis and 46 patients (92%) did not have ecchymosis. On 1 week post operative follow up, 4 patients (8%) had ecchymosis and 46 patients (92%) had no ecchymosis. On 1 month post operative follow up, no patient had ecchymosis. Ecchymosis (P=0.034*) was found to be significantly more in peribulbar group compared to topical and subtenon's group.

As shown in **Table 16,** in our study, in group A and B, no patient had ptosis. In group C, 4 patients (8%) developed ptosis following anaesthesia while 46 patients (92%) had no ptosis. On 1st post operative day, 4 patients (8%) had ptosis and 46 patients (92%) did not have ptosis. On 1 week post operative follow up, 4 patients (8%) had ptosis and 46 patients (92%) had no ptosis. On 1 month post operative follow up, no patient had ptosis. Ptosis (P=0.034*) was found to be significantly more in peribulbar group compared to topical and subtenon's group. All these complications settled down in 1-2 weeks.

In the study conducted by Zafirakis P et al[97], complications like chemosis, and conjunctival hemorrhage occurred significantly more frequently in the sub-Tenon than in the topical group (P < 0.001**).

In the study conducted by Ayyaz Hussain Awan et al[30], complications like conjunctival chemosis and mild subconjunctival hemorrhage occurred in 05 patients in ST anesthesia. This complication reduced as the study progressed. In PB group 1 patient developed post operative ptosis which settled with conservative treatment.

As shown in **Table 17,** in our study, before surgery, in group A, 17 patients (34%) had visual acuity between 6/24-6/36 and 33 patients (66%) had visual acuity <6/60. On 1st post operative day, 19 patients (38%) had vision between 6/6-6/9 and 31 patients (62%) had vision between 6/12-6/18. On 1 week follow up after surgery, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 1month post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 3 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 6 months post operative follow up, 48 patients (96%)

had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. Before surgery, in group B, 13 patients (26%) had visual acuity between 6/24-6/36 and 37 patients (74%) had visual acuity <6/60. On 1st post operative day, 16 patients (32%) had vision between 6/6-6/9 and 34 patients (68%) had vision between 6/12-6/18. On 1 week follow up after surgery, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 1month post operative follow up, 48 patients (96%) had vision between 6/6-6-9 and 2 patients (4%) had vision between 6/12-6/18. On 3 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 6 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. Before surgery, in group C, 14 patients (28%) had visual acuity between 6/24-6/36 and 36 patients (72%) had visual acuity <6/60. On 1st post operative day, 17 patients (34%) had vision between 6/6-6/9 and 33 patients (66%) had vision between 6/12-6/18. On 1 week follow up after surgery, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 1month post operative follow up, 48 patients (96%) had vision between 6/6-6-9 and 2 patients (4%) had vision between 6/12-6/18. On 3 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. On 6 months post operative follow up, 48 patients (96%) had vision between 6/6-6/9 and 2 patients (4%) had vision between 6/12-6/18. There was no significant difference in visual outcome in any of the groups during any time of the 6 months follow up.

CONCLUSION

In our study we found that, onset of action of anaesthesia was fastest for topical and faster in subtenon's compared to peribulbar. Pain during administration of anaesthesia was significantly lower in topical group while intra operative pain levels were comparable among the three groups. Post operative pain was significantly low in both topical and subtenon's group. Intra operative akinesia was comparable among the three groups. But peribulbar proved better for control of intra operative lid movements. Complications like chemosis and SCH were significantly more in subtenon's and peribulbar groups. Other complications like ecchymosis and ptosis were significantly more in peribulbar group. Visual outcome was comparable among the three groups.

Topical anaesthesia has many benefits over subtenon's and peribulbar anaesthesia and a high level of patient satisfaction. The technical difficulty as a result of squeezing of eyelids and eye movements is not a problem for the surgeons experienced in this technique. As trend of less invasive cataract surgery is rapidly growing topical anaesthesia should replace the other methods of anaesthesia in most cases. However patients who are not suitable for topical anaesthesia should be considered for subtenon's anaesthesia rather than peribulbar.

SUMMARY

In order to evaluate the effect of anaesthetic drugs (onset and duration), pain during administration of anaesthesia, intra operative pain, pain 6 hours after surgery, intra operative akinesia, intra operative lid movements and complications like sub conjunctival haemorrhage, chemosis, ecchymosis and ptosis in topical, subtenon's and peribulbar anaesthesia in phacoemulsification, this study was conducted at R.L.Jalappa Hospital and Research Centre, Kolar from December 2010 to July 2012. This study included 150 cases 50 of whom were randomly picked for topical anaesthesia, 50 for subtenon's anaesthesia and 50 for peribulbar anaesthesia adhering strictly to the inclusion and exclusion criterias framed.

Onset of action of anaesthesia was fastest for topical and faster in subtenon's compared to peribulbar. Pain during administration of anaesthesia was significantly lower in topical group while intra operative pain levels were comparable among the three groups. Post operative pain was significantly low in both topical and subtenon's group. Intra operative akinesia was comparable among the three groups. But peribulbar anaesthesia had an upper hand in terms of intra operative lid movements. Complications like chemosis and SCH were significantly more in subtenon's and peribulbar groups. Other complications like ecchymosis and ptosis were significantly more in peribulbar group. All the complications had resolved shortly. Visual outcome was comparable among the three groups.

BIBLIOGRAPHY

1. Javed EA. Phacoemulsification under topical anaesthesia alone versus topical anaesthesia with subconjunctival infiltration of 2% lignocaine. *Pak J Ophthalmol* 2010;26(2):91-95.

2. Vas TA. Cataract surgery in the course of centuries. Netherl Ophthalmol Soc, 166 the meeting. *Ophthalmologica* 1971;171:81.

3. Kirby DB. Surgery of cataract, 1st edition Philadelphia; JB Lippincort. 1950;22.

4. Richard P, Floyd. History of cataract surgery; principles and practice of ophthalmology, Albert Jakobi. 1994;1:605-13.

5. Daviel J. Surune nouvella method de querirla cataract par extraction ducrystalline. mem Acad R Chir pasis 1753;2:337.

6. Duke Elder S. System of ophthalmology, Diseases of the lens and vitreous, Glaucoma and Hypotony. St. Louis C V. Mosby 1969;1(11):248-64.

7. Bauaquer J. Zonulolysis, contribution a lacirugia del Cristalino Ann Med. 1958;38:255.

8. Ridley H. Intraocular acrylic lenses, a recent development in the surgery of cataract. *Br J Ophthalmol.*1952;36:113.

9. Emery JM, Little TH. Phacoemulsification and Aspiration of Cataract.St. Louis C V Mosby. 1979;1.

10. Sinkey RM, Cain W Jr. The posterior capsule and phcoemulsification. *Am. Intraocular Implant Soc*. 1978;4:26.

11. Gimbel HV. Capsulotomy method eases intra-bag-posterior chamber IOL. Ocul Surg News. 1985; 20

12. Fine IH. Infinity suture in Koch pc. Davisan JA (eds), Text book of advanced phacoemulsification techniques. Tholofare N J Slack. 1991;1:383.

13. Calvard Dm, Kratz RP. Endothelial cell loss following phacoemulsification in the papillary plane. *J Am Intraocular implant Soc T*. 1981; 334

14. Shephard J. In Situ fracture phacoemulsification method, phaco, PI. 1989.

15. Rizvi Z, Rehman T, Malik S, Qureshi A, Paul L, Qureshi K et al. An Evaluation of Topical and Local Anesthesia in Phacoemulsification. *J Pak Med Assoc.* 2003 Apr;53(4):167-70.

16. Hoh HB, Bourne R, Baer R. Visual recovery after phacoemulsification using topical anesthesia. J Cataract Refract Surg 1998;24:1385-9.

17. Salahuddin A. Cataract Surgery: Is it Time to Convert to Topical Anaesthesia? *Pak J Ophthalmol* 2008;24(2):62-68.

18. Ellis PP. Retrobulbar injections. *Surv Ophthalmol*. 1974; 18: 425–30.

19. Davis DB II, Mandel MR. Peribulbar anaesthesia: a review of technique and complications. Ophthalmic Clin North Am. 1990; 3: 101-10.

20. Hansen EA, Mein CE, Mazzoli R. Ocular anaesthesia for cataract surgery: a direct sub-Tenon's approach. Ophthalmic Surg. 1990; 21: 696-9.

21. Stevens JD. A new local anaesthetic technique for cataract surgery by one quadrant sub Tenon's infiltration. Br J Ophthalmol. 1992; 76: 670-4.

22. Smith R. Cataract extraction without retrobulbar anaesthetic injection. Br J Ophthalmol. 1990; 74: 205-7.

23. Fichman RA. Use of topical anaesthesia alone in cataract surgery. J Cataract Refract Surg. 1996; 22: 612-4.

24. Nada AY. Sub-Tenon Versus Peribulbar Anaesthesia for Cataract Surgery. *Bahrain Medical Bulletin* 2003;25(3):1-6.

25. Hamilton RC. Complications of ophthalmic regional anaesthesia. Ophthalmol Clin North Am 1998;11:99 –114.

26. Davis DB, Mandel MR. Efficacy and complication rate of peribulbar blocks: A prospective multicenter study. J Cataract Refract Surg 1994;20:327-37.

27. Hay A, Flynn H, Hoffman J. Needle penetration of the globe during retrobulbar and peribulbar injections. Ophthalmol 1991;98:1017–24.

28. Kimble J, Morris R, Witherspoon CD. Globe perforation from peribulbar injection. Arch Ophthalmol 1987;105:149.

29. Said K, Hassan M, Qahtani FA, Mansoori FA. A Comparative Study of Topical Versus Peribulbar Anesthesia in Phacoemulsification and Implantation of Foldable Intraocular Lens in Cataract Surgery. *The Internet Journal of Ophthalmology and Visual Science* 2003; 2(1): DOI: 10.5580/1b7.

30. Awan AH, Rauf A. Comparison of Analgesia in Subtenon and Peribulbar Anesthesia. *Pak J Ophthalmol* 2007;23(3):126-129.

31. Davis DB, Mandel MR. Posterior peribulbar anesthesia: an alternative to Retrobulbar anesthesia. *J Cataract Refract Surg.* 1986; 12: 182-4.

32. Marianne EF. Anesthesia: Atlas of complications in ophthalmic surgery .1st ed. 1993; 1: 7-18.

33. Weiss JL, Deichman CB. A comparison of retrobulbar and periocular anesthesia for cataract surgery. *Arch Ophthalmol.* 1989; 107: 96-8.

34. Greenbaum S. Parabulbar anesthesia. *Am J Ophthalmol* 1992;114: 776.

35. Turnbull CS. The hydochlorate of cocaine, a judicious opinion of its merits. (Editorial) Med Surg Rep (Boston). 1884; 29:628–9.

36. Merle H, Suchocki D, Donnio A, et al. Evaluation of singleinjection caruncular sub-Tenon's anesthesia. *J Fr Ophthalmol*. 2002; 25: 130-4.

37. La Marnierre E, Mage F, Alberti M, et al. Comparison between Greenbaum's parabulbar anesthesia and Ripart's subtenon anesthesia in the anterior segment surgery. *J Fr Ophthalmol*. 2002; 25: 161-5.

38. Rowley SA, Hale JE, Finley RD. Sub-Tenon's local anesthesia: the effect of hyaluronidase. *Br J Ophthalmol.* 2000; 84: 435-6.

39. Tokuda Y, Oshika T, Amano S, et al. Anesthetic dose and analgesic effects of sub-tenon's anesthesia in cataract surgery. *J Cataract Refract Surg.* 1999; 25: 1250-3.

40. Roman S, Auclin F, Ullern M. Topical versus peribulbar anesthesia in cataract surgery. *J Cataract Refract Surg*. 1996; 22:1121-4.

41. Naeem BA , Raja A, Bashir R , Iftikhar S , Akhtar KN , Jaffri RH et al. Comparison of Peribulbar Vs Topical Anaesthesia for Phacoemulsification. *Journal of Rawalpindi Medical College (JRMC)*;2007;11(2):79-82.

42. Knapp H. On cocaine and its use in ophthalmic and general surgery. *Arch Ophthalmol (old series)* 1884; 13: 402-48.

43. Kershner RM. Topical anaesthesia for small incision selfsealing cataract surgery. A prospective evaluation of the first 100 patients. *J Cataract Refract Surg*. 1993; 19: 290-2.

44. Leaming DV. Practice styles and preferences of ASCRS members: 1998 survey. *J Cataract Refract Surg.*1999; 25: 851-9.

45. Roman S, Sit DAC, Boureau CM, et al. Sub-Tenon anaesthesia: an efficient and safe technique. *Br J Ophthalmol.* 1997; 81: 673-6.

46. Rocha G, Turner C. Safety of cataract surgery under topical anesthesia with oral sedation without anesthetic monitoring. *Can J Ophthalmol.* 2007; 42: 288-94.

47. Ugur B, Dundar SO, Ogurlu M, et al. Ropivacain versus lidocaine for deep topical, nerve block anaethesia in cataract surgery: a double-blind randomised clinical trial. *Clin Experiment Ophthalmol.* 2007; 35: 148-51

48. Clendening L. Connor JT. In : Source book of ophthalmology,4th ed. New York: Dover Publication, 1942; 355

49. Kerch SB. Francis T. In: A brief history of cocaine,2nd ed. New York: CRC Press, 2006; 188.

50. James RR. Ophthalmology in lectures of a century ago. *Br J of Ophthalmol* 1946; 30:668-675.

51. Amin S, Minihan M, Lesnik-oberstein S, Carr C. A new technique for delivering sub-tenon's anaesthesia in ophthalmic surgery. *Br J Ophthalmol* 2001; 86:119-20

52. Lobato EB, Gravenstein N, Kirby RR. Wilkins W. In: Complications in anaesthesiology, 3rd ed. Philadelphia: Lippincott, 2007; 412

53. Atkinson WS. Local Anaesthesia in ophthalmology. *Am J Ophthalmol* 1948; 31:1607-1618

54. Unsold R, Stanley JA, De Grout J. The CT- topography of retrobulbar anaesthesia. *Graefes Arch Klim Ophthalmol* 1981; 217:125-36.

55. Havener WH. In: Antibiotics in ocular pharmacology, 5th ed. St. Louis: CV Mosby , 1983; 134-135

56. Oetting TA. In: Cataract surgery for greenhorns. Iowa: Med Rounds, 2005;72-73

57. Ripart J, Lefrant J, de la Coussaye J, Prat-padal D, Vivien B, Eledjam JJ. Peribulbar versus retrobulbar anaesthesia for ophthalmic surgery: an anatomical comparison of extraconal and intraconal injection. *Anaesthesiology* 2001; 94:56-62.

58. Davis DB, Mandel MR. Posterior peribulbar anaesthesia: an alternate to retrobulbar anaesthesia. *Journal cataract Refract Surg* 1986 Mar; 12 (2):182-184

59. Bloomberg LB. Administration of periocular anaesthesia. *J Cataract Refract Surg* 1986; 12(6):677-679.

60. Weiss JL, Diechman CB. A Comparison of retrobulbar and periocular anaesthesia for cataract surgery. *Arch ophthalmol* 1989; 107(1):96-98.

61. Emilio B, Lobato, Gravenstein N, Kirby RR. Lobato.In: Complications in Anaesthesiology, 3rd ed. Philadelphia: Wolters-Klower, 2007; 413.

62. Stevens JD. Curved sub tenon cannula for local anaesthesia. *Ophthalmic Surg* 1993; 24:121-3.

63. Amin S, Minihan M, Lesnik-oberstein S, Carr C. A new technique for delivering sub-tenon's anaesthesia in ophthalmic surgery. *Br J Ophthalmol* 2001; 86:119-20.

64. Greenbaum S. Parabulbar Anaesthesia. *Am J Ophthalmol* 1992; 114:76.

65. Kumar CM, Dodds C. A disposable plastic sub tenon cannula. *Anaesthesia* 2001; 56:399-400.

66. Dark A. Local anaesthesia for routine ocular surgery. *Br J Anaesth* 1999; 82:153-4.

67. Eke T, Thompson JR. The National Survey of Local Anaesthesia for ocular surgery: (1) Survey methodology and current Practice. *Eye* 1999; 13:196-204.

68. Newman DK. Visual experience during phacoemulsification cataract surgery under topical anaesthesia. *Br J Ophthalmol* 2000; 84:13-15.

69. Edge KR, Nicoll JM. Retrobulbar hemorrhage after 12,500 retrobulbar blocks. *Anaesth Analg* 1993; 76:1019-22.

70. Davis DB, Mandel MR. Efficacy and complication rate of 16,224 consecutive peribulbar blocks- A prospective multi-center study. *J Cataract Refract Surg* 1994; 20:327-37.

71. Duker JS, Belmont JB, Benson WE. Inadvertent globe perforation during retrobulbar and peribulbar anaesthesia- Patient characteristics, surgical management and visual outcome. *Ophthalmology* 199; 98:519-26.

72. Hay A, Flynn HW, Hoffmann JI. Needle penetration of the globe during retrobulbar and peribulbar injections. *Ophthalmology* 1991; 98:1017-24

73. Rainin EA, Carlson BM. Post operative diplopia and ptosis. A clinical hypothesis based on the myotoxicity of local anaesthetics. *Arch Ophthalmol* 1985; 103:1337-9

74. Esswein MB, Von Noorden GK. Paresis of a vertical rectus muscle after cataract extraction. *Am J Ophthalmol* 1993; 116:424-30.

75. Nielsen PJ. Immediate visual capability after cataract surgery: topical versus retrobulbar anaesthesia. *J Cataract Refract Surg* 1995; 21:302-4.

76. Brothers-Arbisser L, Wymore JG. Visual acuity immediately following phacoemulsification with subconjunctival anaesthesia. *Ophthalmic Surg Lasers* 1996; 27:640-2.

77. Duguid JG, Claoue CM, Thamby-Rajah Y. Topical anaesthesia for phacoemulsification surgery. *Eye* 1995; 9:456-9

78. Manners TD, Burton RL. Randomised trial of topical versus subtenon's local anaesthesia for small incision cataract surgery. *Eye* 1996; 10:367-70.

79. Patel BC, Burns TA, Crandall A. A comparison of topical and retrobulbar anaesthesia for cataract surgery. *Ophthalmology* 1996; 103:1196-203.

80. Maclean H, Burton T, Murray A. Patient comfort during cataract surgery with modified topical and peribulbar anaesthesia. *J Cataract Refract Surg* 1997; 23:277-83.

81. Gupta SK, Kumar A, Kumar D, Agarwal S. Manual small incision cataract surgery under topical anaesthesia with intracameral lignocaine: Study on pain evaluation and surgical outcome. *Indian J ophthalmol* 2009; 57:3-7.

82. Shah AR, Diwan RP, Vasavada AR, Keng MQ. Corneal endothelial safety of intracameral preservative free 1% xylocaine. *Indian J Ophthalmol* 2004; 52:133

83. Heuermann T, Hartmann C, Anders N. Long term endothelial cell loss after phacoemulsification: peribulbar anaesthesia versus intracameral lidocaine 1%. Prospective randomized clinical trial. *J Cataract Refract Surg* 2001; 27:1643-50.

84. Pandey SK, Werner L, Apple DJ, Agarwal A, Agarwal S. No anaesthesia clear corneal phacoemulsification versus topical and topical plus intracameral anaesthesia: Randomised clinical trial. *J Cataract Refract Surg* 2001; 108:1704-10

85. Karp CL, Cox TA, Wagoner MD, Ariyasu RG, Jacobs DS. Intracameral anaesthesia: a report by the American Academy of Ophthalmology. *Ophthalmology* 2001; 108:1704-10.

86. Barequet IS, Soriano ES, green WR, O'Brien TP. Provision of anaesthesia with single application of lidocaine 2% gel. *J Cataract Refract Surg* 1999; 25:626-31.

87. Assia EI, Pras E, Yehezkel M, Rotenstreich Y, Jager- Roshu S. Topical anaesthesia using lidocaine gel for cataract surgery. *J Cataract Refract Surg* 1999; 25:635-9.

88. Baldacci A, Lofoco G, Perdicaro S, Ciucci F, Manna L. Lidocaine 2 % gel versus lidocaine 4 % unpreserved drops for topical anaesthesia in cataract surgery: A randomized controlled trial. *Ophthalmology* 2003;110:144-9.

89. Soliman MM, Macky TA, Samir MK. Comparative clinical trial of topical anaesthetic agents in cataract surgery: Lidocaine 2% gel, bupivacaine 0.55 drops and benoxinate 0.4% drops. *J Cataract Refract Surg* 2004; 30:1716-20.

90. Wong D, Hunter JM, Mostafa SM. In: Mostafa SM editor. Local anaesthesia for ophthalmic surgery. New York: Oxford university 1991;249-75.

91. Ropo A, Nikki P, Rusuvaara P, Kivisarri L. Comparison of retrobulbar and periocular injections of lignocaine by computerized Tomography. *Br J ophthalmol* 1991; 75:417-20.

92. Ripart J, Vivien B, Pradd D, Eledjamm JJ. Regional anaesthesia for ophthalmic surgery: comparison of retrobulbar and peribulbar injections-An anatomic description. *Reg Anaesth* 1998; 23:80.

93. Koorneef L. The architecture of the musculo-fibrous apparatus in the human orbit. *Acta Morphol Neert-Scand* 1977; 15:35-64

94. Bloomberg LB. Administration of periocular anaesthesia: Five years experience. *J Cataract Refract Surg* 1991; 17:508-11.

95. Mein CE, Flynn HW. Augmentation of local anaesthesia during retinal detachment surgery. *Arch Ophthalmol* 1989; 107:1084.

96. Riad W. Administration of extraconal anesthesia: What care providers should know? *Saudi J Anaesth* 2007; 1:2.

97. Zafirakis P, Voudouri A, Rowe S, et al. Topical versus sub-Tenon's anesthesia without sedation in cataract surgery. *J Cataract Refract Surg* 2001;27:873-879.

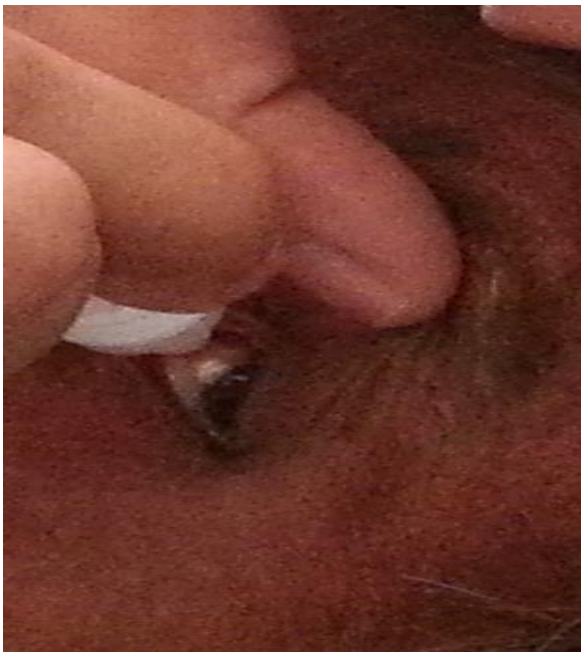
98. Srinivasan S, Fern AI, Selvaraj S, Hasan S. Randomized double-blind clinical trial comparing topical and sub-Tenon’s anaesthesia in routine cataract surgery. *Br J Anaesth* 2004;93:683–6.

ANNEXURE – I

TOPICAL ANAESTHESIA

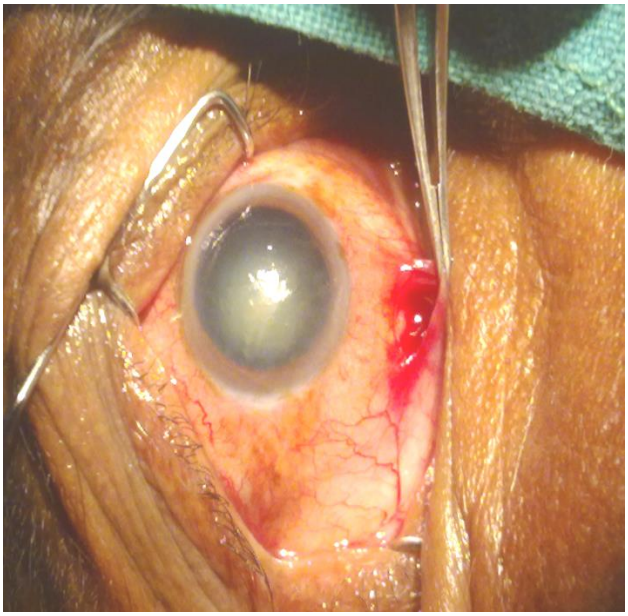
Photograph 1: PROPARACAINE EYE DROPS USED

Photograph 2: INSTILLATION OF TOPICAL ANAESTHESIA IN THE EYE

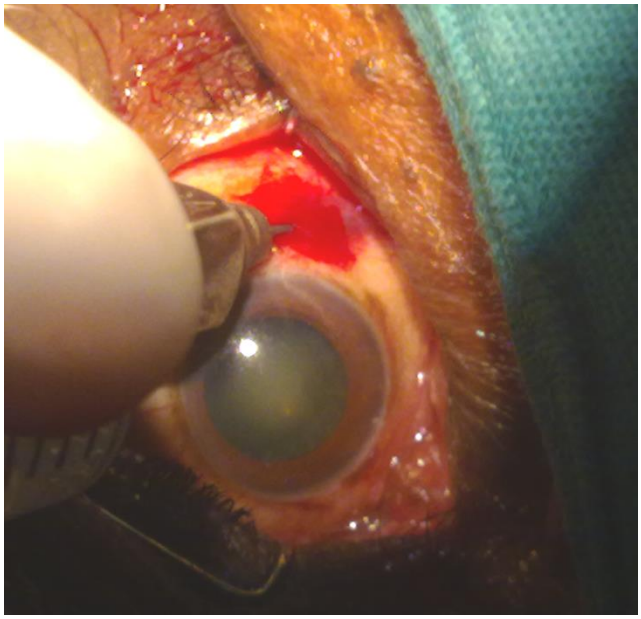


SUBTENON'S ANAESTHESIA

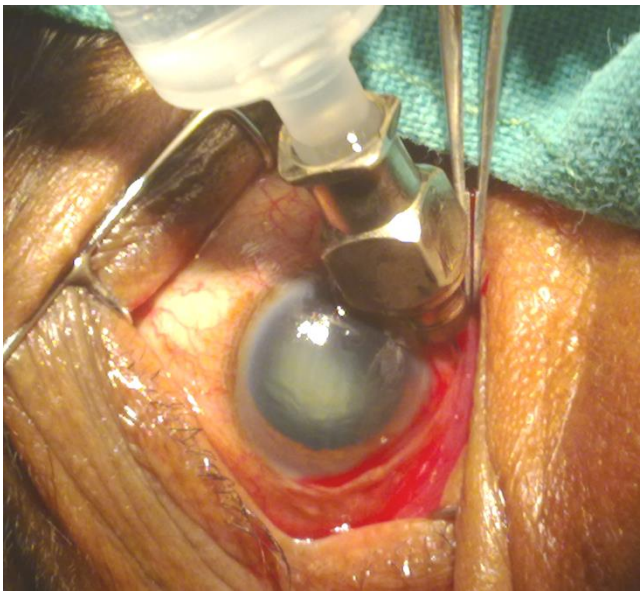
Photograph 3 : INCISION OF CONJUNCTIVA AND FORMATION OF TENT



Photograph 4 : INTRODUCTION OF CANNULA

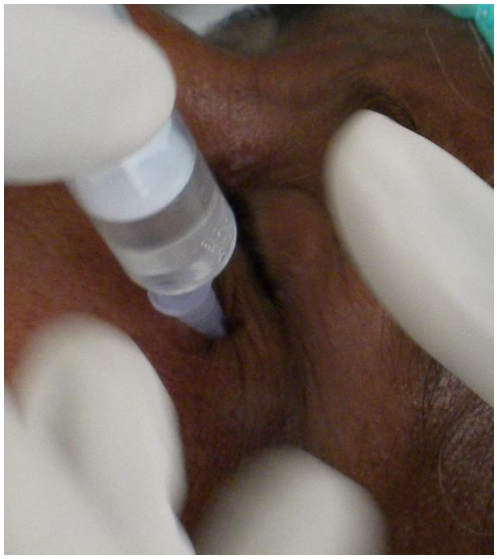


Photograph 5 : INJECTING ANAESTHETIC MIXTURE

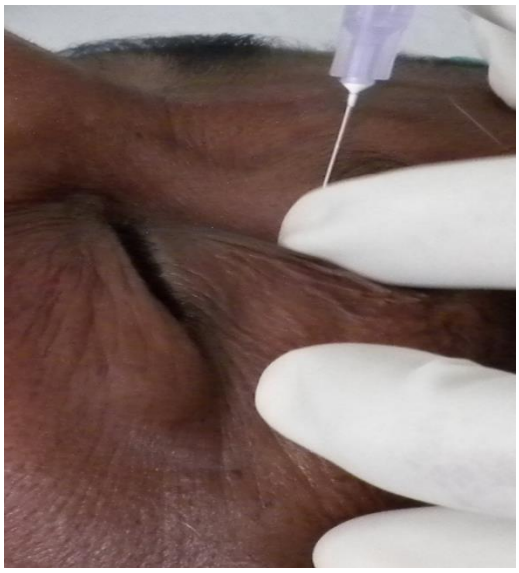


PERIBULBAR ANAESTHESIA

Photograph 6 : INFEROTEMPORAL INJECTION



Photograph 7 : SUPERONASAL INJECTION



ANNEXURE – II

PROFORMA

Name: H. No:

Age: Date of admission:

Sex: Date of discharge:

Address: Date of operation:

Diagnosis: Eye to be operated:

Chief complaints:

History of presenting illness:

Past history:

Personal history:

Family history:

EXAMINATION:-

Vitals:

BP- Pulse-

Systemic examination:

Cardio-vascular system:

Respiratory system:

Per abdomen:

Central nervous system:

Local (ocular) examination:

Head posture:

Ocular posture:

RE LE

Lids:

Conjunctiva:

Cornea:

Anterior chamber:

Iris:

Pupils:

Lens:

Vision: (distant)
(near)

Fundus:

Intra ocular pressure:

Syringing:

INVESTIGATIONS

Random blood sugar: Xylocaine test dose:

K-reading:

K_1:

K_2:

Estimated IOL power: Axial Length:

Type of cataract extraction:

Type of anaesthesia: subtenon / peribulbar / topical

TYPE AND EFFECT (ONSET AND DURATION OF ACTION) OF ANAESTHESIA:

Topical anaesthesia		Subtenon's block		Peribulbar block	
Onset of action	Duration of action	Onset of action	Duration of action	Onset of action	Duration of action

TABLE 1-GRADING OF PAIN

Grade 0	No pain.	
Grade 1	No pain, slight sensation	
Grade 2	Slight pain	
Grade 3	Moderate pain	
Grade 4	Intense pain	

TABLE 2- GRADING OF AKINESIA

Grade 0	No movement	
Grade 1	Mild movements	
Grade 2	Moderate movement	
Grade 3	Severe movements	

TABLE 3- GRADING OF LID MOVEMENTS

Grade 0	Little or no lid squeezing.	
Grade 1	Moderate or ill sustained squeezing throughout.	
Grade 2	Instantaneous and sustained squeezing	

INTRA OPERATIVE COMPLICATIONS

Pain			Kinesia (eye movements)	Lid movements	Chemosis	SCH	Ecchymosis	Ptosis
During anaesthesia	During Surgery	6 Hours Post Surgery						

POST OPERATIVE COMPLICATIONS

	Post op day 1	Post op week 1	Post op month 1	Post op month 3	Post op month 6
SCH					
Ptosis					
Glaucoma					
Corneal oedema					
Others					

VISION IN OPERATED EYE:

Post op day 1	Post op week 1	Post op month 1	Post op month 3	Post op month 6

ANNEXURE III

Key to Master chart

Sl. No.	*Abbreviation*	*Full form*
1.	SIMC	SENILE IMMATURE CATARACT
2.	NS1	NUCLEAR SCLEROSIS GRADE 1
3.	NS2	NUCLEAR SCLEROSIS GRADE 2
4.	NS3	NUCLEAR SCLEROSIS GRADE 3
5.	PSP	PSEUDOPHAKIA
6.	PPC	POSTERIOR POLAR CATARACT
7.	SMC	SENILE MATURE CATARACT
8.	HMC	HYPERMATURE CATARACT
9.	M	MALE
10.	F	FEMALE
11.	RE	RIGHT EYE
12.	LE	LEFT EYE
13.	SCH	SUB CONJUNCTIVAL HAEMORRHAGE
14.	IP NO	INPATIENT NUMBER
15.	SI NO	SERIAL NUMBER
16.	1D	1 DAY
17.	1WK	1 WEEK
18.	1M	1 MONTH
19.	2M	2 MONTHS
20.	3M	3 MONTHS
21.	6M	6 MONTHS
22.	CF 1M	COUNTING FINGER AT 1 METER
23.	CF 2M	COUNTING FINGER AT 2 METER
24.	CF 3M	COUNTING FINGER AT 3 METER
25.	CF 4M	COUNTING FINGER AT 4 METER
26.	CF 5M	COUNTING FINGER AT 5 METER
27.	CF 6M	COUNTING FINGER AT 6 METER