Phacoemulsification Complications

Trend in Cataract Surgery

Cataract responsible for 50-80% bilateral blindness in India[1]

It took until 1990 for phacoemulsification to become the preferred technique of cataract extraction for the majority of cataract surgeons[2]

*ICCE: Intracapsular cataract extraction
#ECCE: Extracapsular cataract extraction

1. Indian J ophthalmol 2008;56:489-494
2. Survey of ophthalmology may–june 2000; 44(6): 541

Basic skills in modern cataract surgery

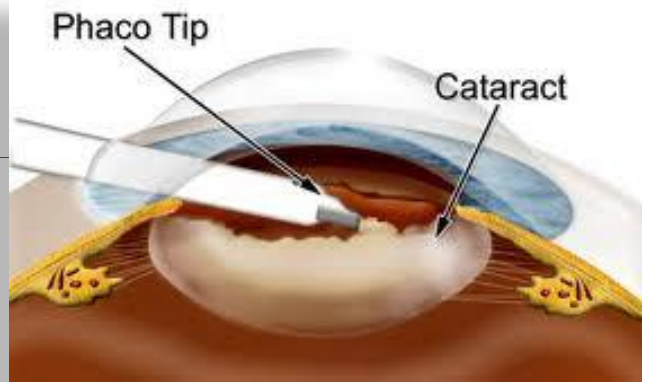
- **Tunnel incision:** proper configuration self-sealing nature
- **Capsulorhexis:** continuous, curvilinear, complete
- **Hydrodissection:** proper, safe and complete
- **Lens rotation:** carefully done, safe
- **Nucleus division:** in different ways
- **Phaco–aspiration:** low power, high vacuum
- Foldable or hydrophilic **IOL implantation**

http://www.expertconsultbook.com/expertconsult/ob/book.do?method=display&type=bookPage&decorator=none&eid=4-u1.0-B978-1-4160-3225-0..00044-1&isbn=978-1-4160-3225-0#lpState=open&lpTab=contentsTab&content=4-u1.0-B978-1-4160-3225-0..00044-1--s0255%3Bfrom%3Dtoc%3Btype%3DbookPage%3Bisbn%3D978-1-4160-3225-0&search=none

Phacoemulsification

- Charles Kelman introduced phacoemulsification in 1967 after being inspired by his dentist's ultrasonic probe

- Phacoemulsification-
  sutureless, self-sealing tunnel incisions; and foldable intraocular lenses (IOLs) have changed cataract surgery dramatically over the past two decades



Challenges in Phacoemulsification

- In the era of modern cataract surgery,
  Phacoemulsification is most demanding procedure by cataract patients and similarly patients' expectations are also high about the out come
- It should be relatively safe with a relatively low incidence of complications
- This requires a high quality surgeon capable of dealing with complications in the safest & most effective way

http://www.expertconsultbook.com/expertconsult/ob/book.do?method=display&type=bookPage&decorator=none&eid=4-u1.0-B978-1-4160-3225-0..00044-1&isbn=978-1-4160-3225-0#lpState=open&lpTab=contentsTab&content=4-u1.0-B978-1-4160-3225-0..00044-1--s0255%3Bfrom%3Dtoc%3Btype%3DbookPage%3Bisbn%3D978-1-4160-3225-0&search=none

Challenges in Phacoemulsification

A perfect surgical procedure consists of several perfect steps. If one step fails e.g. capsulorhexis the rest steps will be difficult, risky, loaded with complications & very disappointing

http://www.expertconsultbook.com/expertconsult/ob/book.do?method=display&type=bookPage&decorator=none&eid=4-u1.0-B978-1-4160-3225-0..00044-1&isbn=978-1-4160-3225-0#lpState=open&lpTab=contentsTab&content=4-u1.0-B978-1-4160-3225-0..00044-1--s0255%3Bfrom%3Dtoc%3Btype%3DbookPage%3Bisbn%3D978-1-4160-3225-0&search=none

Major Intraoperative Complications

Tunnel perforation

- Incision- affects ocular integrity & corneal stability
- Traditional limbal/posterior limbal incision → replaced by tunnel incisions
- **Advantages of tunnel incisions:**

✓ Increased intraoperative safety

✓ Decreased postoperative inflammation & pain

✓ Increased postoperative water tightness

✓ Reduced surgically induced astigmatism

- **Tunnel perforation may lead to:**

✓ Intraoperative leakage(compromises anterior chamber stability)

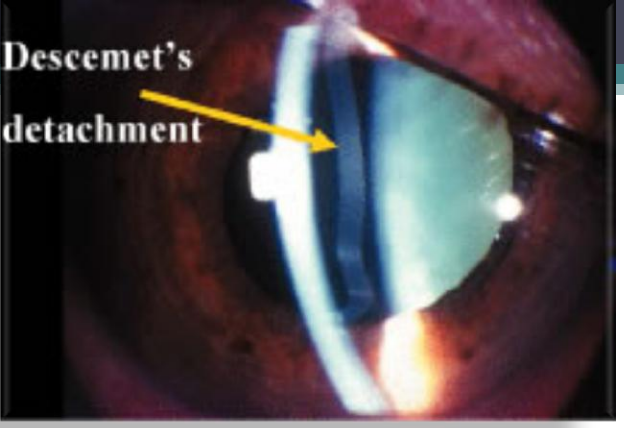
✓ Postoperative wound leakage

Chapter 53 – Complications of Cataract Surgery. Free Medical Textbook:381-390

How to manage Tunnel perforation?

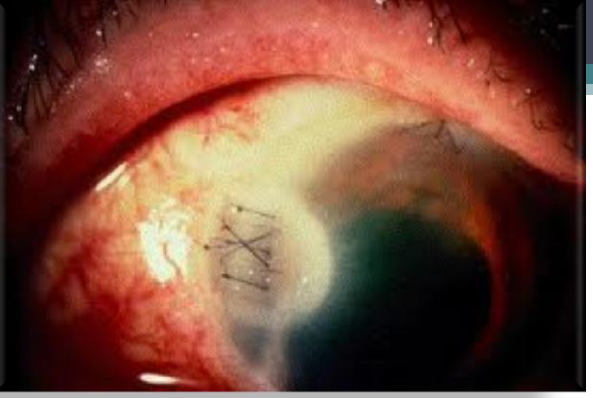
If the tear occurs at :

At Edge of the roof	Roof perforated in the centre of the flap	Tear at floor of the tunnel
✓Surgery completed using initial incision ✓ Observe wound carefully as instruments are introduced	✓ create new incision ✓If the cut is extremely small (e.g., <0.5mm), same procedure as for lateral roof tears can be used ✓Before IOL insertion, opposite margin of the wound is enlarged ✓To prevent further tearing, incision is made larger than normal for IOL insertion ✓Suture closure usually is advisable to restore normal wound architecture	✓Care taken to avoid trauma to any prolapsing uveal tissue ✓ Perforation should be closed with sutures



Descemet's Detachment

- **May lead to** : persistent corneal edema & decreased visual acuity
- **To reattach descemet's membrane:**
  - ✓ **Make a paracentesis incision** inferotemporally. A 27- or 30-gauge cannula attached to a syringe with a filter, syringe is filled with 0.5–1cm3 of air or, for eyes that have an unsuccessful injection of air alone, an expansive gas (e.g., Sulfur hexaflueride)
  - ✓ Using cannula, approximately **50% of the aqueous is drained**, & chamber is reformed with gas injection
  - ✓ More complicated cases **may require direct suturing**
- **If caused by viscoelastic injection:** remove agent using a blunt cannula. Intraoperatively, repositioning of descemet's membrane –inject BSS or occasionally air or an ophthalmic viscosurgical device (OVD) through the paracentesis site.



Thermal burns

- **Cause**- inadequate flow through phacoemulsification tip due to obstruction by a retentive OVD → arises from using low flow & vacuum settings
- **The critical warning sign:** appearance of milky fluid produced around the tip as emulsification is begun
- **To avoid corneal burns**:

✓ Always test phacoemulsification & irrigation-aspiration functions

✓ Some of the viscoelastic material overlying the nucleus can be aspirated before the start of emulsification

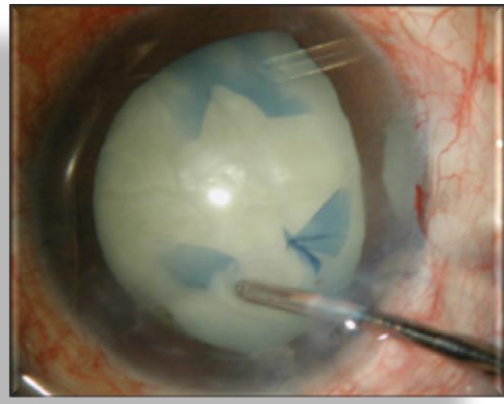
✓ To prevent irrigating sleeve constriction, an incision size appropriate for each particular phacoemulsification tip should be selected

- **Management of burns:**

✓ Meticulous suturing of wound with multiple radial sutures is required

✓ A bandage contact lens may assist with wound closure

Capsulorrhexis : Radial tears/excessively small capsulorrhexis



1. Radial tears:

- **Cause:** irretrievable loss of capsulorrhexis tear peripherally beneath iris
- **Prevention:**

✓ The anterior chamber should be reinflated with an OVD

✓ Redirect tear in a more central direction

✓ If tear is lost beneath iris- restart capsulorrhexis from its origin, proceed in the opposite direction (if possible incorporating the original tear in an outside-in direction)

✓ **An alternative approach:** convert to a can-opener capsulectomy

✓ Safer to have multiple tears rather than a single one as,

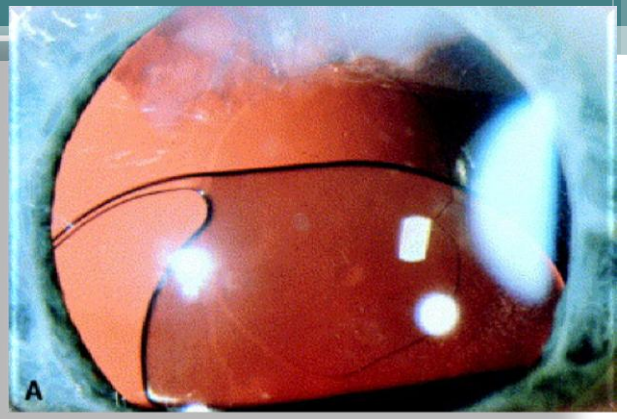
forces that extend these tears can be distributed to multiple sites, which reduces the likelihood of a tear extending equatorially

If radial tears are present, several modifications in surgical technique should be considered to minimize the risk of tear extension into posterior capsule

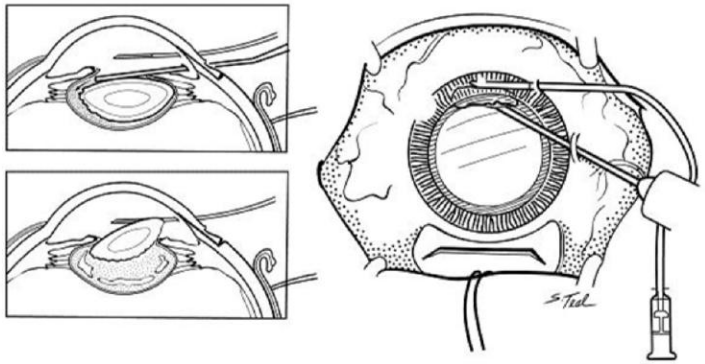
- ✓ Gentle **hydrodissection/hydrodelineation-** minimizes distension of capsular bag
- ✓ **Cracks are made gently away from the area(s)** with radial tears
- ✓ As much of the nucleus as possible is sculpted within capsular bag, rest is removed at iris plane
- ✓ **IOL should be placed with haptics 90° away** from the tear (One-piece polymethyl methacrylate lenses tend to maintain better centration)
- ✓ **Rotation** of IOL should be minimized.
- ✓ **OVD should be removed** in small aliquots
- ✓ **Avoid anterior chamber collapse** at any phase of the operation
- ✓ **To avoid anterior bulging & thus increased stress on the tear** ,chamber is deepened each time the phacoemulsification or irrigation-aspiration tip is removed from the eye; (done by injecting fluid, OVD, or perhaps air through paracentesis incision)

Chapter 53 – Complications of Cataract Surgery. Free Medical Textbook:381-390

2. Excessively small capsulorrhexis:



- In this case, the **tear should be directed more peripherally** & continued beyond original point of origin before completion of capsulorrhexis
- This removes an annulus of capsule & **enlarges the opening**
- If capsulorrhexis has been terminated & **opening is too small, a new tear can be started** by making an oblique cut with Vannas scissors
- **Preferable to enlarge capsulorrhexis after IOL implantation**- to minimize the risk of radial tears during lens implantation



Hydrodissection Complications

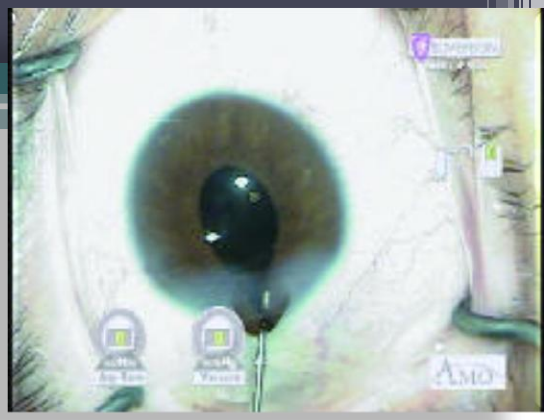
Inadequate hydrodissection

- Results in a nucleus that does not rotate
- Predisposes to zonular dehiscence if excessive force is exerted on the nucleus.
- **Avoid:** by making an additional hydrodissection, in quadrants not hydrodissected before

Overinflation of the capsular bag

- Predisposes to nuclear prolapse into the anterior chamber
- **Serious complication:** posterior capsular rupture with loss of nucleus into the vitreous
- This is more likely to occur in eyes with long axial lengths or with fragile posterior capsules

Iris prolapse



❑ **Causes:**

✓ When anterior chamber is entered too posteriorly

✓ Acute increase of IOP accompanied by choroidal effusion or hemorrhage

❑ **Management:**

✓ **Examine fundus:** To ascertain whether choroidal effusion/hemorrhage exists

✓ **With choroidal effusion**:

- Aspiration of vitreous, administration of intravenous mannitol can be helpful
- Surgery can be deferred until later in the day or the next day

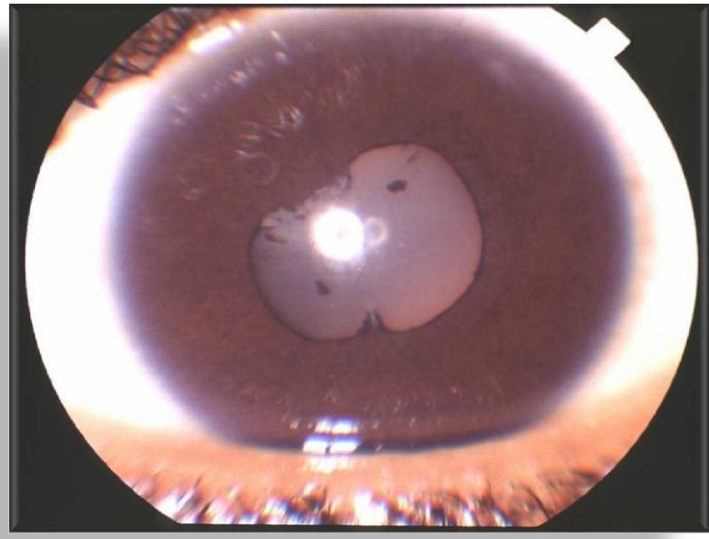
✓ If a **choroidal hemorrhage** /increased IOP from an effusion is resistant to treatment- best to terminate surgery

- **Limited choroidal hemorrhage**: best to wait 2–3 weeks before attempting further surgery

✓ <u>The wound is sutured carefully; intraocular miotics are administered & a peripheral iridectomy may be performed to help reposition the iris</u>

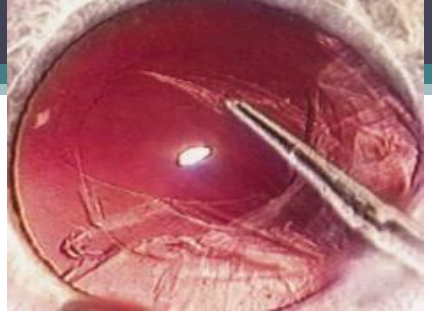
Trauma to the iris from prolapse or emulsification with a phacoemulsification tip **can produce an irregularly shaped pupil & iris atrophy** and can predispose to posterior synechiae formation

Posterior synechiae



If iris damage is produced inferiorly through contact with the phacoemulsification tip:

- ✓ Cut loose strands of tissue to reduce the likelihood of these being aspirated into the phacoemulsification tip.
- ✓ **Another option:** use a single iris hook to retract inferior iris, holding it away from phacoemulsification tip for the duration of the procedure



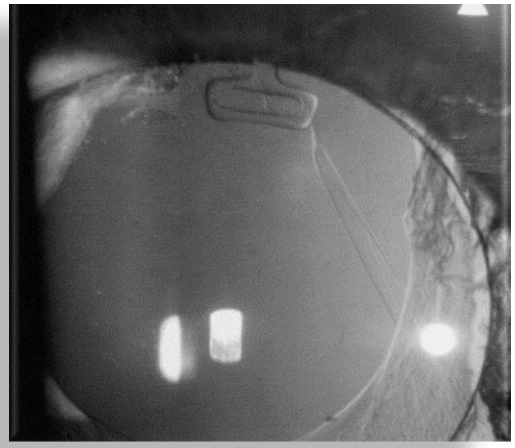
Ruptured Posterior Capsule

- ❑ Most **common serious intraoperative complication**
- ❑ **More likely to occur in** eyes with small pupils, hard nuclei, or pseudoexfoliation syndrome
- ❑ **Posterior capsule rupture can occur:** Before nucleus removal or during cortical irrigation-aspiration

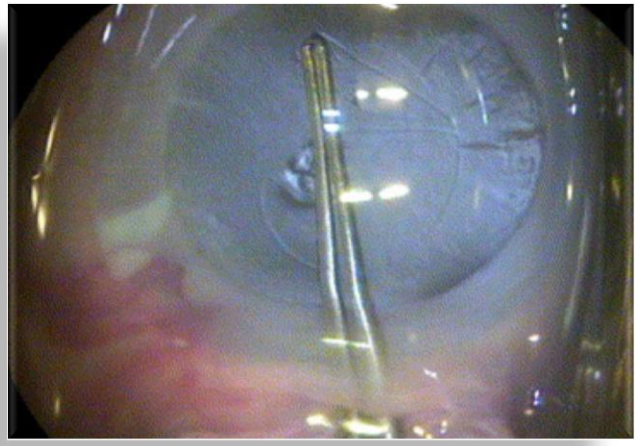
1. Managing rupture occurring before nucleus removal:

- ✓ Prevent nucleus from being dislodged into vitreous cavity
- ✓ An OVD can be injected posterior & anterior to nucleus
- ✓ Another alternative is "posterior assisted levitation"
- ✓ Nucleus is pushed gently anteriorly, so that it can be captured in front of the iris & safely removed from eye
- ✓ Then, the choice is to convert or to continue emulsification. The latter course can be more hazardous
- ✓ Whenever feasible, vitrectomy should be performed before nuclear pieces are removed

Posterior capsule rupture with vitreous loss occurred at the time of cataract surgery

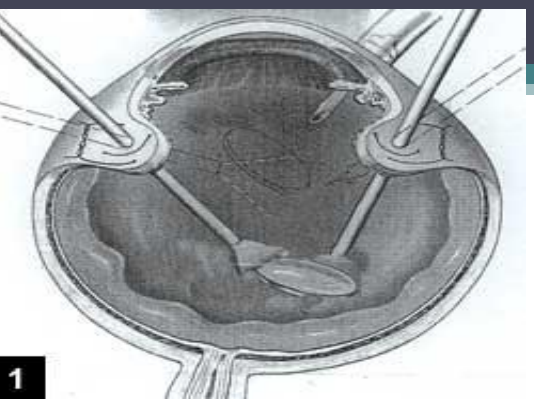


Posterior capsule rupture during irrigation & aspiration



2. Rupture occurred during cortical irrigation-aspiration:

- ✓ Key factor is the status of vitreous
- ✓ If no vitreous is present in anterior segment, vitreous loss often can be averted (an OVD injected through capsular opening to push vitreous posteriorly)
- ✓ If vitreous is present in anterior segment, vitrectomy should be performed first, with necessary caution being taken to prevent extension of the rent
- ✓ A pars plana approach is preferred when tear is remote from incision & therefore less accessible anteriorly



Dropped Nucleus

Loss of nuclear material into the vitreous cavity is one of the most potentially sight-threatening complications

- ✓ **Cause:** posterior extension of breaks in capsulorrhexis
- ✓ **Another risk factor**: Congenital posterior polar cataract
- ✓ **Avoid:** by recognizing early signs like unusual deepening of anterior chamber, decentration of nucleus, or loss of efficiency of aspiration
- ✓ **Management:**
- ✓ **Most recommended:** completing with careful anterior vitrectomy & removal of remaining accessible lens material

Refer to a vitreoretinal surgeon when:-

- ✓ If a significant amount of nuclear material has been retained
- ✓ If increased IOP or uveitis refractory to medical treatment develops

Anterior Segment Haemorrhage

May stimulate postoperative inflammation, synechia formation, and accelerate capsular opacification

- **Sites of haemorrhage :** either wound or iris

- **Steps to minimize or eliminate bleeding from wound:**
  - ✓ Careful cautery of bleeding vessels in the vicinity of incision
  - ✓ Create adequate internal corneal valve to minimize likelihood of scleral blood entering anterior chamber
  - ✓ Perform a clear corneal incision

- ✓ **Intraocular bleeding can be stopped by:**
  - Temporarily elevating IOP with BSS or an OVD
  - Inject dilute solution of preservative-free epinephrine (adrenaline) 1:5000 (or a weaker solution)
  - Direct cautery (if bleeding vessel can be identified) with a needle-tipped cautery probe

Choroidal effusion may be a precursor to suprachoroidal hemorrhage

- ✓ **Risk factors for suprachoroidal hemorrhage** include hypertension, glaucoma, nanophthalmos, highmyopia & chronic intraocular inflammation
- ✓ **If sudden shallowing of anterior chamber occurs** & eye becomes firm, retina is examined, if possible, to ascertain the cause
- ✓ **If a dark choroidal elevation is noted**, a choroidal hemorrhage is likely, & incision should be closed as quickly as possible

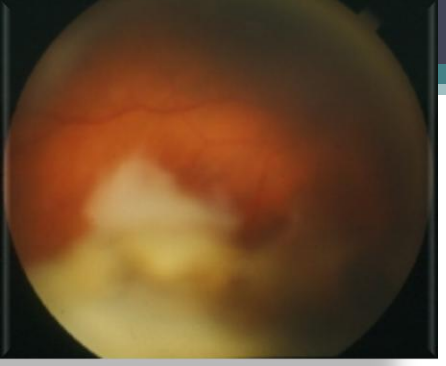
Major Postoperative Complications

Posterior capsular opacification

- Occurs in **5% & 50% of adult patients** within 5 years of cataract surgery
- **Average time of occurance post surgery:** 26 months (range:3 months-4 years)
- **3 sources of cells** with the potential to produce visual opacification are cuboidal anterior epithelial cells, remnant epithelial cells from lens bow, & dislodged cortical fibers

- ✓ **Standard treatment of PCO** consists of opening capsule with **Nd:YAG laser**
- ✓ **Changes in surgical techniques, as well as adjunctive pharmacologic agents**, may reduce incidence of posterior capsular
- ✓ In opacification for congenital cataracts, **primary posterior capsulectomy & anterior vitrectomy** - reduces the incidence

Surv Ophthalmol 44 :123–147, 1999.



Retained lens material in vitreous

- Lens material : known to possess significant antigenic properties that may lead to a severe sterile inflammatory reaction
- Intraocular inflammation may lead to corneal decompensation, glaucoma, uveitis, vitreous opacification &CME
- Initial management should include: removal of easily accessible lens particles, complete anterior vitrectomy and wound closure

Ideally, surgery should be performed when there is adequate corneal clarity & when IOP and inflammation are controlled

Surv Ophthalmol 44 :123–147, 1999.

Retinal detachment

Occurs in approximately 0.5% to 2.0% patients undergoing cataract surgery

❑**Risk factors:**

- ✓ Greater in eyes that have had a posterior capsulotomy than in eyes with an intact posterior capsule
- ✓ Vitreous loss
- ✓ Severe myopia
- ✓ Lattice degeneration
- ✓ Trauma

❑ **Steps to prevent retinal detachment** :

- ✓ A careful preoperative fundus examination
- ✓ Preservation of the integrity of posterior capsule at the time of surgery
- ✓ Educate patients on the symptoms of retinal tears & detachment
- ✓ Regular postoperative dilated fundus examinations
- ✓ Proper management & early patient recognition of symptoms: result in less visual loss

1. *Surv Ophthalmol 44 :123–147, 1999 ; 2. Chapter 53 – Complications of Cataract Surgery*

Endophthalmitis

- Most feared by ocular surgeons
- Risk of endophthalmitis post cataract surgery is between 0.1-0.4%
- Early recognition & treatment are keys to a successful outcome

- **Risk factors:** prolonged surgery (more than 60 mins), contaminated irrigating solutions or IOLs, vitreous loss & diabetes mellitus
- **Hallmark of acute infectious endophthalmitis**: intraocular inflammation with pain, hypopyon, corneal edema, conjunctival injection & vitreous cells
- **Treatment:**

✓ Include intravitreal antibiotics with an agent for gram-positive as well as gram-negative organisms, such as vancomycin & amikacin

✓ The role of vitrectomy is controversial, but removal of membranes & vitreous seems to produce better antibiotics penetration & dilutes exotoxins

Surv Ophthalmol 44 :123–147, 1999

Astigmatic Eye

Astigmatism

- ✓ **Incision location, size & configuration all significantly affect surgical astigmatism**
- ✓ **Decrease astigmatism by:** Decreasing incision size & adjusting suture depth, suture material & suture size
  - An incision that is posteriorly located is associated with less astigmatism than an anterior wound
  - A straight or frown-shaped incision has less astigmatism than a curved incision parallel to limbus
- ✓ **If intraoperative techniques are not successful, postoperative management can include** suture lysis, wound revision, wedge resection & astigmatic keratotomy

Surv Ophthalmol 44 :123–147, 1999

Macular oedema

Most common cause of unexpected visual loss following cataract surgery

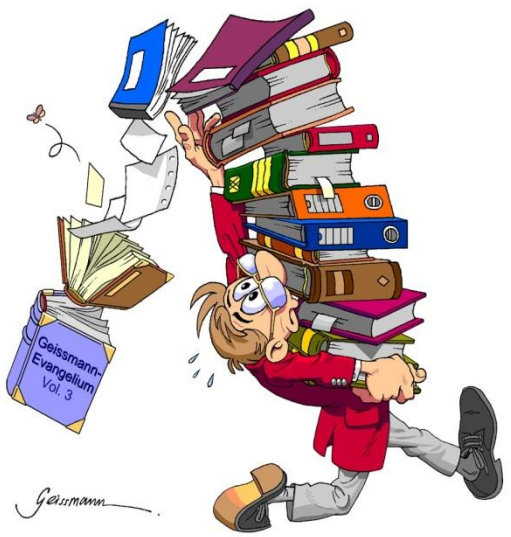
- Clinical CME **occurs** in less than 3% of patients
- Typical time of onset of clinical CME is 3–4 wks postoperatively

- **Predisposing factors** are intraoperative complications (e.g., Vitreous loss or severe iris trauma), vitreous traction at wound, diabetic retinopathy & pre existing epiretinal membrane
- If CME persists longer then 12 to 24 mths, permanent photoreceptor cell damage may occur

- **Treatment:** can be with NSAIDS & corticosteroid drops
- ✓ Other modes of treatment : sub-tenon's corticosteroid injection & administration of systemic NSAIDS with corticosteroids

Chapter 53 – Complications of Cataract Surgery. Free Medical Textbook:381-390

Take home message



- ✓ Phacoemulsification is an elegant & safe procedure that is rewarding to both patient & surgeon
- ✓ Complications will be encountered by every cataract surgeon & successful management will depend upon the ophthalmologist's experience, skill & sound judgment
- ✓ As phacoemulsification techniques change, so also will the types & frequency of complications
- ✓ Surgeons should master & adhere to these basic principles which will still be applicable to new techniques in the future

http://www.expertconsultbook.com/expertconsult/ob/book.do?method=display&type=bookPage&decorator=none&eid=4-u1.0-B978-1-4160-3225-0..00044-1&isbn=978-1-4160-3225-0#lpState=open&lpTab=contentsTab&content=4-u1.0-B978-1-4160-3225-0..00044-1--s0255%3Bfrom%3Dtoc%3Btype%3DbookPage%3Bisbn%3D978-1-4160-3225-0&search=none

Now in MDD* Pack

Cipla data on file

*MDD: Metered DoseDropper

Pre operative Care

- Zero preservative-preferred choice for cataract and refractive surgery[1]
- Safe in pediatrics above one year of age[2]
- Maintains aqueous humor sterility with very low rates of contamination[3]

Ref.:1)Eye world suppl. July 2003, ASCRS
•A Special report from the 2003 eye world symposium
A supplement to refractive eyecare for Ophthalmologists volume 7, Number 3, March 2003
2) Optometry 2004;75:419-29.
3) http://www.crstoday.com/PDF%20Articles/0205/F5_Bucci.html, accessed on 19th December, 2011.

Intra operative Care

- Prophylactic intracameral moxifloxacin (upto 150 µg/mL) may be safely used to prevent endophthalmitis after intraocular surgery.[1]
- Effectively reduces conjunctival bacterial flora when given on the day of surgery.[2]
- Most accepted brand for intracameral use.[3]

Ref.:1) Cornea. 2009; 28(5):553-61.
2)J Cataract Refract Surg. 2008;34(8):13838.
3)Cipla Data on file

Post operative Care

- Excellent penetration into anterior chamber, iris and ciliary body[1]
- Zero preservative- reduces the cytotoxic effects to the ocular surface. [1]
- Ensures 24hr protection against infection with Moxicip eye drop and eye ointment. [2]

1. Katz et al. A fourth generation ocular fluoroquinolone. A suppl. to refractive care for ophthalmologists.vol 7,no 3, march 2003
2. Cipla data on file

Gatiquin

Gatifloxacin 0.3% Eye Drops

- First US FDA approved 4th generation ophthalmic Fluoroquinolone[1]
- Negligible microbial growth observed in aqueous humor of patients treated with preoperative gatifloxacin[2]
- Ideal choice for prophylaxis of post-operative endophthalmitis[3]

Reference:

1.http://www.fda.gov

2.Cataract & Refractive Surgery Today 1, February 2005,Pg. 59-62.

3. Survey of Opthalmic March, 2004; 49:S55-61

World's 1st combination of Gatifloxacin 0.3% and Prednisolone acetate 1%

GATIQUIN-P

Gatifloxacin 0.3% + Prednisolone acetate 1% Eye Drops

Power to Outperform

- **World's first** unique combination for the management of post cataract infection and inflammation[1]
- Effectively eradicates bacteria that frequently cause postoperative ocular infections[2]
- Provides rapid corneal wound healing.[3]
- Has a lower propensity to raise IOP* than Dexamethasone.[4]
- Best inflammatory control and patient compliance with prednisolone.[5]

Ref.:

1. Cipla Data on file
2. Adv Ther 2009; 26(4):447-454.
3. Adv Ther. 2009 Apr; 26(4):447-54
4. American journal of ophthalmology 1975;79(6):1012-1016
5. Graefe's Arch Clin Exp Ophthalmol. 2005; 243: 768–773.

WORLD'S 1st HEC Advantage

Moxicip KT

ZERO PRESERVATIVE

Eye Drops

where power breeds safety

A powerful combination of Moxifloxacin & Ketorolac

- HEC advantage[1]
- Preservative free formulation[1]
- Enhanced patient compliance[1]

Ref.:1.Cipla Data on file

Moxifloxacin –the powerful anti infective

- Excellent penetration into anterior chamber, iris and ciliary body[1]
- Wide spectrum coverage against ocular pathogens[2]

Ketorolac –the time tested NSAID

- Efficacious in preventing CME* and improving visual acuity in immediate postoperative period[3]
- Effectively inhibits miosis during cataract surgery when given pre-operatively[4]

*CME :Cystoid Macular Edema

Ref.:
1. Katz et al. A fourth generation ocular fluoroquinolone. A suppl. to refractive care for ophthalmologists.vol 7,no 3, march 2003
2. J Cataract Refract Surg 2008; 34:1460–1467
3. J Cataract Refract Surg. 2006; 32(9):1474-82.
4. . Clinical Ophthalmology. 2007; 1(4): 367–371.

KetoDrops LS

Heal with comfort

Ketoralac 0.4% + HPMC

Added HPMC* Advantage

- Provides safe and effective relief from post-surgical inflammation and pain
- Effectively treats and prevents Cystoid Macular Edema (CME)
- Effectively reduces intra-operative miosis

*Hydroxy propyl methyl cellusolse

CME Monograph 2005. Inflammation control after cataract surgery

World's 1st with SOC

FloSoft

Eye drops

Fluorometholone acetate 0.1%

Smart & Safe

- World's First formulation of Fluorometholone with SOC$ as a preservative[1]
- Particle size between 1-3 u; uniform particle distribution and no agglomeration[1]
- Superior anti inflammatory effect in the cornea as compared to Fluorometholone alcohol[2]
- As effective as Prednisolone and Dexamethasone in reducing corneal inflammation[2]
- Low propensity to elevate IOP#[3]

1. Cipla data on file
2. Ann Ophthalmol, 1984, 16: 1110-1115
3. Adapted from Ophthal Res 8: 835-39

Intraocular pressure

$ stabilized Oxychloro Complex

THANK YOU