Chapter - 9
VITREORETINAL COMPLICATIONS OF CATARACT SURGERY

With refinement of cataract surgery techniques, outcome of surgery has become predictable and visual restoration is almost a certainty. However, even the most experienced and skilled surgeon will eventually be faced with some complications. It is incumbent upon the anterior segment surgeon to anticipate and recognize predisposing factors and if complications occur, take remedial measures to minimize the damage. This chapter will discuss the posterior segment complications of cataract surgery.

CYSTOID MACULAR EDEMA (IRVINE - GASS SYNDROME)

This is one of the most frustrating and common of all complications, occurring in about 2.5% of cases. Intraoperative loss of vitreous or rupture of posterior capsule is associated with increase incidence and a poorer prognosis.

Clinical Findings

It typically presents 4-16 weeks after uncomplicated cataract extraction with a peak period in 6-8 weeks range. Upon careful fundoscopic examination, with slit lamp biomicroscopy, the macula appears thickened. On closer examination, enhanced with obliquely incident thin beam illumination and retroillumination, cystoid spaces may be visualized. With coalescence of cystoid structures, a central foveal cyst may develop and may result in lamellar macular hole. Other associated findings include internal limiting membrane wrinkling, optic nerve head swelling and vitreous cells. In chronic
cases, atrophy and mottling of retinal pigment epithelium may also be seen. The hallmark feature of CME is easily demonstrated by fluorescein angiography. It gives a typical petaloid pattern.

Risk Factors

Both post-surgical inflammation and vitreous traction on the macula are important in the pathogenesis of CME. An atraumatic and uneventful surgery will greatly lessen the chance of CME. Young age, disruption of posterior capsule, ICCE, pupillary capture, iris supported lens, non UV blocking implants, post YAG-laser are known risk factors.

Management

Management is based on reducing inflammation and taking care of abnormal vitreous traction.

Medical therapy

It is focused primarily on use of anti-inflammatory drugs like NSAIDs and corticosteroid drops. Step-wise management is as follows.

Step-I  **Topical corticosteroids drops**

Prednisolone acetate 1% / phosphate 1% OR
Dexamethasone 0.1% QID

±
Topical NSAIDs (diclofenac sodium 0.1%, flurbiprofen sodium 0.03%, Ketorolac tromethamine 0.5% QID

This should be given for 6-8 weeks

Step-II  **Peribular steroid** (Sub-Tenon's injection) - 0.5 ml Inj Triamcinolone acetonide (Inj Kenacort 40mg/ml)

Wait for 4-6 wks. Keep a watch on IOP

Step-III  **Carbonic anhydrase inhibitor** -

Oral Acetazolamide 250mg twice daily
Oral corticosteroid - Prednisolone 1mg/kg/day for 5-7 days with gradual taper

Step-IV Surgery
- Nd-YAG laser vitreolysis
- Vitrectomy

Generally the prognosis is very good and only 1 to 2% of cases may be left with chronic macular edema.

RETINAL PHOTOTOXICITY INDUCED BY OPERATING MICROSCOPE

This is an iatrogenic light toxicity of the retina from the operating microscope during cataract surgery. Fortunately it is becoming less common as surgical time has reduced from 45 minutes - 1 hr to 10 to 20 mts. Clinically it presents as round or ovoid lesion in parafoveal region. It can be prevented by using superior rectus bridle suture, filling anterior chamber with air after implanting IOL, shifting from co-axial to oblique illumination for suturing, constriction of pupil with pilocarpine, tilting the microscope or using filters to cut down blue light.

EXPULSIVE AND DELAYED SUPRACHOROIDAL HEMORRHAGE

This is the most dreaded complication. Fortunately, it is very rare (a reported incidence of 0.1% to 0.6%). It is very uncommon with phacoemulsification but still a possibility to be kept in mind.

An expulsive or massive suprachoroidal haemorrhage refers to rapid or voluminous blood extravasation into potential anatomical space between the choroid and sclera forcing the extrusion of intraocular contents through the open section. This may be acute or may be delayed hours or even days after surgery.

Clinical Findings

Perhaps the single most important determining factor in minimizing or averting the disastrous consequences of an expulsive haemorrhage is early
recognition. Once the globe has been opened there will be subtle tensing of the globe, loss of red reflex, shallowing of anterior chamber. There will be forward displacement of the iris-lens diaphragm, gaping of section and repeated prolapse of iris, which is difficult to reposit. With continuous rise of IOP, extrusion of lens or IOL, vitreous, retina or blood may follow. Patient may experience ocular pain and nausea and vomiting intraoperatively or while in recovery.

**Risk factors**
1. Hypertension
2. Glaucoma
3. Atherosclerosis
4. Diabetes Mellitus
5. Myopia
6. Previous ocular trauma or surgery
7. Intraoperative tachycardia
8. Advanced age
9. Hard brunescent cataract
10. Valsalva maneuver and coughing
11. Patient on anti-coagulant drugs

**Management**

Surgical intervention can be divided into intraoperative maneuvers and secondary surgical approach. As soon as expulsive haemorrhage is suspected operative wound should be closed immediately by using heavy sutures like 8-0 or 6-0 sutures. Sutures should be placed quickly and wound secured. The role of intra-operative sclerotomy is controversial.

As soon as the surgical wound is secure, the next most important concern is to reduce IOP to maintain perfusion of optic nerve and retina. I.V.
mannitol, carbonic anhydrase inhibitors, followed by topical aqueous suppressants and oral steroid should be started. Analgesics and anti-inflammatory agents should be given.

A combined pars plana vitrectomy with external supra-choroidal haemorrhage drainage may salvage vision in few of cases. It generally carries a very bad prognosis.

**INFECTIOUS POST-OPERATIVE ENDOPTHALMITIS**

This is a potentially catastrophic complication following a cataract extraction procedure. Recent advances in cataract surgical technique, greater attention to sterile measures, use of povidone iodine: disposable plastic drapes and antibiotics have reduced the incidence from 1% to 0.05%-0.1%.

Infectious endophthalmitis, caused by microbial pathogens must be differentiated from aseptic or sterile post-operative endophthalmitis induced by an immune response to surgical trauma, foreign inciting agent or retained lens material.

**Cause of sterile (non-infectious) endophthalmitis**

1. Post-surgical trauma
2. Mechanical uveal irritation by intraocular lens
3. Inflammatory reaction to intraocular lens materials, sterilizing agents, polishing compounds.
4. Toxic effects from intraocular fluids, surgical glove powder, instruments, sterilizing chemicals.
5. Residual lens material

Although all groups of bacteria can produce endophthalmitis, the predominant organisms are gram positive bacteria. They are responsible for 90-95% of cases. In the Endophthalmitis Vitrectomy Study, gram negative organisms were isolated in only 6% of cases. Despite their low prevalence, gram negative infections should be given due importance as infection is very
fulminating, occurs early and if untreated, may lead to loss of the eye. Fungal infection is seen in 3% of cases.

Clinical Findings

The cardinal symptom of post-operative endophthalmitis is blurring of vision. Ocular pain out of proportion to the usual post-surgical discomfort or increasing pain is the second most important presenting symptom. Redness, mucopurulent discharge, excessive tearing, photophobia and blepharospasm may be other symptoms.

On examination, subnormal visual acuity, conjunctival hyperemia, chemosis, worsening anterior chamber and vitreous reaction, hypopyon, corneal haze, corneal abscess, and a poor fundus glow may be found.

Post-surgical Endophthalmitis

<table>
<thead>
<tr>
<th>Fulminant (&lt; 4 days P.O.)</th>
<th>Acute (5-7 days)</th>
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<tbody>
<tr>
<td>- Gram negative bacteria</td>
<td>Staph epidermidis</td>
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<tr>
<td>- Streptococci</td>
<td>Coagulase -ve cocci</td>
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<tr>
<td>- Staph aureus</td>
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Chronic (> 4 weeks)

Fungal, propionibacterium acnes
Staph epidermidis

RISK FACTORS

Cataract Techniques and Complications
- Prolonged operating time
- Vitreous loss and breach of posterior capsule
- Surgical wound abnormalities
- Placement of A.C. IOL v/s P.C. IOL
- Use of prolene haptics versus all PMMA lens

**Host factors**
- Diabetes Mellitus, Systemic hypertension
- Chronic alcoholism, other debilitating disease
- Long term steroid use
- Pre-existing ocular disease or infection

**Management**

It is an ocular emergency and response should be prompt. Any delay will invariably lead to loss of the eye.

**Confirmation of Diagnosis**

It is mainly based on finding organisms from aqueous and vitreous tap. Both aspirates should be taken as there are instances where vitreous aspirate (positive in 56-70%) may be negative and aqueous aspirate (positive in 36-40%) may be positive. Before tap, the part should be prepared with povidone iodine 5% which should be instilled in conjunctival sac also. Aqueous tap is obtained by a paracentesis using a 25-27 G half inch needle mounted on a tuberculin syringe with its plunger on. Aspirate 0.1ml of fluid in controlled manner, with needle bevel facing the surgeon. Withdraw the needle and apply pad & patch.

A sample of vitreous is the most important source to isolate the organism producing the endophthalmitis. It may be obtained by introducing 23 G needle attached to a 2 cc syringe through pars plana (3 mm in aphakic / pseudophakic and 4 mm in phakic eyes) and aspirating 0.2 to 0.3 ml of vitreous
aspirate. This method is fraught with risk of producing vitreous traction particularly when vitreous is not liquefied.

The safest method to obtain vitreous sample is by vitreous biopsy. This provides adequate amount and at the same time does not produce vitreous traction as vitreous is cut before aspiration. Vitreous biopsy may be obtained by one of two methods: with an infusion line and without an infusion line. The former has a disadvantage of diluting the specimen obtained and the need for an additional sclerotomy to be made. For obtaining an undiluted specimen by vitreous biopsy, the suction line on vitreous cutter (which is usually connected to an automated suction in vitrectomy machine) is replaced by shorter 2.5cm tube attached to tuberculin syringe for manual suction. Vitreous cutter is placed in anterior vitreous and cutting is actuated. Assistant withdraws the aspirate to collect 0.2 to 0.3ml of sample. The lost volume may be replaced by saline.

**Treatment**

The mainstay of treatment is injecting broad spectrum intravitreal antibiotics. This remains the first & foremost important step in treatment and can be undertaken at even at remote places.

Line of Management is as follows

1. Antimicrobial therapy - Intravitreal, topical, subconjunctival, systemic antibiotics
2. Anti-inflammatory therapy - Corticosteroids- oral, topical, intravitreal and NSAIDs
3. Supportive therapy - cycloplegics, antiglaucoma
4. Vitrectomy

**Intravitreal Antibiotic**

<table>
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<tr>
<th>First choice</th>
<th>Vancomycin</th>
<th>1 mg in 0.1ml</th>
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<tbody>
<tr>
<td></td>
<td>Ceftazidime</td>
<td>2.25 mg in 0.1ml</td>
</tr>
<tr>
<td>Second choice</td>
<td>Vancomycin</td>
<td>1mg (1000 µg) in 0.1ml</td>
</tr>
<tr>
<td></td>
<td>Amikacin</td>
<td>400 µg in 0.1ml</td>
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Vancomycin is highly effective against gram positive organisms and ceftazidime and amikacin are effective against gram negative organisms. Aminoglycosides, especially gentamicin should be avoided for fear of macular infarction.

**Method of Intravitreal Injection**

Before giving an intravitreal injection, an informed consent should be taken. Any infected suture must be removed and if wound is weak or open additional suture should be placed. IOP should be assessed and if high two tablets of Diamox be given half an hour before the injection. It should be given under facial nerve block with topical instillation of xylocaine / paracaine drops. If necessary retrobulbar block should be given. Peribulbar injection should be avoided as it may increase IOP. Children should be given general anaesthesia for the same.

Following material is required for intravitreal injection.

1. Tuberculin syringes
2. Needles - 26G ½ inch, 23G 1 inch needle.
3. Surgical tray (lid speculum, sterile cotton tipped applicator, calipers, fixation forceps)
4. Topical xylocaine, 5% povidone iodine.
5. Antibiotic vials
6. Clear glass slides, culture plates (nutrient agar, chocolate agar, Saboraud's medium plates)

**How to make Intravitreal drugs:**

*Vancomycin* - available as 500 mg powder vial. Reconstitute with 10 ml of sterile water for injection. 0.2ml of this drug is withdrawn in tuberculin syringe and this is further diluted with 0.8ml of sterile water or saline. 0.1ml of this will give 1 mg or 1000µg of vancomycin.

*Ceftazidime hydrochloride* : (2.25mg in 0.1ml) - Available as 500 mg powder. Reconstitute with 2ml of sterile solution for injection 0.1ml of drug is
withdrawn into tuberculin syringe and diluted further with 0.9 ml. This give strength of 2.5mg (active ingredient 2.25mg) in 0.1ml.

*Amikacin sulfate:* (400µg in 0.1ml) - Available as solution of 100 mg in 2ml (50 mg/ml). 0.2ml of drug is withdrawn in a 2 ml syringe and diluted further with 2.3ml. 0.1 ml of this will contain 400 µg of drug.

The periocular region is painted with povidone iodine and cul-de-sac also washed with the same. Insert speculum. Mark the injection site with help of calipers. Inject transconjunctivally with direction towards the centre of vitreous cavity. Inject drug slowly drop by drop rather than injecting rapidly to avoid jet formation. Needle bevel should always face the surgeon. It is not advisable to make multiple entries into the eye. Syringe should be replaced while needle remains in place. Never mix vancomycin with any other drug, as it will form a precipitate. The IOP is checked at end of procedure. Now give subconjunctival injection. Apply bandage for few hours and start topical fortified drops after that.

**Subconjunctival Injection:** The dosages are as follows

- Vancomycin 25mg/0.5ml,
- Ceftazidime 100mg/0.5ml
- Tobramycin / Gentamycin 20mg/0.5ml
- Cefazolin 100 mg/ 0.5 ml

**Fortified drops:** Doses are as follow-

- Vancomycin 50 mg/ ml -5% drops
- Ceftazidime 50 mg/ ml -5% drops
- Tobramycin 2 ml of parenteral injection to 5 ml 0.3% commercial drops to give about 150 mg/ml.
- Amikacin 50 mg/ ml -5% drops

**Role of systemic antibiotics:**

Systemic antibiotics have a questionable role but may be used in severe cases. Dosages are as follows:

- Vancomycin 500 mg 6th hourly
Gentamycin 8 mg/kg/day iv
Cefazolin and Cefotaxime 2 gm BD iv
Ciprofloxacin 750 mg BD iv or po

**Anti-inflammatory therapy: Role of corticosteroids**

Corticosteroid are the second important group of drugs in management of endophthalmitis. Steroids prevent tissue damage produced by release of inflammatory mediators in large quantities. They are contraindicated in case of suspected fungal infection.

**Recommended doses of corticosteroid**

- Intravitreal Dexamethasone - 400µg in 0.1ml (available as 4mg/ml solution) Withdraw 0.1ml in tuberculin syringe inject without any dilution.
- Systemic corticosteroid - Prednisolone - 1-2mg/kg/day PO
- Subconjunctival dexamethasone - 1mg in 0.25ml

**Role of Vitrectomy**

It is indicated in cases where visual acuity is only perception of light, where intravitreal injections failed to improve the condition, or a rapidly worsening condition as seen in gram negative organisms and fungal endophthalmitis. Nowadays, results of vitrectomy are gratifying.

**RETAINED AND DISLOCATED CRYSTALLINE LENS MATERIAL**

Loss of fragments or total crystalline lens into the vitreous has become common in recent years as phacoemulsification has become the method of choice for cataract surgery. This occurs in cases of posterior capsule tear or with zonular dialysis.

Risk Factors for "dropped nucleus"
1. Inadequate zonular support (pseudoexfoliation, Marfan’s syndrome)
2. Very hard or brunescent cataract
3. Deep set eyes
4. Poor pupillary dilatation
5. Previous pars plana vitrectomy
6. Posterior extension of capsulorrhexis tear

Lens material inside vitreous cavity incites a granulomatous inflammatory reaction consisting of foreign body giant and epitheloid cells surrounding the lenticular material. This may lead to lens particle glaucoma, uveitis with hypopyon, cystoid macular edema, increased risk of endophthalmitis and vitreous opacification and corneal edema.

Immediate management consists of an automated anterior vitrectomy, cortical I/A and closure of the wound. Closure must be secure to withstand pressures during posterior vitrectomy. IOL implantation should be deferred until the posterior vitrectomy. If dropped nuclear fragment is less than ¼ of size of lens and it doesn't incite any reaction, patient may be treated conservatively. Otherwise a pars plana vitrectomy should be undertaken and the nuclear fragment removed. This again gives gratifying results.

RETINAL DETACHMENT FOLLOWING CATARACT EXTRACTION

Aphakia and pseudophakia carries a higher risk of retinal detachment especially in first two years after surgery. Incidence of R.D. are as follows:

- ICCE - 1.55% to 3%
- ECCE - 09% to 1.7%
- Phacoemulsification - 1.17%

Risk factors

- Axial myopia
- H/o detachment in other eye
- Predisposing lesions such as lattice degeneration
- Posterior capsule rupture and vitreous loss
- YAG capsulotomy
The visual prognosis of aphakic and pseudophakic retinal detachment depends on extent of detachment, macular involvement, presence of proliferative vitreoretinopathy. The reported anatomic success rate is 82 to 93%.

Complication of associated with retrobulbar and peribulbar anaesthesia have already been described in the chapter on ocular anaesthesia.