Management of Cataract Complications

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Disclosure Statement:
Allergan Pharmaceuticals Speaker’s Bureau
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Statistics
- Number of Americans > 40 who are affected by cataracts
  22 million
- Number of surgeries performed worldwide in 2010
  Approximately 20 million
- Number of surgeries performed worldwide by 2020
  Approximately 32 million
- Annual amount spent through Medicare to treat cataracts
  $6.8 billion
- Number of Americans who have cataract surgery each year
  3,000,000
- Success rate of cataract surgery
  99%
- Percentage of patients without severe post-op complications
  99.5%

Cataract Extraction
- One of the most commonly performed procedures in the United States
- Personal experience
- Co-management

Complications
- Time
  - Pre-Operative
  - Intra-operative
  - Early post-operative (first few days)
  - Late post-operative (weeks to months)
- Location
  - Anterior (cornea, anterior chamber, IOL, capsule)
  - Posterior (vitreous, retina)
Pre-Operative Care

Pre-existing Ocular Conditions
- High Myopia
- High Hyperopia
- Binocular vision abnormalities
- Blepharitis
- Dry Eye Disease
- Fuchs Dystrophy
- Pseudoxfoliation
- Glaucoma
- ERM
- Macular Degeneration
- Diabetic Retinopathy
- Retinitis Pigmentosa
- Planning combined procedure

Pre-existing Medical Conditions
- Age
- Sex
- Race
- Diabetes Mellitus
- Atherosclerotic Vascular disease
- Hypertension
- Allergies/reactions to sedatives/anesthetics
- Bleeding tendencies
- BPH
- Marfan Syndrome
- Breathing problems
- Systemic medications
- Anti-coagulants
- Alpha-adrenergic receptor antagonists
- Narcotics
- NSAIDS
- Saw palmetto
- Ginkgo biloba

Surgeon Choice
- Older >60 assoc w increased postsurgical complications
- Oldest patients at increase risk for endophthalmitis

Age
- Several studies report inc risk among Men
  - 44% higher odds of endophthalmitis

Race
- Several studies vary on whether whites or African Americans have higher complication rates.
- Higher endophthalmitis rates among African Americans

Diabetes
- Those with ophthalmic manifestations of DM had 33% inc risk for complications
- Complication risk increased with level of DR severity
  - Altered immunity
  - Poor pupil dilation
  - Bleeding tendencies

Same day combined Surgery
- Common to stage two procedures together to help address multiple issues at once
- Stein et al found 151% inc risk for severe adverse events in combined procedures
  - Longer time in operating room
  - Exposure to additional instruments
  - More incisions
  - MIGS

Surgeon Factor
- Surgeon Volume
  - AE 70% lower in surgeons who performed 501-1000 surgeries / yr
  - 86% lower among surgeons >1000 sx
  - Highest risk in surgeons performing 50-250 cases / yr

Intra-Operative Care
Flomax (tamsulosin)
- Most widely prescribed treatment worldwide for BPH
  - $1.9 billion 2009
- Systemic Alpha1 antagonist
  - Highly selective for A1a receptor
- Relaxes smooth muscles
  - bladder neck and prostate
  - permitting more complete emptying
  - iris dilator smooth muscle
- Strong association with IFIS first reported in 2005
  - Iris billowing and floppiness
  - Iris prolapse to main and side incisions
  - Progressive miosis
- Classified:
  - Mild (17%)
  - Moderate (30%)
  - Severe (43%)
- Canadian study
  - Doubling rate of serious postoperative complications following Cat Sx
    - RD, retained fragments, severe inflam, endophthalmitis
  - IFIS can occur more than 1 year after tamsulosin has been discontinued
  - Eventually produce a permanent atrophic change in the iris dilator muscle that is not reversed by discontinuation
  - IFIS has occurred within 3 – 7 days of initiating tx
  - Stopping pre-operatively is of unpredictable and questionable value
  - Iris dilator muscle 23% thinner
  - Important to make surgeon and patient aware

Flomax (Tamsulosin)
- Iris dilator muscle 23% thinner
- Important to make surgeon and patient aware

Posterior Capsule Rupture
- Most common intraoperative complication (1.9-3.5%)
  - Vitreous Loss
  - Need for vitrectomy
  - Placement of intraocular lens in ciliary sulcus or AC
  - Additional surgical interventions
- Risk factors for Post Cap Rupture
  - Increasing age
  - Male sex
  - Comorbid glaucoma
  - Diabetic retinopathy
  - Brunescent/white cataract
  - Poor views of the fundus
- Exfoliation syndrome / phacodonesis
- Small pupil
- Axial length >26mm
- α-antagonist use
- Inability to lay flat
- Trainee surgeon

Post-Operative Care
- Jason Jones, MD Sioux City, Iowa
Critical evaluation of the operated eye during the immediate post-operative and peri-operative period is extremely important:
- 1 day
- 1 week
- 1 month

Thorough DFE is mandatory in any patient who does not meet or exceed expected VA.

1 day
1 week
1 month

Areas of Decreased Vision

In evaluating reduced post-operative acuity, one should know both the timing and severity of the visual complaint in order to determine an etiology.
- Early Visual Impairment
  - Severe (20/200 or worse)
  - Moderate (20/100 or better)
  - Delayed Visual Recovery

Early Visual Impairment

Vascular Occlusion
- Retinal Detachment
- Infectious Endophthalmitis
- Toxic Anterior Segment Syndrome
- Delayed Suprachoroidal Hemorrhage
- Optic Nerve Damage
- Globe Rupture or Perforation
- Intraocular aminoglycoside toxicity

These injuries often occur through vascular insult, direct mechanical injury, or retinal toxicity.

Epithelial Irregularity
- Irregular or Marked Corneal Astigmatism
- Corneal Edema
- Dislocated / subluxated IOL
- Operative / Post-operative bleeding
- Retained Cortex or Nuclear fragments
- Hypotony
- Photoretinal Toxicity
- Extraocular Muscle paresis

These complications predominantly affect optical clarity, macular function or refractive state.

Early Visual Impairment

Vascular Occlusion
- CRVO, CRAO
- Choroidal Infarction
- May occur in Sx if complicated by:
  - retrobulbar hemorrhage
  - nerve sheath injection
  - elevated IOP

Retinal Detachment
- Occurs in 1% (85% within 3 years)
- Increases to 5% with loss of vitreous
- If immediately after surgery—usually tractional or from globe perforation
- Tractional RD assoc with vitreous to wound or aspiration instrument, or dropped nucleus
Retinal Detachment

- If RD from globe perforation usually by retrobulbar needle & most commonly at equator or post pole (Vit heme & hypotony)
- Higher risk if high myopia, prior scleral buckle, staphyloma, enophthalmos

Early Visual Impairment

Acute Bacterial Endophthalmitis

- Usually manifests 2-7 days after surgery, most within 6 weeks
- Pain, injection, significant decrease in VA, purulent discharge
- Incidence 1:1000
- Most acute cases due to Staphylococci (aureus and epidermidis)
- Act as soon as possible
- Key to Dx is culturing aqueous and vitreous

Acute Endophthalmitis

- Clinical Appearance
  - Ant chamber cell
  - Hypopyon
  - Fibrin
  - Focal Corneal edema
  - Eyelid edema
  - Chemosis
  - Hyperemia
  - Vitreal involvement
  - Pt has pain
  - 21% with underlying DM

Endophthalmitis Vitrectomy Study (EVS)

- Multicenter randomized trial carried out at 24 centers in U.S. (1990-1994)
- Looked at 420 patients with clinical evidence
- To determine the role of IV and systemic antibiotics
- To determine role of immediate PP Vitrectomy
- Results
  - No difference in final visual acuity or media clarity with or without use of systemic / IV antibiotics
  - Therefore recommend intravitreal injection of AB


Endophthalmitis Vitrectomy Study (EVS)

- Patients with LP vision or worse with an early vitrectomy did favorably with final VA
  - 20/40 or better was achieved 3x more often following PPV than needle tap
- Patients with better than LP VA, do not require a vitrectomy only required tap/biopsy

Overall 53-60% achieved ≥20/40 following AB therapy
Early Visual Impairment

**ESCRS Protocol**
- European Society of Cataract and Refractive Surgeons protocol
- Intracameral injection of 1mg cefuroxime (10mg/ml) (Ceftin)
  - Prior to protocol
    - 2299 pts Cat Sx – 6 cases of postop endophthalmitis (0.26%)
  - After protocol
    - 13,390 pts Cat Sx – 0 cases of endophthalmitis

*Tap and Inject for Endophthalmitis using 25G Trocar Cannula, Theodore Leng, MD, FACS*

Early Visual Impairment

**Toxic Anterior Segment Syndrome**
- Monson et al. first used the term TASS in 1992
  - received greater attention because of a national outbreak in 2005 that affected 112 patients treated at seven sites in six states and was linked to endotoxins in Advanced Medical Optics Endosol balanced salt solution (BSS).
  - Develop in response to retained lens, toxic intraocular reaction, mechanical irritation, exacerbation of pre-existing uveitis

*Careful Hx and exam help differentiate between the two and timely intraocular cultures and intravitreal AB must be utilized when interpretation difficult*

**Most common clinical symptom is significantly blurred vision**
- Corneal Edema is most common clinical finding
- Limbus to limbus – Indicative of widespread endothelial damage

Early Visual Impairment - TASS

**Marked ant seg inflammation**
- Hypopyon
- Fibrin from surface of iris onto surface to IOL, to wound and side ports
- Can create significant iris damage
  - Permanently dilate
  - Transillumination
  - Damage to TM leading to 2nd Glc

**Treatment**
- Immediate high dose topical corticosteroid
- Follow closely
  - Same day
  - Daily
- IOP monitoring
- Usu low to start but can rise rapidly
- Acute trabeculitis
- PAS development – gonio
- Specular Microscopy
- Monitor for permanent endo damage
- No help to wash out the AC
Early Visual Impairment

**TASS vs Infectious Endophthalmitis**

<table>
<thead>
<tr>
<th>CLINICAL FEATURES</th>
<th>TASS</th>
<th>INFECTIONOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of symptoms</td>
<td>Relatively immediate (12-48 hours)</td>
<td>Somewhat delayed (2-7 days)</td>
</tr>
<tr>
<td>Pain</td>
<td>Most patients do not experience</td>
<td>&gt;75% of patients have pain</td>
</tr>
<tr>
<td>Corneal Edema</td>
<td>Diffuse &quot;limbus-to-limbus&quot;</td>
<td>Focal corneal edema</td>
</tr>
<tr>
<td>Anterior Segment Inflammation</td>
<td>Increased cell/flare, hypopyon, marked fibrin reaction</td>
<td>Increased cell/flare, hypopyon, moderate to severe fibrin</td>
</tr>
<tr>
<td>Iris/pupil</td>
<td>Iris atrophy, with dilated, non-reactive pupil</td>
<td>Changes relatively uncommon</td>
</tr>
<tr>
<td>Vitreous</td>
<td>Usually clear, rare spillover</td>
<td>Opacified</td>
</tr>
</tbody>
</table>

**Early Visual Impairment**

- **Corneal Irregularity**
  - Corneal punctate epithelial keratopathy
  - Exposure
  - Topical drug toxicity
  - Irregular tear wetting patterns

- **Common causes of corneal edema**
  - Dense cataracts
  - Shallow anterior chamber
  - Pre-existing corneal disease
  - High IOP

- **Management of corneal edema**
  - Time
  - Ocular hypotensive agents
  - Topical hyperosmotics

- **Post-Op pressure elevation**
  - Viscoelastic
  - Inflammation
  - Hyphema
  - Ciliary or pupillary block
  - Mechanical angle closure

**Early Visual Impairment**

- **Corneal edema**
  - Epithelial edema often associated with elevated IOP
  - Stromal edema from endothelial dysfunction
  - Mechanical injury, cell toxicity or pre-existing
  - Cataract surgery accompanied by anterior vitrectomy
    - 3x more likely to be associated with chronic post-operative corneal edema
Early Visual Impairment

- Corneal Irregularity
  - Irregular or high post-operative astigmatism may substantially reduce visual acuity
  - Results from excessive suture tension or wound misalignment
  - Thermal injury with resultant collagen shrinkage
  - Keratometry or topography will help quantify the problem
  - Refraction performed over RGP will neutralize effect and help determine etiology

Early Visual Impairment

- Post-operative Bleeding
  - Hyphema
  - Vitreous Hemorrhage
  - Intracapsular blood
  - Minor ant./post. Seg heme usu. clear in days to weeks
  - If interfere with fundus exam – ultrasound R/O RD, etc.

- Patients taking anticoagulants do not appear to have significantly increased rates of serious post-op bleeding

Early Visual Impairment

- Retained lens fragments
  - Aasuri and colleagues
    - Overall Incidence: 1:300
    - 1:500 experienced
    - 1:165 novice

- Risk factors
  - Limited pupil dilation
  - Traumatic cataract
  - Patient movement during surgery
  - Disorders that predispose to zonular weakness?

- Causes variable visual symptoms depending on amount and location
  - Nuclear more than cortical incite inflammation, corneal edema, eie. IOP, RD
  - Medical Tx directed toward controlling IOP and inflammation
  - PPV for large particles

Early Visual Impairment

- Hypotony
  - Wound leak or globe perforation
  - Serous or hemorrhagic choroidal detachment
  - Cyclodialysis cleft
  - Marked inflammation
  - Retinal detachment

Determining the etiology requires examination of the wound, gonioscopy of the angle, BIO, B-scan, etc.

Early Visual Impairment

- Photoretinal toxicity
  - Photoretinal injury from operating microscope
  - Patients complain of scotoma
  - If injury near fovea, VA will be compromised
  - Appears as subtle pale oval lesion, commonly located inferior to fovea
  - Healing results in mottling of RPE – Prognosis excellent if outside fovea

- Temporary diplopia
  - pre-existing sensory strabismus worsening
  - the prismatic effect of a new spectacle correction
  - prolonged anesthetic effect
  - transient myotoxicity
  - low-grade operative trauma to the orbital soft tissues.

- Forcedduction testing

For (Ophth) 2008 Aug;22(8):1057-64. Epub 2007 Apr 27.
Diplopia following cataract surgery: a review of 116 patients.
Shahid Al., Feiner BF, Brown GL, Cook RD, Cowan DE.
Delayed Visual Recovery
- Cornea
- IOL
- Inflammation
- Retina
- Pre-existing condition

Delayed Visual Recovery
- Epithelial Irregularity
- Persistent Corneal Edema
- Irregular or high corneal astigmatism
- IOL subluxation, tilt, or capture
- Ant. Seg. Inflammation
- Post. Seg. Inflammation
- Hypotony
- Posterior Vitreous Detachment
- Macular Edema
- Photoretinal Toxicity
- UnDx pre-existing conditions
- Incorrect IOL power
- Others

By 6 weeks, intraocular inflammation and minor corneal edema should be resolved, IOP should be normal, and the macula should be distinct without edema.

Delayed Visual Recovery
- Chronic Endophthalmitis
  - manifest as AC cell / vit cells, mod VA red, ocular discomfort, 1-4 months following cataract surgery
  - Propionibacterium Acnes -an anaerobic pleomorphic gram positive bacillus
  - White plaque on PC and granulomatous KP
- May become apparent after Yag Cap
- Responds transiently to topical steroid
- Intravitreal ab therapy gives favorable visual outcome

Delayed Visual Recovery
- Rebound Inflammation
  - Occurs in 5% of patients
  - More common in dark irides
  - More common in patients with DM
  - Occurs when steroids are discontinued too early or tapered too quickly
  - Always look for retained lens material with gonio

Rebound Inflammation
- Treatment
  - Resume topical steroids
  - Consider cycloplegia
  - Consider tap and injection to rule out chronic endophthalmitis

Delayed Visual Recovery
- Cystoid Macular Edema
**Delayed Visual Recovery**

- **Cystoid Macular Edema**
  - Most common cause of decreased vision after cataract surgery
  - Incidence?
  - Higher risk patients?

  ![CME Image](image)

  *Courtesy of Steven Silverstein, MD*

**Delayed Visual Recovery CME**

- Presents 4-12 weeks after uncomplicated sx with
  - reduced VA
  - modest ocular inflm
  - leakage of FL from optic nerve and macula
- Results from retinal leakage in perifoveal region and accum. of fluid in the outer plexiform layer of the retina
- Major contributing factors
  - intraocular inflammation
  - vitreous traction (wound, iris, or macula)
  - pre-existing microvascular disease
  - biomicroscopy and fundus contact lens exam
  - yellowish spot in fovea
  - ERM, retinal striae & tortuosity of the retinal vessels is assoc. 10-20%

**Delayed Visual Recovery CME**

- Fluorescein angiography
  - Early to mid arteriovenous phase shows selective leakage of the perifoveal capillaries
  - Late phase shows discrete lobules of hyperfluorescence in petaloid app., usu with assoc. hyperfluorescence of the optic nerve
  - Poor correlation between the degree of leakage seen in FA and VA – Retinal thickness a better indicator of decreased VA, ie
  - Clinical CME vs. Angiographic CME

  ![FA Image](image)

- Optical Coherence Tomography
  - appears as non-reflective cystoid spaces in the outer plexiform and inner nuclear layers
  - OCT much less-invasive than fluorescein angiography
  - Also measures retinal thickness, which is invaluable in monitoring the course of therapy

  ![OCT Image](image)

**Delayed Visual Recovery**

- **Avastin**
  - Initially approved to treat colo-rectal cancer
  - Inhibits VEGF
  - Study in 2008 at University of Wisconsin
    - Macular degeneration
    - Diabetic macular edema
    - ROP
    - Pre-surgical treatment for diabetic vitreous hemorrhage
    - Subconjunctival for corneal neovascularization

  ![Avastin Image](image)

**Delayed Visual Recovery**

- **Posterior Capsular Opacity**
  - “Secondary Cataract”
  - Occurs in 40% of patients
  - Occurs a few weeks to many years after surgery
  - Peak incidence is 2-6 months after surgery
  - Caused by:
    - epithelial cell proliferation and migration
    - epithelial-mesenchymal transition
    - collagen deposition
    - lens fiber generation

  ![Posterior Capsular Opacity Image](image)
Types of capsular opacification

- **Elschnig pearls**
  - Proliferation of lens epithelium
  - Usually occurs within 2-6 months
  - May involve remnants of anterior capsule and cause phimosis

- **Fibrosis**
  - Age Dependent
  - Low incidence in older patients, high in young

Ways To Decrease Incidence

- Attempted removal of lens epithelial cells
- Aspiration of the anterior capsule
- Pharmacological dispersion
- Manual polishing of the anterior and posterior capsule
- IOL material and design
- Sharp-edged IOLs and those made of acrylic and silicone have lower rates of PCO

Posterior Capsular Opacity

- Treatment
  - Nd:YAG laser capsulotomy
    - Creates a clear (3mm) opening in the posterior lens capsule
    - Not performed within 3 months of surgery
- Risks:
  - Retinal detachment
  - Damage to IOL
  - CME
  - Increased IOP
  - Corneal edema

Delayed Visual Impairment

- Diplopia persistent for 6 mo after SX
  - Incidence 0.17%
  - 34% - Decompensation of pre-existing asymptomatic strabismus
  - 25% - Extraocular muscle restriction or paresis
  - 8.5% - Refractive
  - 5% - Concurrent onset of systemic disease (including sixth nerve palsies)
  - 5% - Central fusion disruption (acquired loss of fusion)
  - 2.5% - Monocular double vision
  - 20% - Undetermined etiology

Femtosecond Laser-Assisted Surgery

- First human LCS performed 2008 Budapest, Hungary
- Creation of precise anterior capsulotomies
- Liquefaction of Nuclear (N1)
- Fragmentation of N2 and N3 lenses
- Creation of corneal wounds in any position and size
- Treatment of preoperative astigmatism

- Complications reported
  - All complications occurred in first 100 eye
  - Suction Break
  - Conjunctival Redness or Hemorrhage
  - Capsule Tags and Bridges
  - Anterior Capsule Tear
  - Endothelial Damage
  - Capsular Blockage Syndrome and Posterior Capsule Rupture
  - Miosis
  - Vitrectomy
Capsule Tags and Bridges
Anterior Capsule Tear
Endothelial Damage
- Endothelial cut is serious complication of femto tx
- High hyperopes at higher risk due to shallow AC
- Less common with systems that have integrated OCT
Capsular Blockage Syndrome with consecutive Posterior Capsule Rupture
- Serious complication
Intralenticular gas bubbles form due to excessive energy dissipation in the lens material
After capsulotomy the gas bubbles tend to move toward the anterior chamber
Can be avoided with Rock N Roll technique which allows air bubbles to leave the crystalline lens

Miosis
- Femtosecond creates shockwave that can affect the surrounding tissue in a 1.0mm area.
- Therefore with a 5.0mm dia capsulotomy, width of pupil should be 6.5mm
- Larger the pupil the less chance of shockwave hitting the margin (ie eliation should begin min 1hr before sx)
- Hitting the pupil margin further increases the miosis and creates inflammatory debris and fibrin
- Highly myopic eyes and pseudoxfoliation are prone to miotic reaction after femtosecond
Vitrectomy

Dropless Cataract Surgery
- Imprimis, dropless.com
- Transzorular injection into vitreous (time released over post op period)
  - Tri-Moxi
  - Tri-Moxi + Vanco
- Patient doesn’t need to buy drops after Cat sx
  - More like “Less Drops” cataract surgery
- 30 to 50% of patients notice
  - floaters, bubbles, swirls, etc
- Decreased vision last less than 24 hours
- 10-14 day spike in inflammation
- ? Inc risk of IOP spike
- Potential for additional complications including CB
- Bleeding and retinal holes, breaks tears and detachment

Additional Considerations
Injurious falls between first and Second eyes
- Hospitalization for Falls Doubled between 1st and 2nd eye sx
- 7 Expeditied 2nd eye cat sx
- Mental health visits
decrease of 18.80% (p ≤ 0.001) in number of mental health contacts for depression and/or anxiety the year after cataract surgery
- 28% reduction in health care costs
Driving Risk
risk for driving-related difficulties was reduced by 88% after sx

Case Study
- 81 year old AA female
- Medical history: HTN
- Ocular history: unremarkable
- Uncomplicated cataract surgery
- Uncorrected VA @ 3 months: 20/20 OD, OS
- Returned two months later
  - BCVA 20/30 OD, 20/60 OS

12
85 yo wf uneventful cataract surgery
- 1 day visit (out of town) so pt saw surgeon
- At 1 week post op 20/25
- Had discontinued AB and on Pred and NSAID BID
- plano Rx
- Pt reports had been doing fine but now noticing some redness and mild discomfort.
  - Had 1+ cell and 1+ injection
  - Ta 20mmHG
  - Dx with probably rebound Iritis from Tapering too quickly and
  - Increased pred back to QID and told to return in 1-2 week.
Case Study

- 76 year old Caucasian male
- Uncomplicated cataract surgery 3 days prior OS
- Woke up with complaint of redness, pain, and decreased VA

What are differentials?
- TASS
- Increased IOP
- CME
- Subluxated IOL
- Endophthalmitis

Case Study

- BCVA: Hand Motion at 3’
- 4+ cell / fibrin in chamber
- No view of fundus
- Plan?

Case Study

- Spring 2001
- 71 white male 1 day uncomplicated Cataract Post Op evaluation
- Pt reports slept well and in no acute distress
  - No real pain or discomfort but blurry
- 20/200
- SLE
  - 2-3+ Diffuse limbus to limbus Corneal edema
  - 3+ Fibrin in AC emanating from pupil to wound
  - + Hypopyon
  - Pupil mid dilated
  - Ta 18 mmHg
  - Ant Vitreous – difficult to view but appeared clear
Evidence has shown a steady decline in rates of serious adverse events over the past few decades. Cataract Surgery is a relatively safe procedure in experienced hands. Patients who are at risk include older age, male sex, comorbid DR, combined procedures, those taking a-agonists. Complications are less likely to lead to visual loss if handled promptly and properly. Newer technologies have ability to decrease future complications.

**Conclusion**

- Evidence has shown a steady decline in rates of serious adverse events over the past few decades.
- Cataract Surgery is a relatively safe procedure in experienced hands.
- Patients who are at risk include older age, male sex, comorbid DR, combined procedures, those taking a-agonists.
- Complications are less likely to lead to visual loss if handled promptly and properly.
- Newer technologies have ability to decrease future complications.

**Thank you**

Please feel free to contact us:

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