CATARACT CARE 2020
AND BEYOND

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How to Design Successful Outcomes
DISCLOSURES

• We have no personal conflicts of interest.

• We have no relevant financial relationships.
WHAT IS A SUCCESSFUL CATARACT SURGERY?
The case of the 8D surprise
The case of the 8D surprise

- 48-yo male Pacific Islander: BK
- Poor historian; blurry OS>OD x 1 year
- DM2, HTN
- metformin, glipizide, pioglitazone, Lantus long-acting insulin
- BCVA: OD +0.50 -0.50 x 120 20/30
  OS unable to refract HM
- IOPs 14/13 iCare
- H/o treatment for PDR and TRDs in Hawaii
  - Avastin injections OD x 7
  - Vitreous hemorrhage OS
  - Silicone oil in OS
# The case of the 8D surprise

<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
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</thead>
<tbody>
<tr>
<td>Cornea</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>Iris</td>
<td>No rubeosis</td>
<td>No rubeosis</td>
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<tr>
<td>Lens</td>
<td>1+ NS</td>
<td>Mature white cataract</td>
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<tr>
<td></td>
<td>1+ CS</td>
<td></td>
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<tr>
<td>ONH</td>
<td>0.45/0.45</td>
<td>No view</td>
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<tr>
<td></td>
<td>Regressed PDR</td>
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</tbody>
</table>
The case of the 8D surprise

- Referred to retina. Why?
- “Will you be taking out the silicone oil?”
- “No, it is permanent.”
The case of the 8D surprise

• Cleared by retina for surgery
• Limited potential thoroughly explained to patient

• Scheduled with Dr. Bill Gruzensky for CE/IOL OS
• IOL calculated for silicone oil
  • Index of refraction for vitreous humor: 1.337
  • Index of refraction for silicone oil: 1.405
• High-risk macula: diclofenac qid PO

• Surgery: posterior capsular tear at 1:00, but no vitreous came forward, and IOL centered in bag
• Outcome: 20/50 UCVA OS, pt delighted
The case of the 8D surprise

- 10 months later, pt presents c/o blurry vision OS
- BCVA OS 20/400
- No change in diabetic retinopathy; IOL stable and well-positioned

- Pt remembers another retina surgery
- Loose -9.00D lens: 20/50+2

- Retina removed the silicone oil!
The case of the 8D surprise

• Scheduled with Dr. David Gano for IOL exchange
• Smooth surgery
• Final vision OS: -0.50 -0.75 x 103 20/50-2 Delighted
The case of the 8D surprise

• Why is a 20/50-2 outcome a successful surgery?
  • Appropriate referral by optometrist
  • Good communication (initially) with retina
  • Posterior capsular tear well-controlled by surgeon
  • No post-op CME, possibly prevented by NSAID
  • Fumble by retina successfully corrected
  • Patient has functional vision
  • Patient’s expectations were fulfilled
SUCCESSFUL SURGERY HAPPENS WHEN THE OPTOMETRIST AND SURGERY CENTER:

• communicate clearly to the patient what to expect,

• and deliver the best outcome possible for that patient.
THE COMING CRISIS IN CATARACTS*

* (and how you can benefit from it)
The coming crisis in cataracts

Incidence of cataract surgery/100,000 is growing

Number of seniors is growing

Age at cataract surgery is decreasing
Number of ophthalmologists is stagnant

US Department of Health & Human Services, 2015
Optometry is perfectly positioned to help
Benefits of post-op care
9:15 – 12:00  1. Pre-op  
               2. Surgery  
               3. Post-op  

12:00 – 12:45  Lunch  

12:45 – 3:30  4. Refractive-cataract surgery  
               5. MIGS
1. PRE-OP
ESSENTIALS OF YOUR CATARACT EVALUATION

- Subjective exam
- Objective exam
Subjective exam

• Symptoms of visual impairment
  • Not correctable with a tolerable change in glasses or CLs
  • Inability to function satisfactorily while performing Activities of Daily Life
    • Reading
    • Watching TV
    • Driving
    • Other recreational activities

• Mandatory for reimbursement
What if no symptoms?

• “Doctor, I see fine!”

• Probe activity by activity (“How is night driving?”)

• Inform patient of your assessment of their driving safety

• Often OK to defer surgery: some people just don’t want it!
Ocular health history

• Critical in determining patient’s need for surgery & prognosis

• Coexisting ocular diseases
  • Many will be discussed in Special Cases

Left-sided hemianopia secondary to stroke
General medical history

• **Significant health problems**
  - May provide a clue to the etiology of cataracts
  - May provide prognosis for surgery
  - May determine suitability for surgery
  - Mental state must allow cognizant decision to have surgery

• **Untreated or uncontrolled conditions may delay surgery**

• **General medical eval and pre-op lab testing rarely necessary**
Objective exam: vision

• **Visual acuity**
  • Best corrected
  • No longer need to meet 20/40-or-worse requirement if symptoms affect Activities of Daily Life (ADLs)

• **Glare**
  • Any bright light directed toward patient while checking vision
  • Not standardized; different systems are available
Objective exam: testing

• Ocular motility & binocularity

• Pupillary testing
  • Afferent pupillary defects → suggest deeper problems
  • Large pupil → potential effects from IOL edge
  • Poorly dilating pupils → more difficult surgery

• IOP

• Visual fields (if relevant)
Objective exam: slit lamp

• **Biomicroscopy**
  • Ant. seg. abnormalities
    • Corneal scars
    • Endothelial disease
    • Iris or angle changes

• **Presence of cataract**
  • Type and grade should correlate with patient’s symptoms
Nuclear sclerosis

Posterior subcapsular (retro-illumination)

Cortical (retro-illumination)

True posterior polar
Cataract pearl

- Milky (white) NS
- Younger patient
- Often hx of myopia
- Often missed
- Often dramatic myopic shift
Objective exam: posterior seg.

- Dilated fundus examination, looking for:
  - Factors that will adversely affect post-op vision
  - Factors that increase risk for post-op macular edema or retinal detachment
The same-day surgery

• Only for “ordinary” cases

• Not a good idea for:
  • Complex cataracts
  • High refractive errors (may need special-order IOLs)
  • Patients wanting premium IOLs
  • Complex ocular conditions
  • Complex psychological/systemic conditions

Not a good SDS candidate
BEWARE THESE 9 CASES
POST-LVC PATIENTS
Risk of refractive surprise: Standard cataract surgery

• Worse than +/- 0.50D: 27%
• Worse than +/- 1.00D: 7%

Risk of refractive surprise: Post-LASIK cataract surgery

- Worse than +/- 0.50D: 55-62%
- Worse than +/- 1.00D: 37-24%

Post-LASIK calculation errors

1. Keratometry error
Post-LASIK calculation errors

2. Effective Lens Position (ELP) error
Management of the post-LASIK patient

• The very patients that have the highest post-operative expectations have the least predictable outcomes

• Manage expectations
  • “You have a 1 in 3 chance of needing glasses to pass the driver’s license test.”
  • “Your vision will not be perfect, but glasses will help you see well.”
  • “Cataract surgery will improve your vision, but you will definitely need glasses for many activities, and maybe even full-time.”
THE PATIENT IN CONTACTS
The patient in contacts

• CLs alter corneal curvature

• We want to measure curvature (for IOL calculation) in the cornea’s natural state

Orthokeratology-induced changes in cornea
The patient in contacts

- **Recommendations:**

<table>
<thead>
<tr>
<th>Soft contact lenses &lt;6.0D</th>
<th>d/c for 1 week</th>
</tr>
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<tbody>
<tr>
<td>Soft contact lenses &gt;6.0D</td>
<td>consider d/c for 2 weeks</td>
</tr>
<tr>
<td>RGPs</td>
<td>d/c for 3 weeks</td>
</tr>
</tbody>
</table>
The patient in contacts

• If patient cannot function without CLs:
  • Discontinue 1 CL at a time, or
  • Obtain temporary back-up glasses
FUCH’S ENDOTHELIAL DYSTROPHY
Fuch’s Endothelial Dystrophy

- Phacoemulsification can cause temporary corneal swelling even in a healthy cornea.
- Risk is higher in pts with Fuch’s.
- Fuch’s patients should be counselled about increased risk of corneal edema, longer healing time, limitation to BVA, and even risk of PK.
Fuch’s Endothelial Dystrophy

- Fuch’s patients may need DSAEK or DMEK following CE/IOL if corneal edema becomes chronic.

- Patients with visually significant Fuch’s prior to CE/IOL may be candidates for combined CE/IOL with DSAEK or DMEK.
GLAUCOMA
3 reasons to quantify level of damage from glaucoma prior to cataract surgery:

1. Educate patient that pre-existing glaucomatous vision loss will not be recovered with CE/IOL.

2. Severe glaucoma may need a combined cataract/trabeculectomy.

3. Determine eligibility for MIGS devices.
Does cataract surgery alone lower IOPs?

- Average post-op lowering of IOP: 2–4 mmHg
- Greater drop in those with higher pre-op IOPs
  - Pre-op 23–31 mmHg → 6.5 mmHg drop
  - Pre-op 15–17 mm Hg → 1.6 mmHg drop

Does cataract surgery alone slow glaucoma?

Cataract Surgery and Rate of Visual Field Progression in Primary Open-Angle Glaucoma

Ji Hyun Kim, Alessandro Rabiolo, Esteban Morales, Nima Fatehi, Wen-Shin Lee, Fei Yu, Abdelmonem A. Ahfi, Kourosh Nouri-Mahdavi, and Joseph Caprioli

PURPOSE: To test the hypothesis that cataract surgery slows the apparent rate of visual field (VF) decay in primary open-angle glaucoma patients compared with rates measured during cataract progression.

METHODS: Consecutive open-angle glaucoma patients who underwent cataract surgery and who had ≥4 VFVs and 23 years of follow-up before and after surgery were retrospectively reviewed. Mean deviation (MD) rate, visual field index (VFI) rate, pointwise linear regression (PLR), pointwise rate of change (PRC), and the Glaucoma Rate Index (GRI) were compared before and after cataract surgery.

RESULTS: A total of 134 eyes of 99 patients were included. Median (interquartile range) follow-up was 6.5 (4.7-8.1) and 5.3 (4.0-7.3) years before and after cataract surgery, respectively. All intraocular pressure (IOP) parameters (mean IOP, standard deviation of IOP, and peak IOP) significantly improved (P < .001) and the progression rates dropped significantly (P < .001). Cataract and glaucoma frequently coexist, as the prevalence of both diseases increases with age. Moreover, glaucoma treatment, including medication in addition to surgery, increases the rate of cataract development. The presence of cataract causes diffuse visual field (VF) loss in patients with glaucoma, and differentiating perimetric deterioration caused by cataract from deterioration that is caused by worsening glaucoma is an important but challenging clinical task. A number of studies have investigated changes in VF after cataract surgery in glaucoma patients. Most studies have shown that cataract surgery results in improvement of mean deviation (MD) in normal and glaucomatous eyes, although changes in indicators of localized field loss such as pattern standard deviation (PSD) in glaucomatous eyes after cataract surgery have been more variable. We have developed a technique based on trend analysis that uses a pointwise exponential model to fit the behavior of VF change in glaucoma patients with cataract surgery.
Is CE/IOL ever helpful for glaucoma?

Effectiveness of early lens extraction for the treatment of primary angle-closure glaucoma (EAGLE): a randomised controlled trial

Augusto Azzaro Bianco, Jennifer Bank, Craig Ramsay, David Cooper, Paul Foster, David S Friedman, Graham Scotland, Mehdi Javadi, Claire Cochrane, John Norris, for the EAGLE study group.

Summary
Background Primary angle-closure glaucoma is a leading cause of irreversible blindness worldwide. In early-stage disease, intraocular pressure is raised without visual loss. Because the crystalline lens has a major mechanistic role, lens extraction might be a useful initial treatment.

Methods From Jan 8, 2009, to Dec 28, 2011, we enrolled patients from 30 hospital eye services in five countries. Randomisation was done by a web-based application. Patients were assigned to undergo clear-lens extraction or receive standard care with laser peripheral iridotomy and topical medical treatment. Eligible patients were aged 50 years or older, did not have cataracts, and had newly diagnosed primary angle closure with intraocular pressure of 30 mm Hg or greater or primary angle-closure glaucoma. The co-primary endpoints were patient-reported health status, intraocular pressure, and incremental cost-effectiveness ratio per quality-adjusted life-year gained 36 months after treatment. Analysis was by intention to treat. This study is registered, number ISRCTN44446607.

Findings Of 419 participants enrolled, 155 had primary angle closure and 263 primary angle-closure glaucoma. 299 were assigned to clear-lens extraction and 211 to standard care, of whom 351 (84%) had complete data on health status and 366 (87%) on intraocular pressure. The mean health status score (0-87 [SD 0-123], assessed with the 30 mm Hg or greater or primary angle-closure glaucoma. The co-primary endpoints were patient-reported health status, intraocular pressure, and incremental cost-effectiveness ratio per quality-adjusted life-year gained 36 months after treatment. Analysis was by intention to treat. This study is registered, number ISRCTN44446607.

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PSEUDOEXFOLIATION & TRAUMA
Primary concern is the possibility of loose or broken zonules

It is difficult to assess strength of zonules pre-operatively
Counsel patients about potential risks:
- Longer surgery time
- Capsular tension rings
- Pupil expanders
- Rarely, sutured IOL may be necessary
- Rarely, left aphakic and IOL inserted at a second surgery
6.

ALPHA-ADRENERGIC ANTAGONISTS
Alpha-adrenergic antagonists

• Used to treat Benign Prostate Hyperplasia (BPH)
• All the “-osin” drugs, includes:
  • Tamsulosin (Flomax)
  • Prazosin (Minipress)
  • Doxazosin (Cardura)
  • Terazosin (Hytrin)
  • Alfuzosin (Uroxatral)
  • Silodosin (RapaFlo)

• Tamsulosin is highest concern
  • Related to its high affinity for iris dilator muscle receptors

• No benefit to stopping before surgery
Alpha-adrenergic antagonists

- Linked to Intraoperative Floppy Iris Syndrome (IFIS)
  - Poor dilation
  - Iris billowing
  - Iris prolapse
  - Intra-operative miosis

- Potential complications:
  - Iris damage
  - Hyphema
  - Capsular rupture
  - Vitreous loss
Alpha-adrenergic antagonists

• Complications are uncommon in the hands of experienced surgeons

• Still important to inform patient of risks, especially:
  • Longer surgery time
  • Irregular pupil post-op (does not affect vision)
7. HISTORY OF UVEITIS
History of uveitis

• Ideally, patient would be free of inflammation without steroids for 6 months prior to surgery

• Could consider surgery if controlled for 6 months with minimal steroid (qd or less)
History of uveitis

- Consider pre-treating with steroid pre-emptively for one week prior to CE/IOL
- Risk of longer and slower post-op tapering
- Risk of persistent inflammation
OCULAR SURFACE DISEASE
E.g. dry eye disease, ABMD, corneal scarring, neurotrophia. 3 main concerns:

1. OSD affects keratometry errors and leads to IOL calculation errors.
2. Patients must be told that cataract surgery will not affect vision problems stemming from dry eye.
3. Cataract surgery can create or worsen OSD, leading to patient dissatisfaction.
Treat OSD aggressively prior to surgery

• Strategies:
  • Preservative-free artificial tears
  • Pulse dosing of topical loteprednol (Lotemax) or fluoromethalone
  • Cyclosporine 0.05% (Restasis) or lifitegrast 5% (Xiidra)
  • Consider dietary omega-3 fatty acids

• If lid margin disease and/or ocular rosacea:
  • Oral doxycycline, even if only for 1 month
  • Hypochlorous acid (Avenova)
  • LipiFlow therapy
RISK OF CYSTOID MACULAR EDEMA
Risk factors for CME:

- Retinal vein occlusions
- Diabetic retinopathy
- Epiretinal membrane
- Uveitis
- ARMD
- Retinitis pigmentosa
- Prostaglandin analogs (mild risk)
- Retinal vasculopathies
Management of high-risk CME patients

- Education of risk
- Notify surgery center
- Consider retinal consult and pre-treatment
A crucial discussion – and you are the best one to conduct it
How to talk about targets

• This decision affects your patient’s vision for the rest of their life
• Patients already have a lot of decisions at the surgery center
• Many factors influence this decision:
  • Personality
  • Lifestyle & activities
  • Pre-existing refraction
  • Financial status
  • Affection or otherwise for glasses

• You have the most intimate knowledge of these factors for your patient!
Simplest and most common solution
Monofocal IOLs (spherical and toric) give the crispest vision
With a 3.5mm pupil, patients enjoy a depth of focus about 0.75 – 1.25D
Most likely choice for:
  • Hyperopes
  • Extreme (non-functional) myopes
  • Pilots and military
  • Drivers
Myopes

• Beware of myopes! Especially “functional” myopia. Does your patient take their glasses off to:
  • Read? Read in bed?
  • Work on computer/phone?
  • Apply make-up?
  • Do crafts?
  • Pick out splinters?

• Some of the most disappointed cataract surgery patients are prior myopes who did not fully understand the impact that this would have on their vision.
Many myopes will choose to remain near-sighted.

- Target may range from -1.00 to -3.00 depending on their needs.
  - Discuss carefully with patient.
  - Ask them to demonstrate where they would like to be focused. Measure this carefully.
  - Relay this information to the surgery center.

- Essential to clearly communicate what they will and will not be able to see after surgery.
Astigmatism

- Pre-op refractive cylinder can be misleading
- Instead, depend on pre-op keratometry
- Residual astigmatism will limit UCVA
- Very important to set realistic expectations for post-op UCVA
- We will talk about toric IOLs later
Presbyopia

• Consider monovision
  • The crispest vision now available
  • Must have been successful in monovision in contact lenses
  • Must control astigmatism tightly, especially in distance eye
  • Must communicate to surgery center which eye was near eye, and the desired target (typically -1.50 to -2.75)
  • Prepare patient for mild loss of accommodated vision in intermediate zone

• Beware “natural monovision” patients.
  • A patient functioning well without glasses will be disappointed with an emmetropic OU outcome

• We will talk about premium IOLs later
Everything that you have already done is reviewed, and also ...
Biometry

• Refractive accuracy depends overwhelmingly on accurate pre-op measurements

• The most important measurements when calculating IOL power:
  • Axial length
  • Keratometry
Axial length and keratometry

- Lenstar LS 900 and IOL Master 700 are currently the most precise
- Both measure axial length to within 0.030mm
- Lenstar uses laser interferometry
- IOL Master uses OCT
• Axial length
• Pachymetry
• ACD
• Lens thickness
• Keratometry
• White-to-white
• Pupil centration
Keratometry

- Pentacam: anterior segment tomography
- Anterior and posterior curvature
- Pachymetry map
- Angle imaging
- Can detect very mild keratoconus
B-scan ultrasound

- Used to assess posterior segment when mature cataracts block direct visualization
  - Primarily used to rule out RDs, vitreous hemorrhage, or tumors
• Accurately measuring potential acuity is difficult but important

• Super Pinhole (SPH) and Potential Acuity Meter (PAM) are most popular

• Both are imperfect but reasonably reliable and easily available

• Both may over-estimate potential in the presence of macular disease
IOL formulas, 1967 - 2015

- Over 100 formulas

- Almost all are based on the Gullstrand Schematic Eye, thin-lens formulas, and simple regression mathematics

- Crucial to final refractive outcome:
  1. Axial length
  2. Corneal curvature
  3. Effective lens position (ELP)

Allvar Gullstrand (1862-1930)
Conventional IOL formulas

- Quite accurate for average eyes
- Much less accurate at the extremes, both very long eyes (myopic) and very short (hyperopic)

One 21st-century formula

• Hill-RBF: radial-basis functions + artificial intelligence
Formula accuracy

- Often measured as percentage of patients within $\pm 0.50\text{D}$ of their intended target:
  - 1980: 33%
  - 2000: 61%
  - 2016: 73%
  - Hill-RBF: claimed at >90%

- Accuracy is getting quite better ...
  ... except for post-LVC patients
2. THE SURGERY
WHY YOU SHOULD KNOW THE DETAILS OF YOUR SURGEON’S TECHNIQUE:

• Enables you to reassure patient before surgery
• Assures patient that comanaging doctor and surgeon are a seamless team
• Allows you to predict the range of normal appearances post-op
• Allows you to manage complications
WHY YOU SHOULD KNOW THE DETAILS OF YOUR SURGEON’S TECHNIQUE:

• Allows understanding of the type and location of specific post-op complications
• Helps you to understand the relative risks of certain general complications:
  A faster surgeon may have more corneal edema, but less infection
  A more anterior phaco may result in more corneal edema
  A more posterior phaco may result in greater capsular tears

• Cataract surgery is a balancing act of reducing the risk of one kind of complication but possibly increasing another
First steps

• Nametag: Name, surgery, & side
• Bonnet
• Vitals: BP, pulse, oximetry
• Mark forehead on side of surgery
Pre-op medications

1. Dilation
2. Sedation
3. Anesthesia
Pre-op medications: dilation

• Our mixture: equal parts
  • 1% tropicamide
  • 2.5% phenylephrine
  • 2% cyclopentolate
• One drop 1-4 times as needed

• Topical NSAID
  • flurbiprofen or voltaren
• One drop 1-3 times as needed
• Reduces intra-operative miosis
• Anti-inflammatory, reduces risk of CME
Pre-op medications: dilation

- Identify those most likely to dilate poorly in clinic:
  - Alpha antagonists (the –osins)
    - Flomax the worst
  - Pseudoexfoliation
  - Taking miotics (pilocarpine: D/C several days before surgery)
Pre-op medications: sedation

- **Oral sedation: light**
  - midazolam (Versed) 5mg/mL, 1-4mg
  - diazepam (Valium), 2-5mg

- **Oral sedation: moderate**
  - MKO Melt
    - midazolam 3mg (sedative)
    - ketamine 25mg (anesthetic)
    - ondansetron 2mg (antiemetic)

  - First effect: 3-5 minutes
  - Peak effect: 20 minutes
  - Duration: at least 1 hour
Pre-op medications: sedation

• IV heavy sedation
  • midazolam
  • propofol (Diprivan)

• CAUTION: more complications from IV sedation than from either surgery or anesthesia
Other pre-op medications

- Post-op IOPs: acetazolamide 250mg po (Diamox)
- Hypertension: nifedipine (Procardia)
- Coughing: dextromethorphan (DM)
Pre-op medications: anesthesia

• Objective: Anesthesia = happy patients
  Akinesia = happy surgeons

• Options:
  1. General
  2. Regional / local / block
  3. Topical / intracameral
General anesthesia

• **Indications:**
  • Pediatrics
  • Severe cognitive impairment
  • Open eye injuries
  • Major prolonged procedures

• **Risks**
  • Respiratory and cardiovascular risks
  • Postop confusion
  • Vomiting and coughing post-op
  • Deep vein thrombosis
Regional / local anesthesia

• 5mL of lidocaine 2%

• Retrobulbar block
• Peribulbar block
Retrobulbar block

- Injection within the muscle cone
- Blocks 2nd through 7th cranial nerves
- Blocks pain
- Blocks movement
- Blocks vision
  - Less photophobia from OR lamp
Peribulbar block

• Injection outside muscle cone under Tenon’s capsule

• Compared to retrobulbar anesthesia:
  • Slightly less anesthesia and akinesia
  • Onset of effect is slower
  • Eliminates risk of optic nerve/subarachnoid penetration
  • Risk of globe penetration remains
Local anesthesia: complications

- Globe penetration or perforation
- Retrobulbar hemorrhage
- Inadvertent blood vessel injection
- Subarachnoid injection
  - Rapid onset of respiratory arrest
  - Rapid recovery of breathing
- Diplopia
- Chemosis
Topical anesthesia

• **Agents**
  - xylocaine 4% jelly
  - marcaine 0.75%
  - tetracaine 0.5%
  - proparacaine 1%

• **Blocks pain**
• **Does not induce akinesia or block vision**
Intracameral anesthesia

- Effective supplement to topical anesthesia
- Non-preserved lidocaine 1-2%
- Transient amaurosis reported particularly in patients with prior vitrectomy or open capsules
Topical anesthesia: contraindications

- Light sensitivity through a dilated pupil

- The Five D’s:
  - Deafness
  - Dementia
  - Dysphagia
  - Dense cataract
  - Dysfunctional ocular motility
STANDARD OPERATING PROCEDURE
Standard surgery

• Incisions:
  • Main
  • Port incisions
• Capsulorhexis
• Phacoemulsification
Main incision

• Scleral tunnel incision
  • Mini-scleral tunnel incision (MSTI)
  • Located at superior conjunctiva

• Clear corneal incision (CCI)
  • Located at temporal cornea
Clear corneal incision

- No conjunctival periotomy
  - Slightly faster
  - No bleeding
- Incision location can slightly and unpredictably affect astigmatism
- Increased risk of endophthalmitis (0.004%, compared to 0.001% with MSTI)
- Heals more slowly, more leaks post-op
- Visualization can be distorted
Mini-scleral tunnel incision

- Conjunctival periotomy
  - Slightly slower
  - Redness at incision site; SCH common
- Usually no effect on corneal toricity
- Heals faster, fewer leaks
Which is better: CCI or MSTI?

- Each has advantages and disadvantages
- Both can be used with any anesthesia or sedation
Ophthalmic viscosurgical devices (OVDs)

• **Viscoelastics**
  • Protect tissue by absorbing energy
  • Compartmentalize/separate interior structures
  • Pressurize the anterior chamber

• **Dispersives (Viscoat, Healon D, OcuCoat)**
  • Low viscosity, coat instruments, partition spaces
  • May take longer to remove at end of procedure

• **Cohesives (Healon, Amvisc)**
  • High viscosity, increase space, flatten anterior capsule
  • Expand a small pupil
  • Removal is typically easy
Entering the capsule

- Can opener technique has been largely abandoned

- Continuous curvilinear capsulorhexis is nearly universal
  - Round, central circular opening
  - Size around 5mm diameter, 1mm less than optic
  - Least incidence of capsular tears
  - Less vitreous loss
  - Less opportunity for posterior segment lens fragments
  - Less IOL decentration
Hydrodissection

• Separates lens from capsule to allow easier manipulation
Phacoemulsification

- High-frequency ultrasound, irrigation and aspiration
- Balance of each to divide, emulsify, and remove lens

- Try it yourself:

CataractMobile app
(iPhone/iPad only)
Capsule polishing

- Removes lens epithelium adherent to posterior capsule to reduce incidence of PCO
Standard operating procedure

PCLI VIDEO HERE
INTRA-OP COMPLICATIONS
Anterior capsular tears

- Occur during capsulorhexis or phaco
- Rarely extend beyond the equator
- IOL haptics are then positioned in the bag at right angle to the tear
- Avoid one haptic inside the bag and one outside
- Sulcus fixation may not be stable
Posterior capsular tears

• Most common with small pupils, hard nuclei or complex cataracts

• Usually occurs during phaco, I/A or IOL placement

• Often continue to enlarge

• Multiplies risk of endophthalmitis 10-fold
Posterior capsular tears

• Try to convert to posterior capsulorhexis

• IOL placement
  • In the bag if posterior capsulorhexis present
  • Sulcus fixation with anterior optic capture if anterior capsulorhexis intact
  • Scleral-fixated IOL if poor capsule support
Torn capsule sequelae: vitreous loss or prolapse

• Avoid vitreous wicks or incarceration into the wound: risk for chronic CME

• Management:
  • Cut with scissors
  • Anterior vitrectomy
  • Pars plana vitrectomy
  • Constrict pupil
  • Sweep the internal wound
Torn capsule sequelae: dropped lens fragment

- Risk of retinal damage
- Risk of phacoanaphylaxis
- Usually requires retinal specialist consult
The invisible capsule

- Capsule often not visible in a mature or white cataract
- Trypan blue stains anterior capsule for easier visibility against white cataract
Zonular weakness

• Pseudoexfoliation accounts for less than 10% of occurrences

• Complications same as torn capsule:
  • vitreous loss
  • dropped lens fragments
  • early or late dislocated IOL
Capsular stria

- Caused by the force of haptics pressing against the capsule
- Typically fades with time
- Usually do not cause visual symptoms
- YAG posterior capsulotomy if patient continues to be symptomatic
Capsular tension ring (CTR)

- Intra-operative device for weak zonules
- PMMA ring placed in the bag with the IOL
- Distributes tension equally between zonules
- Can be used only with limited zonular defects
For larger zonular defects

- Posterior assisted levitation
  - Instruments
  - Viscoelastic
- Extracapsular cataract extraction (no phaco)
- Anterior vitrectomy
- Scleral-fixated IOL
6 SPECIAL TOPICS
THE DENSE PSC
The dense PSC

- Plaque-like adhesions on posterior capsule may be hard to remove with phaco: risk of capsular tear
- Treatment: subsequent YAG posterior capsulotomy
IRIS / PUPIL EXPANDERS
Iris/pupil expanders

• **Indications:**
  • Alpha agonists: - osins, especially Flomax
  • Miotic agents: pilocarpine
  • Posterior synechiae
Surgical aids for the small pupil

Iris hooks  Pupil expanders  Viscoelastics  Intracameral epinephrine

All of these may leave the pupil permanently larger, misshapen (oval), or with an irregular or serrated border

• Functionally insignificant
miLOOP
miLOOP

• Nucleus-cutting device using a filament snare
• Indications: Dense cataract, Fuch’s dystrophy
• Benefits: Reduces total phaco energy and endothelial trauma
  • Therefore less corneal edema
THE IOL EXCHANGE
The IOL exchange: indications

• Refractive surprise
  • Laser refractive surgery may be better option, especially if astigmatism

• Intolerable and persistent dysphotopsias

• Clear communication of expectations and risks is essential
  • Increased risk of capsular tear and CME
The IOL exchange

• **Timing**
  • Earlier the better
  • Haptics and IOL scar into bag after a few months, increasing the risk of capsular tear

• **Vitreous management in the post-YAG patient**

• **Post-op management same as original procedure**
5.

TRANS-SCLERAL IOL FIXATION
Trans-scleral IOL fixation

• Indications: poor or absent zonular/capsular support
• Largely replacing ACIOL
• The new Gold Standard?
The Yamane technique

• “The double-needle technique”
  • Three piece PCIOL
  • Sclera is marked 180° apart, 2mm posterior to the limbus, usually at 2 and 8 o’clock
  • PCIOL inserted and haptics are docked and externalized at the marked locations using hypodermic needles
  • External cautery creates a flange/bulb on each haptic end
  • Ends of the haptics are reduced and tucked intrascleral just below the surface, anchoring the IOL to the sclera
  • The IOL is approximately where the IOL would sit in the bag
  • No sutures - seeing the haptic ends post-op may be difficult
The Yamane technique

**Advantages:**
- Minimally invasive and quick
- Faster recovery
- Eliminates risk of suture breakage/erosion over time in sutured IOL’s
- Better in younger patients
- Decreases risk of corneal decompensation compared to ACIOL
- Decreases risk of iris/angle damage in ACIOL
- Decreases risk of chronic inflammation from IOL/iris contact and secondary glaucoma compared to ACIOL or Iris fixation

**Complications:**
- Optic centration/tilt can occur
- Iris capture
- IOL slippage (rare)
The Yamane technique

PCLI VIDEO HERE
DROPLESS CATARACT SURGERY
Dropless cataract surgery

• Purpose: to eliminate or reduce the need for postop eye drops

• Tranzonular triamcinolone-moxifloxacin (TriMoxi)
• Tranzonular triamcinolone-moxifloxacin-vancomycin
  • Associated with hemorrhagic occlusive retina vasculitis (HORV)
• Intracameral dexamethasone-moxifloxacin combination
• Intracameral moxifloxacin, subconjunctival injection Celestone
3. POST-OP
Medications

Steroid

Antibiotic

NSAID
Medications

- Combinations drops
  - Typically include steroid, antibiotic, and NSAID
- More convenient
- Less confusion
A typical timeline

- 1-day exam
- 1-week exam
- 1-month exam
Why do a 1-day exam?

- To diagnose pain:
  - Corneal abrasion
  - Pressure spike
  - Wound leak
  - Endophthalmitis

- To answer questions
The 1-day exam

- History, VAs (and PH if worse than 20/80), pupils, IOP check, and slit-lamp exam
- Grade findings
- Verify no wound leak
- Address questions and concerns
- Describe proper drop usage and restrictions
Normal 1-day exam findings

- cells and flare
- small fragments of capsular debris
- disruption of the endothelium (“snail tracks”)
- a primary incision and several side-port incisions
- subconjunctival hemorrhages
- mild keratitis
- headache

- reduced VAs (20/25 - 20/80)
- foreign body sensation
- ache
- a small ptosis
- residual dilation
- IOP elevated by 5-10
- conjunctival injection
- dysphotopsias, either positive or negative
Why do a 1-week exam?

- Major concerns: endophthalmitis
cystoid macular edema (CME)
The normal 1-week exam

- History, VAs, pupils, auto-refractor reading, IOP check, and slit-lamp exam
- All findings should be stable or improved
- Address questions and concerns
- Adjust medications
Why do a 1-month exam?

• Major concerns:
  - endophthalmitis
  - cystoid macular edema (CME)
• Resume regular care
The 1-month exam

- History, VAs, pupils, refraction, IOPs, slit lamp exam, DFE
- Normal:
  - Comfort and exam findings returned to baseline
  - Vision improved
- Investigate unexplained poor vision
- Review ocular status
The importance of expectations

WHAT GRADE DID YOU GET?  I GOT AN 'A'.

REALLY? BOY, I'D HATE TO BE YOU. I GOT A 'C'.

WHY ON EARTH WOULD YOU RATHER GET A 'C' THAN AN 'A'?!

I FIND MY LIFE IS A LOT EASIER THE LOWER I KEEP EVERYONE'S EXPECTATIONS.
I THOUGHT THIS WAS SUPPOSED TO BE EASY: COMPLICATIONS AND HOW TO DEAL WITH THEM
High IOP

- Greater than 30 in normal eyes
- Only use aqueous suppressants
- Lower threshold if glaucoma
Microcystic edema from high IOPs
Corneal edema
## Causes of corneal edema

<table>
<thead>
<tr>
<th>1. Surgical trauma</th>
<th>Stromal thickening</th>
<th>Tincture of time Muro128 ung qhs-qid?</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Endothelial folds</td>
<td></td>
</tr>
<tr>
<td>2. Endothelial shut-</td>
<td>3-4+ cell in AC</td>
<td>Increase steroid</td>
</tr>
<tr>
<td>down (inflammatory)</td>
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</table>
Inflammation

FIGURE 4–16. Grade 4+ cells in anterior chamber.
Cataract fragments
Refractive surprise

Standard cataract surgery:
• Worse than +/- 0.50D: 27%
• Worse than +/- 1.00D: 7%

Post-LASIK cataract surgery:
• Worse than +/- 0.50D: 55-62%
• Worse than +/- 1.00D: 37-24%
Refractive surprise: treatments

• LASIK
• Piggyback IOL
• IOL exchange
Toric rotation
Dysphotopsias: positive
Dysphotopsias: negative
Wound leak

- IOP less than 8
- Flat anterior chamber
- Corneal waffling
- Unusual sensitivity at incision site
Wound leak management

- If AC is flat… refer for anterior chamber reformation & wound suture
Wound leak management

• If AC well-formed or only slightly shallow
  • Discontinue corticosteroid
  • Continue antibiotic
  • Consider topical aqueous suppressant & eyeshield
  • Consider BCL if it covers the leak
  • Consider wound suture at 1 week
Vitreous to the wound
Vitreous to the wound: management

• Refer to surgical center for YAG vitreolysis
Cystoid macular edema
Cystoid macular edema: management

- Peak incidence 6-10 weeks after CE
- Treat with steroid and NSAID
- Monitor by vision and ideally by OCT
- Refer if they don’t improve every 2-4 weeks
  - Usually to retina
Endophthalmitis
Endophthalmitis

SYMPTOMS:
• Suddenly reduced vision
• Pain (usually)

SIGNS:
• Hypopyon
• *Severe* anterior chamber cells and flare
• Vitreous cells and flare
• Decreased red reflex
Endophthalmitis

TIMELINE:
• Unpredictable
• Can present from 1-day exam to months later
• Peak 3-14 days post-op
• Capsular tear increases risk by 10x

MANAGEMENT:
• Immediate call to surgery center
• Likely immediate referral to retina for anterior & vitreous tap and culture
Retinal detachment
• Posterior capsular
• opacification
Capsular distension syndrome

“Lactoecccumenasia”
HOW TO SET UP A SURGERY FOR SUCCESS
Does surgeon experience matter?

- Study of 91,084 surgeries
- Complication rates, low-volume surgeons versus high-volume surgeons: 150 - 220%
- Other studies have found a complication rates of trainee residents compared to staff ophthalmologists: 117-435%

Does surgeon experience matter?

- Lower complications strongly correlated to the surgeon’s:
  - Total volume of surgeries
  - Daily volume of surgeries
  - Getting adequate sleep (>6 hours/night)
  - Having limited volume of procedures on weekends
  - Having adequate vacation/time off
  - Performing at a high-volume clinic that is dedicated to surgery

The second most important thing

- Communication with surgery center:
  - Patient’s desired refractive outcome
  - Patient’s ocular health
  - Helpful comments about working with patient
  - Post-op findings that could affect the patient:
    - Refractive error
    - Rotated toric IOL
    - CME or other medical concerns
    - Dissatisfaction for any reason
  - Post-op findings that would help the surgery center get better:
    - All surgical centers should want to constantly improve
The most important thing

• Communication with the patient

• Accurate understanding of expectations for upcoming surgery is the single most important predictor of patient satisfaction
IF YOU REMEMBER NOTHING ELSE ...

1. Maintain a heightened alert with any posterior capsular tear.

2. Know the symptoms and signs of endophthalmitis.

3. Both before and after surgery, tell your surgery center everything you can about your patient.
SCHEDULE

9:15 – 12:00  
1. Pre-op
2. Surgery
3. Post-op

12:00 – 12:45  
Lunch

12:45 – 3:30  
4. Refractive-cataract surgery
5. MIGS