Extracapsular Cataract Extraction: Manual Large and Small Incision Approach

ASCRS 2014


Course Objectives

At the conclusion of the course you should be able to:

1. To understand the indications for primary ECCE and for conversion to ECCE surgery
2. To understand how to competently perform the steps of primary ECCE and conversion to ECCE surgery
3. To become familiar with and understand how to deal with complications of ECCE surgery

Introduction

Why are we doing this course?

As small incision phacoemulsification surgery becomes the standard of care, trainees are often not being taught how to perform manual large or small incision ECCE surgery. We believe primary and conversion to ECCE surgery still play an important role in certain cases. Knowing how to perform this surgery competently is crucial when faced with complications during phacoemulsification surgery. Manual ECCE surgery is widely practiced internationally where access to expensive phacoemulsification equipment is limited.

Primary ECCE

I Primary ECCE Surgery - Maria Aaron MD/John Kim MD

1. Indications
   a. Brunescent lens
   b. Subluxated lens - zonule loss
   c. Traumatic cataract
   d. Missions overseas

2. Learning Pearls
   a. Dilating drops
   b. Incisions
   c. Capsulorhexis
   d. Saturing
   e. Wet lab

3. Surgical Technique - Large Incision
   a. Incisions - limbal vs tunnel
   b. Capsulorhexis methods
   c. Basic techniques if lens extraction
   d. Cortex removal

4. Wet Lab - Only realistic place to learn well

Complications

IV. Complications – Bonnie An Henderson M.D.

1. Intraoperative
   a. Suprachoroidal hemorrhage
   b. Vitreous loss
   c. Dropped lens fragment
   d. Iris prolapse

2. Postoperative
   a. Wound leak
   b. High astigmatism
   c. Suture cutting techniques and guidelines
   d. Medications


Resources

Primary ECCE - Small Incision Cataract Surgery (SICS)

II Primary ECCE with Small incision (SICS) – Geoffrey Tabin M.D./Jeff Petey MD

1. Indications
   a. Same as large incision
   b. Benefits of small incision – less astigmatism, less suturing and postop suture cutting, etc.
   c. Use around the world

2. Surgical techniques
   a. Videos - Step by step instruction, discuss techniques
   b. Instrumentation – i.e. Irrigating lens loop
   c. International use

Conversion to ECCE

III. Conversion to ECCE Surgery – Thomas Oetting MD/Bonnie An Henderson M.D.

1. Indications
   a. Non-continuous capsulorhexis
   b. Posterior capsular tear
   c. Zonular dialysis
   d. Poor visualization

2. Considerations
   a. Timing of conversion
   b. Anesthesia – supplementation
   c. Patient factors – blood pressure, brow

3. Surgical Technique
   a. Converting a clear corneal vs scleral tunnel wound
   - New wound location
   - Considerations for original wound
   b. Lens fragment removal techniques
   c. Vitreocochlear differences: when and which one to choose
   d. Sheets glide
   e. Expressing lens in the presence of a posterior capsule tear

3. Vitreoscopy
   a. Settings
   b. Technologies for lens removal
   c. Techniques for cortex removal
   d. How much to do
   e. Use of Kenalog

Complications

IV. Complications – Bonnie An Henderson M.D.

Primary Extracapsular Cataract Extraction

Maria Aaron, MD
Department of Ophthalmology
Emory University School of Medicine

A. Indications
   • Subluxated lens
   • Significant zonule loss (e.g., pseudoxfoliation)
   • Traumatic cataract
   • Mature cataracts (brunescent internal)
   • Large posterior capsule tear at beginning of planned phaco surgery
   • Overseas Missions

B. Preoperative Preparation
   • Consent
   • Intracocular lens
   • Operative site identification
   • Adequate papillary dilation or prepare for pupil stretch
   • Patient position

C. Anesthesia
   • Retrobulbar block (pneumatic anesthesia: including peribulbar or subtenon’s techniques)
   • Eliminate Posterior Pressure – This is extremely important in ECCE and should be done for approximately 10 minutes unless there is a known zonular problem
     - Manual – Apply pressure for a few seconds and then release for a few seconds
     - Honan Balloon – Use a 30 mmHg Honan and be careful that it is positioned properly on the globe
     - Mercury Bag

D. Position Surgeon and Microscope

E. Procedure
   a. Bridle Suture - Route globe inferiorly with a muscle hook. Grasp superior rectus (SR) with 0.3 to 0.5 toothed forceps approximately 10 mm posterior to the limbus and lift the muscle off the globe. Pass 4-0 silk suture with a tapered needle under the SR tendon (needle should be flat with the globe to avoid penetration). Cut off needle and clamp the suture to the drape with a hemostat to rotate the globe down
   b. Conjunctival Peritomy - Use blunt Wescotts to make a radial incision at the 10:00 position, 2 mm posterior to the limbus (Tenon’s capsule inserts 1.5 mm posterior to the limbus). Use blunt dissection to remove Tenon’s and conjunctiva from globe. Keep scissors blades parallel to the limbus, insert one blade into the conjunctival pouch, pull blades gentle toward the
enlarge the wound at the most anterior aspect of the iris. Mainline scissor blades in the groove and keep blades parallel to the iris plane.

i. Nucleus Removal

- Manual Expression
  This is achieved by applying external, posterior pressure with forceps or the irrigating lens loop 2 mm posterior to the limbus at the 12:00 position and using an assistant to elevate the anterior lip of the wound. When the nucleus begins to prolapse, counterpressure is applied with a muscle hook at the 6:00 position to facilitate removal of the nucleus. Once the nucleus is partially out of the eye, any pointed instrument may be used to completely rotate the remainder of the lens out of the eye.
  - Lift and extract
  Either hydrodissection or manual rotation should be performed to elevate the 12.00 mm into the anterior chamber. To manually rotate the nucleus, use a Simkhey hook, cannula or cystotome to gently rock the lens in a dinding/circumferential manner and then lift and rotate. Once the superior portion of the lens is elevated, an irrigating lens loop may be inserted under the lens. The irrigating lens loop is then flattened parallel to the iris plane, lifted toward the cornea, and removed from the eye with the nucleus.
  - Suture Placement
    To maintain the anterior chamber during cortical removal, it is beneficial to place 2 or 3 10.0-or 10-0 nylon sutures at the 10:00 and 2:00 positions. If the iris is light-colored or there is a tendency for iris prolapse, additional sutures may be placed.
  - Cortical Removal
    - Manual or Automated – The cortex may be removed by using either a manual or automated irrigating/aspiration system. This technique is similar to phacoemulsification, however, with a can-opener capsulotomy, care should be taken not to accidentally grasp the anterior capsule leaflets. Strip the cortical band toward the center of the pupil and aspirate more aggressively only when the port is fully occluded with cortex.

l. IOL Implantation

- The capsular bag is reconstituted to reinsert the IOL. It is important to reinsert the capsular bag and not just deepen the anterior chamber. This is achieved by directing the viscoelastic under the anterior capsular leaflet of the capsular bag at the 6 o’clock position.
  - If sutures were placed prior to cortical removal, one or more will need to be removed in order to insert a non-folding lens. To insert a non-

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The evening before surgery the patients’ faces are vigorously washed and antibiotic drops and ointment are instilled. Prior to surgery the eyelashes are closely clipped and fluorouracil solution eye drops are instilled at the time of dilation. The eye is then prepped with Betadine and a retrobulbar anesthetic is administered by an anesthetic technician, after which, a Betadine-soaked gauze is held over the eye. At the start of the case the surgeon performs a final Betadine prep with instillation of a small amount of 5% Betadine into the limbus of the eye. This preoperative cleaning and sterilization regimen leads to a low infection rate. Efficiency of patient turnover, until maximized: as the surgeon is prepping and draping the eye the scrub nurse is arranging a new instrument set and surgery proceeds with a typical delay of less than three minutes between cases.

Surgical Technique

Access the Anterior Chamber (AC) by Creating a Sclerocorneal Tunnel

A superior rectus traction suture may be used if operating superio rly to enhance exposure. A firm-based conjunctival peritomy to sclera is performed superiorly from 10 to 2 o’clock to bare sclera. Light cauteration is used to control bleeding and blunt episcleral vessels over the incision site. A straight to slightly frown shaped incision centered at 12 o’clock is carried to 30-35% scleral depth tangential to the limbus for 6.7 mm and approximately 1.5-2 mm from the limbus. This incision can be made with a razor blade fragment or crescent blade, the former helping with cost containment. The crescent blade is then used to create a lamellar scleral corneal tunnel from the initial incision in a single plane approximately 1.1-1.5 mm from the clear corneas and parallel to the corneal surface. The dissected pocket should extend nasally and temporally to the limbus so that the transverse extent is much greater in the cornea than in the sclera (Figure 2).

Triangular Capsulotomy vs. Continuous Curvilinear Capsulorrhexis (CCC)

Triangular capsulotomy

In the developing world mature, hypermature and Morgagnian cataracts are common; the anterior capsule is associated with such dense cataracts are often tough and leathery, and there are frequently adhesions between the anterior capsule and the lens nucleus. Furthermore, poor surgical visibility is common due to corneal scars, pterygium, climatic keratopathy, sub-optimal surgical microscopes. Under these circumstances, capsulorrhexis types of capsulotomies are difficult to complete and can lead to incomplete or inadequate capsular openings or tears in unexpected directions, increasing the risk of posterior capsular rupture.

Continuous Curvilinear Capsulorrhexis (CCC)

We often employ a CCC for less advanced cataracts by using a 27-gauge needle introduced into the anterior chamber through a separate tunnel puncture to the external wound of the sclerocorneal tunnel. Viscoelastic is instilled prior to insertion of the needle into the anterior chamber. This capsular opening needs to be approximately 5-6 mm in diameter, substantially larger than that utilized during phacoemulsification, as the entire lens must be expressed through this capsular window.

Triangular Capsulotomy

The triangular capsulotomy is performed before the sclerocorneal tunnel is completed so that the depth of the AC is maintained. A straight 26-gauge needle attached to a 1 ml syringe filled with balanced saline solution is passed through the scleral tunnel with the entry point into the AC in sclera, not the more rigid corned tissue. Using the bevelled tip of the needle, the linear cut in the capsule is made from 4 o’clock to twelve o’clock and then from 8 o’clock to twelve o’clock so the incisions meet at 12 o’clock. Thus, a triangular, or V-shaped flap of anterior lens capsule still attached at its base is created (Figure 3). Each point of the triangular flap should be approximately 3mm from the center of the pupil. The apex of the capsulotomy is then filled with the needle tip and pedicled towards 6 o’clock to ensure the capsular cuts are complete. If the chamber shallows a small amount of fluid may be irrgated through the needle to re-deepen the chamber.

Following capsulotomy, the sclerocorneal tunnel is then completed using a keratome blade to enter the anterior chamber. The sides of the blade are used to open the cornea from the temporal to the nasal aspects of the wound. The wound should be internally flared to encourage the nucleus to engage the tunnel at the time of expression. Viscoelastic may be placed in the AC to facilitate wound creation.

Nucleus Delivery into the Anterior Chamber

The lens nucleus is displaced from the capsular bag into the AC using both hydrostatic and gentle mechanical pressure. Irrigating under the displaced triangular anterior capsular flap as well as under the posterior lens capsule and behind the nucleus provides hydrodissection. The nucleus is then gently directed inferiorly within the capsular bag while intermittently directing irrigation posterior to the nucleus until the superior nuclear pole emerges from the capsular bag into the AC, forming a new cleavage plane between the nucleus and the iris. This newly formed cleavage between the nucleus and the iris is then accentuated by directing flow between the iris and the nucleus with the Simcoe cannula until the lens is entirely delivered into the AC. It is important not to force the nucleus in any one direction too strongly as this will strain and possibly compromise the zonules.

Extraction of the Nucleus from the Anterior Chamber

The lens nucleus is now removed from the eye. While several potential protocols are available for nucleus removal we recommend avoiding temporary sutures that require sectioning or fragmentation of the nucleus, as these may traumatize the corneal endothelium. We recommend the following technique:

The vigorously flowing Simcoe cannula is passed posterior to the nucleus until the tip is fully visible beyond the distal pole of the nucleus. The eye is then gently rotated downward with hooked lenses held in the other hand. The accumulating irrigation fluid from the cannula will engage the nucleus into the internal mouth of the sclerocorneal tunnel. Hydrostatic pressure plus gentle lifting and retraction with the tip of the Simcoe cannula will force the nucleus further into the tunnel. Open the external flaps of the tunnel with gentle downward pressure using the heel of the Simcoe cannula and deliver the entire nucleus (Figure 4).

PC IOL Placement

The Simcoe cannula is then used in the standard fashion to remove all nuclear and cortical debris from the AC and capsular bag. Next, air is injected into the anterior chamber using the Vycryl cannula and a DDMA (polyethyleneimine) IOL is inserted into the capsular bag. Alternatively, the capsular bag can be reconstituted, with viscoelastic. The apex of the V-shaped capsulotomy tear should also be folded backwards during this maneuver so that the flap lies on top of the anterior capsule. During insertion of the leading haptic, the anterior lip of the cornea isifold towards the corneal endothelium during lens implantation. The leading haptic is then passed into the capsular bag inferiorly, behind the base of the triangular capsulotomy (Figure 5). The folded anterior capsular flap at the base of the triangular capsulotomy serves as an easily identifiable landmark and facilitates correct PC IOL placement. The trailing haptic is then passed into the capsular bag and correct placement of the PC IOL within the capsular bag is confirmed by observing posterior capsular stretch lines that form perpendicular to the contacts between the IOL haptics and the capsulotomy.

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Capulotomy

If a triangular capsulotomy was performed, the anterior capsular flap is removed to prevent obscuration of the visual axis. A small incision is made in the anterior capsule at the edge of the triangular flap with the Vannas scissors while maintaining the AC depth with an irrigating Simcoe cannula. The capsular flap is then engaged with aspiration using the Simcoe cannula (using low flow irrigation) and used to gently tear the flap entirely across its base which then should be removed from the AC (Figure 6).

Closure

The Simcoe cannula is used to irrigate and aspirate residual air or viscoelastic in the AC and intracocular pressure is restored. The 3-plane sclerocorneal tunnel will self-seal which is confirmed by applying gentle pressure to the globe with an instrument and observing for wound leakage. Fewer puncture sites immediately advance wound closure for adequate closure. A subconjunctival injection of antibiotic and steroid is given just superior to the conjunctival wound which bolus the conjunctiva and moves it over the limbus to cover the scleral wound. In the instance of a temporal surgical approach the conjunctiva is closed over the scleral wound with cauterey at the wound edges.
After removing the sterile drapes antibiotic ointment is applied to the eye which is then patched and shielded. Steroid and antibiotic drops are instilled every two hours for the first post-operative day and then four times per day for three weeks.

Surgical Outcomes

Utilizing intraocular lenses manufactured in India or Nepal and local pharmaceuticals the cost per surgery is less than twenty dollars per case. Moreover, experienced surgeons routinely perform more than fifty cases per day with an average operating time of five minutes per surgery. The results of a prospective, randomized clinical trial in Nepal comparing our manual sutureless extracapsular technique with phacoemulsification were published in the January 2007 American Journal of Ophthalmology. It was an “Expert Trial” with Professor David Chang operating with a phaco-tip (phaco) technique and Dr. Sundak Rutt doing the temporal approach small incision ECCE (SICS). Both techniques achieved excellent and equivalent results. At six months 89% of the SICS patients had an uncorrected visual acuity (UCVA) of 20/60 or better and 98% had a best-corrected acuity (BCVA) of 20/60 or better; this outcome was equivalent to the visual acuity outcomes of the phaco patients (Figure 7). Furthermore, SICS is significantly faster, less expensive and less technology-dependent than phacoemulsification and may be the more appropriate surgical procedure for the treatment of advanced cataracts in the developing world.

References


Table 1

<table>
<thead>
<tr>
<th>Factor</th>
<th>Time</th>
<th>Equipment/Aids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zonular laxity</td>
<td>Moderate</td>
<td>3 iris retractors available to hold capsule</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capsular Ring (CTR) Ready for sutured IOL</td>
</tr>
<tr>
<td>Rock Hard Lens</td>
<td>Add 50%</td>
<td>Consider planned ECCE Consider sup limbal wound w/PFE Consider RI</td>
</tr>
<tr>
<td>Small Pupil</td>
<td>Add 50%</td>
<td>Stretch Pupil (only w/o Flomax) Consider IOL retractors</td>
</tr>
<tr>
<td>Floxax</td>
<td>Add 50%</td>
<td>Strongly consider iris retractors Consider single iol retractor Consider RI</td>
</tr>
<tr>
<td>Poor Red Reflex</td>
<td>Add 50%</td>
<td>Trypan Blue Consider RI Consider sup limbal wound</td>
</tr>
<tr>
<td>Big Brow</td>
<td>Add 25%</td>
<td>Consider sutured bridle sutures Consider RGI to give pupillary help</td>
</tr>
<tr>
<td>Narrow Angle</td>
<td>Add 25%</td>
<td>May need m hooks for prolapse Consider smaller phacotip Frequent dispersal OVD</td>
</tr>
<tr>
<td>Predisposition for corneal decompensation</td>
<td>0%</td>
<td>Hard IOL: phaco-chop Arshiniff shell w/OVD Consider conversion to ECCE</td>
</tr>
<tr>
<td>Exiting Traj</td>
<td>0%</td>
<td>Avoid Fixation ring Avoid Conj manipulation Always suture</td>
</tr>
<tr>
<td>Past PPVx</td>
<td>0%</td>
<td>Possible CTR Careful during I/A</td>
</tr>
<tr>
<td>Cannot Lay flat</td>
<td>0%</td>
<td>Consider general or at least monitored</td>
</tr>
<tr>
<td>Anterior</td>
<td>0%</td>
<td>Topical to avoid injection risk</td>
</tr>
<tr>
<td>Monocular</td>
<td>0%</td>
<td>Topical for faster rehabilitation Try to forget about it</td>
</tr>
</tbody>
</table>

Indications for conversion

Conversion to ECCE is indicated when phacoemulsification is falling. Sometimes this is due to a very hard lens which does not submit to ultrasound or a lens that is hard enough that the surgeon is concerned that the required ultrasound energy will harm a tentative cornea, e.g. Fuchs’ endothelial dystrophy or posterior polymorphous dystrophy (PPMD). Sometimes one will convert to ECCE when an errant capsulotomy cannot be made, e.g. a hard crystalline lens when the surgeon is concerned that the risk of dropping the lens is too great with continued phacoemulsification. Rarely now with Triplan Blue dye, a surgeon will choose to convert to ECCE when the anterior capsule is hard to see and capsulotomy must be completed with the cap opener technique. More often the conversion is indicated when the crystalline lens is loose from weak zonules or a posterior capsule tear which make phacoemulsification less safe than extending the wound and removing the residual lens material. Indications for conversion to ECCE include:

- Hard crystalline lens or unstable endothelium
- Radial tear in anterior capsule with hard lens
- Poor visualization despite Triplan dye
- Posterior capsular tear
- Zonular dialysis

Converting to subtenon’s anesthesia.

Often we convert cases from topical clear corneal to ECCE. While the ECCE can be done under topical it is usually more comfortable and safer to give additional anesthetic which is typically a sub tenon’s injection of bupivacaine and lidocaine. This will provide some akrineus and additional anesthesia. There is usually subconjunctival hemorrhage and if the injection is made too anterior it can cause chemosis and ballooning of the conjunctiva. The steps of the sub tenon’s injection are outlined below:

1. Prepare 3cc syringe with equal parts of 2% lidocaine:0.75% bupivacaine
2. Place lacrimal canula (or Masket canula) with gentle curve to approximate that of the globe
3. Pick a quadrant for the block (best to go for a lateral quadrant to avoid oblique retraction)
4. Have the patient look away from the chosen quadrant to increase exposure
5. Use .12 forceps to retract conjunctiva
6. Make small incision down to sclera with Wescott scissors
7. Reduct Wescott scissors with curve down and bluntly dissect through quadrant
8. Dissect past the equator (similar to using scribes tenonotomy in pediatrics)
9. Use .12 forceps for counter traction
10. Place canula through incision and direct past the equator before injecting
11. The local anesthetic should flow easily and cause little chemosis -- If not redistack with the wescott scissors to get more posterior
12. Use 2-3 cc of the local mixture
Converting the Wound

The major step toward converting to ECCE is to either extend the existing wound or close and make another. The ECCE will require a large incision of from 9-12 mm which is closed with suture. The decision to extend the existing wound or make a new wound hinges on several factors: location of the original wound, size of the brow, past surgical history, and possible need for future surgery.

<table>
<thead>
<tr>
<th>Original wound</th>
<th>Advantages of making new wound for ECCE</th>
<th>Advantages of extending wound for ECCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal</td>
<td>Allows limbal incision superior</td>
<td>Protects existing trab</td>
</tr>
<tr>
<td></td>
<td>Allows lids to cover suture</td>
<td>Assists big brow</td>
</tr>
<tr>
<td></td>
<td>Should iris damage occur it will be</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Superior Simple to start fresh</td>
<td></td>
</tr>
<tr>
<td>Sup Temporal</td>
<td>none</td>
<td>Already have sup incision</td>
</tr>
<tr>
<td>Left eye</td>
<td></td>
<td>No need to change position</td>
</tr>
<tr>
<td>Til Temporal</td>
<td>Allows limbal incision superior</td>
<td>Protects existing trab</td>
</tr>
<tr>
<td>Right Eye</td>
<td>Allows lids to cover suture</td>
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</table>

Making a new incision during conversion is identical to that for a planned ECCE. The original incision is closed with a 10-0 nylon suture. The surgeon and microscope are rotated so the surgeon should sit superior. The steps to make a new superior incision are:

- Conjunctival peritomy of about 170 degrees
- Use 64 or crescent blade to make limbal groove with a chord length of 11 mm
- Bipolar cautery for hemostasis
- Use keratome to make initial incision starting in groove into AC
- Extend initial incision to full length of groove (with scissors or knife)
- Safety sutures are placed usually 7-0 Vicryl

Extending an existing incision can be tricky and the technique is different for scleral tunnels compared to clear corneal incisions. However in both cases the original extension is brought to the limbus. In the case of an original scleral incision the incision is brought anterior to join the limbus on either end before extending along the limbus for a chord length of about 11 mm. In the case of an existing corneal incision the incision is brought posterior toward the limbus before extending the wound along the limbus for a chord length of about 11 mm. In iris hooks are being used in a diamond configuration the wound can be extended to preserve the sub-incisional hook and the large pop-fill.

- Conjunctival peritomy of about 170 degrees
- Use 64 or crescent blade on either side of the existing wound to make a limbal groove with a chord length of 11 mm
- Bipolar cautery for hemostasis
- Use Crescent to bring existing scleral wound anterior or existing corneal wound posterior to join limbus
- Extend final incision to full length of groove (with scissors or knife)
- Safety sutures are placed usually 7-0 Vicryl

Removing the lens

One has to be far more careful when removing the nucleus during the typical conversion to ECCE which comes along with vitreous loss. First the anterior capsule must be large enough to allow the nucleus to express which may require relieving incisions in some cases. When the zonules are weak or the posterior capsule is torn the lens cannot be expressed with fluid or external pressure as is often done with a planned ECCE with intact capsule/zoneulae. After any vitreous is removed (see below), the lens must be carefully looped out of the anterior chamber with minimal pressure on the globe. If the posterior capsule and zonules are in tact the lens can be expressed as described with a planned ECCE.

Removing Lens with intact capsule complex

- Mobilize lens (physically with cystotome -- be careful)
- Lens removed w/ lens loop or w/ counter pressure technique
- Wound is closed with safety sutures and additional central Vicryl suture

Placement of the IOL

IOl selection with ECCE conversion depends on the residual capsular complex. The key to IOL centration is to get both of the haptics in the same place: either both in the bag or both in the sulcus.

- When the posterior capsule is intact following a conversion to ECCE the anterior capsular opening is usually poorly defined which can make bag placement difficult. If the anterior capsule and thus the bag is well defined, then place a single piece acrylic IOL without folding it directly and gently into the bag using kelman forceps.
- When the posterior capsule is intact and the anterior capsule is poorly defined then place a 3 piece IOL in the sulcus such as a large silicone IOL or the MA50 acrylic by placing these directly and unfolded into the sulcus with kelman forceps. Make sure that both haptics are in the sulcus.
- When the posterior capsule is damaged, if enough anterior capsule and posterior capsule is left to support the IOL, define the sulcus with viscoat and place the IOL directly in the sulcus. Make sure both haptics are in the sulcus. If the IOL does not seem stable then place McCannel sutures to secure the IOL to the iris or remove and replace with an AC IOL (don’t forget to place a PI with vitreoret)
- When the capsule is severely damaged and cannot support an IOL then place the IOL in the anterior chamber. Use kelman forceps to place the IOL, then secure the chamber, and use a sinsky hook to place the AC IOL into its final position. (don’t forget to place a PI with vitreoret)

Postoperative issues

Postoperative care for patients following conversion from phaco to ECCE is a bit more complicated and focused on preventing cyclodial macular edema and limiting induced astigmatism. Often the care is very similar to that of a planned ECCE with about 3 post operative visits one the same day or next, one a week later, and one about 5-6 weeks later. Depending on the amount of astigmatism the patient may require several visits to sequentially remove sutures while eliminating induced astigmatism.

First post operative visit

Often on the same afternoon 4-6 hours following surgery or next morning with the primary emphasis to check the IOP, look for wound leaks and scan for residual lens material or vitreous in the anterior chamber. Most wound leaks should be sutured but if the AC is not formed closing these is mandatory. Residual nuclear material should be removed in the next few days if present but residual cortical material will often dissolve away with fluid or external pressure as is often done with a planned ECCE without intact capsule/zoneulae. After any vitreous is removed (see below), the lens must be carefully looped out of the anterior chamber with minimal pressure on the globe. If the posterior capsule and zonules are intact the lens can be expressed as described with a planned ECCE.

Removing Lens with vitreous present

- mobilize lens with visco with viscoat
- Wound is closed with safety sutures and additional central Vicryl suture
- OVD is removed
- OVD is removed

Week 1 post operative visit

The vision and pressure should dramatically improve in patients over the next week where you have converted to ECCE. The vision should be in the 20/100 range with an improvement with pin hole to 20/20. The vision is usually limited by residual edema and astigmatism. In a study of our ECCE we found about 7 diopters of cylinder at the one week visit. You should expect very little inflammation and limited by residual edema and astigmatism. In a study of our ECCE we found about 7 diopters of cylinder at the one week visit. You should expect very little inflammation and astigmatism induced by ECCE sutures was about 5.0 diopters at the incision. The vision is usually in the 20/80 range with an improvement with pin hole to 20/50. The vision is usually limited by residual edema and astigmatism. In a study of our ECCE we found about 7 diopters of cylinder at the one week visit. You should expect very little inflammation and

Week 2 post operative visit

The vision should continue to improve as the astigmatism settles and the cornea clears further. The eye should be comfortable. The vision should be in the 20/80 range with an improvement to 20/40 with pin hole. In our study the astigmatism induced by ECCE sutures was about 5.0 diopters at the incision. The anterior segment should be quiet and the IOP normal (unless the patient is a steroid responder). Consider CME as a possibility in patients where conversion was required as these are often long and can involve vitreous loss with OCT, FFA, or clinical exam.

But the main issue is astigmatic control with suture removal. Use keratometry, reflection, streak retinoscopy, or topography to guide in suture removal. If the keratometry is 45.00 at 90, and 40.00 at 180 then look for tight sutures at around 90 degrees (12 o'clock) that are causing 5 diopters of cylinder. You can take only one suture at 5 weeks, then can take maybe 2 at a time by 8 weeks. The plan is to remove a suture
and see how the cornea settles. When the astigmatism is less than about 1.0 to 1.5 diopters you should stop. Use antibiotic drops for a few days after suture removal.

After this visit you should consider the following choices with each visit (don’t waste too much time thinking about other possibilities and remember not everybody is going to be 20/20:

1. Pull a stitch (i.e. cyl at axis of stitch is greater than 1 on MR)
2. Give glasses (i.e. no stitch to pull or cylinder is less than 1 on MR)
3. Get FFAs or OCT because you suspect CME

**Anterior Vitrectomy.** Converting to ECCE is almost always accompanied by vitreous. Sometimes the conversion comes when the lens is too hard and the capsule is intact but most often it seems conversion comes when the zonules or capsule releases the vitreous into the relevant hands of the anterior segment surgeon. We will cover the causes and signs of vitreous prolapse and the principal of anterior vitrectomy in various situations.

**Causes of vitreous prolapse.** The vitreous either comes around the zonules or through a tear in the posterior capsule. Posterior capsular tears are caused commonly by: anterior tear extending posteriorly – most common, posterior tear – secondary to phaco needle being too deep, a chopper or from the I/A instrument, or a pre-existing injury (eg: posterior polar cataract iatrogenic from PPV, or from penetrating lens trauma). Zonular problems are often pre-existing such as from trauma, PXF, or Marfan’s but can also be iatrogenic from forceful rotation of the lens or pulling on the capsule during I/A.

**Signs of vitreous prolapse.** The first sign of vitreous prolapse is denial. Something seems wrong but you can’t quite pin point the issue. At first you deny that an issue exists but soon it becomes clear. More tell tale signs of vitreous prolapse include: the chamber deepens, the pupil widens, lens material no longer centered, particles no longer come to phaco or I/A, and the lens no longer rotates freely. When you suspect vitreous prolapse you should place dispersive OVD into the eye before removing the phaco needle or I/A and can check the wound with a Weck sponge for vitreous.

**Basic Principles of anterior vitrectomy.** The key to a successful anterior vitrectomy is to control the backside of the eye. The first step is to close the chamber. This is often hard when you have converted to an ECCE as the wound is large. However you must close the wound so that the only exit point for fluid is the aspiration/cutting device. Separate the irrigation device from the aspiration/cutting device so that you can create a pressure differential such that the vitreous is encouraged to go to the aspiration/cutter. The final important point is to cut low and irrigate high. If you can place the irrigation device in the anterior chamber above the aspiration/cutter down near the plane of the posterior capsule than the vitreous will leave the anterior chamber.

- Close the chamber
- Separate irrigation and cutter
- Cut low/Irrigate high

**How to deal with Vitreous Presenting late in the case – while placing IOL.** This is the least problematic and least common time to loose vitreous. The main issue is to make sure the IOL is stable while attending to the vitreous and then to secure a proper IOL in either the AC, sulcus, or bag.

- Place viscoat in area of tear or dialysis before removing instruments
- Make separate or 1.5 mm incision for anterior vitrectomy
- Separate irrigation (through paracentesis) and aspir/cutter (through larger paracentesis)
- May need to suture original wound to keep chamber formed
- Irrigate high and cut/suck low – creates a pressure gradient to push the V back
- Settings low vacuum 100 range, low bottle height 50 range, max cut rate
- If the skin can support an IOL then
  - Move existing 3 piece IOL into sulcus
  - Replace existing single piece IOL with 3 piece in sulcus
  - Consider anterior capsule capture of optic if CCC is round and centered
- If the tear in the posterior capsule is round and secure
  - Place viscoat in hole
  - Gently place single piece IOL into the bag (be very careful with 3 piece in bag)
- Mochel to bring pupil down

**Staining the Vitreous with Kenalog.** Scott Burk at Cincinnati Eye described using Kenalog off label to stain vitreous that had prolapsed into the anterior chamber2. As Kenalog is not approved by the FDA for this indication and as some retinal surgeons have had sterile and even infectious endophthalmitis from using Kenalog its use is controversial. However it is a very useful adjunct to anterior vitrectomy. The method for mixing the Kenalog to dilute 10:1 and to wash off the preservative follows:

- TB syringe to withdrawn 0.2 ml of well shaken Kenalog (40mg/ml)
- Remove the needle and replace with a 5 (or 22) micron syringe filter (Sherwood Medical)
- Force the suspension through the filter and discard the preservative filled vehicle
- The Kenalog will be trapped on the syringe side of the filter
- Transfer the filter to a 5 ml syringe filled with balanced salt solution (BSS)
- Gently force the BSS through the filter to further rinse out preservative
- Repeat rinsing a few times
- Place a 22 gauge needle on the distal end of the filter
- Draw 2 ml of BSS into the syringe through the filter to resuspend the Kenalog

In general the bottle height should be low – just high enough to keep the AC formed and not so high to push fluid and possibly vitreous out from the eye. The cutting rate should be as high as possible when cutting vitreous and low when cutting cortical lens material. We will separately discuss early, mid, and late case vitreous loss below.

**Vitreous Presenting early in case – while most of crystalline lens is in eye.** This is the worst time for vitreous to prolapse and one should strongly consider converting to ECCE. The steps to consider are outlined below:

- If topical do subtenon injection (as described above)
- Consider closing the temporal incision with 10-0 and make separate incision with peritomy superiorly especially (as described above)
- Use dispersive scissors to lift lens up near the wound and to displace vitreous more posterior
- May need week cell vitrectomy to clean up if the vitreous is very prolapsed
- Use lens loop to remove lens (as described above)
- Have Wescott scissors ready when looping out lens to cut vitreous
- Close with 2-0 vicryl and 3 mm away (allows removal of center suture to place 6 mm IOL)
- May need to add some 10-0 nylon at wound edges to get watertight
- Anterior vitrectomy (as discussed above separate aspir/cutter from irrigator)
- Dry removal of residual cortical material with syringe on 27 gauge cannula
- Use J-cannula or paracentesis if needed for sub-incisional material
- Consider staining with Kenalog (see below)
- Place IOL if possible in sulcus (adjust power) or use an AC IOL (don’t forget peripheral iridotomy)
- Mochel to bring pupil down—seats sulcus IOL, peaked pupil helps to detect vitreous

**Vitreous Presenting mid case – while removing cortical material.** This seems to be the most common time for vitreous loss. Often one will get the posterior capsule just as the last nuclear fragment is taken. Of course there is no reason to convert to ECCE in this case:

- Place viscoat in area of tear or dialysis before removing instruments
- Make separate or 1.5 mm incision for anterior vitrectomy
- Separate irrigation (through paracentesis) and aspir/cutter (through larger paracentesis)
- Make sure the IOL is centered
- Do subtenons injection (as described above)
- Place IOL if possible in sulcus or AC (if AC don’t forget peripheral iridotomy)
- Try to get some of the residual cortical material
- Dry removal of residual cortical material with syringe on 27 gauge cannula
- Use J-cannula or paracentesis if needed for sub-incisional material

- The Kenalog (now without preservative and dilute 10:1) will stain vitreous strands white

**References**


IV. COMPLICATIONS – Bonnie An Henderson M.D.

1. Intraoperative

A. Suprachoroidal hemorrhage

Risks:
With large incision surgery, the risk of a hemorrhage increases as well as the risk of a catastrophic outcome. The known risks include increased age with nature lenses, preexisting retinopathy, glaucoma, systemic hypertension, high myopia, and patients on antiocoagulation medications.

Diagnosis:
Patient may complain of severe pain. The surgeon may notice chamber shadowing, loss of red reflex, and hardening of the eye. Indirect ophthalmoscopy is necessary to assess the fundus. If unavailable, a handheld lens with the operating microscope (Osher Panfundus lens) can be used to quickly view the fundus.

Treatment:
First and foremost is closure of the eye to prevent further expulsion of the ocular tissues. If the eye cannot be closed with sutures, the incision can be held closed with direct pressure while IV Mannitol is given. Once the eye is secured with sutures, any prolapsing uveal tissue can be repositioned. If the eye cannot be closed, the choroidal hemorrhage can be drained by placing a posterior sclerotomy. 3.5 to 4.0 mm posterior to the limbus. However, many retina surgeons do not recommend attempting to drain an acute hemorrhage unless it is done with the goal of closing the eye. If the eye has been successfully closed, it is prudent to refer to a retinal specialist for possible drainage at a later time, if needed. The complete removal of corneal material or implantation of the IOL is secondary to the primary goal of stabilizing the eye. Prompt referral to a retina specialist is recommended.

B. Vitreous Loss

This has been covered in Dr. Oetting's lecture above.

C. Dropped Lens Fragment

Risks:
With any posterior capsular tear, there is a risk of dislocating a lens fragment. Often the posterior capsular tear goes undetected and is discovered when a fragment suspiciously appears to be too posterior. The causes of dropped lens fragments in the presence of a capsule tear are a history of a v streakectomy or excessive infusion.

Treatment:
If the lens fragment is in the anterior vitreous, a high molecular weight viscoelastic can be injected posterior to the fragment to elevate it anteriorly. This can be done through the anterior capsulotomy wound if the fragment is anterior and easily accessible. If the fragment is not in the anterior vitreous or if the fragment fails to elevate, a posterior assisted levitation (PAL) can be performed by injecting viscoelastic solution via a pars plana incision or using a spatula through the pars plana to support and elevate the lens. If the lens fragment is too posterior or not easily accessible, it is always safer to close the eye and refe the dropped lens to a retinal surgeon. If the patient needs additional retinal surgery to remove the dropped fragment, it is important to consider the pros and cons of placing the IOL. If the lens fragment is large and hard, the retina surgeon may need to prolapse the fragment anteriorly. Therefore, it may be beneficial to leave the patient aphakic until after the fragment has been removed.

D. Iris Prolapse

Risks:
With a large incision, iris prolapse is common even in an uncomplicated ECCE. A poorly constructed unplanar wound with a posterior entry will increase the risk of iris prolapse. The use of alpha adrenergic blockers such as Timolol (Flomax) can cause the iris tissue to be floppy and also increase the likelihood of prolapse during surgery. Elevating the intracocular pressure with excessive injection of fluid or viscoelastic can cause iris prolapse.

Continued iris prolapse during surgery can cause pupil irregularities, iris damage, inflammation, bleeding, and peripheral anterior synechiae.

Treatment:
Intracameral miotic should be used to constrict the pupil to assist in reducing the iris prolapse. If the iris prolapse is mild, gentle repositioning of the iris with a blunt instrument such as a cannula or spatula can be effective. If the iris cannot be repositioned, a small peripheral iridectomy can be performed. Once the iris has been repositioned back in the eye, be careful not to overly inflate the eye which may cause the iris to prolapse again.

2. Postoperative

A. Wound leak

Risks:
In complicated cases with posterior capsular tears, vitreous or iris tissue may be incarcerated in the wound and hindering wound closure. If this is suspected, carefully examine for peaked pupils or vitreous strands to the wound. If iris tissue has prolapsed through the wound, the bluish color of the uvea can be seen in the wound under the conjunctiva.

Diagnosis:
If the anterior chamber is flat or the intracocular pressure is low, always test the wound for leakage. Using a concentrated fluorescein strip or drop, place on the wound and evaluate for dilation of the stain by leaking aqueous humor.

Treatment:
If the cause of the wound leak is incarcerated vitreous or iris, the patient must have a wound revision in the operating room. A v streakectomy should be performed if vitreous is found. If there is no posterior capsular tear or vitreous presenting, but iris tissue is prolapsing, intracameral miotic can be given to pull the iris out of the wound. Gentle reposition of the iris can be performed. The wound should be re-sutured to prevent further leaking.

If the wound leak is not due to the above reasons, it may be sufficient to follow the patient medically for a few days. A bandaged contact lens can be placed and an aqueous humor suppressor can be given topically. Be sure to place the patient on topical antibiotics in the presence of any wound leak. If the wound leak does not resolve after several days, the wound should be re-sutured.

B. High Astigmatism/Suture Cutting

Risks:
The evolution of cataract surgery is towards smaller and smaller incisions. Therefore, cataract surgeons and those in training are suturing less often. When sutures are not placed in a proper manner, the result can be a asymmetric wound closure. Sutures placed with different tensions and different orientations can cause high astigmatism postoperatively. This is often true in cases where an ECCE was unplanned.

Diagnosis:
Intraoperatively, the induced corneal astigmatism can be measured using a handheld portable keratometer or photokeratoscope. If there is a large amount of astigmatism from a tight suture, the suture should be replaced.

Postoperatively, the vision will be poor with high uncorrected astigmatism. Keratometry measurements, manifest refraction, corneal topography are all useful in evaluating the amount and location of the astigmatism.

Treatment:
When and how to remove large incision sutures is controversial. The sooner the sutures are cut, the greater the effect of relaxing the steepness in that meridian. However, the timing must be balanced to ensure proper wound healing while considering the effectiveness of astigmatism control. Most physicians agree to wait at least 3-4 weeks before cutting sutures in a large ECCE incision. Some physicians will wait until after the topical steroid drops have been stopped before cutting sutures.

How many sutures to cut at one time is also controversial. Some physicians will only remove one suture at a time and have the patient return in 1-2 weeks to recheck the astigmatism. Others will cut many at the same time. If using the conjunctival closure. Each case should be considered individually and the stability of the wound should be considered when choosing the number of sutures to cut.

When cutting sutures, the goal is to minimize pulling any exposed suture through the eye during the removal procedure. Therefore, cut the suture closest to the corneal edge and pull the end out of the scleral cut in the corneal plane. The suture eye (lying on top of the sclera) is not pulled through the eye, only the interior portion is pulled out of the eye. Always use a drop of topical antibiotics before and after the suture removal. Some surgeons will continue the topical antibiotics up to one week after suture removal.

C. Medications

Preoperatively, if an ECCE is planned, anticoagulants including aspirin and NSAIDs should be discontinued if possible. Consult with the primary care physician and discuss possible discontinuation.

Patient who are undergoing a primary ECCE or conversion to an ECCE should have an injected (peribulbar or retrobulbar) anesthetic. Topical, intracanalicular, and subtenon's anesthesia does not provide sufficient anesthesia or akinesis for large incision surgery. If the injection is being given during a conversion with an open eye, place temporary sutures and inject a smaller volume than would normally be injected in a primary ECCE. Since direct pressure with a hand balloon cannot be used with an open eye, the surgeon should wait for the injected anesthetic to diffuse behind the eye before attempting to proceed.

Postoperatively, the topical medication regimen should also be altered. Since larger incisions take longer to heal and have more inflammation, the antibiotics and steroid duration is often longer. Although there are no set guidelines for postoperative medications, many surgeons will continue the topical antibiotics for several weeks. The steroids may also be used longer before tapering if there was significant iris manipulation or a posterior capsular tear. NSAIDs are also useful to decrease inflammation and risk of cystoid macular edema.