Surgical Management of Complex Anterior Segment Problems

or

Some things you might want to know when you are faced with situations during surgery that make you wish you were someplace else.

NMAO Annual Meeting
September 29, 2012  2-3pm

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1) GSH Ogawa has no financial interests in anything discussed in this presentation
   a) Information about brands and manufacturers is only for participants to understand the differences between products and from whom products can be obtained.

2) Purpose of this presentation
   a) To provide detailed information about some equipment, techniques and maneuvers to help in the surgical management of complex anterior segment cases

3) Peripheral iridectomy with a vitrector
   a) Advantages
      i) Controlled size and location
      ii) Can avoid the very peripheral iris, so can minimize the risk of the foot of an ACIOL dropping through the PI with subsequent UGH syndrome or corneal edema
      iii) Done in a pressurized system so bleeding can be controlled more easily
      iv) Minimal pulling / stretching / tearing of iris and ciliary body tissues
      v) Avoids mal-positioning of other devices that can happen with iris manipulation during traditional surgical PI’s – such as shifting the position of an ACIOL
      vi) Traditional surgical PI’s are now very difficult to make through modern, narrow, tunneled incisions
   b) Indications
      i) ACIOLs
      ii) Sulcus IOLs in eyes with
         (1) Small anterior segments / narrow angles
         (2) History of pigment dispersion
         (3) Thick, high powered sulcus IOLs
      iii) Sutured PCIOLs to prevent reverse pupillary block
      iv) Uveitis patients who are prone to posterior synechiae
      v) Other
   c) Set up
      i) Two ports
         (1) Infusion cannula through one port
         (2) Vitrector through the other – can be 20, 23 or 25 gage
ii) Settings
   (1) Slow cut rate
      (a) 60-100 cuts per min
      (b) The slowest the machine allows
   (2) Low vacuum
      (a) Peristaltic machine: 60 mmHg
      (b) Diaphragmatic/Venturi: 80-100 mmHg
   (3) Aspiration Flow Rate on peristaltic machine
      (a) ~18 cc/min
   (4) Mode
      (a) Aspiration to pull some iris into the port followed by cut - ‘I&A / Cut mode’
         on machines that have that option (this mode is the opposite of what should
         be used for vitrectomy where one starts the cutting, then begins aspirating)
   (5) Bottle height / IOP setting
      (a) Bottle about 50 CM
      (b) IOP about 20 for machines with IOP controlled infusion pressure

d) Technique
   i) Instill a miotic agent, if needed, before creating the PI
   ii) Go slowly and inspect the PI site frequently for optimal size
   iii) Thin irides cut more quickly than thick irides
   iv) Peristaltic machines with the above settings and a 20 gage hand piece often get a 1+
       mm PI with just 2-3 cuts
   v) Smaller gage vitrectors often need more cuts

4) Iris Suture – placement and tying
a) Indications
   i) Notable iris sphincter damage that can occur with IFIS or a short incision during
      cataract surgery
   ii) Traumatic iris sphincter damage co-existing with traumatic cataract
   iii) Iris damage from prior eye surgery or prior trauma
   iv) Posterior chamber IOL stabilization
   v) Other
b) Techniques and materials
   i) 10-0 polypropylene suture – preferably on a long curved trans chamber type needle
      (e.g. Ethicon 9091G which has a CTC-6L needle)
   ii) Often need a device to support the iris while passing the needle through it, such as a
       pair of coaxial forceps with finely serrated jaws, or an Ogawa Iris Reconstruction
       Hook (D&K 6-109)
   iii) Titanium tying forceps grip the tip of steel needles better than stainless steel forceps
        when the needle tip first comes out through the eye wall. Very fine forceps do not
        have enough ‘heft’ to hold the needle tip, so one that is not too fine is preferred.
        (e.g. D&K 2-523)
   iv) Need a straight ‘hook’ type of instrument to pull the sutures out through the
       paracentesis incision, such as a straight Ogawa mini dialer (Katalyst 2502S-6; Storz
Sutures tend to fall off of a Sinsky hook because there is no ‘hook’ aspect to the tip.

v) Suture tying should be finalized with the iris in the desired position rather than pulling the iris outside of the eye or into the incision. Internal knot finalization may be performed in a few ways

1) Creating the throws outside the eye with the knot moved inside the eye through a single incision with an instrument like the angled mini dialer (D&K 6-418), using the In Situ Tying technique – see included article

2) Creating the throws outside the eye with the knot moved inside the eye through a pair of correctly placed incisions, e.i. a Siepser knot

3) Using a pair of micro coaxial tying forceps through a pair of incisions to make the throws and tie the knot inside the eye

vi) If the lens diaphragm is not intact, then an anterior chamber infusion cannula is needed (e.g. Ogawa re-usable infusion cannula, D&K 8-616; or Lewicky disposable infusion cannula, Visitec 5061)

5) Congenital iris coloboma repair at, or after, the time of cataract surgery

a) The thing that makes congenital colobomas very different than other iris defects is that the colobomatous area has sphincter muscle along its edges that goes out to the periphery of the iris. When such a pupil is not dilated, the sphincter muscle, along the edges of the iris defect area, constricts and pulls the pupil downward.

b) If one leaves the iris in its native state after cataract surgery, then the patient gets glare from the IOL and has sub-optimal vision as peripheral capsule opacification develops. The pupil needs to be created and centered for an optimal result in these patients.

c) Combine the principles from iris PI creation with the vitrector and iris suturing techniques above for this repair

d) Technique

i) Use the vitrector in the above described PI settings to gently shave off the sphincter muscle area of the iris along the sides of the colobomatous part of the iris

ii) Approximate the appropriate pupil sphincter edges using iris suturing/tying techniques

iii) Further close the inferior radial defect in the iris, as needed, with the iris suturing/tying techniques

6) IOL exchange concepts and techniques

a) Remove vitreous that is attached to or around the IOL before removing the IOL to decrease chance of vitreous traction. A dispersive OVD, such as Viscoat, may be useful to create a layer between the IOL and remaining vitreous.

b) Can use a CTC-6L needle on 10-0 polypropylene (Ethicon 9091G) as a “Safety needle” to stabilize an IOL by passing it through the limbus, under a haptic, and part way out the limbus elsewhere, while removing the vitreous from around the IOL, or if the IOL stability seems very tenuous

c) Keep the eye pressurized for as much of the procedure as possible

i) OVD if the lens capsule is essentially intact
ii) Infusion cannula if the lens capsule is open

d) IOL removal
i) Free the IOL from capsular material before removing the IOL from the eye unless the plan is to remove the capsular material with the IOL
(1) ‘Visco dissect’ the lens capsule open as needed around the IOL and its haptics
(2) Capsular support hooks may be used to stabilize the capsule when needed

ii) The IOL comes out of the eye best if it is lifted toward the incision from the underside of the IOL
(1) Straight Ogawa mini dialer works well for this (Katalyst 2502S-6; Storz ET0571; D&K 6-418-1)
   (a) The mini dialer has a small enough diameter knob to be able to catch IOL haptics and/or optics through remaining lens capsule material
   (b) The mini dialer has a rounded knob so it maintains a hold on haptic or optic even if the orientation is not optimal
(2) Coaxial forceps with serrated jaws may be useful for grasping a haptic to remove an IOL
(3) Tying, or 0.12 forceps may be useful for IOL removal when the lens has already been mobilized into the anterior chamber
(4) Placing OVD between the IOL and the cornea can help protect the cornea during IOL removal

e) Placement of new IOL - Safety Suture on the IOL
i) Useful if placing a lens in the sulcus with a small rim of capsule, particularly if there is some question as to the integrity of the capsule in some locations
ii) Tie a 10-0 polypropylene suture onto one of the IOL haptics (with two wraps around the haptic) prior to placing the IOL into position
   (1) If the IOL is stable, then can use scissors to cut the suture near the haptic
   (2) If the IOL is not stable, and starts to drop posteriorly, then have the suture to hold the IOL in the front of the eye and aid in removal of the IOL

7) Vitrectomy

a) Intro
i) Some cataract surgeons address this by hoping that they just don’t encounter vitreous during any case
ii) Many ophthalmologists now finish residency with very little experience or training in performing anterior vitrectomy

b) Set up
i) Two ports
(1) Infusion cannula
   (a) Self-retaining
   (b) Designed for anterior chamber use
      (i) Need good flow. Since most anterior vitrectomy machines have gravity flow infusion, a cannula in the 20g size range is needed
      1. Ogawa reusable infusion cannula – titanium, the tip and the outside of the cannula is less than 20g in size with circumferential ridges on it that go out to 20g sizing (D&K 8-616)
2. Lewicky disposable infusion cannula – stainless steel, the tip and entire exterior of cannula is 20g size with circumferential grooves into the exterior of the cannula (Visitec 5061)

(2) Vitreector
   (a) Size
      (i) 20g is what is generally available on phaco machines
      (ii) Smaller gauge (23,25) is nice, but not necessary – they are generally on posterior segment machines with ‘packs’ that tend to be rather pricey
   (b) Some anterior seg vitrectors have a removable infusion sleeve (remove it and use a separate infusion cannula)
   (c) Some anterior seg machines have two types of vitrectors available
      (i) handpieces that have a permanently attached infusion sleeve
      (ii) handpieces that have no infusion sleeve – use these

ii) Settings
(1) Cut rate
   (a) Higher rate decreases traction on vitreous
      (i) For anterior segment machines generally run at highest rate since they tend to not be very fast
      1. Infinity – 800 cuts/min is the max
      2. Probably don’t need it set higher than ~1,600 cuts/min for ant seg work

(2) Mode
   (a) Cut, then aspiration to decrease traction on vitreous (if the machine has those options)
   (b) Continuous irrigation through the cannula once the eye is sealed

(3) In a peristaltic type system – like the Infinity
   (a) Bottle about 60-65 cm
   (b) Vacuum about 240
      (i) At this level generally get intermittent port occlusion ‘dinging’ sound from the machine when encounter notable amounts of vitreous. This sound acts as an audible indicator that the port is working on removing vitreous.
   (c) Aspiration flow rate about 22

(4) In a Venturi or Diaphragmatic pump that does not have a flow rate setting
   (a) Bottle about 60 cm (or if the machine has an IOP based infusion control put it at about 20)
   (b) Vacuum about 130-150 – smaller port sizes may need vacuum levels toward the higher end of the range

(5) If things are ‘jumping’ too much, then increase the cut rate, and/or decrease the aspiration flow rate in a peristaltic system or decrease the vacuum in a Venturi/Diaphragmatic system

(6) To remove thick, dispersive ophthalmic viscoelastic device (OVD), like Viscoat, before getting to the vitreous behind it, then you may need to increase the vacuum, also the smaller the port on the vitrector handpiece the greater the potential for the OVD to plug it and prevent flow into the port
(a) On a peristaltic machine (Infinity), a vacuum of about 320 mmHg will generally pull Viscoat through the port
(b) On a Venturi/Diphragmatic machine it may require the vacuum to be elevated to something more like 180
(c) Adjust as needed

c) Techniques
i) First get the eye sealed
ii) Use the vitrector to clean off vitreous that is already outside of the eye
   (1) Pinch off the infusion while doing this to avoid flushing more vitreous out through the incision
   (2) May need to do this prior to sealing the eye if there are notable amounts of vitreous out through an incision
iii) When inside the eye
   (1) Move the tip of the vitrector around slowly to minimize the potential for traction on vitreous
   (2) Pay close attention to what non-vitreous structures might go into the port and position the port appropriately to avoid damaging them
   (a) Iris
   (b) Anterior and/or posterior capsule
   (3) Generally keep the vitrector tip in view, or ‘mentally visualize’ where it is and which direction the port is oriented if you can’t actually see it for short periods of time – like when going behind the iris
   (4) When moving the vitrector tip posteriorly keep the microscope focused on the tip/port of the vitrector, that way if the tip is coming close to something else (like retina) you will see it since it too will be in focus
iv) Remove vitreous from the anterior chamber and from around anterior segment structures, like IOLs
v) Remove vitreous from the posterior segment
   (1) Don’t need to go into the posterior segment if you are dealing only with a single strand under a little tension that retracts back posteriorly once it is cut in the anterior chamber
   (2) Don’t be afraid of removing vitreous from much of the anterior half of the vitreous cavity, as long as you can keep the vitrectomy port in view
   (a) Thorough vitrectomy decreases the chance of traction on vitreous while placing or removing an IOL
   (b) Thorough vitrectomy also decreases the chance of having vitreous left in the AC and/or to an incision at the end of the case or in the post-op period
   (c) Quote: “I have seen many eyes destroyed by inadequate vitreous removal during complicated cataract surgery, but have rarely (maybe never) seen eyes destroyed from thorough, prudent vitreous removal in the same situation.” – GSHO 09-2012
(3) Turn the port in the direction of the vitreous that you want to remove
   (a) If that is posterior, then turn it posteriorly
   (b) If that is peripheral, than turn it peripherally
(c) Many people have been taught to always keep the port face anteriorly – this makes sense if you are right in front of the lens capsule and want to preserve it, but it does not make sense for thoroughly removing vitreous from the anterior half of the vitreous cavity.

(4) One often is able to remove other material (such as lens material) from the anterior portion of the posterior segment if a thorough vitrectomy is performed, even if not specifically trying to remove that material.

vi) Limbal Approach vs. Pars Plana Approach

(1) Vitreous ‘goes with the flow’. In a sealed system flow goes to the port of the vitrectomy hand piece regardless of whether the shaft of the hand piece enters the eye through the limbus or through the pars plana.

(2) The standard for pars plana incisions by vitreo retinal specialists has substantially moved smaller with the use of smaller diameter instruments (23g, 25g), but most anterior segment machines in use today do not have the option for the use of small gage vitrectors. So, pars plana incisions made by anterior segment surgeons will generally be 20g incisions with their intrinsic downsides.

(3) Surgeon comfort – the surgeon should be comfortable with the creation and management of any incision he/she creates. The majority of anterior segment surgeons have very little experience with pars plana incisions.

(4) Pars plana incisions are not risk free – risks include

(a) Wound and vitreous hemorrhage
(b) Retinal tears and dialysis
(c) Vitreous incarceration
(d) Retinal detachment
(e) Fibrous downgrowth

(5) Limbal incisions for vitrectomy do not offer the same level of access to the vitreous cavity as pars plana incisions, but must anterior segment surgeons do not use posterior segment viewing devices when they perform vitrectomy so they are not able to take full, and safe, advantage of the access from a pars plana incision.

vii) Posterior pole visualization when unsure of whether lens material has dropped to the back of the eye

(1) Indirect ophthalmoscope with a sterile lens or second pair of gloves

(2) Flat irrigating Landers’s contact lens

(a) A sterile way to get some intraoperative visualization of the posterior segment if it is tipped at an angle to avoid reflection from the microscope light

(b) Offers a higher magnification view of the posterior segment than the indirect ophthalmoscope

(c) Is small enough in diameter to be able to use while cannulas and instruments are in the eye through limbal incisions

(3) Other lenses designed for intraoperative viewing of the posterior segment

d) Vit Tips

i) Signs of vitreous into the anterior chamber and possibly to an incision

(1) Deformation of an intraoperatively created posterior capsule opening
Deformation of an intact anterior capsulorhexis

An odd looking grey colored strand waving in the anterior chamber from under the iris during cataract surgery can be vitreous prolapsing through a pre-existing zonular dialysis – particularly if the patient has a history of prior blunt trauma

Don’t assume it is cortex

Treat it as if it is vitreous until you prove it isn’t

A thin wisp of vitreous floating in the anterior chamber that is long enough to reach one of the incisions, will, in most cases, be in an incision by post-op day #1

Even incisions that appear very well sealed at the end of the case are prone to very small amounts of leakage in the first day after surgery from ocular manipulations such as blinking

Since thin strands of vitreous have very little mass (inertia) they move very quickly and easily with the flow of aqueous to places such as a minimally leaking incision

8) Bridle sutures (superior and inferior) with a lid speculum that can help lift the globe

a) Indications
   i) When things are difficult because of eye mobility or enophthalmic positioning of the globe – stabilizing the globe with bridle sutures can often help substantially
   ii) Sutured IOL cases
   iii) Iris reconstruction cases
   iv) Larger incision extra capsular / Intracapsular lens removal
   v) Other

b) Technique and Materials
   i) 4-0 silk suture
   ii) Tapered curved needle on the 4-0 silk minimizes the chance of globe perforation or cutting of vessels which can cause bulky accumulations of subconjunctival hemorrhage (e.g. Ethicon C-1 needles double armed on 4-0 silk, product #709)
   iii) Cutting or reverse cutting needles have a notably higher risk of globe perforation and subconjunctival hemorrhage
   iv) Forceps for grasping conjunctiva, tenons, and muscle tendon deeply enough to be able to place the bridle suture under muscle tendon fibers, or through episclera
      (1) The Moria Paufique forceps (model 3225) with 0.8 mm oblique teeth may be the best forceps for this purpose
   v) Lid speculum that allows draping of the bridle sutures around the speculum – such as the Ogawa lid speculum (Storz SP7-65532) to lift and stabilize the globe
   vi) Small hemostats to clamp onto the bridle sutures so that gravitational pull on the small hemostats can lift and stabilize the eye – more reliable and more precise globe positioning than clamping the sutures to the drapes
   vii) Cut the suture in half, grasp the superior conjunctiva / tenons / rectus muscle fibers with the forceps, place the needle under the tip of the forceps and be sure it is in stable tissue, and not too deep, before passing it the rest of the way through the tissue. Tie the ends of the suture to each other; drape them over the edge of the lid speculum. Go through the same process for the inferior rectus tendon. Attach the
small ‘mosquito’ size hemostats to the end of each tied suture. Apply traction as needed with either suture to manipulate the position of the globe.

9) **Capsular Tension Segment**  
   a) Useful when capsular hooks were needed to get the cataract out, yet there is not enough support for the IOL in the capsular bag when the capsule hooks are removed. Morcher’s Ahmed Capsular Tension Segments (6D) is a reasonable option, but it tends to flip out of the bag with manipulation, so it should be placed as the last device (after the IOL is in)  
   b) Morcher’s Ogawa modification of the Ahmed Capsular Tension Segment (6F) is more stable and easier to place in the eye – available in Europe, but not yet in the US  
   c) Needs to be sutured to the sclera with 9-0 polypropylene (not 10-0) because of the forces on it and because it goes outside the sclera eye where suture degradation happens more quickly