Anterior Vitrectomy Masterclass

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Posterior capsule tear with vitreous loss occurs in 1% to 2% of all cataract operations, causing additional morbidity if ineffectively managed. Thus, anterior vitrectomy techniques are an essential skill for all cataract surgeons. Posterior capsule tear is an unplanned occurrence; the surgeon may need to use unfamiliar instruments and surgical approaches in an already difficult situation. This paper highlights the techniques used to manage vitreous presentation, emphasizing a step-by-step approach.

It is best to familiarize yourself with available instrumentation, especially if operating in a new environment. Even in one’s regular operating theatre, it is advisable to ensure that the entire team—including the scrub team, who needs to know how to set up for the anterior vitrectomy—is trained to deal with this occurrence. The team should know (1) where the anterior vitrectomy kit is physically kept, (2) how it needs to be connected, and (3) what settings will be used. It is a useful exercise to ask your scrub nurse, “What would you do if I asked for [fill-in-the blank],” during a routine uncomplicated case. This gives the entire team a chance to rehearse, at least verbally, what needs to be done when the complication does occur. Many commercially available anterior vitrectomy probes take a full function approach (i.e., irrigation, aspiration, and cutting are combined into one instrument). This is mentioned here only to be dismissed. In this type of probe, the irrigation port is placed adjacent to the cutting port. When the tip is placed through a capsular tear into the anterior vitreous, the flow of fluid may further tear the capsule. More vitreous comes forward—due to local turbulent flow—and vitreous volume expansion from hydration occurs. It is clearly advantageous to use a separate infusion line, with the active instrument cutting and removing the vitreous. When a separate irrigation line is used, it is placed through a sideport incision with the flow directed toward the anterior chamber angle, reducing turbulence at the site of cutting. Modern machines such as the Alcon Infiniti and Bausch & Lomb Stellaris, have setup screens which show the irrigation separate from the ocutome (Vitrectomy and aspiration).

### Aims of anterior vitrectomy in complicated cataract surgery
- Remove all vitreous from the anterior chamber
- Ensure that no vitreous is incarcerated in the incision/s
- Securely place an intraocular lens

### Surgical principles for vitreous management in cataract surgery
- Maintain a closed chamber as far as possible
- Separate the infusion from the cutter
- Use a low bottle height
- Use a high cut rate
- Use low to moderate aspiration
- Identify any vitreous remaining with triamcinolone stain
- Preserve the capsule
- Use both hands!

Many techniques have been described, however, it is useful to employ a standardized approach, applicable to most situations.
BIMANUAL ANTERIOR VITRECTOMY

**Identify the problem.** The first step to managing a problem is the need to recognize it early. The classic signs of capsular tear are (1) sudden deepening of the anterior chamber and (2) pupil dilation, occurring due to abrupt equalization of hydrostatic pressure between the anterior and posterior segments. Nuclear material may also move posteriorly through the capsular tear. Early signs of trouble are noted when the nucleus moves less readily than expected, as the fluid currents no longer move smoothly in the enclosed bag, or vitreous blocks the phaco tip. Generally, if the surgeon suspects that a capsule tear has occurred, it probably has, and immediate steps must be taken to minimize further damage.

**Immediate actions.** Phacoemulsification and aspiration should be stopped immediately. The foot pedal should move to position one (ie, irrigation only), thus maintaining inflow to stabilize the anterior chamber. Continuing with ultrasound use or aspiration will draw in more vitreous. Avoid any manoeuvre that pulls on vitreous, which may cause retinal traction and retinal tear. The phaco probe is kept stable with one hand, the second instrument is removed, and viscoelsatic is injected through the sideport. As the anterior chamber is stabilized, the bottle height is lowered (20 cm to 40 cm). Irrigation is then eased off. The phaco probe may now be withdrawn, without collapsing the anterior chamber. You have now bought yourself thinking time!

**Assess the situation.** Most capsular tears occur during the last stages of nuclear emulsification. The capsular bag is more prone to collapse at this stage, because a majority of the nuclear material is gone, and the bag is no longer held open. At this stage, assess the remaining nuclear segments, the site, and the extent of the capsular tear and presenting vitreous.

**Management of remaining nuclear fragments.** If small nuclear fragments remain, move them away from the site of the tear with gentle injection of viscoelsatic and guide them out of the wound, which may be extended slightly, if needed. Any nuclear segments that are dislodging posteriorly through the capsular opening should never be chased with instruments behind the capsule. It is much safer to manage the anterior segment and leave any posteriorly dislocated nuclear fragments for a vitreo-retinal specialist to manage later. Although not essential, it is useful to inject a small amount of triamcinolone into the anterior chamber at this stage. The triamcinolone (Kenalog™) crystals adhere to any vitreous that has presented, thus greatly facilitating visualization.

The transparency of vitreous makes it difficult to visualise, making the surgeon dependant on indirect clues, such as a peaked pupil or a wick presenting through an incision to guide complete removal. Burke first reported the idea of using triamcinolone to identify the vitreous directly. Commercially available Kenalog (40mg / ml), is best diluted with BSS 1:1 before use in the anterior chamber. Controversy exists about the need to remove the preservative in the solution prior to use, but in practice this has not been an issue, and many surgeons are using the preparation straight from the bottle with suitable dilution, both to stain vitreous and for the treatment of some forms of macular oedema. This is a very important advance in the management of vitreous prolapse, and highly recommended.

![Figure 1. Persistence of vitreous 'staining'. Following IOL implantation and pupil constriction, some vitreous remains in the anterior chamber and is easily visualised due to the triamcinolone crystals, facilitating removal.](image)

*Note: Triamcinolone is not licensed for intraocular use, and its use in this setting is on an ‘off-label’ basis. We believe that the risks of using it during anterior vitrectomy are far fewer than the risks of NOT using it. Since December 2007 Alcon have made available Triesence (Triamcinolone 40mg/ml), this is preservative free and licensed for intraocular use.*

Anterior vitrectomy. A second sideport incision is created at the 9 o’clock position (i.e., for a superior main incision) or the 6 o’clock position (i.e., for a temporal incision). Do not use the cutter through the larger phaco incision, as it encourages fluid leakage, leading to intermittent anterior chamber shallowing. If the main incision seals securely, it may be left alone. An unstable wound (e.g., in a case involving prolonged ultrasound use and extensive manipulation), should be closed with a suture. The infusion line is placed through the first sideport with a low bottle height, and the fluid flow is directed toward the anterior chamber angle. The cutter is now inserted through the second sideport, establishing a stable closed system and allowing for a controlled environment. A high cut rate and low flow are advisable; the cutting rate should be set at 600 to 700 cuts/min (or up to 5000 cuts/min on newer machines), with a vacuum of 150 mm Hg to 200 mm Hg. (Figure 2). The high cut rate minimizes the risk of retinal traction while the vitreous is cut and removed. The cutter is placed through the tear, pointing toward the optic nerve, with the cutting port positioned behind the posterior capsule to minimize the risk of engaging the capsule during the vitrectomy. Most of the anterior vitreous is drawn backward and efficiently removed.

Figure 2. Bimanual anterior vitrectomy. Note the position of the infusion line (right sideport) with flow directed anteriorly and cutter placed through the capsular tear, with cutting port behind posterior capsule.

This is continued till the anterior segment is free of vitreous. Once accomplished, the cutter is moved forward into the capsular bag. The remaining lens matter is removed with the cutter, reducing the cut rate to 300 cuts/min and increasing vacuum to draw the firmer lens material into the cutting port and allowing it to engage sufficiently to permit cutting. The cortex is then engaged, using the vacuum-only setting of the cutter, and stripped off the capsule. The cortex is freed and drawn into the center, and the cutting action is activated to remove it. If vitreous strands remain, they will be highlighted by the triamcinolone, allowing easy identification and removal. The cutter is now withdrawn, and the anterior chamber is refilled with viscoelastic as the infusion is withdrawn. This maintains a stable anterior chamber. The stage is now set for IOL implantation.

IOL implantation. In most cases, there is adequate capsular support to implant an IOL into the ciliary sulcus. The overall diameter of the chosen IOL should be at least 13 mm. There are two optional manoeuvres to consider at this stage.

1. If the tear in the posterior capsule is small and central, it may be possible to grasp the torn flap of capsule with an Utrata or similar forceps and convert the opening into a posterior capsulorrhexis. If this is achieved, then in the-bag IOL
implantation is safe. If this is impossible, plan a sulcus implantation.

Figure 3. Posterior capsular tear grasped with forceps and being converted to a posterior capsulorrhexis.

(2) If the anterior capsulorrhexis is intact and central, place the IOL into the sulcus, and push the optic through the rhexis. The haptics remain in the sulcus, but the optic is positioned behind the anterior capsule captured by the capsulorrhexis (Figure 3), achieving a stable IOL position. If the anterior capsulorrhexis is split or zonular loss resulting in an eccentric rhexis is suspected, implant the lens into the sulcus. If the IOL is to be sited in the sulcus, adjust the IOL power for the changed lens position. A rule of thumb is to reduce the lens power by 0.50 D from that calculated for in-the-bag implantation.

Figure 4. Optic capture of IOL. IOL is placed with optic behind the rhexis and haptics in the sulcus. The edges of the anterior capsule are visible in front of the IOL, with the rhexis margin disappearing under the pupil at the 1 o’clock and 7 o’clock procedure, where it is peaked out by the haptics extending across it.

On the rare occasion of extensive capsule loss, an open loop anterior chamber lens or an iris claw lens should be used.

Finishing steps. Once the IOL has been placed, the viscoelsatic should be removed from the anterior chamber, no attempt being made to remove viscoelastic from behind the IOL. The pupil is then constricted with an agent such as Miochol (Novartis Pharmaceutical, Basel, Switzerland). This will help identify any persistent vitreous strands that extend to the wound, causing a peaked pupil. If Miochol is injected with a blunt cannula through a sideport, the cannula may be used to confirm the absence of vitreous extending to the wound by placing it into the anterior chamber, near the angle under the incision, and sweeping it centrally toward the pupil. After shutting down the pupil a final instillation of triamcinolone is helpful to identify any residual strands and remove them, especially if the pupil won’t shut down enough to peak! Finally, if wound integrity is in any doubt, put a suture in.

DRY ANTERIOR VITRECTOMY

An alternative approach is to use a dry technique, where vitreous is cut and removed without an infusion. This is especially useful for small amounts of vitreous presenting towards the end of a procedure (e.g., if a strand of vitreous presents through a small area of zonular loss toward the end of cortical cleanup or after IOL implantation). In this setting, it is efficient to refill the anterior chamber with a viscoelastic and cut and remove the strand of vitreous with the cutter (Figure 4). As minimal manoeuvring is required—and only a small volume removed—the anterior chamber will not collapse, and the surgical goal is rapidly achieved. A dispersive viscoelsatic will tamponade the vitreous, and is preferred in this setting. A useful tip when performing a dry anterior vitrectomy to prevent chamber collapse is to have a syringe of viscoelastic in the non-dominant hand through the sideport and use this to top up the viscoelastic fill as the vitrectomy proceeds.
Figure 5. Dry Anterior vitrectomy. (Left) Vitreous strand presents through zonule at 9 o’clock position toward the end of cortical clean-up. This is tamponaded by viscoelsatic and most of the cortex removed without disturbing this limited amount of presenting vitreous. (Right) After IOL implantation in the bag, the cutter is used to remove the vitreous strand in a viscoelsatic filled anterior chamber without infusion.

SINGLE PARS PLANA INCISION

A conceptually attractive alternative to bimanual anterior vitrectomy is to use infusion through the sideport and make a single pars plana incision 3.5 mm behind the limbus. The cutter is then placed into the vitreous cavity. This is done after reflecting the conjunctiva with a MVR blade for a 20-gauge cutter or transconjunctivally for a 25-gauge trocar cannula system for a high-speed 25-gauge cutter. This allows the flow to move in one direction—from anterior to posterior—making removal of vitreous more efficient. Many anterior segment surgeons may not be familiar or comfortable with pars plana incisions, and a bimanual anterior approach as detailed above will therefore be preferred.

Postoperative care. There are some important issues that must be managed in the postoperative period. Frequent topical steroids are useful postoperatively, as the increased manipulation involved often causes a higher level of inflammatory response than after uncomplicated surgery.

Intraocular pressure (IOP) may be elevated, both because of any remaining viscoelsatic and postoperative inflammation. This must be monitored and managed medically. The oft-employed technique of depressing the posterior lip of the sideport to release some aqueous when raised IOP is found after uncomplicated surgery should not be used after surgery complicated by capsular or vitreous loss.

If intraocular triamcinolone is used, some will invariably remain in the eye. The crystals may be seen as particles floating in the aqueous or unusually may collect in the anterior chamber, giving the false impression of a hypopyon. A clue to its benign nature is that the eye is not significantly inflamed. Also, under high magnification, the granular nature of the material is obvious. Triamcinolone may also raise the IOP, because of a steroid response, which should be treated medically. If a steroid response occurs, IOP-lowering medication should be continued for 4 months to 6 months after surgery, but the raised IOP usually normalizes afterward.

Finally, detailed fundus and full peripheral examinations must be obtained before the patient is discharged. This may be done a few days or even weeks after the surgery to allow time any postoperative inflammation to settle and the wound to be secure.
Effective management with good surgical technique and postoperative care will, in most cases, ensure excellent visual outcomes—even when vitreous loss occurs in cataract surgery.

VIDEO RESOURCES:

FURTHER READING: