Avoiding Phaco Complications

Strategies to avoid complications and manage them when they arise.

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Cataract surgery provides prompt visual recovery and improved quality-of-life outcomes. Rapid advances in microincisional phaco technology, innovations in IOLs and devices, and more effective means for infection control and surgical audit processes have maximized the results we can offer patients. We are now experiencing a trend toward refractive cataract surgery, fueled by the high success rates brought on by these technological improvements. As a result, there has been a dramatic jump in patient expectations.

Despite ongoing innovations, complications can occur during or after phacoemulsification surgery, even in the most experienced hands. The best possible visual outcomes for each case may be achieved by adopting a combination of preventive and interventional strategies to minimize complications and their long-term sequelae.

Complication prevention starts with a thorough preoperative assessment. The surgeon should not only diagnose the cataract as the cause of visual loss but also gain an understanding of the patient's psyche, including his fears, expectations, visual needs, and lifestyle requirements. This assessment should also identify systemic and ocular risk factors.

DISCUSSING REFRACTIVE GOALS

Aggressive industry marketing directed at the benefits of new IOL technologies including toric, multifocal, and accommodating IOLs has led to an increasing number of patients expecting complete spectacle freedom after cataract surgery. To moderate expectations, we must educate patients with respect to these technologies' limitations. Particularly, patients must be made aware of visual side effects such as glare, halos, and reduced contrast sensitivity function associated with multifocal IOLs.[1,2] Patients who have previously undergone refractive surgery should be forewarned of the potential for a refractive surprise due to the inherent inaccuracies of current IOL power calculation formulas in eyes with surgically modified corneas. Several IOL power calculation formulas for eyes with previous myopic or hyperopic refractive surgery are available on the American Society of Cataract and Refractive Surgery (ASCRS) Web site (http://iol.ascrs.org/).

RISK FACTORS FOR SURGERY

Patient risk factors. Understanding the patient's general state of health ensures holistic management. For example, knowledge of anticoagulant history and cardiovascular status (including hypertension) allows the surgeon to plan for the most appropriate method of anesthesia and predict possible problems such as risk of orbital or suprachoriodal hemorrhage. Difficulty in achieving a supine position during surgery may be encountered in patients with congestive cardiopulmonary problems, cervical spondylosis, kyphoscoliosis, and severe obesity; it may be necessary to adjust the ambulatory surgical bed or perform surgery with the patient's head angled forward.

Ocular risk factors. Assessing ocular risk involves evaluation of the cataract density as well as corneal health risk factors including low endothelial cell count, corneal scars, or history of previous immune-related keratitis; anterior chamber depth; extent of pupil dilation; zonular weakness; and preexisting retinal pathology. In relation to zonular weakness, the patient should be examined at the slit lamp and in supine position to determine the extent of posterior dislocation of the lens.

THE COMPROMISED CORNEA

History of recurrent herpetic stromal keratitis or keratouveitis. Keratitis may recur due to surgical stress. Phacoemulsification should not be performed until the cornea has been quiescent for several months. Although there is no consensus as to duration of therapy, consider the use of twice daily oral acyclovir 400 mg with postoperative gradually tapered topical steroids over 1 to 2 months, especially if there is a history of recurrent disease.

Corneal scarring. Scarring from previous infectious keratitis or interstitial keratitis can cause irregular corneal

haze, increasing light scatter and reducing contrast during surgery. Consider the use of trypan blue to stain the anterior capsule during capsulorrhexis formation.

Corneal epitheliopathy, tear film abnormalities, and chronic lid margin disease. Pretreatment with a combination of lid scrubs, preservative-free topical steroids, and antibiotics optimizes the ocular surface, promotes epithelial regeneration, and reduces the inflammatory effects of delayed tear clearance or tear stasis.

Postoperatively, topical steroids may be required for a longer duration in these eyes. If there is history of recurrent corneal erosion, especially with prolonged surgical time, the patient should wear a bandage contact lens for several days postoperatively to stabilize the corneal epithelium. Patients with irregular ocular surfaces are unsuitable for multifocal IOLs.

Low endothelial cell count. Before surgery, explain to the patient the clinical implications of a low endothelial cell count (less than 1,000 cells/mm^2). The most important points for the surgeon in these eyes are minimizing surgical time, performing phaco as far from the cornea as possible, and using minimum ultrasonic power.

The corneal endothelium may be protected with a dispersive ophthalmic viscosurgical device (OVD) in combination with a cohesive OVD using Arshinoff's soft-shell technique.[4] A meticulous check for Descemet's membrane tears or detachments, which tend to occur around paracentesis wounds and main phaco wounds, should be performed. OVD must be carefully aspirated at the conclusion of surgery to ensure no postoperative intraocular pressure (IOP) spike. Consider suturing the corneal wound to ensure watertightness instead of performing stromal hydration. Prolonged postoperative topical steroids may be required.

COMPLICATED CATARACTS

Complicated cataracts include white intumescent cataracts and dense brunescent cataracts, which may be associated with a small pupil, shallow anterior chamber, pseudoexfoliation syndrome, posterior polar plaque, zonular laxity, zonular dehiscence, or lens dislocation.

Explain to patients the risks of posterior capsular rupture (PCR), dropped nucleus, vitreous loss, and associated retinal complications. Due to increased surgical time and exposure to higher phaco power, the incidence of postoperative corneal edema and inflammation may be higher, which may translate to significant endothelial cell loss and subsequent corneal decompensation.

It is wise not to attempt surgery beyond one's training level and technical abilities. When necessary, refer to a more experienced colleague and learn by observing or assisting him during surgery.

Small pupils and shallow anterior chambers can also heighten the risk of complications. In these eyes, consider the following steps to avoid complications:

- Excessive hydrodissection may cause iris prolapse, especially if the pupil is small;
- Keep phaco instruments in the center of the chamber to reduce the risk of iris trauma;
- Dilate the pupil with synechiolysis, multiple sphincterotomies, manual pupil stretch, or pupil dilating devices;
- If the continuous curvilinear capsulorrhexis (CCC) is smaller than desired, do not over-hydrodissect. It may lead to hydrorupture of the posterior capsule;
- Perform direct phaco chop in the bag with lowered parameters;
- During irrigation and aspiration of cortex, be careful not to pull on the anterior capsule, especially during subincisional cortex removal. Alternatively, rotate the eye to obtain better access or use a bimanual I/A technique; and
- Consider implanting the IOL into the bag before removing residual cortex.

MANAGING COMPLICATIONS

Incision problems including short corneal tunnel, wound burn, and wound leak. A well-constructed clear corneal incision is a key factor in the prevention of endophthalmitis. Use a sharp keratome to create a relatively square wound; it may be prudent to close a poorly constructed wound and create a new incision at a fresh site. A short wound predisposes to iris prolapse; increased risk of postoperative wound leakage, leading to the optic slipping out of the bag and myopic surprise; and reactive inflammation and anterior chamber contamination due to reverse flow of tears. Detection of wound leakage may be facilitated by applying a dripping solution of povidone iodine 5%.[5] (Wound leakage is observed as a ribbon of clear fluid streaming from the incision site amid a pool of brown solution.) In the case of wound burn, it is advisable to suture the wound to prevent wound gape and epithelial irregularity, which may cause irritation (especially with temporal wounds).

Runaway CCC. When there is positive posterior pressure or high capsular bag pressure relative to pressure in the anterior chamber, the CCC tends to run out. This creates vector forces and encourages peripheral splits toward the equator. A common place where the CCC runs out is at the subincisional site, due to anterior chamber shallowing after OVD leakage. The CCC may be reinitiated after refilling the OVD; create a new tear at another site using Vannas scissors or a bent 27-gauge needle. If the pupil is small and the CCC edge has run behind the iris, use a Kuglen hook to push the iris away to expose the runaway flap edge. The flap edge may be folded over, flattened, and pulled radially inward, toward the center, with Utrata forceps to complete the rhexis.[6] For intumescent cataracts, after the initial capsule puncture, the bag

TABLE 1. HOW TO MANAGE VITREOUS WITH POSTERIOR CAPSULAR RUPTURE	
No vitreous	• OVD used to push vitreous face back and maintain anterior chamber space
Vitreous wick	• Sponge or scissors vitrectomy
Excessive vitreous	• Anterior vitrectomy with dissociated infusion (anterior chamber maintainer or bimanual vitrectomy) allows more refined titration of vitreous cutting and aspiration; anterior chamber depth may be maintained without excessive use of OVDs; start vitrectomy dry to remove small fragments in anterior chamber first, then fluid flow may be controlled using a drip regulator • Vitrector cut rate at least 450 cuts/min • Vacuum greater than 150 mm Hg, slowly increased until vitreous removal observed • 23- or 25-gauge pars plana vitrectomy

can be decompressed by aspirating the liquefied soft lens material, reducing tension on the anterior capsule and preventing radial extension of the capsulorrhexis.

Posterior capsular rupture (PCR). Successful management of PCR starts with early recognition. Signs of PCR include change in fluid dynamics, pupil dilation and constriction, sudden deepening of the anterior chamber, lens material blowing out of the bag, a bounce in the posterior capsule during phacoemulsification, inability to attract the fragment to the phaco tip due to aspiration of vitreous, linear lines on the posterior capsule with a clear red reflex, and the appearance of star folds during I/A followed by failure to aspirate.

Immediate management is directed toward preventing the fragment(s) from dropping into the vitreous, stabilizing fluid dynamics, and mobilizing the fragment(s) into safety. Plan an approach to manage the nucleus, cortex, and vitreous with safe placement of the IOL.

When PCR is recognized, stay calm. First, keep the phaco tip in the eye with infusion on. At this stage, injecting OVD through the sideport helps to push back the vitreous, support the fragment, and stabilize and maintain space in the anterior chamber. Second, check if vitreous is present above the pupillary plane and at the main wound by using a spatula from the sideport (approximately 90º away) to sweep over the iris at the wound and toward the pupil's edge. Look out for pupil movement while performing the sweeping action. Perform cutting with the Vannas scissors using a barber technique if a few strands are present. Third, if a small fragment is dropping but still visible behind the posterior capsule, perform scleral indentation with a cotton-tipped applicator to push the fragment forward toward the anterior chamber. Then, with a vectis, retrieve the fragment into the anterior chamber and remove it from the eye. One may also perform posterior assisted levitation[7,8] of the fragment if it is in the anterior vitreous. The nucleus can be maneuvered into the OVD-filled anterior chamber and supported on a Sheets glide, which acts as a pseudocapsule. This allows completion of phacoemulsification. A guide to managing vitreous is seen in Table 1.

At the Singapore National Eye Centre, cases of dropped nucleus requiring retrieval undergo a pars plana vitrectomy in the same sitting by the on-call vitreoretinal specialist. Undoubtedly, same-day surgical management facilitates faster visual recovery and saves the surgeon from awkward explanations.

Intraoperative zonular dehiscence. Signs of intraoperative zonular dehiscenceinclude uneven anterior chamber depth; appearance of star folds when initiating the CCC; pseudoelasticity of the anterior capsule, making tearing of the anterior capsule more difficult; visibility of the lens equator; tumbling fragments due to collapse of the equator of the bag; tilted nucleus; and decentered IOL.

The management approach depends on the extent of zonular dehiscence, the strength of the remaining zonules, and whether the disease process is static or progressive. Capsular tension rings (CTRs) promote circular expansion of the capsular bag and may be useful in progressive zonular disease (eg, pseudoexfoliation syndrome); however, CTRs cannot provide anterior-posterior support for a tilted or decentered IOL. In these instances, sutured CTRs or capsular tension segments (CTS) are indicated. CTSs are useful for more focal zonular weakness and may be used in the presence of anterior capsular tears.

Management of intraoperative zonular dehiscence may include the following: (1) administer intravenous mannitol to reduce vitreous pressure; (2) use iris hooks to provide anterior support for the capsular bag; (3) delay placement of a CTR as long as possible, such as until the bag equator presents; (4) employ a vertical chop technique using lowered fluidics parameters; (5) perform viscodissection of residual cortex in the capsular bag, injecting OVD under the

TAKE-HOME MESSAGE

- Preventing complications starts with thorough preoperative assessment.
- Identify patient and ocular risk factors, such as a compromised cornea, preoperatively.
- Patients with a white intumescent or dense brunescent cataract should be told of the risks associated with operating on a complicated cataract.

anterior capsule to displace the lens cortex without adding zonular stress; (6) insert the CTR external to the cortical material; and (7) use the I/A tip to tease cortex trapped by the CTR with side-to-side rather than radial movements.

IOL insertion techniques in the presence of a compromised posterior capsule. Techniques for IOL implantation depend on the extent of capsular and zonular support, integrity of the anterior rhexis rim, and size of the CCC.

For a small linear PCR not involving the lens equator, the goals are to ensure that the posterior chamber rent does not extend and that there is no vitreous loss. After filling the bag with the OVD, a one-piece IOL may be injected into bag. Alternatively, a small PCR may be fashioned into a stable posterior CCC, allowing safe in-the-bag IOL implantation.

If the PCR is large, IOL placement depends on the following scenarios:

• If the anterior rhexis rim is intact, use sulcus IOL placement or consider optic capture (ie, for a three-piece IOL, place the haptics in the sulcus and capture the optic edge behind the anterior capsular rim; for a one-piece IOL, place the haptics in the bag and capture the optic anteriorly above the anterior capsular rim). Optic capture is possible only when the CCC is central and the diameter is less than 6 mm. Do not place a one-piece IOL in the sulcus;

• If the anterior rhexis rim not intact, sulcus IOL placement can be performed; and

• In the case of a disrupted CCC and significant loss of capsular support, either an anterior chamber IOL or a posterior chamber IOL (iris- or scleral-fixated) can be used.

Biometry inaccuracies. If there is significant residual refractive error due to implanting an IOL with the wrong power, do not panic. Perform an IOL exchange, implant an additional (piggyback) IOL in the sulcus, or perform a bioptics excimer laser correction.[9] Techniques used for IOL exchange depend on the type of IOL and the length of time it has been in the eye. We generally attempt to remove the IOL without enlarging the initial clear corneal incision. The IOL may be refolded or cut and removed.

The essential steps in bisection or trisection of acrylic or silicone IOLs are as follows. First, OVD is injected under the anterior capsule to dissect and lyse adhesions around 360º, freeing the IOL from the capsular bag. Next, the IOL may be cut in half to create half moons for negotiation through wound, or, if the wound is less than 2 mm, it may be trisected[10] to facilitate removal. Always check the IOL pieces after removal and place them together like a jigsaw puzzle to ensure that there are no retained IOL pieces.

Postoperative management of PCR. PCR increases the risk of postoperative infection, inflammation, and retinal complications. The following steps are employed in our practice:

• Prophylactic oral antibiotics (eg, ciprofloxacin, moxifloxacin, gatifloxacin) are prescribed;

• Inflammation control is instituted using a combination of intensively applied strong topical steroids and topical NSAIDS;

• The patient is instructed to watch for signs and symptoms of endophthalmitis, which peak between postoperative days 3 and 5;

• IOL stability and intraocular pressure are checked; and

• A retinal examination is performed in the first week or the patient is referred for a retinal consult.

When a major complication has occurred, the ophthalmologist should explain the surgical mishap and assure the patient that corrective steps have been taken to maximize vision outcome. Our center's policy is to inform the patient of his eye condition so that in the event of further complications, such as retinal detachment, the patient has been forewarned and does not lose confidence in his primary care physician. This practice may also avert medicolegal action.

CONCLUSION

The goals of phacoemulsification are to safely and efficiently remove a cataract, inducing minimal damage to ocular structures for a prompt restoration of vision with a good refractive outcome. With careful preoperative assessment, appropriate patient counseling, continuous upgrading of medical knowledge and technical skills, and meticulous postoperative management, these goals can be achieved. ■

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