Managing Challenges of Phacoemulsification in Vitrectomized Eyes: A New Technique

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Abstract:
AIM: This study aimed to describe a novel approach to manage the challenges of phacoemulsification in vitrectomized eyes.

METHODS: Intraoperative titrated intravitreal injection of balanced salt solution (BSS) through pars plana was done using a 30G needle hooked to a 1 cc syringe to build up the vitreous pressure.

RESULTS: Five eyes of five patients who had previous vitrectomy were given intraoperative injection. This led to the prevention of lens–iris diaphragm retropulsion and routine completion of phacoemulsification. The preoperative visual acuity was < 6/60 in all patients. The postoperative visual acuity was 6/9 or better in all patients, except in one patient which was 6/60, which is explained by diabetic ischemic maculopathy. Neither injection-related intraoperative nor postoperative complications were noted.

CONCLUSION: Challenges of phacoemulsification in vitrectomized eyes can be prevented by a simple titrated intraoperative injection of BSS intravitreally through pars plana.

Keywords: Lens–iris diaphragm retropulsion syndrome, phacoemulsification, vitrectomized eyes

Introduction

The rate of intraoperative complications of phacoemulsification in vitrectomized eyes is more than 10%, which is ten times higher than that in nonvitrectomized eyes.[¹] Certain factors such as longer axial length, older age, male gender, deep anterior chamber (AC), and extensive original vitrectomy increase the likelihood of these complications.

Intraoperative challenges that can lead to complications in these vitrectomized eyes include extreme AC deepening and instability with severe pain, pupil size variations, posterior bowing of iris and zonulo-lenticular diaphragm (lens-iris diaphragm retropulsion syndrome [LIDRS]), and zonular stretch or damage. These can lead to zonular dialysis, posterior capsule rupture, and possible dislocation of lens matter into the vitreous cavity.

Certain maneuvers were suggested to prevent LIDRS and subsequent possible complications during phacoemulsification in vitrectomized and high myopic eyes; these include manual separation of the iris from the anterior capsule remnant,[²] use of iris hooks,[³] performing peripheral iridotomy,[⁴] use of an inflow-splitting technique with an additional AC maintainer,[⁵] and using modified phaco sleeves.[⁶]

We propose a new hypothesis to explain LIDRS during phacoemulsification in vitrectomized eyes, which is the presence of pressure and compressibility differences between the AC and vitreous cavity as the...
vitreous cushion is lost, removal of anterior vitreous face, and frank or microtrauma to zonules during previous pars plana vitrectomy (PPV) surgery, which can cause escape of some vitreous cavity fluid into AC during the procedure when AC pressure becomes low. Based on this hypothesis, a new technique to manage the problem is suggested. The aim is to build up the pressure in the vitreous cavity intraoperatively by a simple maneuver.

**Methods**

After getting approval of our institutional review board and a signed patient consent, this technique was used in five patients (three males and two females). The mean age of the patients was 55 years. All patients were with visually significant nuclear sclerosis cataract and had previous 23G PPV with no silicone oil tamponade used. No lens complications were reported during the previous vitrectomy surgery. Indications for previous PPV included two patients with diabetic vitreous hemorrhage (VH), two patients with macula-on rhegmatogenous retinal detachment, and one patient with acute posterior vitreous detachment with VH and a retinal break. Prior to the phacoemulsification surgery, the cataractous lens was stable with no signs of phacodonesis or sublaxation. Intraocular pressure was normal in all patients.

**Surgical technique**

Following routine anterior capsulorhexis, hydrodelineation, and hydrodissection, a phacoemulsification probe is introduced and low infusion is started. If the iris–lens–diaphragm starts bowing posteriorly [Figure 1], the phaco probe is kept inside the eye and simultaneously, using the other hand, balanced salt solution (BSS) is injected transconjunctivally through the pars plana 3.5 mm posterior to the limbus using a 3G short needle hooked to a 1 cc syringe. This is done while the phaco handpiece is in the AC with infusion on and off for simultaneous titration of pressure in both AC and vitreous cavity till pressures in the two compartments are equalized [Figure 2]. Usually, 0.1–0.3 cc is injected which takes less than a minute to do, and the injection can be repeated if needed.

**Results**

Intraoperatively, following the BSS pars plana injection, the AC depth is stable with no posterior bowing of the iris–lens diaphragm in all eyes. In one eye, the injection was repeated because the AC starts deepening during the course of phacoemulsification. The procedure went uneventful with no operative complications in all patients.

Postoperatively, no increased inflammation was seen, neither in the AC nor in the vitreous cavity. The intraocular pressure was normal. No retinal detachment or endophthalmitis was seen. There were no injection-related complications. The mean preoperative visual acuity was 20/200, and after a minimum of 6-month follow-up, the best-corrected visual acuity was 20/30 or better in all patients except in one patient which was 20/200, which is explained by diabetic ischemic maculopathy.

**Discussion**

We present a simple approach to prevent LIDRS during phacoemulsification in vitrectomized eyes, which can be used in high-myopic eyes as well. Intravitreal injection through pars plana using a small, sharp needle is a commonly used procedure by most ophthalmologists.
This is routinely used to inject anti-vascular endothelial growth factor (VEGF), steroids, and antibiotics under topical anesthesia. This is not a new procedure even to the phaco surgeons as they are used to give intravitreal injection of anti-VEGF at the end of phaco surgery in patients with treated or existing diabetic macular edema.

Those who suggested the inflow-splitting technique with the use of additional AC maintainer, based this on the theory that zonular laxity is the cause for LIDRS. The zonular fibers are lax because of zonular elongation as accommodation is at rest (not used) in high myopic eyes or in eyes where accommodation is not used for some time. In fact, zonular laxity cannot solely explain LIDRS as we have seen it in hyperopic eyes after vitrectomy, in addition to the fact that this approach is cumbersome.

Others have proposed that reverse pupillary block is the mechanism behind LIDRS. Different ways were used to break this block, such as manual separation of the iris from the capsule, or use of one or more iris hooks. Even some have suggested doing preoperative peripheral iridotomies in such cases. However, AC deepening happens instantaneously as AC is entered with the phaco probe with infusion on, making this explanation unlikely, rather the mere buildup of pressure in AC pushes the iris and the lens–zonular diaphragm backward to the unsupported vitreous as the gel was removed in cases of vitrectomized eyes or it is extremely degenerated as in the high myopic eyes.

When the manual separation of the iris is used, the second instrument (usually the chopper) will be busy manipulating the iris most of the time. In addition, irritating the iris with this and other maneuvers will increase postoperative inflammation. In our experience, iris manipulation maneuvers were not helpful except in mild cases, which can usually be handled by lowering the infusion bottle. Even if the iris is held away from the anterior capsule, the lens–zonular diaphragm will still bow posteriorly because of the lost vitreous cushion and the lower vitreous cavity pressure compared to the well-infused AC. Preoperative iridotomy is not recommended as its effect is doubtful, and it is difficult to preoperatively anticipate which patient might need it. In vitrectomized eyes, where the retrolental cortical vitreous is not thoroughly removed, LIDRS is minimal and can be easily managed by lowering the infusion bottle.

In fact, in eyes after complete vitrectomy with removal of the anterior vitreous face, some fluid from the vitreous cavity can leak into the AC when it is deflated by the corneal wounds. This is augmented by frank or microtrauma to the zonules during the previous vitrectomy surgery, which will lead to a lower vitreous pressure and more LIDRS and more patient discomfort.

In conclusion, our approach in preventing LIDRS in vitrectomized eyes is simple, effective, safe, rapid, and can be done while the patient is under topical anesthesia after instructing the patient of feeling a needle prick. Large patient numbers are needed to confirm these results.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

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