Intravitreal Phacoemulsification Through Corneal Incision for Management of Posteriorly Dislocated Lens Material After Complicated Cataract Surgery: A New Surgical Technique

Phacoemulsification is the most frequently performed ophthalmologic surgery, and very satisfactory outcomes are usually achieved. However, final outcome may be affected by surgical complications, being the posterior capsular rupture the most commonly reported. It occurs in 0.45% to 5.2% of cataract surgeries[1] and could be associated with lens material dislocation into the vitreous cavity in 0.3% to 1.5% of cases.[2–4]

Presence of lens fragments in the vitreous cavity, especially its nuclear portion, leads to corneal edema, uveitis, cystoid macular edema, and glaucoma.[2,3,5] Therefore, timely and proper removal of lens material from the vitreous cavity by a retina specialist is required to avoid these complications.[6,7]

Traditionally, retained lens material removal is achieved by performing three-port pars plana vitrectomy, followed by fragmentation and extraction of the material using a fragmatome.[2] The latter is a 20-gauge instrument; therefore, it requires either a port of such caliber or the expansion of one of the ports previously created, as in the case of a smaller gauge vitrectomy. In addition, it uses longitudinal ultrasound, which generates a repulsive effect on the lens fragments, which causes mechanical trauma to the retina and prolonged duration of surgery.[3–5]

The ideal technique for retained lens fragments would be one that is safe and efficient, regardless of lens hardness. In addition, it should maintain the benefits of small-gauge vitrectomy leading to little inflammation, and few complications. Therefore, in this study, we describe a new surgical technique for posteriorly dislocated lens material removal and its outcomes, which strongly suggest that our technique is closely approximating to an ideal one.

From the *Retina Department, School of Medicine, CES University, Medellín, Colombia; and †Ophthalmology Department, School of Medicine, CES University, Medellín, Colombia.

None of the authors has any financial/conflicting interests to disclose.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.retinajournal.com).

Reprint requests: Mauricio Arango, MD, Retina Department, School of Medicine, CES University, Medellín, Colombia, Cra 48 #19A-40, 050021. CLOFAN Clinic. Of 1520, Medellín, Colombia; e-mail: arangohurtado@gmail.com

Methods

Study Design and Patients

In this retrospective, descriptive study, records of all patients who underwent surgery for posteriorly dislocated lens material after cataract surgery between August 2012 and March 2017 were analyzed. One retina specialist (M.A.) in one institution performed all surgeries. Patients, who underwent intraocular lens (IOL) implant during the same procedure, or in a second intervention, were included in the analysis. Patients presenting posttraumatic or spontaneous dislocation of the lens to vitreous cavity were excluded from the study. Minimum required follow-up time was 3 months.

For each of the cases included in the study, the following variables were recorded: sex, age, preoperative best-corrected visual acuity (BCVA), postoperative BCVA, concurrent ophthalmic disease, intraoperative and postoperative complications, follow-up time, and need for additional surgeries.

Surgical Technique

All patients were intervened either immediately or up to three days after complicated cataract surgery. Local or general anesthesia was used based on patients' systemic conditions and preferences. A transconjunctival self-sealing three-port 25-gauge pars plana vitrectomy was performed, followed by careful examination of the retina and treatment of predisposing lesions if identified.

Once the cavity was free of vitreous, a small amount of perfluorocarbon liquids (Perfluorodecalina—HPF10—Alchimia) is applied to protect the macula and optic nerve during the procedure. Contrary to previously

described techniques, the purpose of using perfluorocarbon is not to raise the lens material to the level of the iris.

The endoilluminator is introduced through the upper left port, which is occasionally used as a second instrument. The other port is occluded, and the posterior infusion is kept open with a pressure of 15 mmHg during the entire procedure, it is only closed at the time the phaco handpiece is introduced to prevent herniation of the iris through the main incision.

After applying viscoelastic in the anterior chamber, the OZil—torsional phacoemulsification handpiece (Constellation), with its protective plastic sleeve—is introduced through the previously performed corneal incision. This instrument is advanced through the pupil and capsular remnants, being careful not to damage them. Once an intermediate position in the vitreous cavity is achieved, a noncontact viewing system (BIOM) is used to continue with the intravitreal procedure.

The "segment removal" option is selected on the equipment, and the lens fragments are easily captured and emulsified by the phacoemulsification handpiece in the middle of the vitreous cavity using a torsional amplitude between 60% and 100%—according to nucleus hardness, an aspiration rate of 35 cc/minute, and vacuum of 300 mmHg to 400 mmHg.

Once the emulsification is finalized, the handpiece is removed, followed by extraction of perfluorocarbon liquids, implantation of a 3-piece IOL in the ciliary sulcus, and close of the main incision with one 10-0 Nylon suture. If there is lack of capsular support, an iris-fixated IOL (Artisan—Ophtec) can be implanted during a second procedure.

Air–fluid exchanged is performed, and appropriate ocular tone, self-sealing sclerotomies, and corneal incisions are verified (see **Video, Supplemental Digital Content 1**, http://links.lww.com/IAE/A875).

Ethical Considerations

This study did not involve any risk because all data were collected from reviewing medical records.

Statistical Analysis

Data were analyzed using SPSS version 21 software. Central tendency (average) and dispersion (SD) measures are shown for quantitative variables. Categorical variables are presented as percentages. Bivariate analysis included chi-square test for categorical variables, and Mann–Whitney *U* test to compare averages. Statistical significance was established as $P < 0.05$.

Results

A total of 62 medical records corresponding to all patients who underwent surgery for posteriorly dislocated lens material removal between August 2012 and March 2017 were reviewed. Of those, a total of 27 cases met the inclusion criteria and were included in the analysis.

Average age was 73.22 years, and 55.6% (15/27) were men. Preoperative BCVA was on average 2.68 logarithm of the minimum angle of resolution (SD ± 0.71) (Snellen equivalent: 20/9573 = counting fingers − hand motion). The above-described surgical technique was performed in all patients included in the study, and during the same procedure, a 3-piece IOL implantation at sulcus was achieved in 74.1% (20/27) of patients, and iris-fixated IOL (Artisan—Ophtec) was implanted during a second procedure for the remaining 25.9% (7/27) of patients.

A concurrent ophthalmic disease, which could affect the final visual outcome, was identified in 29.6% (8/27) of patients, being advanced glaucoma, the one more frequently diagnosed. Although no intraoperative complications were documented for any of the patients, postoperative complications were observed in two patients (7.4%) who developed epiretinal membranes, and only 1 (3.7%) required surgical intervention.

Average postoperative BCVA was 0.29 logarithm of the minimum angle of resolution (SD ± 0.25) (Snellen equivalent: 20/39), a statistically significant improvement compared with preoperative BCVA ($P < 0.001$). In addition, we analyzed the effect of concurrent ophthalmic disease on postoperative BCVA and found a statistically significant ($P < 0.001$) difference in average BCVA because patients with concurrent ophthalmic disease exhibited an average BCVA of 0.57 logarithm of the minimum angle of resolution (SD ± 0.21) (Snellen equivalent: 20/74), whereas those without concurrent ophthalmic disease presented an average BCVA of 0.17 logarithm of the minimum angle of resolution (SD ± 0.15) (Snellen equivalent: 20/30). No statistically significant difference was found in postoperative BCVA when the two type of implanted IOL (3-piece sulcus implantation. vs. iris-fixated) were compared ($P = 0.153$). Average follow-up time was 12.2 months (SD ± 8.6).

Discussion

Intravitreal phacoemulsification through a corneal incision for the removal of retained lens material after complicated cataract surgery is a technique that has

multiple advantages over traditional surgical approaches described throughout the literature.

The conventional technique consists on a 3-port pars plana vitrectomy with an expansion of one of the ports to 20-gauge to insert the fragmatome.[2] The technique described in this study preserves the benefits of small-gauge vitrectomy because it does not require expansion of any of the sclerotomies, thus leading to less inflammation, fewer complications, and self-sealing sclerotomies.

We used the phaco handpiece that has a torsional emulsification mechanism instead of a longitudinal one, which provides better effectiveness, reduces repulsive effects on nucleus fragments, reduces possibility of mechanical trauma to the retina, and finally, it substantially reduces surgery duration.

Previous studies have reported the removal of retained lens material using only a small-gauge vitrector without requiring the use of a fragmatome, thus maintaining the benefits of small-gauge vitrectomy. However, they reported difficulties when fragments were large, multiple, or hard.[8–13]

In 2013, Millar et al[14] and Jang et al[15] described the use of perfluorocarbon liquids as a mechanism to raise the retained material up to the level of the iris followed by phacoemulsification with a phaco handpiece at this level. Such technique achieves adequate protection of the posterior pole, maintains the benefits of small-gauge vitrectomy, and allows lens material phacoemulsification with a decreased incidence of fragment repulsion. However, it requires the use of large amounts of perfluorocarbon, which, in addition to increasing the cost of surgery, it involves investing surgical time in its complete removal to avoid complications. In our technique, we used perfluorocarbon in small amounts and only as a posterior pole protective mechanism.

Other authors have described the use of phaco handpiece without the protective plastic sleeve through the sclera to deliver ultrasound to the vitreous cavity.[3–5] This technique aims to avoid issues related to the use of the fragmatome but has the disadvantage of being very destructive to the sclera, requiring sutures, presenting increased risk of infection, and possibly increased inflammation. Unlike this technique, our approach maintains the benefits of intravitreal lens emulsification performed with a phaco handpiece, and however, it does not sacrifice the benefits of small-gauge vitrectomy, as the handpiece is introduced into the vitreous cavity through the corneal incision.

Recently, Tzamalis et al[16] described a technique in which, similar to our technique, a corneal access is used to insert the instrument, but in this case, the fragmatome instead of the phaco handpiece. This allowed them to maintain the benefits of small-gauge vitrectomy; however, use of the fragmatome leads to fragment repulsion and prolonged duration of surgery. In addition, introducing heat-generating equipment through the cornea, without the protective plastic sleeve, is concerning since may produce burns or damage to the tissue at the incision site. Taking that into account, in our technique, the main corneal incision is used as access for the phaco handpiece with its protective plastic sleeve, which allows for intravitreal torsional ultrasound, increases effectiveness, reduces surgical time, uses previous incisions, and avoids corneal burns.

To our knowledge, this technique has not been previously described in the literature, and we are therefore unable to compare our observations to previous results. However, because of the described results, we propose this technique as an ideal choice for the management of retained lens material because it provides the same benefits of small-gauge vitrectomy, and by intravitreal torsional ultrasound reduces fragment repulsion and surgery duration.

A drawback of our technique is that there might be some difficulty in accommodating the indirect viewing system, so that it does not collide with the phaco handpiece when it is vertically inserted through the corneal incision, but this is something that can overcome because it can be easily learned. Finally, there are no additional considerations that need to be taken into account because this is a quick technique thus reducing surgery duration and leading to less inflammation and fast visual recovery.

Key words: cataract surgery, dislocated lens material, retained lens, vitrectomy.

*MAURICIO ARANGO, MD**
ANDREA CÓRDOBA, MD†
ANDRÉS ARANGO, MD†

References

1. Hong AR, Sheybani A, Huang AJ. Intraoperative management of posterior capsular rupture. Curr Opin Ophthalmol 2015;26: 16–21.
2. Rofagha S, Bhisitkul RB. Management of retained lens fragments in complicated cataract surgery. Curr Opin Ophthalmol 2011;22:137–140.
3. Garg SJ, Lane RG. Pars plana torsional phacoemulsification for removal of retained lens material during pars plana vitrectomy. Retina 2011;31:804–805.
4. Chiang A, Garg SJ, Alshareef RA, et al. Removal of posterior segment retained lens material using the OZil phacoemulsification handpiece versus fragmatome during pars plana vitrectomy. Retina 2012;32:2119–2126.
5. Kumar V, Takkar B. Intravitreal phacoemulsification using torsional handpiece for retained lens fragments. Retina 2011; 31:804–805.

6. Ho SF, Zaman A. Clinical features and outcomes of pars plana vitrectomy in patients with retained lens fragments after phacoemulsification. J Cataract Refract Surg 2007;33:2106–2110.
7. Ho LY, Doft BH, Wang L, Bunker CH. Clinical predictors and outcomes of pars plana vitrectomy for retained lens material after cataract extraction. Am J Ophthalmol 2009;147:587–594.
8. Horozoglu F, Yanvali A, Mancin A, et al. 23-gauge transconjunctival sutureless vitrectomy for retined lens fragments after complicated cataract surgery. Retina 2012;32:493–498.
9. Barthelmes D, Alexander S, Mitchell P, Chandra J. Hybrid 20/23-gauge pars plana vitrectomy for retained lens fragments after cataract surgery. Retina 2012;32:1749–1755.
10. Cho M, Chan RP. 23-gauge pars plana vitrectomy for management of posteriorly dislocated crystalline lens. Clin Ophthalmol 2011;5:1737–1743.
11. Baker PS, Spirn MJ, Chiang A, et al. 23-gauge transconjuctival pars plana vitrectomy for removal of retained lens fragments. Am J Ophthalmol 2011;152:624–627.
12. Ho LY, Walsh MK, Hassan TS. 25-gauge pars plana vitrectomy for retained lens fragments. Retina 2010;30:843–849.
13. Scupola A, Abed E, Sammarco MG, et al. 25-gauge pars plana vitrectomy for retained lens fragments in complicated cataract surgery. Ophthalmologica 2015;234:101–108.
14. Millar ER, Steel DH. Small-gauge transconjunctival vitrectomy with phacoemulsification in the pupillary plane of dense retained lens matter on perfluorocarbon liquids after complicated cataract surgery. Graefes Arch Clin Exp Ophthalmol 2013;251:1757–1762.
15. Jang HD, Lee SJ, Park JM. Phacoemulsification with perfluorocarbon liquid using a 23-gauge transconjunctival sutureless vitrectomy for the management of dislocated crystalline lenses. Graefes Arch Clin Exp Ophthalmol 2013;251:1267–1272.
16. Tzamalis A, Symeonidis C, Brazitikou IP, et al. Sutureless clear corneal ultrasonic fragmentation for retained lens fragments: a pilot study. Retina 2017;37:494–499.