Acta Scientific Ophthalmology

Volume 2 Issue 5 June 2019

Research Article

Phacoemulsification for Cataract in Vitrectomized Silicone Oil Filled Eyes. Pearls for How to Manage

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Received: April 23, 2019; **Published:** May 22, 2019

Abstract

Aim of the work: To highlight the best techniques in the management of cataract in silicone oil filled eyes and how to manage the challenges and complications encountered in these difficult cases.

Methods: This retrospective non comparative consecutive case series analyzed the medical records of 166 eyes of 166 patients filled with silicone oil and treated with phacoemulsification and IOL implantation without concomitant silicone oil removal.

Results: In this case series many intraoperative challenges were faced including emulsified oil particles at the back of the cornea in 42 cases (25,3%), narrow non dilating pupil with or without posterior synechea in 30 cases (18%), Silicone bubbles migrating to the anterior chamber inspite of an intact posterior capsule in 25 cases(15%), shallowing of the anterior chamber and anterior bowing of the posterior capsule in 130 cases (78,3%) which caused relative difficulty in performing anterior capsulorhexis and IOL implantation, dense posterior capsular plaques in 102 cases (61,4%) Posterior capsular rupture developed in 6 cases (3,6%). Postoperatively, in cases that had an original pathology of advanced proliferative diabetic retinopathy with tractional retinal detachment and marked ischemia (90 cases), 10 of them (11,1%) developed post phacoemulsification and IOL rubeosis iridis. Increased IOP in the immediate postoperative period and for 1-2 days occurred in 140 eyes (84.3%).

Conclusion: Phacoemulsification in silicone oil filled eyes poses several challenges not usually met with in non silicone oil filled eyes. A knowledge of how to face those challenges is mandatory before going into those difficult cases.

Keywords: Phacoemulsification; Silicone Oil; Vitrectomized Eyes

Introduction

The development of cataract is the most frequent complication associated with parsplana vitrectomy. While the formation of lens opacities frequently occurs postoperatively, especially following long-term tamponade, it may also occur intraoperatively [1].

The precise causes of intraoperative cataract formation or progression during vitrectomy are unknown. But several risk factors have been identified and comprise extensive surgical manipulation, high fluid flow during the procedure, and repetitive fluid-air/gas exchanges [2].

One of the most important risk factors for intraoperative (and postoperative) lens opacification is age. If lens opacification occurs during vitrectomy, it is most likely that a pre-existing cataract has deteriorated intraoperatively. Elder lenses are obviously more prone to cataract progression [3-6].

A lens touch during pars plana vitrectomy is a serious complication. It nearly always results in rapid cataract formation and bears the potential of capsular damage during phacoemulsification. A circumscribed mild lenticular touch most likely will result later in sectorial or generalized lens opacity; however, it will not interfere with the intraoperative course during vitrectomy [6].

Postoperative

Postoperative development of cataract in silicone oil filled eyes is mainly malnutritional due to inhibition of lens metabolism (anaerobic glycolysis). Histologically, proliferation and metaplasia of the lens epithelium was observed [7].

Phacoemulsification for cataract in silicone oil filled eyes was not precisely described in the literature before except may be in very few articles according to our knowledge.

Methods

This retrospective non comparative consecutive case series analyzed the medical records of 166 eyes of 166 patients filled with silicone oil and treated with phacoemulsification and IOL implantation without concomitant silicone oil removal in the period from

January 2016 –March 2019 done all by myself in Dhahran Eye Specialist Hospital, KSA.

Those eyes represented 69.1% of the 240 phakic eyes who performed pars plana vitrectomy in this period.

Vitrectomized silicone oil filled eyes account for some of the most challenging cataract surgery cases. They present higher risks for complications due to residual effects of previous surgery, inflammation, and associated comorbidities; have an increased likelihood for denser cataract; and lack the physical support of the vitreous gel. In addition silicone oil because of its floatation force pushes the posterior capsule anteriorly thus continuously shallowing the anterior chamber and posing a higher risk for posterior capsular rupture and more difficult capsulurhexis and IOL implantation. Several pre-, intra-, and postoperative considerations can help surgeons achieve successful outcomes in these difficult cases.

A detailed patient history including the nature of the vitreoretinal pathology and extent of previous surgery are mandatory to alert the surgeon to potential dangers or complications that can occur during phacoemulsification. Because all those patients where operated by myself with previous pars plana vitrectomy and silicone oil injection, I had a full knowledge of their posterior segment pathology and the stability of their retinal states. Generally, all cases had a flat retina under silicone oil and secured properly with an appropriate laser treatment each case as needed.

A detailed description of the phaco technique I employed to avoid expected intraoperative complications with the results of our technique will be mentioned in detail in the following section.

Results

A detailed description of the phaco technique I employed to avoid expected intraoperative complications with the results of our technique is as follows.

Surgical technique

Clear corneal wounds: Because increased episcleral scarring and bleeding are common in these patients, it is wisest to perform phacoemulsification through a clear corneal incision rather than a scleral tunnel.

Always keep a positive pressure in the anterior chamber to avoid silicone oil migration anteriorly from weak zonular areas: this is usually done by keeping the anterior chamber always filled with viscoelastic (as will be mentioned in detail in the following steps) or by using a high infusion rate, all to antagonize the forward pressure on the posterior capsule exerted by silicone oil.

Manage obstacles hindering proper visualization

- **Emulsified silicone oil at the back of the cornea**: (Figure 1) This is managed by injecting viscoelastic into the anterior chamber directing the emulsified oil out of one of the corneal wounds.

- **Migration of big silicone globules to the anterior chamber:** This could be avoided by rendering the globe hypotonus following local anaesthesia by globe compression before beginning surgery and by continuously reforming the anterior chamber with viscoelastic during all steps of surgery. If inspite of these precautions if silicone oil still migrated to the anterior chamber, it can be removed readily by the phaco suction. If a large amount of silicone oil was lost, which is very rare and never occurred in this series, silicone oil must be added at the end of the procedure if the surgeon feels the retinal state is not safe with silicone oil under fill. Addition of silicone oil in this case is better done through an infusion cannula inserted in the pars plana and proper fluid silicone oil – fluid exchange to secure the retinal state.

- **Extensive posterior synechae:** We faced this situation in10 eyes (6%). This is best managed by injecting viscoelastic in the anterior chamber followed by breaking the posterior synechae with an instrument that can engage the edge of the pupil bluntly without injuring the anterior lens capsule. In our series we used a Y-shaped IOL dialer for this purpose (Figure 2).

- **Non dilating pupil:** We faced this problem in 30 eyes (18%), 10 of them were because of posterior synechae and the remaining 20 cases were old aged persons and mostly diabetics. Our strategy in facing this situation is to break first the posterior synechae if present then to inject 50% diluted intracameral adrenaline, if this fails a mechanical pupillary stretch technique is used with injection of additional viscoelastic in the anterior chamber. This technique succeed in 26 out of the 30 cases to achieve an at least acceptable pupillary dilatation to perform surgery. In the remaining 4 cases we used iris hooks (Figure 3). With the iris hooks 2 patients had an asymmetric pupil shape post operatively. Trial to dilate the pupil mechanically was faced with the occurrence of minimal iris bleeding in 4 cases, all were diabetics probably with minimal unrecognized neovascularization of the iris pre operatively (Figure 2). In those cases an intracameral anti VEGF injection was done at the end of the surgery.

Figure 1: Emulsified silicone oil at the back of the cornea.
This is managed by injecting viscoelastic into the anterior chamber directing the emulsified oil out of one of the corneal wounds.

Figure 2: Extensive posterior synechae.
Breaking the posterior synechae using a Y-shaped IOL dialer for this purpose.

Figure 3: Iris hooks.

Shallowing of the anterior chamber and anterior bowing of the posterior capsule: This occurs because silicone oil is lighter than intraocular fluids floating anteriorly towards the anterior chamber when the patient is in the supine position during surgery. The floatation force of silicone oil continuously pushes the lens iris diaphragm anteriorly shallowing the anterior chamber an posing difficulty for all steps of the surgery that was managed in our series as follows:

- **During capsulorehexis:** We usually inject vision blue for staining the anterior capsule. The dye is then displaced from the anterior chamber by injecting a viscoelastic beginning injection at 6 O`clock and gradually filling the anterior chamber completely till 12 O`clock. By this technique you do not give a chance for a period of hypotony in the anterior chamber in which silicone oil can migrate anteriorly. In our series, capsulorehexis was begun with a cystotome and completed with a micro capsulorehexis forceps (Figure 4). Any technique can be done but the most important item is to inject enough viscoelastic in the anterior chamber to flatten the anterior lens surface which is usually more than usually anteriorly convex to prevent extension of the capsular flap peripherally. A 5 - 5.5 mm rehexis is usually satisfactory to cover a 6 mm IOL in the bag.

- **Do a good hydrodeleniation:** (Figure 5) This facilitates dislodging of the nucleus from the posterior cortex and nuclear fragment emulsification in the pupillary plane away from the posterior capsule.

- **Do a good hydrodissection**: This will facilitate removal of posterior cortical matter from the posterior capsule without the need to manipulate the posterior capsule much

- **During the irrigation aspiration of cortical matter:** The best technique I invented is to go under the anterior capsular flap with the irrigation tip directing one stream towards the posterior capsule pushing it back and the other dislodging the cortical matter towards the pupillary area where the aspiration tip aspirates them safely (Figure 6). Another less safe technique is what we usually do in non silicone oil filled eyes where we enter by the aspiration tip under the anterior capsular flap and by a sweeping movement dislodge the cortical matter towards the pupil for aspiration. It is usually advised to use a high bottle height to keep a relatively deep anterior chamber facing the posterior forward force created by silicone oil.

- **During IOL insertion**: Inject viscoelastic in the anterior chamber first till the anterior chamber becomes moderately deep and the posterior capsule becomes stretched. There is no need to inject any viscoelastic inside the bag at this point. While injecting the IOL keep some viscoelastic in the injector in front of the IOL to open the capsular bag and push the posterior capsule posteriorly. Try to let the IOL enter totally in the capsular bag with the injector (Figure 7) to avoid further rotational manipulations but if you fail try entering the upper haptic into the bag with the least manipulation to avoid silicone oil anterior migration. In our series we did not wash the viscoelastic at the end of the surgery to ensure stability of the IOL in place and prevent forward silicone oil migration into

the anterior chamber. Postoperative oral acetazolamide and topical anti glaucoma drops were used for 5 days to avoid high IOP spikes.

Figure 4: In our series, capsulorehexis was begun with a cystotome and completed with a micro capsulorehexis forceps.

Figure 5: Hydrodeleniation

Figure 6: Irrigation aspiration of cortical matter:

Dense posterior capsular plaques

Those cases were frequently encountered in our series (102 eyes, 61.4%) and were managed by leaving the plaque intraoperatively untouched, inserting the IOL in the bag (Figure 8), and later doing a YAG posterior capsulotomy. Silicone oil did not prolapse into the anterior chamber in any case of our series after the YAG posterior capsulotomy.

Figure 7: IOL implantation

Figure 8: IOL insertion over dense capsular plaque in 2 cases.

IOL calculation and material

In all our cases we used the IOL master to calculate the power of the IOL. The IOL implanted was chosen to give the patient a refractive power of -1.0 to -1.5 after silicone oil removal. Till the time silicone oil was removed, we did not have a refractive anisometropia between the 2 eyes because we used a plano convex lens with the plane surface in the direction of the silicone oil. In this series we used acrylic foldable hydrophobic IOL with excellent stability and functional results.

Postoperative complications

1. **Intraocular pressure rise:** This occurred in 140 eyes (84.3%) in the immediate post operative period because of the visco elastic remnants we usually leave in the anterior chamber at the end of the surgery to avoid silicone oil anterior migration. This was routinely treated by postoperative acetazolamide orally and topical anti glaucoma drops. IOP usually returned to normal within 1-2 days.

2. **Rubeosis iridis:** This occurred in 10 out of 90 eyes (11.1%) who had an original pathology of proliferative diabetic retinopathy with tractional retinal detachment and marked ischemia. These cases were treated by the injection of intra-

cameral anti VEGF together with augmentation of pan retinal photocoagulation and topical anti glaucoma drugs. In 5 patients a cyclo photocoagulation was needed to lower the IOP to an acceptable level.

Discussion

The development of cataract is the most frequent complication associated with parsplana vitrectomy.1 Rates varying from 12.5% to 80.0% reported in the literature [8-14]. In our series we had an incidence of 69.1% which is in the upper range of the literature incidence may be because we usually perform surgeries for late complicated cases that require silicone oil too remain in the eye for a longer duration.

In our series we performed phaco incisions through clear corneal wounds to avoid the increased episcleral scarring and bleeding which are common in these patients. Chakrabarti [15], also agrees with approach and adds that a clear corneal incision is preferred to a scleral tunnel, unless the patient opts for a rigid IOL or if the surgeon is worried that he or she will have to convert to a large-incision, nonphaco technique, also creating the tunnel becomes even more challenging if the patient has previously undergone a scleral buckling procedure, as scarring around the bridled extraocular muscle can make exposure difficult or insufficient.

In our series we had 30 eyes (18%) with very narrow pupil not responding to mydriatics. This was also described by other authors [15,16]. Management of this situation by those authors is to a great extent similar to our management including posterior synechiolysis, viscomydriasis, pupillary membrane dissection, stretch pupilloplasty, and iris hooks and Malyugin Ring (MicroSurgical Technology, Inc.).

Posterior capsular plaques were found in 61.4% of our cases. We always did not attempt to remove these plaques but instead we implanted the IOL in the bag and then post operatively we performed a YAG posterior capsulotomy. Many authors [17-20] agree that removal of those plaques is unsafe and usually difficult, however others 15 The presence of silicone oil in the vitreous can appear to increase axial length and alter the eye's optics. Before the surgeon can calculate the correct IOL power, he or she must convert the apparent axial length to a true measurement. The viscosity of silicone oils vary from 1,000 to 5,000 centistoke (cSt) and, in general, the higher the viscosity, the higher the change in refraction and axial length.14,15 According to Sharma., *et al*,16 correcting the axial length induced by silicone oil with a viscosity of 1,300 cSt can be accomplished by multiplying the measured axial length by a conversion factor of 0.71. The formula to correct axial length in any eye with silicone oil.

In our series we used acrylic hydrophobic IOLs. Many authors agree about this choice [15,21-23], as they mentioned that presently acrylic or polymethyl methacrylate (PMMA) IOLs are preferred over silicone IOLs. Several reports describe silicone oil adherence to silicone IOLs after silicone oil removal (silicone-fluid exchange). Adherent silicone oil, besides hindering the surgeon's view of the retina, may also interfere with the patient's visual acuity. Removal of adherent oil droplets is difficult and radical methods like intraocular lens exchange may be required [22,23].

We routinely used the IOL master to calculate the power of the IOl and we chose a power which will make the patient slightly myopic of 1.0-1.5D after silicone oil removal. The presence of silicone oil in the vitreous can appear to increase axial length and alter the eye's optics. Before the surgeon can calculate the correct IOL power, he or she must convert the apparent axial length to a true measurement. The viscosity of silicone oils vary from 1,000 to 5,000 centistoke (cSt) and, in general, the higher the viscosity, the higher the change in refraction and axial length [24,25]. According to Sharma., *et al.* [26] correcting the axial length induced by silicone oil with a viscosity of 1,300 cSt can be accomplished by multiplying the measured axial length by a conversion factor of 0.71. The formula to correct axial length in any eye with silicone oil.

Conclusion

Phacoemulsification in eyes filled with silicone oil presents a challenge that needs special precautions to reach a safe outcome.

A knowledge of the challenges and how to manage them is mandatory before operating on those cases.

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