

# Management of Secondary Glaucoma after Pars Plana Vitrectomy (PPV) and Silicone Oil Injection in Rhegmatogenous Retinal Detachment

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**Purpose:** To determine the outcome of secondary glaucoma after pars plana vitrectomy (PPV) and silicone oil injection in rhegmatogenous retinal detachment

**Materials and Methods:** This Interventional quasi experimental study was conducted at Isra Postgraduate Institute of Ophthalmology, Al-Ibrahim Eye Hospital, Malir, Karachi; from January 2006 to December 2007. Study included total 50 eyes of 50 patients fulfilling the inclusion criteria. After examination, patients were divided into three groups. Group - I if IOP (intraocular pressure) from 22 mmHg up to 28 mmHg managed medically by anti-glaucoma drug like timolol 0.5% alone, group - II if IOP was raised over 28 mmHg than timolol 0.5% with dorzolamide 2% were prescribed and group - III if the patient's IOP was not controlled medically, additional surgical intervention like silicone oil removal, diode cycloablation, cyclocryopexy and glaucoma valve surgery was performed. Success was defined as IOP  $\leq$  21 mmHg and  $\geq$  05 mmHg with or without medication. Patients were followed for 6 months.

**Results:** Over follow up period of 6 months, successful IOP control was achieved in all 50 (100%) eyes.

**Conclusions:** Glaucoma after PPV with silicone oil injection in rhegmatogenous retinal detachment can be effectively managed by anti-glaucoma medicines or with additional surgical measures.

Intraocular silicone oil is used for the repair of complicated cases of retinal detachment.<sup>1,2</sup> Previous reports have described secondary glaucoma as a relatively common complication after pars plana vitrectomy (PPV) with silicone oil injection. Gray, Leaver et al<sup>3</sup> have ranked glaucoma second to cataract as a late complication of silicone oil injection. Highly purified silicone oils (5000cst) have been introduced for prolonged retinal tamponade in patients with complex retinal detachment. This silicone oil is chemically stable in the human eye, does not undergo chemical modification, and is less toxic to eye structures compared to other silicone oils, thus potentially reducing the incidence of secondary glaucoma<sup>4</sup>. Other risk factors associated with an

elevation of intraocular pressure after PPV with silicone oil injection include aphakia, pre-existing glaucoma, scleral buckling and other surgical procedures commonly used in conjunction with PPV, neovascular glaucoma, uveitis, peripheral anterior synechiae, pupillary block, steroid response, and mechanical obstruction of the trabecular meshwork by lens remnants and pigments<sup>5-7</sup>. Most of the eyes are effectively managed with anti-glaucoma medications. Eyes that did not respond to medical therapy may be effectively managed with surgical measures. This study was undertaken to determine the outcome of secondary glaucoma after pars plana vitrectomy (PPV) and silicone oil injection in rhegmatogenous retinal detachment.

## MATERIALS AND METHODS

This study was conducted at Isra Postgraduate Institute of Ophthalmology, Al-Ibrahim Eye Hospital, Malir, Karachi, from January 2006 to December 2007. There were 50 consecutive patients of age 8 to 92 years with IOP  $\geq 22$  mmHg after pars plana vitrectomy with silicone oil injection in rhegmatogenous retinal detachment. The patients with corneal decompensation, cataract, uveitis, significant complications of surgery, previous history of glaucoma and retinal detachment surgery in same eye were excluded. Patients who failed to follow up were also excluded from the study. Success was defined as IOP  $\leq 21$  mmHg and  $\geq 05$  mmHg with or without medication. The relevant information was entered on performa. An informed consent was taken from all patients for inclusion in the study as well as for treatment. After examination, patients were divided into three groups. Group -I if IOP was raised over 22 mmHg up to 28 mmHg, then topical timolol 0.5% twice daily was prescribed, and group-II if IOP was raised over 28 mmHg, then additional drugs like topical carbonic anhydrase inhibitor (CAIs) were prescribed in combination with topical beta-blockers like (timolol 0.5% with dorzolamide 2%).

In those circumstances, group-III where IOP couldn't be managed medically, then after one month additional surgical measures were undertaken. Some form of treatment designed to reduce aqueous production, such as cyclocryotherapy and diode cycloablation, or removal of silicone oil. Patients were followed up in the surgical retina clinic at 1st week, 2nd week, 1st month, 2nd month and at 6th month. The final outcome was measured at 6th month. On each follow up visit, patients were evaluated in terms of IOP, anterior segment examination, fundus examination and gonioscopy.

The data was statistically analyzed using SPSS version 10.0. All categorical response variables including gender and age groups, medical and surgical management were given in frequencies and percentages. Quantitative variables including age and intraocular pressures were computed and presented by mean and standard deviation. Mean and standard deviation of IOP were computed for pre treatment 1st day, 1st week, 2nd week, 1st month, 2nd month and 6th month after medical and surgical management. Student "t" test was applied for pre and post treatment IOP. Statistical significance was considered if  $p < 0.05$ .

## RESULTS

There were 50 eyes of 50 patients with raised intraocular pressure after PPV with silicone oil injection included in this study ranged from 8-92 years of age; mean age was  $42.68 \pm 21.41$  years. There were 36 (72%) male and 14 (28%) female patients.

In this study, 5000 cst silicone oil was used in all the eyes; Cup-disc ratio in our patients ranged from 0.3 – 0.6, with 70% patients having cup-disc ratio below 0.4. The mean  $\pm$  SD preoperative IOP was  $7.5 \pm 3.6$  mmHg. The mean  $\pm$  SD postoperative IOP at first postoperative (Pretreatment) day was  $26.5 \pm 2.8$  mmHg, which was an increase of  $19.16 \pm 5.4$  mmHg, as compared to preoperative IOP (95% C.I of 17.62 - 20.70,  $p < 0.001$ ).

The mean  $\pm$  SD IOP after one week of treatment was  $19.62 \pm 3.39$  mmHg, after two weeks of treatment was  $17.20 \pm 3.17$  mmHg, after 1 month of treatment was  $16.96 \pm 3.03$  mmHg, after 2 months of treatment was  $15.72 \pm 2.80$  mmHg and after 6 months of treatment was  $15.0 \pm 1.63$  mmHg, which was a decrease of  $11.60 \pm 2.65$  mmHg, as compared to pre-treatment IOP (95% C.I of 10.85-12.35,  $p < 0.001$ ) (Table 1).

**Table I:** Outcome of medical and surgical treatment (n = 50)

Factors	Intraocular pressure	Mean $\pm$ S.D (in mmHg)	P-Value
I	Pre treatment	$26.68 \pm 3.25$	$<0.001$
II	After 1 week	$19.62 \pm 3.39$	
III	After 2 weeks	$17.2 \pm 3.17$	
IV	After 1 month	$16.96 \pm 3.03$	
V	After 2 months	$15.72 \pm 2.80$	
VI	After 6 months	$15.08 \pm 2.80$	

Significant mean reduction in intraocular pressure at 6 months was observed as compared to pre treatment IOP (95% C.I. 10.85-12.35) as shown in Fig. 1. Average reduction in IOP after 2 weeks was insignificant as compared to latest follow up after 6 months (95% C.I. = 8.69 - 9.97,  $p < 0.05$ ).

Use of anti-glaucoma drugs as a sole treatment controlled IOP in 45 (90%) eyes, by reducing the IOP from a mean  $\pm$  SD of  $25.96 \pm 2.35$  mmHg (18-32) before

treatment to  $16 \pm 1.6$  mmHg after 6 months of treatment. In these patients, group -I the drug most commonly used was solely beta-blocker topical timolol 0.5% in 38 (74.5%) patients, and in group - II combination of beta-blockers and CAIs in 7 (15.5%) patients. Complications of medical treatment included irritation, lethargy and bitter taste in 2 (4%) patients.

In group - III diode cycloablation for uncontrolled IOP was performed in 3 (6%) eyes with failed medical treatment to control IOP for 1 month. The mean  $\pm$  SD IOP prior to diode cycloablation was  $26.67 \pm 1.15$  mmHg. The post-laser mean  $\pm$  SD IOP was  $17.33 \pm 1.15$  mmHg after 1 month, and  $17.33 \pm 1.15$  mmHg after 5 months. After diode cycloablation, medical treatment in the form of combined therapy was continued.

Silicone oil removal for uncontrolled IOP group-III was performed in 2 (4%) eyes with failed medical treatment and emulsification of silicone oil. The mean  $\pm$  SD IOP prior to silicone oil removal was  $27 \pm 1.41$  mmHg. Postoperative mean  $\pm$  SD IOP was  $17 \pm 1.41$  mmHg after 4 months.

## DISCUSSION

Silicone oils are widely used as a surgical tamponade and vitreous substitute in complicated retinal detachment repair and can be valuable in the surgical management of difficult vireo-retinal diseases. Postoperative anterior segment complications have been reported after silicone oil injection, such as glaucoma, cataract, and keratopathy even after successful reattachment of the retina. In this study, 5000 cst silicone oil was used in all patients undergoing PPV in rhegmatogenous retinal detachment.

The incidence of IOP elevation after silicone oil injection has been described in case series using 1000 cst silicone oil. Honavar et al<sup>8</sup> reported the overall incidence of glaucoma after PPV and silicone oil injection was 40% (60 of 150 eyes). Nguyen et al<sup>5</sup> reported a 48% (24 of 50 eyes) incidence of glaucoma after PPV and silicone oil injection. Valone and McCarthy<sup>9</sup> reported a 23% (11 of 48 eyes) incidence of glaucoma after PPV and silicone oil injection. Belington et al<sup>10</sup> reported a 29% (16 of 55 eyes) incidence of glaucoma after PPV and silicone oil injection. In a case series that included patients treated with 5000 cst silicone oil, Henderer et al<sup>6</sup> found elevated IOP in 12.9% at 6 months, 21% at 1 year and 29.5% at 2 years.

The underlying mechanism of glaucoma associated after PPV with silicone oil injection is often

multifactorial. For example, aphakia could contribute to the development of glaucoma after PPV with silicone oil injection by allowing direct entry of silicone oil into the anterior chamber, in addition to increasing the risk of pupillary block by the silicone oil bubble. In the Silicone Oil Study, Barr et al<sup>11</sup> noted that all of the eyes with elevated IOP were aphakic. In our study, most of the patients were either phakic (58%), or pseudophakic (36%), with only 6% of the patients having aphakia. None of the patients in our study experienced pupillary block, which might have been avoided by peripheral iridectomy done at the time of PPV. Ando<sup>12</sup> introduced the concept of inferior peripheral iridectomy in aphakic and pseudophakic eyes to prevent forward migration of silicone oil and to reduce the incidence of pupillary block glaucoma.

In this study, those patients were included who developed early postoperative rise in IOP. Early postoperative rise in the IOP is common after PPV with silicone oil injection in both phakic and aphakic eyes. This rise in the IOP is possibly related to anterior chamber inflammatory activity, obstruction to aqueous flow by choroidal effusion, a buckle or a combination<sup>13,14</sup>. Al-Jazzaf et al<sup>15</sup> reported that over a period of 2 years, 78% of patients can be successfully managed medically. Honavar et al<sup>8</sup> reported that over a period of 5 years, 72% of patients can be successfully managed medically. In this study, it was observed that over a period of 6 months, 90% of patients were successfully managed medically. The IOP was controlled in most eyes (90%) with topical beta-blockers and CAIs.

The small proportion of patients requiring surgical therapy may be due to the availability of highly effective topical anti-glaucoma medications, or reduced severity of glaucoma due to improved silicone oil and surgical techniques. In this study, diode cycloablation was performed in 3 patients (6%) with failed medical therapy. This procedure was successful in controlling IOP in all 3 (100%) patients. Han SK et al<sup>16</sup> reported a drop of IOP before diode cycloablation of  $43 \pm 14.4$  mmHg to  $14.5 \pm 4.3$  mmHg after laser over a period of about 1 year. Ghazi-Nouri SM et al<sup>17</sup> reported a drop of IOP before diode cycloablation of  $31.4 \pm 10.9$  mmHg to 18.8 mmHg after laser over a period of about 1 year. In our study, a drop of IOP before diode cycloablation of  $26.67 \pm 1.15$  mmHg to  $17.33 \pm 1.15$  mmHg after laser over a period of about 5 months was observed. The most common complication of this procedure was transient uveitis, which was well controlled by topical steroids.

In this study, 2 patients developed resistant glaucoma to medical treatment along with emulsification of silicone oil. For these 2 (4%) patients, silicone oil removal was done.

Honavar SR et al<sup>8</sup> reported that over a follow up period of 5 years, 25% of the patients needed silicone oil removal for controlling IOP. In our study, over a follow up period of 6 months, 2% of the patients needed silicone oil removal for controlling IOP. Budenz DI et al<sup>18</sup> noted a 60% (20 of 32 patients) success in controlling IOP in patients with refractory glaucoma by silicone oil removal. Nguyen QH et al<sup>5</sup> noted a 60% (8 of 14 patients) success in controlling IOP in patients with refractory glaucoma by silicone oil removal. Jonaz JB et al<sup>19</sup> noted a 90% (188 of 198 patients) success in controlling IOP in patients with refractory glaucoma by silicone oil removal. Overall, the results of our study are comparable to the studies published in the international literature. The main drawback of our study is the short follow up period.

## CONCLUSION

The results of this study indicate that glaucoma after PPV with silicone oil injection can be effectively managed by anti-glaucoma medicines. In cases where glaucoma can't be controlled by medication alone, additional surgical measures can effectively manage it.

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## REFERENCE

1. **Wolf S, Schon V, Meher P, et al.** Silicone oil RMN3 mixture ("Heavy Silicone Oil") as internal tamponade for complex retinal detachment. *The journal of retina and vitreous diseases.* 2003; 23: 340-1.
2. **Schocket LS, Witkin AJ, et al.** Ultra high resolution optical coherence tomography in Patients with decreased visual acuity after retinal detachment repair. *Am J Ophthalmol.* 2006; 113: 666-72.
3. **Leaver PK, Grey HB, Ganer A.** Silicone injection in the treatment of massive preretinal retraction. II. Late complications in 93 eyes. *Br J Ophthalmol.* 1979; 63: 361-7.
4. **Lakits A, Nannadal T, Scholda C, et al.** Chemical stability of silicone oil in the human eye after prolonged clinical use. *Ophthalmology.* 1999; 106: 1091-100.
5. **Nguyen QH, Lloyd MA, Heuer DK, et al.** Incidence and management of glaucoma after silicone oil injection for complicated retinal detachment. *Ophthalmology.* 1992; 99: 1520-6.
6. **Henderer JD, Budenz DL, Flynn HW Jr, et al.** Elevated intraocular pressure and hypotony after silicone oil retinal tamponade for complex retinal detachments: Incidence and risk factors. *Arch Ophthalmol.* 1999; 117: 189-95.
7. **Gedde SJ.** Management of glaucoma after retinal detachment surgery. *Curr Opin Ophthalmol.* 2002; 13: 103-9.
8. **Honavar SG, Goyal M, Majji AB, et al.** Glaucoma after pars plana vitrectomy and silicone oil injection for complicated retinal detachment. *Ophthalmology.* 1999; 106: 169-76.
9. **Valone J Jr, McCarthy M.** Emulsified anterior chamber silicone oil and glaucoma. *Ophthalmology.* 1994; 101: 1908-12.
10. **Belington BM, Leaver PK.** Vitrectomy and fluid/silicone oil exchange for giant retinal tears: Results at 18 months. *Graefes Arch Clin Exp Ophthalmol.* 1986; 224: 7-10.
11. **Barr CC, Lai MY, Lean JS, et al. II.** Postoperative intraocular pressure abnormalities in the Silicone Study. *Silicone Study Report 4. Ophthalmology.* 1993; 100: 1629-35.
12. **Ando F.** Intraocular hypertension resulting from pupillary block by silicone oil. *Am J Ophthalmol.* 1985; 99: 87-8.
13. **Gallemore RP, McCuen BW.** Silicone oil in vitreoretinal surgery. In: Ryan SJ, editor. *Retina.* 3<sup>rd</sup> ed. St. Louis: Mosby. 2001; 2195-220.
14. **Allingham RR.** *Shield's text book of Glaucoma.* 5<sup>th</sup> ed. Philadelphia: Lippincott, Williams and Wilkins; 2005: 410-33.
15. **Al-Jazzaf AM, Netland PA, Charles S.** Incidence and management of elevated intraocular pressure after silicone oil injection. *J Glaucoma* 2005; 14: 40-6.
16. **Han SK, Park KH, Kim DM, et al.** Effect of Diode laser trans-scleral cyclophotocoagulation in the management of glaucoma after intravitreal silicone oil injection for complicated retinal detachments. *Br J Ophthalmol.* 1999; 83: 713-7.
17. **Ghazi-Nouri SM, Vakalis AN, Bloom PA, et al.** Long term results of the management of silicone oil induced raised intraocular pressure by Diode laser cycloablation. *Eye* 2005; 19: 765-9.
18. **Budenz DL, Toba KE, Feuer WJ, et al.** Surgical management of secondary glaucoma after PPV and silicone oil injection for complex retinal detachments. *Ophthalmology* 2001; 108: 1628-32.
19. **Jonas JB, Knorr HL, Rank RM, et al.** Intraocular pressure and silicone oil endotamponade. *J Glaucoma* 2001; 10: 102-8.