ORIGINAL ARTICLE

OCCURRENCE OF GLAUCOMA AFTER PARS PLANA VITRECTOMY & SILICONE OIL INJECTION FOR RETINAL DETACHMENT AT A TERTIARY CENTRE OF WESTERN INDIA

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HOW TO CITE THIS ARTICLE:

Neha Desai, Shashank Patel, Somesh Aggarwal, Sonali Shah, Puja Negi. "Occurrence of Glaucoma after Pars Plana Vitrectomy & Silicone Oil Injection for Retinal Detachment at a Tertiary Centre of Western India". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 09, March 3; Page: 2389-2394, DOI: 10.14260/jemds/2014/2149

ABSTRACT: PURPOSE: To study the occurrence of glaucoma & management of glaucoma that occurs after pars plana vitrectomy & silicone oil injection for retinal detachment at a tertiary center of western India. **MATERIAL & METHODS:** A prospective, non-comparative, interventional study of 50 patients who underwent parsplana vitrectomy with silicone oil injection for rhegmatogenous retinal detachment was carried out. Preoperative & Postoperative IOP measurement & disc evaluation was done for 24 weeks postoperatively. Patients who develop glaucoma postoperatively are managed with antiglaucoma drugs & surgical treatment such as silicone oil removal, trabeculectomy & cyclocryo. **RESULTS:** Mean IOP rise of 15.5mmHg was noted postoperatively compared to preoperative level. 24% patients develop glaucoma after parsplana vitrectomy & silicone oil injection. In 50% patients developing glaucoma, IOP was controlled by antiglaucoma drugs. IOP was controlled by silicone oil removal in 33.3% patients, by antiglaucoma surgery in 8.3% patients & by cyclocryo in 8.3% patients. **CONCLUSION:** Postoperative glaucoma is one of the most common complications of silicone oil injection. Glaucoma occurring after silicone oil injection is well controlled by newer antiglaucoma drugs that are available at present.

KEYWORDS: silicone oil, glaucoma, retinal detachment.

INTRODUCTION: The use of silicone oil as a vitreous substitute was first described by Stone in 1958. Since US FDA approved the use of silicone oil as an intraocular tamponade in 1996, this agent has been used with increasing frequency in the USA & elsewhere as an adjunct in vitreoretinal surgery.¹ The silicone oils in current use have viscosities ranging from 1000 to 12500 cSt. Silicone oil has a refractive index of 1.4035, which is slightly higher than that of the vitreous (1.33).^{2,3} Cataract, Silicone oil keratopathy, Silicone oil emulsification, Glaucoma & Recurrent retinal detachment are the common complications encountered with silicone oil injection.⁴⁻⁶ After cataract, postoperative glaucoma is the second most common complication of intravitreal silicone oil injection.⁷ Emulsified silicone oil droplets can block the trabecular meshwork & can cause glaucoma.⁸ Eyes undergoing vitrectomy & silicone oil injection may have other contributing factors that lead to elevated IOP, such as rubeosis iridis, hemolytic causes, phakolytic causes, inflammation & steroid response.⁹

Intraocular silicone oil can produce glaucoma through a variety of mechanisms: pupillary block, synechial angle closure, inflammation, neovascular glaucoma & migration of oil into the anterior chamber.¹⁰ Another form of acute glaucoma occurring in the early postoperative period results from an overfill of silicone oil. Signs include shallowing of the anterior chamber with or without displacement of silicone oil into the anterior chamber. Overfill is prevented by making sure that the intraocular pressure is left low or normal at the end of the procedure & that the silicone oil

ORIGINAL ARTICLE

remains posterior to the iris or intraocular lens, if present.¹¹ The results of the Silicone Study suggest that hypotony was present in 24% of eyes compared with 5% of eyes with chronically elevated IOP. At 36 months, an elevated intraocular pressure did occur more frequently in silicone filled eyes than in C3F8 gas eyes.¹² Since silicone oil removal alone does not usually relieve the chronic elevation of intraocular pressure once it is established; a permanent scarring of the trabecular meshwork is likely. Initially, medical management of chronic elevation of the intraocular pressure can be effective but ultimately, glaucoma surgery may be required.

MATERIAL & METHODS: A Prospective, non-comparative, interventional study of 50 patients who underwent parsplana vitrectomy with silicone oil injection for rhegmatogenous retinal detachment was done. Following inclusion & exclusion criteria were considered.

Inclusion Criteria:

- patient age between 10 to 80 years
- patient with rhegmatogenous retinal detachment with more than PVR C1

Exclusion Criteria:

- patient with history of previous retinal surgery
- patient with tractional retinal detachment
- patient with associated complications such as trauma, nucleus drop, iol drop, intraocular foreign body.
- patient with ocular inflammation

A comprehensive ophthalmic examination included age, gender, detailed history, best corrected visual acuity, slit lamp examination, stereoscopic evaluation of disc & macula with 78, 90 D lens, goldmann applanation tonometry, gonioscopy & retinal evaluation by binocular indirect ophthalmoscope. All the patients underwent belt buckling, 3 port parsplana vitrectomy, and endolaser with silicone oil (1000 centistokes) injection. Postoperatively best corrected visual acuity, slit lamp examination, stereoscopic evaluation of disc & macula with 78, 90D lens, goldmann applanation tonometry & retinal evaluation by binocular indirect ophthalmoscope was done at day 1, 1week, 6 weeks, 12 weeks & 24 weeks.

Glaucoma was predefined as IOP greater than 22 mm Hg or 10mm Hg or greater above the preoperative level & sustained for at least 4 weeks. Medical management was the primary modality of treatment for all glaucoma patients. If the IOP was not control by maximum tolerable antiglaucoma medication, then surgical intervention was done. Silicone oil removal was primary surgical intervention when IOP was not controlled with medical management. Antiglaucoma surgery such as trabeculectomy with Mitomycin-C (0.2 mg/ml) for 2 minutes was considered when IOP was not control by silicone oil removal.

RESULTS: The mean age of the patients in the study was 45 years (10 to 80 years of age). Out of the 50 patients, total no of male patients are 38(76%) & total female patients are 12(24%). Out of 50 patients 28 (56%) patients had PVR C3 or worse, 5(10%) patients had choroidal coloboma with retinal detachment & 5(10%) patients had giant retinal tear.

ORIGINAL ARTICLE

• Figure 1.anatomical success rate after surgery & after silicone oil removal

Fig. 1: sex-wise distribution of patients: 76% male, 24% female

Anatomical success was defined as complete retinal reattachment after surgery & after silicone oil removal. Because of its specific gravity silicone oil does not provide support to inferior retina. Out of 50 patients, 48 patient's retina was settled, so success rate of anatomical retinal attachment was 96% after surgery. One month after removal of oil, 41 patients retina was settled out of 48 patients so success rate was 87% after removal of oil. So 9 patients out of 50 patients required resurgery (18%). Out of 50 patients, 23(46%) patients has best corrected visual acuity(BCVA) of counting finger <1 meter, 13(26%) patients has BCVA of counting finger 1-3 meter, 5(10%) patients has BCVA of counting finger 3-6 meter, 8(16%) patients has BCVA of 6/60-6/24 & 1(2%) patient has BCVA of 6/12-6/6.

• Figure 2.success rate of antiglaucoma druge,silicone oil removal,antiglaucoma surgery & cyclocryo.

Fig. 2: Anatomical success rate after surgery & after silicone oil removal

12 patients (24%) develops glaucoma out of 50 patients. 2 patients has silicone oil in anterior chamber & 2 patients has silicone oil emulsification. Preoperative IOP range from 6-22 mmHg (mean IOP 14mmHg) & postoperative IOP range from 11-48 mmHg (mean IOP 29.5 mmHg) indicating mean rise of 15.5 mmHg. Glaucoma was successfully controlled by medical treatment in 6 patients out of 12 glaucoma diagnosed patients (50%), 6 patients undergone silicone oil removal, out of them 4 (33.3%)

ORIGINAL ARTICLE

patients glaucoma was controlled by silicone oil removal, 2 patients undergone Antiglaucoma surgery, out of them 1(8.3%) patient glaucoma was controlled by surgery & 1(8.3%) patient has to undergo cyclocryo to control the glaucoma.

Fig. 3: success rate of antiglaucoma drugs, silicone oil removal, antiglaucoma surgery & cyclocryo

Silicone oil was removed when needed in relation to anterior chamber inflammation, emulsification & presence of well-formed chorioretinal scar. The trabeculectomy was performed after silicone oil removal. The patients did not develop neovascular glaucoma but showed persistent elevated IOP probably due to emulsified silicone oil which may induce changes in trabecular meshwork, thereby leading to decreased aqueous outflow.

DISCUSSION: Postoperative glaucoma is the second most common complication of silicone oil injection.⁷ The Silicone Study noted a 5% incidence of chronically elevated IOP in eyes with severe PVR. Eyes randomized to silicone oil had a higher incidence of glaucoma than eyes in the C3F8 group (8% vs. 2%).¹² To avoid complications related to intraocular oil, silicone oil is usually removed from the eye when the retina is attached, when chorioretinal scars are formed & when there is no significant traction on the retina.¹³

Henderer et al reported that 21% (80 out of 383 eyes) of patients treated with silicone oil injection for retinal detachment had an elevated IOP (greater than 25mm Hg) over 12 month follow up. These author pointed out that risk factors for postoperative elevated IOP were a history of glaucoma; diabetes mellitus & raised IOP on first postoperative day.¹⁴ In our study 24% patients (12 out of 50 patients) develop glaucoma.

In a series of 70 eyes of 70 patients, Tranos et al showed that although medical treatment is successful in lowering IOP in most patients, there was a mild progression of the mean vertical cup/disc ratio from 0.6(SD 0.2) TO 0.7(SD 0.2) in the majority of the patients during follow-up period.¹⁵ The visual outcome of the eyes with final IOP greater than 21 mmHg was significantly worse than that exhibited by eyes with a normal IOP range (6-21 mmHg).¹⁶

Mario R. Romano et al reported that glaucoma occurred in 14% patients (15 out of 105) & in our study 24% patients develop glaucoma. Mario R. Romano et al stated that 45% patients IOP was well controlled by antiglaucoma drugs only; in our study it was 50%.¹⁷

Dr. Sumeet Malhotra & group has reported that overall incidence of glaucoma in their study was 30% (39 of 130 eyes), in our study it was 24%. Mean IOP rise was 15.5 mmHg over postoperative period.¹⁸

There are several important limitation of this study including diurnal variation of IOP, variety of surgeons, techniques & instruments used. The presence of red blood cell membranes, plasma

ORIGINAL ARTICLE

lipoproteins, purified high-density lipoprotein apolipoproteins, an encircling band & even the oil/aqueous movement generated by high-speed vitrectomy hand pieces result in shearing forces & support the silicone oil emulsification.¹⁹

We believe that the long term raised IOP depends on the open angle mechanism rather than the closed angle mechanism. Persistence of raised IOP could be related to presence of emulsified oil in the anterior chamber & trabecular meshwork, which persists after removal of oil. A high IOP value on the first postoperative day represents a prognostic factor for development of glaucoma on long term follow-up. In most cases topical treatment is sufficient to keep the IOP under control. Advent of newer antiglaucoma drugs like prostaglandin analogues, topical carbonic anhydrase inhibitors & alpha adrenergic agonists & combination drug therapy has become useful in controlling glaucoma in such cases.

There is a decreased in rate of development of glaucoma in recent years due to early removal of silicone oil, use of better quality of silicone oil & doing peripheral iridectomy in aphakic patient. Conventional glaucoma filtration surgery have limited role in management of glaucoma after parsplana vitrectomy & silicone oil injection, so adjuvants like Mitomycin-C & 5-Flurouracil are used to prevent fibrosis & failure of trabeculectomy²⁰. Trabeculectomy was always preceded by silicone oil removal in our study to prevent blockage of ostium by silicone oil & thus preventing failure of trabeculectomy surgery.

CONCLUSION: Glaucoma is one of the most common complications of silicone oil injection. Further studies with long term follow-up & on larger scale are needed in this subject to give guidelines for prevention & treatment of complications associated with silicone oil injection after parsplana vitrectomy. Present available medical & surgical treatments are effective in managing glaucoma after parsplana vitrectomy & silicone oil injection.

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ORIGINAL ARTICLE

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Date of Submission: 24/01/2014.
Date of Peer Review: 25/01/2014.
Date of Acceptance: 07/02/2014.
Date of Publishing: 03/03/2014.