ORIGINAL ARTICLE

CHANGES OF INTRAOCULAR PRESSURE IN VITRECTOMISED EYES AFTER REMOVAL OF SILICONE OIL

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Background: Patients with Rhegmatogenous retinal detachment develop raised intraocular pressure (IOP) when they undergo pars plana vitrectomy with silicone oil. The present study was done to document changes in IOP with silicone oil and after its removal. **Methods:** The interventional study was conducted at Eye department of Lady Reading Hospital Peshawar, from August 2012 to July 2014 on 30 patients with Rhegmatogenous retinal detachment in whom pars plana vitrectomy with silicone oil injection was indicated. IOP readings were obtained on 1st postoperative day, at one month and at 6 months; the silicone oil was removed after the third reading and the IOP readings obtained after 2 weeks. **Results:** Of the 30 patients selected for the study, there were 25 (83.3%) males and 5 (16.7%) females with ages ranging from 12–80 years (mean age 41.83±21.43 years). The mean of three pre silicone oil removal IOP readings was 27.35±9.20 mmHgwhich was reduced to a mean of 16.10±6.14mmHg following the removal of silicone oil at 6 months (p<0.001). Postoperative raised IOP values were highly predictive of persistently elevated IOP readings in patients after six months. **Conclusion:** Vitrectomised eyes with silicone oil raised intraocular pressure which was reduced after silicone oil removal.

Keywords: Retinal Detachment, Vitrectomy, Vitreoretinal surgery, Silicone oil, intraocular pressure, Tonometry, Scleral Buckling

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INTRODUCTION

Transient elevation of intraocular pressure (IOP) in vitrectomised eyes caused by inflammation, residual viscoelastic substance, silicone oil tamponade, , and filling of expansile gas are all important early complications after operation.[1,2] However, open-angle glaucoma (OAG) may develop late in the vitrectomised eyes as reported by some researchers.[3,4] In 2006, Chang *et al*. firstly reported the development and deterioration of OAG in vitrectomised eyes.[3] Different diseases, IOP measurement methods, and OAG diagnostic criteria were reported. In addition to this, an associated diabetes might complicate OAG due toretinal hypoxia.[5,6]

The underlying mechanisms of intraocular pressure increase after intravitreal silicone oil injection are probably secondary pupillary block, inflammation, rubeosis iridi, speripheral anterior synechae, and transfer of emulsified and non-emulsified oil into the anterior chamber. Pupillary blockade is prevented by a prophylactic inferior iridectomy at the time of surgery. Patients developing uncontrolled IOP may benefit from medical and surgical treatment with silicone oil removal with and without the associated glaucoma surgery, glaucoma implants or cyclo-destructive procedures.[7]

Clinically significant increase in intraocular pressure after pars plana vitrectomy associated with silicone oil tamponade usually occurs very rarely. This problem can be controlled using topical anti-glaucoma medication and is reversible after oil removal in most of the patients. In cases with increased IOP and silicone oil tamponade, removal of oil is preferred as compared to anti-glaucoma surgery to reduce IOP[8], because IOP returns to normal after removal of silicone oil in majority of the patients[9].

Chronic elevation of IOP occurs in minority of patients with silicone oil therapy and most of them are treated with anti-glaucoma medication. Patients who do not respond to medical treatment could be managed by placing drainage implants in the inferior quadrant.[10] Patients treated with silicon oil injection who develop medically uncontrolled glaucoma may require oil removal with or without concurrent glaucoma surgery. Eyes filled with Silicone oil are unusually difficult for glaucoma management, since the filtration opening is obstructed due to silicone oil and laser techniques have not been effective. In 75% of ultrasound treated eyes, successful reduction of IOP was possible to a level below 20 mmHg with or without concomitant medical treatment.[11] In pars pars plana vitrectomy, the use of silicon oil increases the likelihood of postoperative IOP elevation which could be managed medically or in some cases surgical intervention is required.[12]

Patients with medically uncontrolled glaucoma after intravitreal silicone oil removal (SOR) responded successfully to trans-scleral cyclophotocoagulation.[13] Some other complications of silicone oil injection in the eyes are cataract and band keratopathy.[14] Cataract is treated by removal of the silicon oil along with phacoemulsification of the lens

and insertion of an intraocular lens. Similarly, the removal of silicone oil may slow the progression of band keratopathy.[15] There is a significant risk of retinal re-detachment after silicone oil removal. Additional 360° laser posterior to encircling buckle may lower the risk.[16] The low re-detachment rate post-SOR may be due to prophylactic 360° retinopexy along with the use of encircling buckles at the time of primary retinal reattachment.[15]

We evaluated IOP changes in vitrectomised eyes with silicone oil injection in patients with rhegmatogenous retinal detachment and studied the effect of silicone oil removal on the postoperatively raised IOP.

MATERIAL AND METHODS

The intervention study of sequential design was conducted at Eye department of Lady Reading Hospital, Peshawar from August 2012 to July 2014 on patients who were operated for Rhegmatogenous Retinal Detachment (RRD). The procedure consisted of pars plana vitrectomy with silicone oil injection. Patients having glaucoma, ocular hypertension, diabetes with and without retinopathy, penetrating ocular trauma, ocular inflammation and ischemia, long term topical steroid therapy and previous vitrectomy were all excluded. The sampling technique was Convenience Sampling based on consecutive cases meeting the selection criteria.

The patients complained of decrease in vision and painful eyes. First of all the cases were identified after detailed history and ocular examination including visual acuity on Snellen's chart, slit lamp examination, intraocular pressure measurement with Air puff tonometer and fundus examination with indirect ophthalmoscope using 20D lenses and with slit lamp using 78D and 90D Lenses.

After admission, investigations like Haemoglobin (Hb), Hepatitis B Antigen (HbsAg) and Hepatitis C Antibody (HCV Ab), Fasting and Random Blood Glucose and Blood Pressure were measured. Peribulbar anaesthesia was given. A three port pars plana vitrectomy using 20G system was used. The surgery was performed using Millennium Vitrectomy system and the Erect Indirect Binocular Ophthalmic System (EIBOS). First posterior vitreous detachment was induced followed by core vitrectomy and peripheral vitrectomy. The heavy liquid was injected. After that, air fluid exchange was done followed by injection of silicone oil.

The patients were then prescribed topical steroid and antibiotic eye drops, artificial tear substitute and cycloplegic eye drops to reduce inflammation. The IOP was measured on 1st post op day, after 1st month, and after 6th month. Patients then underwent removal of silicone oil from operated eyes; further IOP readings were obtained after two weeks. All data were entered in SPSS version 20 for analysis. Mean IOP readings were compared using Paired Sample *t* test; regression analysis was done to enable prediction of post silicone oil removal IOP from the previous IOP readings. A $p \leq 0.05$ denoted significance.

RESULTS

Of the 30 patients selected for the study, there were 25 (83.3%) males and 5 (16.7%) females with ages ranging from 12–80 years (mean age 41.83±21.43 years) with no significant differences in ages between the genders. There was right eye involvement in 12 (40%), while left eye involvement in 18 (60%) patients. The IOP readings of three postoperative intraocular pressure measurements are given in table-1.

It can be seen from table 1 that the mean IOP was raised in the immediate postoperative period (day 1); thereafter the levels declined after one month and six months, but remained steady at three months. Following silicone oil removal, the mean IOP showed a significant drop to normal levels in 24 (80%) cases but remained at slightly raised levels in the remaining 6 (20%) cases (Table-2).

Regression analysis showed a highly significant correlation between the pre and post silicone oil removal IOP values, as shown in table-3.

It can be seen that there is a high degree of significant correlation between the pre and post silicone oil removal IOP readings; this allows a good prediction of patients likely to have persistently raised IOP values at six months based on their immediate postoperative readings or the one month postoperative readings.

Table-1: Intra Ocular Pressure (IOP) readings of patients (n=30)

Variables	Range	Mean±SD
Postop Day 1 IOP (mmHg)	17–65	34.47±12.83
Postop 1st month IOP (mmHg)	15–55	24.13±8.56*
Postop 6thmonth IOP (mmHg)	17–50	23.47±7.11*
Mean Pre silicone oil removal IOP (mmHg)	16.33–56.67	27.35±9.20*
IOP after silicone removal (mmHg)	8–35	16.10±6.14**

*p<0.001 for differences from the postop day 1 IOP; p=0.077 for the difference in IOP between Postop 1st month and Postop 6thmonth readings. **p<0.001 for differences of IOP from all pre silicone oil removal readings

Table-2: Distribution of IOP readings based on raised levels (n=30)

IOP Readings	Normal (11–21 mmHg) f (%)	Raised (>21mmHg) f (%)
Postop Day 1 IOP (mmHg)	8 (26.7)	22 (73.3)
Postop 1st month IOP (mmHg)	13 (43.3)	17 (56.7)
Postop 6thmonth IOP mmHg	16 (53.3)	14 (46.7)
IOP (mmHg) after silicone removal	24 (80)	6 (20)

Table-3: Regression analysis of the pre and post silicone oil removal IOP values (n=30)

Variable X	Variable Y	r (R^2)	*p* value of r
Post op Day 1 IOP	Post silicone oil removal IOP	0.915 (0.837)	<0.001
Post op 1st month IOP	Post silicone oil removal IOP	0.968 (0.938)	<0.001
Post op 6th month IOP	Post silicone oil removal IOP	0.938 (0.899)	<0.001
Mean Pre silicone oil removal IOP	Post silicone oil removal IOP	0.970 (0.941)	<0.001

DISCUSSION

Intra vitreal silicone oil injection used for retinal detachment was probably associated with raised intraocular pressure. This study was conducted to determine the incidence of raised intraocular pressure in patients who underwent silicone injection and to evaluate the effectiveness of silicone oil removal therapy in patients in whom raised IOP persisted at 6 months.

In our study the patients with silicone oil had mean Pre silicone oil removal IOP of 27.35±9.20 mmHg (range 16.33–56.67 mmHg) which decreased to 16.10±6.14 mmHg (range 8–35 mmHg, $p<0.001$, Student's paired *t*-test) after silicone oil removal. In another study, the IOP was found to have decreased significantly from a pre-treatment value of 34.5±5.37 mmHg (range 24–44 mmHg) to 20.47±4.49 mmHg at 6 months of follow up (range 12–30 mmHg, $p<0.01$, Student's paired *t*-test) after silicone oil removal.[13] One of the study describes that silicone oil removal did not affect intraocular pressure (IOP) in 10 out of 11 (91%) patients.[17] Wesołek-Czernik[9] observed increased intraocular pressure (>22 mmHg) in 27 eyes (seven of them were aphakic) during tamponade. Silicone oil was removed due to glaucoma in 6 eyes (three of them were aphakic). In 9 eyes (four aphakic) the intraocular pressure was higher than 22 mmHg after silicone oil removal. Seven patients required additional topical medication and 2 patients were qualified for operation-trabeculectomy. Six (20%) of our patients had raised IOP (22–35 mmHg) and were treated medically.

In our study raised intraocular pressure was secondary to inflammation, peripheral anterior synechae migration of emulsified and non-emulsified oil into anterior chamber. According to Chang S,[3] there is an increased risk of Open Angle Glaucoma (OAG) after vitrectomy. The presence of the lens may be protective. In established OAG before the operation, the number of anti-glaucoma medications may increase after surgery. Oxidative stress is hypothesized to have a role in the pathogenesis.

Beekhuis WH *et al*[18] found that an iridectomy at the 6 o'clock position allows free passage of aqueous to the anterior chamber which remains free of silicone oil. No permanent contact with silicone oil and the cornea is established, and development of keratopathy is prevented. Only in 6.5% of the cases was silicone oil present in the anterior chamber at the end of the follow-up period of 7 months.

RECOMMENDATION

As silicone oil causes raised IOP, regular monitoring of IOP should be done. Before removal of silicone oil, glaucoma should be treated with IOP lowering medications. Also optic disc should be monitored for optic disc atrophy because of raised IOP, as this can result in permanent blindness even after IOP is normalized after silicone oil removal. Silicone oil should be removed at 6 months interval to prevent the complications of glaucoma, cataract and band keratopathy.

Limitations of the study: A larger sample size and random sampling would have further validated the results, but it was not possible under the circumstances prevailing for the present study (also true for most hospitals of the country) due to limited availability of patients, deficiencies in record keeping, data retrieval and problems related to follow-up.

CONCLUSION

Silicone oil injection following Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachment causes persistently raised IOP in most of these patients. Removal of silicone oil after 6 months results in reduction of raised IOP in these patients.

AUTHOR'S CONTRIBUTION

MJ: Concept, data collection, literature search, write up, proof reading. BK: Data collection, proof reading. MAS: Data collection, proof reading. IQ: Concept, literature search, write up, data analysis, proof reading. MA: Concept, proof reading. MJ: Conceived the idea, discussed and finalised it with IQ and MA. For data collection BK and MAS were required and the concept was agreed upon them prior to data collection. Furthermore IQ did data analysis and helped in write up. Article was distributed to all authors for their input and proof reading, after which it was finalised.

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