EFFECT ON CORNEAL DIOPTRIC POWER IN PATIENTS UNDERGOING 23G SUTURE LESS PARS PLANA VITRECTOMY

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ABSTRACT

Objective: To determine the effect of 23-gauge pars plana vitrectomy on corneal dioptric power through a comparison of difference in pre- and post- surgery keratometry.
Study Design: Prospective non-comparative interventional type.
Place and Duration of Study: The study was conducted at the Armed Forces Institute of Ophthalmology (AFIO) Rawalpindi from Dec 2016 to Jul 2017.
Material and Methods: We studied 33 patients (33 eyes) who underwent 23-gauge vitrectomy with mean age of 46.4 ± 12.8 years. Among them 13 were females and 20 were males. These patients were divided in four groups on the basis of pre-surgical diagnosis. 18 (55%) patients had rhegmatogenous retinal detachment, 9 (27%) had macular holes 3 (9%) with Vitreous hemorrhage and last 3 (9%) had dislocation of intraocular lens. Total vitrectomy was performed in all patients by standard 23G pars plana vitrectomy (PPV) procedure as used with three scleratomies and tunnel shaped incision. Keratometry readings before the surgery and at the end of 1st, 6th and 12th post procedural weeks were recorded in horizontal (K1) and vertical meridian (K2) by utilizing topcon auto kerato-refractometer.
Results: The pre-operative dioptric power of cornea in horizontal and vertical meridian (K1 and K2 respectively) was statistically compared with post- operative dioptric power of cornea at the end of 1st, 6th and 12th post-opertive weeks. At the end of first post- operative week there was significant difference between pre and post-operative corneal dioptric power with horizontal p-value<0.05 and vertical <0.04; leading to astigmatism. However, at the end of 6th and 12th post procedural weeks there was no significant difference between pre and post-operative corneal dioptric power which is evident with insignificant p-values. The p-value at the end of 6th post-operative week was 0.521 and 0.57 for K1 and K2 respectively. At the end of 12th post-procedural week these values are 0.854 and 0.941 for K1 and K2 respectively. Clinically these patients did not have any sign or symptoms of astigmatism.
Conclusion: 23G was found safe procedure in vitreoretinal surgery with no insignificant change in corneal dioptric power except in cases in which silicone oil was used. However, due to small study group and short follow up further studies with longer follow-ups are required to establish the long-term changes in corneal dioptric power after 23G suture less vitrectomy.

Keywords: Astigmatism, Dioptric power, Keratometry, Pars plana vitrectomy, Suture less,

INTRODUCTION

Pars plana vitrectomy (PPV) is surgical removal of vitreous humor through pars plana[1]. O'Malley and Heintz developed the first 20-gauge three port vitrectomy system[2]. For over thirty years, PPV was performed using a 20-gauge three port system for nearly all vitreoretinal surgeries. However, as 20-gauge PPV became more widely used, a number of complications became apparent including unfavorable control of intraoperative pressure (IOP), hypotony and astigmatism[3]. Several studies have shown that corneal curvature was significantly changed after 20-gauge standard vitrectomy, inducing post-operative astigmatism[4]. This increase may be attributed to sclerotomy size (1.7mm), scleral cautery and suturing at entry point[5]. Twenty-three-gauge (23G) suture less transcon-

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junctival pars plana vitrectomy (PPV) offers minimal surgical trauma at incision site and suture less closure, which may reduce surgically induced astigmatism[6,7]. Sclerotomy size in 23-gauge PPV is 0.7mm with minimal trauma to conjunctiva. And studies have concluded that 23-gauge PPV does not induce significant astigmatism in the post-operative period[8]. Rationale of the study was to measure the change in corneal dioptric power; which is a crucial indicator of any change in refractive power of the eye, as a result of the 23-gauge pars plana vitrectomy.

MATERIAL AND METHODS

The study was conducted at the Armed Forces institute of Ophthalmology Rawalpindi from Dec 2016 to Jul 2017. The patients were included in the study by Non-probability consecutive sampling method. The total number of patients included in the study were 33. The study was designed as Prospective non-comparative interventional type. These 33 patients who underwent vitrectomy have diagnosis of Rhegmatogenous retinal detachment in 18 patients, Macular holes in 9 individuals, Vitreous hemorrhage in 3 cases and last 3 (9%) have Dislocation of intraocular lens. The patients with pre-existing corneal pathology like chronic keratitis, corneal dystrophies and degenerations, prior vitreoretinal surgery and any corneal injury were excluded from the study. Similarly, patients with glaucoma, uveitis, scleromalacia, long-term contact lens use and severe dry eyes were also excluded. Written informed consent was taken and surgical procedure was performed according to case to case basis international protocols

Before the procedure Keratometry (K1 and K2) readings were taken pre-operatively in the affected eye using topconauto kerato-refractometer. Patients were asked to lie in supine position. Retrobulbar or pre-bulbar local anesthesia (mixture of 2% lidocaine and 0.75% bupivacaine) was injected in all patients except two teenagers; who were operated under general anesthesia. Three cannulas were passed through at 3.5cm from limbus, measured using a caliper. Cannulas were placed at superotemporal, superonasal and inferotemporal position. Inferotemporal cannula was used for infusion line and both superior cannulas were used for light pipe and vitrector. Core vitrectomy was done in all patients. The technique to insertion of cannulas by inserting it at 30 to 40 and then vertically to reach the posterior chamber creating a tunnel which is self-sealing and hence requires no suturing. Endolaser photocoagulation was done in patients with retinal breaks both around the break and 360 around the retina. Silicone oil tamponade was given in 2 patients. Internal limiting membrane peeling was done in patients with macular hole and gas tamponade were given. In one patient with both tractional and rhegmatogenous RD, segmentation was done before Endolaser and silicone oil tamponade placement.

Patients were advised oral Ciprofloxacin 500mg and ibuprofen 400mg b.d. Topical vigamox (moxifloxacin 0.5%) qid, cyclopen (cyclopentolate sodium 1%) tds and pred forte (prednisolone acetate 1%) eye drops were advised. Post-operative K1 and K2 readings were taken at the completion of 1, 6 and 12 weeks of surgery.

Statistical Analysis

Statistical analysis was performed using the SPSS-16.0. Descriptive statistics were used to describe this information and data. Chi square test was applied to compare qualitative variables between the pre- and post-procedural changes. Independent samples' t-test was used to compare pre- and post-procedural corneal dioptric power. Continuous and categorical variables are reported as mean ± SD and percentages, respectively. A p-value <0.05 was considered as significant.

RESULTS

Total 33 subjects were included in our study who underwent vitrectomy with 23 gauge needle. The age of these patients ranged from 14 to 70 years with mean age of 46.4 ± 12.8 years. Among these 33 subjects 20 (60.6%) were male and 13 (39.4) were female patients. On the basis of clinical indications, they were divided in four groups which included 18 (55%) patients having

Rhegmatogenous retinal detachment, 9 (27%) having Macular holes, 3 (9%) with Vitreous hemorrhage and last 3 (9%) having Dislocation of intraocular lens table-I. The right eye was operated in 21 (64%) patients and left eye has been operated in remaining 12 (36%) of cases. The Vitreous hemorrhage and Dislocation of intraocular lens was noted in male patients in our study that might be an incidental finding.

The pre-operative Dioptric power of cornea in horizontal and vertical meridian (K1 and K2 respectively) were statistically compared with post procedural dioptric power at the end of post opertive 1st, 6th and 12th weeks. The data is summarized in table-II. At the end of first post-operative week there was significant difference in the corneal dioptric power leading to astigmatism as compared to the pre-operative values. The results are evident with significant *p*-value which is <0.05 horizontally and <0.04 vertically. However, at the end of 6th and 12th post procedural weeks there was no significant difference in the K1 and K2 values as compared to the pre-operative readings as shown in table-II. The *p*-values are non-significant. Apart from non-significant *p*-value there was much clinical improvement as compared to first post-operative week.

Table-I: Baseline clinical and demographic data

Indication for surgery	No of cases	Male	Female	Mean age	Eye involved	
					Rt	Lt
Rhegmatogenous Retinal detachment	18	12	6	45.8 ± 15.9	13	5
Macular hole	9	2	7	49.8 ± 9.8	6	3
Vitreous hemorrhage	3	3	0	33.4 ± 8.7	1	2
Dislocation of intraocular lens	3	3	0	56.8 ± 9.2	1	2
Total	33	20	13	46.4 ± 12.8	21	12

Table-II: Comparison of pre and post-operative corneal dioptric power horizontally and vertically

No of cases	Dioptric power	*p*-value at 1 wk	*p*-value at 6 wk	*p*-value at 12 wk
33	Horizontally (K1)	<0.05	0.521	0.854
33	Vertically (K2)	<0.04	0.570	0.941

DISCUSSION

Twenty three gauge suture less vitrectomy had transformed vitreoretinal surgery since its inception[9]. With the evolution of smaller gauge vitrectomies like 25G and 27G patient comfort has increased, however certain surgical procedures are preferably done by 23G or 20G surgery for better outcome especially where silicone oil tamponade is required; 23 G is considered a better option[10]. Even though with smaller gauge there are less chances of change in corneal dioptric power, topography and astigmatism[11] but small gauge cannulas with complete machinery are not available readily, especially in countries like Pakistan. Considering this 23G vitrectomy is considered "goldilocks" gauge, not too big neither too small and it takes care of complications which are more prominent with 20G[12] and gives almost similar results to smaller gauge vitrectomies. Kim *et al*, have stated 23 G as the most convenient method both for surgeon and patient[13]. Also, availability of instruments for 23G is easier and complications of all sorts are less common as compared to 20G. Similar results were reported by Tewari *et al* in his study with and declared better visual outcomes with 23G PPV[14]. Kim *et al,* has reported in his study that there was no significant change in corneal topography and surgically induced astigmatism was negligible[15]. Our study revealed almost similar results except in patients with silicone oil tamponade. Our study has considered a singular factor to demonstrate the safety and good visual outcome at the end of the surgery. Corneal dioptric power is a factor which changes with radius of curvature and corneal topography and hence the visual outcome is affected[16] considering K1 as

horizontal dioptric power and K2 as vertical dioptric power. At one-week changes in dioptric power were significant especially in patients with silicone oil tamponade, however changes in dioptric power were almost negligible in patient with no tamponade. Upon further follow ups, change in dioptric powder was seen coming back closely to their pre-op values except in the cases with silicon oil tamponade. This may be because of increased pressure leading to increase in axial length of eye and flattening of cornea[17-19]. On the other hand, patients injected with gas tamponade showed changes in K readings only in first week. The data indicated that with the passage of time the change in corneal dioptric power became less apparent as gas tamponade tends to absorb over a period of time. In our study, patients with no tamponades whether silicone oil or expandable gas showed changes in corneal dioptric power hence leading to astigmatism on refractometer. This change tends be more prolonged with silicone oil as compared to patients with no tamponade or gas tamponade as silicone oil remains in the eye as compared to expandable gases. No intraoperative or post-operative complication were noted in our group of patients. Limitations in our study include small sample size and consideration of singular factor using auto keratorefractometer which is a basic machine. High end machines like video keratograph, Orbscan and Pentacam are more sophisticated and give very accurate reading about corneal topography and astigmatism. Further studies are required with a larger sample group, prolonged follow up and use of more advanced machines may provide more accurate results.

CONCLUSIONS

23G vitrectomy was found safe procedure with minimal changes in dioptric power of cornea when no tamponade was used. Gas tamponade absorbed depending on the type of expandable gas used, as each one of those has different half-life.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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