Visual Outcomes Of Secondary Iol Implantation In Vitrectomized Eyes At A Tertiary Eye Hospital

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Abstract

Vitrectomized eyes are challenging to implant intraocular lens (IOL) secondarily. Secondary intraocular lens (IOL) implantation is often required, particularly when there is a preexisting zonular or capsular weakness or removal of a cataractous lens during a primary vitrectomy procedure. The present study was planned to evaluate the associate factors that influence the outcome of secondary IOL implantation in aphakic vitrectomized eyes. It was a prospective longitudinal study. The study was done in Ispahani Islamia Eye Institute and Hospital, Dhaka, Bangladesh from April 2022- March 2023. Detailed information was obtained in each cases according to protocol. Complete history was taken either from patient or accompanying attendants. With proper evaluation patient was diagnosed of vitrectomized aphakic eyes then patient under to surgery. IOL was given by scleral flaps or clear corneal incision and it was fixated in different location. After all post-operative visual acuity and other positive finding will be recorded. Collected data were classified, edited, coded and entered into the computer for statistical analysis by using SPSS version 23. Out of 42 patients with vitrectomized aphakic eyes, majority 15(35.7%) patients belonged to age group 41-50 years with the mean age was 39.5±14.7 year. Male to female ratio was 2.2:1. The BCVA ranged from 0.1 to 1.0 after secondary IOL implantation in vitrectomy. In this study, one eye (2.4%) had final BCVA of 1.0 and 30 eyes (71.4%) had a BCVA ranging from 0.3 to 1.0 at the 3rd follow-up (3rd month). The other 11 eyes (26.2%) achieved final BCVA from 0.1 to 0.3. The mean IOP was significantly increased in different follow up than baseline ($p<0.05$). The mean interval between secondary IOL implantation was 2.7±1.5 months. Postoperative complications after secondary IOL implantation included mild anterior chamber exudates in 5 eyes (11.9%), temporary IOP elevation in 6 eyes (14.3%), decentered IOL in 3 eyes (7.1%), exposed suture in 3 eyes (7.1%) and corneal oedema in 5 eyes (11.9%). Our results indicate that secondary foldable IOL implantation is a safe and effective option, with few reported complications in eyes which underwent vitrectomy for ocular injury. A small proportion reported mild intraocular pressure elevation, but IOP remained within the normal range. Thus, currently practiced methods of secondary IOL implantation covered by the current study appear safe and effective.

Keywords: *visual outcomes, secondary intra-ocular lense, vitrectomized eyes*

Introduction

Ideally, after uneventful cataract surgery, a posterior chamber IOL (PC-IOL) is implanted in the capsular bag. However, this is not always possible, as capsular bag-associated complications may already exist preoperatively (loose zonula, IOL luxation) or occur intraoperatively (anterior or posterior capsular tear). In these cases, either no IOL will be implanted (aphakia) or the IOL has to be fixated in other positions such as the anterior chamber (AC), iris, sulcus, the sclera.[1,2] Several surgical options are available to correct aphakia in those who have had pars plana vitrectomy (PPV)

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and lensectomy.[2] In cases of secondary aphakia or IOL-related complications, secondary intraocular lens implantation is the preferable surgical procedure. IOL luxation, incorrect IOL power, IOL opacification, uveitis-glaucoma-hyphema (UGH) syndrome, patient dissatisfaction, or secondary aphakia indicate the major reasons for such surgery [3]. Riazi et al. Eye (Lond). 2008 Nov. had undergone to evaluate the efficacy and safety of Artisan-Verysise intraocular lens (IOL) secondarily implanted for aphakic correction in post-traumatic vitrectomized eyes.[3]

Postoperative outcomes of secondary implantation of an iris-supported Artisan IOL in 17 unilateral aphakic patients with previous pars plana vitrectoIdeally, after uneventful cataract surgery, a posterior chamber IOL (PC-IOL) is implanted in the capsular bag. However, this is not always possible, as capsular bag-associated complications may already exist preoperatively (loose zonula, IOL luxation) or occur intraoperatively (anterior or posterior capsular tear). In these cases, either no IOL will be implanted (aphakia) or the IOL has to be fixated in other positions such as the anterior chamber (AC), iris, sulcus, the sclera.[1,2] Several surgical options are available to correct aphakia in those who have had pars plana vitrectomy (PPV) and lensectomy.[2] In cases of secondary aphakia or IOL-related complications, secondary intraocular lens implantation is the preferable surgical procedure. IOL luxation, incorrect IOL power, IOL opacification, uveitis-glaucoma-hyphema (UGH) syndrome, patient dissatisfaction, or secondary aphakia indicate the major reasons for such surgery.[4]

Riazi et al. Eye (Lond). 2008 Nov. had undergone to evaluate the efficacy and safety of Artisan-Verysise intraocular lens (IOL) secondarily implanted for aphakic correction in post-traumatic vitrectomized eyes.[5] Postoperative outcomes of secondary implantation of an iris-supported Artisan IOL in 17 unilateral aphakic patients with previous pars plana vitrectomy secondary to posterior segment trauma were evaluated prospectively. Eyes had vitrectomized in the previous 6-60 months. Patients were followed for visual outcome, endothelial cell density (ECD), and occurrence of complications. Some studies show that patient's postoperative mean follow-up was 14.65+/-5.21 months. UCVA improved in all patients. (0.03+/-0.1 preoperatively vs 0.45+/-0.29 postoperatively, P=0.0001). However, the improvement of BCVA was not significant. The mean postoperative SE was 0.84+/-1.32 D, whereas it was 10.85+/-1.70 D preoperatively (P=0.0001). SE was within +/-2.00 D of emmetropia in 16 eyes (94.1%). Mean endothelial cell loss was 8.1% in the first 6 postoperative months. All eyes achieved the desired anatomic results. No intraoperative complications occurred in any of our cases. Complications were transient pigmented precipitates (three cases), choroidal detachment (one case), and transient vitreous haemorrhage (one case).[3,4]

Secondary IOL is a clinically safe and effective procedure to correct aphakia in vitrectomized eyes. Secondary IOL implantations have increased over recent years, and this newer technique (TF) surgical procedure is now considered common.[5,6] In these prospective studies, we will evaluate the outcomes of secondary lens implantation for aphakic correction in post vitrectomized eyes in different locations of fixation.[7-10] Nowadays secondary IOL Implantation is commonly used on vitrectomized aphakic eye patients but the outcomes of these patients were few studied in our country. There have been few studies regarding the outcomes of secondary IOL in vitrectomized eyes mainly in the western population and India. Our country there is not so much study on this topic. IIEI&H is the best teritary place to conduct such study to see the outcome of vitrectomized aphakic eye patients. As because of considerable geographical variation, the results from these studies cannot be extrapolated to the Bangladeshi population. We believe that this study will help to guide the ophthalmologist for the implantation of secondary IOL in vitrectomized eyes secondary to posterior segment trauma were evaluated prospectively. Eyes had vitrectomized in the previous 6-60 months. After a complete ophthalmologic examination, IOL implantation was performed through a scleral tunnel incision. Patients were followed for visual outcome,

endothelial cell density (ECD), and occurrence of complications. Uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), spherical equivalents (SE), and ECD were compared before and after IOL insertion.

Materials And Methods

The study was a prospective longitudinal study. Department of vitreo-retina, Ispahani lslamia Eye Institute & Hospital, Farmgate, Dhaka, Bangladesh during the period of April 2022-March 2023. Study adhered to the ethical principles of the Helsinki declaration. Institutional permission to collect data was obtained before conducting the study. All patient parties were explained their conditions in details with treatment options in easily under stable local language. Informed written consents were obtained from the patients/Attendants/Parents before intervention. The study not interfered with patient management or deal with moral or social issue. All the information and records were kept confidential. In the literature it was found that of the vitrectomized aphakic patients who are getting treatment is prevalence is low. Sample size was calculated by the following formula:

$$n = \frac{Z^2(p \times q)}{d^2}$$

Where,

n=the required sample size,

z=the standard normal deviate set at 1.96 which corresponds to the 95% confidence level.

p = Expected proportion of the events = 90%= 0.90.

q=1-p = 0.10

d= the degree of accuracy desired (absolute precision), set at 10% of p = 0.09

$$\text{So, } n = \frac{1.96^2(0.90 \times 0.10)}{0.09^2}$$

$= 42.05 \approx 42$ (round figure)

So, 42 vitrectomized aphakic patients were enrolled in the study.

Purposive sampling technique was used to get the sample size. Post vitrectomized aphakic patient with age between 15-80 years were included in study. Patient age less than 15 years, patients with other ocular diseases, and non-co-operative patient were considered in exclusion criteria. Secondary intraocular lens implantation is defined as the implantation of an intraocular lens following an initial surgery that resulted in aphakia or a deficient intraocular lens.[4] Visual acuity and immediate and delayed postoperative visual were the main outcomes. All patient parties were explained their conditions in detail with treatment options in easily under stable local language. Informed written consent were obtained from the patients/ Attendants before intervention by consent form. Systemic evaluation was done before starting treatment. Pre-operative visiual acuity record and meticulous ophthalmic examination was done (Visual acuity slit-lamp examination, direct and indirect opthalmo scope corneal endothelium, B scan and intraocular pressure). Data was collected by using Data sheet. Snelles vision chart, retinoscope, indirect ophthalmoscope, slit-lamp bio microscope, laptop, Keratometry, Biometry, B scan, Specular microscope, and Tonometer were study materials. With proper evaluation the patient was diagnosed of vitrectomized aphakic eyes then patient under to surgery. Secondly IOL implantation was perform under peri ocular injection. In eye with a remaining anterior capsule IOL was fixated in sulcus. In eye without as anterior and posterior capsule 25 G infusion cannula was created. IOL was given by scleral flaps or clear corneal incision and it was fixated in different location. After all post-operative visual acuity and other positive finding was recorded. Data was collected by using Data sheet. Statistical analyses were carried out by using the Statistical Package for Social Sciences version 23.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Paired sample t-test was used for comparing measurements before and after treatment. P value<0.05 was considered as statistically significant

Results And Discussion

Table I shows that majority 15(35.7%) patients belonged to age group 41-50 years with the mean age was 39.5±14.7 years. Figure 1 demonstrated that gender distribution of patients and show that male patients were predominant 29(69.0%) and female was 13(31.0%). Male to female ratio was 2.2:1. Table 2 shows that most of the patients were service holder 18 (42.9%), housewife 9 (21.4%), businessman 7 (16.7%), student 3(7.1%) and others were 5 (11.9%). Table 3 shows that out of 42 injured eyes, 8 eyes of 8(19.0%) patients with lenticular nucleus drop, 6 eyes of 6(14.3%) patients with posterior dislocation of intraocular lens (IOL), 12 eyes of 12(28.6%) patients with penetrating injury, 3 eyes of 3(7.1%) patients with intraocular foreign body (IOFB), 8 eyes of 8(19.0%) patients with ocular rupture and 5 eyes of 5(11.9%) patients with endophthalmitis. Figure 2 shows that right eye was involved in 25(29.5%) and left eye in 17(40.5%). Table 4 showed that the BCVA ranged from 0.1 to 1.0 after secondary IOL implantation in vitrectomy. In this study, 1 eye (2.4%) had final BCVA of 1.0 and 30 eyes (71.4%) had a BCVA ranging from 0.3 to 1.0 at the 3rd follow-up (3rd month). The other 11 eyes (26.2%) achieved final BCVA from 0.1 to 0.3. The mean BCVA was significantly decreased at different follow up than baseline ($p<0.05$). Table 5 showed that the UCVA improved in all patients with IOL ranging from 0.1 to 0.8. In this study, 31 eye (73.8%) had final UCVA of 0.3-0.8 and 11 eyes (26.2%) had a UCVA ranging from 0.1 to 0.3 at the 3rd follow-up (3rd month). The mean UCVA was significantly decreased at different follow up than baseline ($p<0.05$). Table 6 mean IOP was significantly increased in different follow up than baseline ($p<0.05$). Table 7 shows that mean interval between secondary IOL implantation was 2.7±1.5 months. Figure 3 shows that postoperative complications after secondary IOL implantation included mild anterior chamber exudates in 5 eyes (11.9%), temporary IOP elevation in 6 eyes (14.3%), decentered IOL in 3 eyes (7.1%), exposed suture in 3 eyes (7.1%) and corneal oedema in 5 eyes (11.9%), complications were subsequently managed by surgery. No other complications were observed in this study.

Table I: ***Distribution of the study patients by age group***

Age group (years)	Frequency (n)	Percentage (%)
20	2	4.8
21-30	5	11.9
31-40	10	23.8
41-50	15	35.7
51-60	7	16.7
>60	3	7.1
Mean±SD	39.5±14.7	

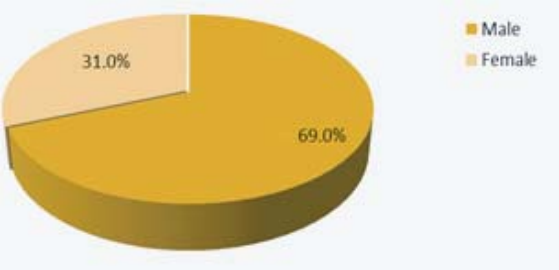

Figure I : Distribution of the study subjects according to gender (n=42)

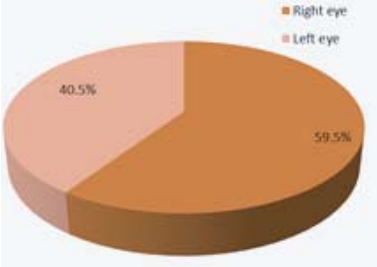

Figure II : Distribution of the study subjects according to eyes (n=42)

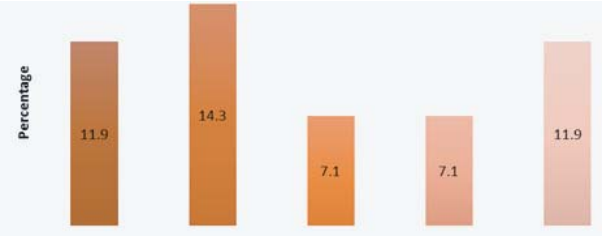

Figure III: Distribution of postoperative complications

Table 2: ***Distribution of the study subjects according to occupational status***

Occupational status	Number of patients	Percentage (%)
Housewife	9	21.4
Student	3	7.1
Service	18	42.9
Business	7	16.7
Others	5	11.9

Table 3: ***Distribution of the study subjects according to injured eyes (n=42)***

Injured eyes	Number of patients	Percentage (%)
Lenticular nucleus drop	8	19.0
Posterior dislocation of intraocular lens (IOL)	6	14.3
Penetrating injury	12	28.6
Intraocular foreign body (IOFB)	3	7.1
Ocular rupture	8	19.0
Endophthalmitis	5	11.9

Table 4: ***Distribution of the study subjects according to BCVA***

BCVA (LogMAR units)	Number of eyes	Percentage
Initial (Baseline)		
0.1-0.3	2	4.8
0.3-1.0	5	11.9
>1.0	35	83.3
Mean±SD	1.35±0.42	
1st follow up (7th day)		
0.1-0.3	6	14.3
0.3-1.0	17	40.5
>1.0	19	45.2
Mean±SD	1.12±0.33	
P value	*0.001s*	
2nd follow up (1st month)		
0.1-0.3	13	31.0
0.3-1.0	24	57.1
>1.0	5	11.9
Mean±SD	0.87±0.18	
P value	*0.001s*	
3rd follow up (3rd month)		
0.1-0.3	11	26.2
0.3-1.0	30	71.4
1.0	1	2.4
Mean±SD	0.68±0.47	
P value	*0.001s*	

Table 5: ***Distribution of the study subjects according to UCVA***

UCVA (LogMAR units)	Number of eyes	Percentage
Initial (Baseline)		
<0.1	39	42.9
0.1-0.3	2	7.1
0.3-0.8	0	0.0
Mean±SD	0.035±0.14	
1st follow up (7th day)		
<0.1	5	11.9
0.1-0.3	22	52.4
0.3-0.8	15	35.7
Mean±SD	0.31±0.17	
P value	***0.001s***	
2nd follow up (1st month)		
<0.1	0	0.0
0.1-0.3	19	45.2
0.3-0.8	23	54.8
Mean±SD	0.39±0.21	
P value	***0.001s***	
3rd follow up (3rd month)		
<0.1	0	0.0
0.1-0.3	11	26.2
0.3-0.8	31	73.8
Mean±SD	0.47±0.32	
P value	***0.001s***	

All p-values measured with initial (baseline) vs different follow up

Table 6: ***Distribution of the study subjects according to IOP***

IOP (mmHg)	Mean±SD	Range (min-max)	P value
Initial (Baseline)	12.01±2.17	9-15	-
1st follow up (7th day)	13.25±1.92	10-17	0.001s
2nd follow up (1st month)	13.81±1.75	11-18	0.001s
3rd follow up (3rd month)	14.23±1.97	10-19	0.001s

Table 7: ***Distribution of the study subjects according to the interval between secondary IOL implantation in vitrectomy***

	Mean±SD	Range
Interval between secondary IOL implantation (months)	2.7±1.5	2-6

Discussion

This prospective longitudinal study was carried out with an aim to find evaluate the associate factors that influence the outcome of secondary IOL implantation in aphakic vitrectomized eyes. Patient age less than 15 years, patients with other ocular diseases and non-cooperative patients were excluded from the study. The present study findings were discussed and compared with previously published relevant studies. In this study observed that majority 15(35.7%) patients belonged to age group 41-50 years with the mean age was 39.5±14.7 years. In a study [1] reported that the age ranged from 15 to 67 years with a mean of 37 years. Li et al. described that mean age of the patients was 45.6 years. Riazi et al. [10] revealed that age of the participants ranged from 14 to 65 years with mean age 27.7±13.3 years. Another study done by Kim et al.[10] showed that mean age of the patients was 48.8±14.4 years. This difference across various studies may be because of the different demographic, geographic and gender distribution of the population. In present study observed that male patients were predominant 29(69.0%) and female was 13(31.0%). Male to female ratio was 2.2:1. In a study conducted by He et al.[1] demonstrated that out of 89 patients, 61(68.5%) were male and 28(31.5%) female. Riazi et al.[3] had observed that 14 (82.4%) were men and 3 (17.6%) were women.. Brunin et al.[7] obtained that 32 (67.0%) were male and 16(33.0%) were females. The Incidence was higher in males (89.7%) in a study done by Kim et al. [11]. The above mentioned studies finding were almost similar in this study. In this current study observed that out of 42 injured eyes, 8 eyes of 8(19.0%) patients with lenticular nucleus drop, 6 eyes of 6(14.3%) patients with posterior dislocation of intraocular lens (IOL), 12 eyes of 12(28.6%) patients with penetrating injury, 3 eyes of 3(7.1%) patients with intraocular foreign body (IOFB), 8 eyes of 8(19.0%) patients with ocular rupture and 5 eyes of 5(11.9%) patients with endophthalmitis. In a study observed by He et al.[1] where they documented in all injured eyes, there were 36 eyes of 36 patients with penetrating injury, 28 eyes of 28 patients with IOFB, 13 eyes of 13 patients with ocular rupture, and 12 eyes of 12 patients with endophthalmitis, that was support with our study. In this study observed that right eye was involved in 25(29.5%) and left eye in 17(40.5%). Agarkar et al. [12] reported that surgery was done in the right eye in 27 eyes (51.92%) and 25 in the left eye (48.07%). Kim et al. [10]. also obtained that right eye was found in 22(55.0%) and left eye 18(45.0%). The above mentioned studies finding were almost similar to this study. In present study observed that the BCVA ranged from 0.1 to 1.0 after secondary IOL implantation in vitrectomy. In this study, 1 eye (2.4%) had final BCVA of 1.0 and 30 eyes (71.4%) had a BCVA ranging from 0.3 to 1.0 at the 3rd follow-up (3rd month). The other 11 eyes (26.2%) achieved final BCVA from 0.1 to 0.3. The mean BCVA was significantly decreased at different follow up than baseline ($p<0.05$). In study conducted by He et al.[1] revealed that the BCVA was 0.1 to 1.0 after vitrectomy. The BCVA ranged from 0.1 to 1.0 after secondary IOL implantation. In their data, 3 eyes (3%) had final BCVA of 1.0, and 61 eyes (69%) had a BCVA ranging from 0.3 to 1.0 at the last follow-up. The other 25 eyes (28%) achieved final BCVA from 0.1 to 0.3.

Riazi et al. [3] described that improvement in BCVA was not significant (0.48±0.22 preoperatively and 0.52±0.24 postoperatively, P=0.94). After surgery BCVA remained the same or became better in 15 eyes (88.8%). Yan in 2014 observed that the best corrected visual acuity was from 0.1 to 1.0 after vitrectomy [8]. Li et al. [9] showed BCVA of logMAR 0.82 at baseline improved to logMAR 0.66 at final visit. Kim et al. [10] demonstrated that mean BCVA (log MAR) was 0.53 ± 0.51 preoperatively and 0.54 ± 0.46 at 6 months postoperatively. Postoperative refractive error was -1.28 ± 1.40 D and the astigmatism was 2.54 ± 1.52 D. The difference between the target and postoperative refractive error was a myopic shift of -0.63 ± 1.44 D. Postoperative BCVA had

no significant correlation with preoperative factors other than preoperative BCVA ($p < 0.001$). Guell et al. [13] reported satisfactory results of Artisan IOL implantations in 16 aphakic patients. After 36 months follow-up, BCVA was 20/40 or better in 31.25% and mean SE was 0.46 D. These findings are also consisted to our findings. In our study observed that the UCVA improved in all patients with IOL ranging from 0.1 to 0.8. In this study, 31 eye (73.8%) had final UCVA of 0.3-0.8 and 11 eyes (26.2%) had a UCVA ranging from 0.1 to 0.3 at the 3rd follow-up (3rd month). The mean UCVA was significantly decreased at different follow up than baseline ($p<0.05$). He et al [1] had observed that the UCVA improved in all patients with IOL ranging from 0.1 to 0.8. In a study done by Yan revealed that the uncorrected visual acuity ranged from 0.1 to 0.8 after IOL implantation. Riazi et al. [3] also showed that UCVA improved in all patients (0.03±0.1 preoperatively vs 0.45±0.29 postoperatively, $P<0.0001$). Due to time constraints, a large sample could not be included in this study. Randomization and blinding were not done. Therefore, selection bias in this study can't be fully eliminated. Unwilling participants were not included in this study.

Conclusions

This study concluded that the appropriate interval of secondary IOL implantation in Vitrectomized Eye is important. Posterior chamber IOL implantation is performed in eyes with integrity of posterior capsule, and IOL sutured in the sulcus in eyes without posterior capsule support. Our results indicate that secondary IOL implantation remains a safer and more effective option with fewer complications in Vitrectomized eyes. To our knowledge, there are few reports on secondary IOL implantation with 25-G infusion in Vitrectomized eyes. Further studies can be undertaken by including large number of patients. Proper method and timing for secondary foldable IOL implantation can offer advanced visual rehabilitation with low rate of complications in vitrectomized eyes. The main disadvantage of this procedure is an added surgery, increasing cost and patient discomfort. Randomized controlled studies involving larger numbers of patients with longer follow-up period are required before any further conclusions can be drawn.

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