Original Article

Surgical and visual outcomes of posterior dislocated lens fragments after cataract surgery during 5-years at a tertiary eye hospital of North India

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Abstract

Objective: To determine the surgical and visual outcomes of posteriorly dislocated lens fragments in the vitreous cavity in patients undergoing cataract surgery.
Methods: A total of 149 eyes of 149 patients from 2013 to 2018 were included in the study. The primary cataract surgery was performed either at the base hospital and its peripheral centres or referred from elsewhere. Pars plana vitrectomy and nucleus removal was performed along with implantation of intraocular lens, wherever possible. Success was defined as best corrected visual acuity (BCVA) ≥ 6/12 at 3 months follow up. Poor visual outcome was defined as per WHO guidelines as BCVA ≤ 3/60.
Results: Posterior capsular rupture and dislocation into vitreous cavity most frequently occurred during phaco-fragmentation in cases of phacoemulsification and during nucleus delivery in cases of small incision cataract surgery. Early vitrectomy was performed within 3 days in 36.2% of cases and within 14 days in 63.8% of cases. Successful visual outcome was achieved in 85.2% of patients at 3 months follow up after vitrectomy. Iatrogenic retinal break occurred in five patients during vitrectomy and five patients had retinal detachment. Poor visual outcome was observed in 12 eyes, out of which glaucomatous optic neuropathy seen in 5 cases, cystoid or diabetic macular edema in 4 cases and age related macular degeneration in 3 cases.
Conclusion: Posterior dislocation of lens can be successfully managed in majority of cases with vitreoretinal surgical intervention. The timing of vitrectomy whether performed early or late did not affect the visual outcome. The most important predictor of final visual acuity after PPV for retained lens fragments is a less complicated clinical course without any associated complications such as retinal detachment, cystoid macula edema and glaucoma. Expertise of the primary cataract surgeon could not be assessed in this study, though surgeon grade with more experience is an important factor in the assessment of complications during the cataract surgery.

Key words: Lens fragment drop, Cataract surgery, Vitrectomy

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Introduction

Cataract surgery has evolved as a highly satisfying and gratifying surgery in the current era. However, it has a learning curve and can be associated with serious complications.

Dislocation of nucleus or lens fragments into the vitreous cavity during cataract surgery is a rare but serious complication. (Wong et al, 1997; Yeo et al, 1999)

The overall frequency of retained lens fragments after cataract surgery has been reported to vary from 0.3% to 1%. (Pande and Dabbs, 1996) The incidence of posterior dislocation is associated with the type of cataract, the type of cataract surgery performed and the surgeon's expertise with the surgical technique. The incidence of dropped nucleus in the vitreous cavity is inversely related to the expertise of the primary operating surgeon and the visual outcome also depends on the expertise and skill of the secondary vitreoretinal surgeon.

Risk factors for vitreous loss and dislocation of lens material into the vitreous cavity include elderly patient, hard nucleus, posterior polar cataract, small pupillary diameter, deep set eyes, pseudo-exfoliation syndrome, vitrectomised eyes and ocular trauma. (Scott and Flynnjr, 2001; Monshizadeh et al,1999)

The presence of retained lens fragments in the vitreous cavity may result in complications such as uveitis, corneal edema, cystoid macular edema (CME) and retinal detachment (RD), thereby, resulting in decrease in visual acuity in eyes with good visual potential. (Monshizadeh et al, 1999; Kim and Miller, 2002)

Pars plana vitrectomy (PPV) is performed to remove these retained lens fragments. Early opinion of the vitreoretinal surgeon facilitates quick evaluation and vitrectomy with the removal of lens fragments along with intraocular lens (IOL) implantation in case it was deferred in the primary cataract surgery. (Rofagha and Bhisitkul, 2011) However, the optimal time for vitrectomy has not been established. (Steganiotou et al, 2003) Leading causes of poor visual outcome in such cases include CME and RD. (Greven and Piccione,2004; Smiddy et al, 2003)

This retrospective study was conducted to evaluate the best corrected visual acuity and factors affecting the visual outcomes in patients who underwent PPV to retrieve the posteriorly dislocated nucleus fragments after a routine cataract surgery in a tertiary eye care hospital over a period of 5 years.

Methods

We conducted a medical record review for patients who had posteriorly dislocated lens fragments into the vitreous cavity during cataract surgery from April 1, 2013 to March 31, 2018. All patients were examined and treated at a tertiary eye care hospital. The study was approved by the Institutional Review Board of the hospital. The study adhered to the tenets of the Declaration of Helsinki.

The inclusion criteria included patients of any age group who underwent PPV for removal of posteriorly dislocated lens fragments after cataract surgery with a follow-up period of minimum three months. The exclusion criteria included patients who had undergone any previous vitreoretinal intervention or who had traumatic or spontaneous dislocation of the lens into the vitreous cavity.

Being a tertiary eye centre, the vitreoretinal department of our hospital provides retina backup to the peripheral centres of the institute as well as other surrounding ophthalmic centres which do not have surgical retina facilities. Depending upon the availability of skilled vitreoretinal surgeon and logistics, patients were taken up for primary or secondary vitreoretinal surgical intervention.

Data collected included patient demographics, associated ocular co-morbidities, the expertise level of primary cataract surgeon, grade of cataract, pre-operative visual acuity, type of cataract surgery, any associated intraoperative complication, stage of posterior capsular rupture, timing between two surgeries, gauge of vitrectomy used and the method used to retrieve

the nucleus fragment. The post-operative visual acuity at 3-months after secondary surgery was documented and causes of decreased vision were analysed.

The operating surgeons were classified into trainee, junior fellow, senior fellow and consultant. Fellows with more than 1 year experience (≥ 250 cataract surgeries) were considered as a senior fellow and less than 1 year duration as a junior fellow (< 250 cataract surgeries). Consultants with more than 5 years experience (≥ 2000 cataract surgeries) were considered as senior. Trainees were referred to those who joined for short term hands on training in small incision cataract surgery or phacoemulsification.

Success was defined as the percentage of patients who achieved best corrected visual acuity level (BCVA) ≥ 6/12 (Snellen's visual acuity chart) at 3 months follow up. Poor visual outcome was defined as BCVA ≤ 3/60 (as per WHO guidelines).

Primary vitrectomy was defined as PPV performed at the time of cataract surgery at the same sitting. Secondary vitrectomy refers to PPV performed at any given point of time thereafter.

For the purpose of this study, early vitrectomy was defined as vitrectomy performed either at time of primary cataract surgery or within 3 days of cataract surgery. Late vitrectomy was defined as PPV performed after 3 days of cataract surgery. Visual outcomes were compared between these two groups. The potential causes of poor visual outcome following the surgery were grouped into ocular comorbidities and those related to surgery.

Statistical analysis

Statistical Package for the Social Sciences software version 23 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Mean and standard deviation was calculated for continuous variables. Categorical variables were reported in percentages. Visual acuity was recorded through snellen visual acuity chart and chi square test was used for comparison between the two groups. P value of 0.05 or less was considered statistically significant.

Results

A total of 149 patients were included in this study. All patients had retained lens fragments after routine cataract surgery and were managed with PPV. The age of patients varied from 35 to 87 years with the mean age of 62.1 ± 5.2 years. The demographic analysis of the patients has been described in Table 1.

Of these, 60.4% cases were hospital complications followed by 26.2% cases from neighbouring hospitals. 31 patients had hard cataract, 10 patients had posterior polar cataracts, 4 patients had hypermature cataract and 2 patients had pseudo exfoliation syndrome (Table 2). Larger number of cases were operated by junior consultant (52) and senior fellow (35), followed by junior fellow (28), senior consultant (28) and trainee (6).

Majority of patients had posterior capsular tear and dislocation of lens fragment during phacoemulsification (105) followed by small incision cataract surgery (SICS) (37) and extracapsular cataract surgery (ECCE) (7). During phacoemulsification, phaco-fragmentation and nucleus disassembly was the most common step at which posterior capsular rupture occurred whereas in SICS, nucleus delivery was the most common step leading to dislocation of lens matter into the vitreous. Complete lens was dislocated in 70.3% of SICS cases (26 of 37) whereas fragment drop was seen in 57.14% cases of phacoemulsification (60 of 105). (Table 3)

All cases underwent three-port PPV for removal of lens matter by vitreoretinal surgeon. Most of the cases were taken up in the second sitting. In 34 cases, primary vitrectomy was performed.

In secondary cases, the average interval between cataract and vitreoretinal surgery was 12.97 ± 3.5 days. One patient was operated after 90 days due to poor systemic condition. After vitrectomy, the dropped lens matter was removed either by anterior route (17 cases) or by using a phacofragmatome (52 cases) or vitrectomy cutter (80 cases) depending on the grade of cataract and size of the fragment. In 9 cases, 25 gauge vitrectomy was used for removal of the epinucleus or significant cortical matter. (Table 4)

Intraocular lens (IOL) was implanted in 121 eyes. In 60 eyes, the IOL was implanted at the time of primary cataract surgery and in 61 eyes, IOL was implanted by the vitreoretinal surgeon during vitrectomy. IOL could not be implanted in 28 cases and were left aphakic.

Posterior chamber IOL was implanted in 76 cases either primary or secondary and anterior chamber IOL in 35 cases. Scleral fixated IOL was implanted in 8 cases and glued IOL was performed in 2 cases.

Successful outcome, defined as best corrected visual acuity ≥ 6/12 was achieved in 127 cases (85.2%). Visual acuity was ≤ 3/60 in 12 patients (8.0%). Causes of decreased visual acuity post operatively was glaucomatous optic neuropathy seen in 5 cases, cystoid or diabetic macular edema in 4 cases and age related macular degeneration in 3 cases. Final visual outcome could not be evaluated in 10 cases (6.7%) as they were lost to follow up.

Early vitrectomy was performed in 54 cases and late vitrectomy was performed in 95 cases. (Table 4) We did not find significant difference in the visual outcomes between the two groups of early and late vitrectomy (p= 0.17).

Surgical complications during vitreoretinal surgery were encountered in 19 cases; 9 cases developed glaucoma. Out of these 9 cases, 2 cases developed steroid induced glaucoma, 2 cases developed secondary glaucoma due to tamponade and 5 had pre-existing open angle glaucoma. All cases were managed medically with anti-glaucoma medications and/or peripheral iridectomy except one case that had to undergo trabeculectomy.

In 5 cases, iatrogenic retinal breaks occurred during vitrectomy. Two iatrogenic breaks were located superiorly at 12 clock hour, 3 were located between 2-2:30 clock hours and one was located at 10:30 clock hours. These breaks were adequately treated with endolaser photocoagulation and fluid air exchange, and air was used as the tamponade.

Retinal detachment surgery was performed in 5 cases, out of which silicon oil tamponade was used in 3 cases that had inferior retinal breaks and gas perfluoropropane C3F8 14% tamponade was used in 2 cases with superior breaks. Liquid perfluorocarbon was not used in any retinal detachment surgery (Table 4).

Table 1: Demographics and systemic co-morbidities

I. Patient Demographics	
1. Mean Age (in years)	62.1 ± 5.2
2. Male : Female ratio	85:64
II. Laterality	
1. Right eye	81 (54.4%)
2. Left eye	68 (45.6%)
III. Systemic co-morbidities	
1. Hypertension	34 (22.8%)
2. Diabetes mellitus	18 (12%)
3. Asthma	8 (5.3%)
4. Coronary artery disease	2 (1.3%)

Table 2: Cataract related data (Part A)

I. Type of cataract	**Number of cases**	**%**
1. Hard cataract	31	20.8
2. Posterior polar	10	6.7
3. Posterior subcapsular	40	26.8
4. Hyper mature cataract	4	2.6
5. Intumescent	3	2.0
6. Nuclear sclerosis	96	64.4
7. Pseudo exfoliation syndrome	2	1.3
II. Type of cataract surgery		
1. Phacoemulsification	105	70.5
2. Small incision cataract surgery (SICS)	37	24.8
3. Extracapsular cataract extraction (ECCE)	07	4.7
III. Expertise of cataract surgeon		
1. Senior consultant	28	18.8
2. Junior consultant	52	34.9
3. Senior Fellow	35	23.5
4. Junior Fellow	28	18.8
5. Trainee	06	4.0

Table 3: Cataract related data (Part B)

	Number of cases, n(%)			
I. Step at which complication occurred (PHACO*/SICS†/ECCE‡)	**Phaco***	**SICS†**	**ECCE‡**	**Total**
1. Capsulorrhexis	0	0	1	1 (0.7%)
2. Hydro-dissection	6	12	0	18 (12.1%)
3. Phaco-fragmentation during phacoemulsification	79	0	0	79 (53%)
4. Nucleus delivery during SICS†/ECCE‡	0	14	2	16 (10.7)
5. Irrigation & Aspiration	20	11	4	35 (23.5%)
Total	**105**	**37**	**7**	**149 (100%)**
II. Size of dropped nucleus				
1. In toto	78	0	0	78 (52.3%)
2. Fragment drop	71	0	0	(47.7%)
Total	**149**	**0**	**0**	**149 (100%)**
III. Location of surgery				
1. In Base hospital	90	0	0	90 (60.4%)
2. Peripheral hospital	20	0	0	20 (13.4%)
3. Elsewhere (referrals)	39	0	0	39 (26.2%)
Total	**149**	**0**	**0**	**149 (100%)**
IV. Other complications of cataract surgery				
1. Zonular dehiscence	3	0	0	3 (50%)
2. Iridodialysis	1	0	0	1 (1.7%)
3. Choroidal detachment	2	0	0	2 (3.3%)
Total	**6**	**0**	**0**	**6 (100%)**

*Phacoemulsification, †Small Incision Cataract Surgery, ‡Extracapsular Cataract Extraction

Table 4. Vitrectomy related data

	Number of cases	%
I. Timing of vitrectomy (days)		
1. 0-3	54	36.2
2. 4-7	86	57.8
3. 8-14	5	3.3
4. ≥14	4	2.7
Total	**149**	**100**
II. Method of removal of nucleus		
1. Anterior route	17	11.4
2. Phacofragmatome	52	34.9
3. Vitrectomy cutter	80	53.7
Total	**149**	**100**
Type of vitrectomy (Gauge)		
1. 20 G	86	57.8
2. 23 G	54	36.2
3. 25 G	9	6.0
Total	**149**	**100**
IV. Complications		
1. Glaucoma	9	6.0
2. Retinal detachment	5	3.3
3. Iatrogenic retinal break	5	3.3

Discussion

Vitreous loss and posterior dislocation of lens matter into the vitreous cavity remains the most common complication of cataract surgery which impacts visual recovery. Eyes with poor visual acuity, retinal tears, retinal detachment, glaucoma, large amount of lens matter in vitreous, raised intraocular pressure and intraocular inflammation warrant early vitreoretinal intervention.

Timing of pars plana vitrectomy has not been well established. If associated with retinal detachment, early vitrectomy is advisable to remove the retained lens fragments and settle the retina. In other cases, a controversy exists between early and late vitrectomy in literature. Histological studies have showed that although inflammatory reaction is more severe with longer duration of lens fragments remaining within the eye, its implication in clinical outcome is not well established. Several studies in literature found no association between timing of vitrectomy and the visual outcome. (Ho et al, 2009; Merani et al, 2007; Scott et al, 2003)

Some surgeons favour vitrectomy in the same setting as cataract surgery but surgical fitness and logistics remain a matter of concern. Vitrectomy in first few days becomes challenging especially if there is corneal edema and intraocular inflammation.

We did not find any significant difference in the visual outcomes of early (≤ 3 days) versus late (>3 days) vitrectomy thus implying that the timing of vitrectomy does not affect the visual outcome. Maximum number of cases of lens fragment drop were observed during phacoemulsification surgery probably due to higher volume of phacoemulsification performed in comparison to SICS and ECCE.

In this study, the median interval between cataract surgery and vitrectomy was

approximately 13 days (0-90 days). Previous studies did not found any correlation between the timing of vitrectomy and the final visual outcome. (Fastenberg, 1991; Gilliland et al, 1992; Vilar, 1997; Vanner et al, 2011) Successful visual outcome was observed in 85.2% of cases; 36.2% of cases underwent early vitrectomy and 63.8% of cases underwent late vitrectomy. The visual outcome was comparable in both groups i.e. early versus late vitrectomy. The performance of primary PPV to retrieve the dislocated lens fragments at the time of cataract surgery, therefore, may be beneficial to minimize postoperative inflammation and its associated morbidity as well as to eliminate the need of two separate operations.

Ho et al (2009) did not find early vitrectomy to be a predictor of good visual outcome in a multivariate analysis but found its association with occurrence of secondary glaucoma. Merani et al (2007) and Margherio et al (1997) observed significant association of retinal detachment with delayed vitrectomy for dropped nucleus. But in our study, only five patients (3.3%) developed retinal detachment and out of which, four had poor visual outcome.

Narendran et al (2008) highlighted that the surgeon grade is an important determinant of complications and surgery performed by the trainees and cases operated by beginners can have poor visual outcomes. Lens fragment drop was observed in 63 cases of fellows and 80 cases of junior consultants. We also observed higher number of nucleus drop in the cases operated by junior consultant and fellows in comparison to the senior consultant. But, we could not analyse if the poor visual outcomes were due to the expertise of the primary surgeon as a handful of cases were referred from other hospitals.

The visual outcome success in our study was 85.23%, which is close to the observations in various studies that report final visual acuity of 20/40 or better in 60-68% of the patients. (Tommila and Immonen, 1995; Kim et al, 1994) This better outcome can be attributed to meticulous training and management, both at the time of primary cataract surgery and secondary vitreoretinal surgery. Intraocular lens implantation was done in 81.2 % of the patients, out of which 51.0 % had a posterior intraocular placement in sulcus.

Limitation of our study is its retrospective nature and short follow-up period. Post-operative refraction was done at 6 weeks after the surgery in our hospital. All the patients followed up till 3 months after surgery in our hospital and as a large number of patients were out-station, further follow-ups were done locally. There was incomplete documentation about the size of fragment drop observed intraoperatively. Some of our patients were lost to follow up and thus they were excluded in post operative visual outcome assessment.

Conclusion

This study highlights the assessment and outcome measures of cataract surgeries with dropped lens fragments in terms of predisposing risk factors, visual outcomes, surgical complications with comparison to the expertise of the primary cataract surgeon. The most important predictor of final visual acuity after PPV for retained lens fragments is a less complicated clinical course without any associated complications such as retinal detachment, cystoid macula edema and glaucoma. Though vitrectomy should be performed in early period, in order to reduce glaucoma and uveitis, its timing does not have any implication on the final visual outcome. Expertise of the primary cataract surgeon could not assessed in this study, though surgeon grade with more experience is an important factor in the assessment of complications during the cataract surgery.

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