Original Article

Outcome of Pars Plana Vitrectomy for Dropped Nucleus, Nucleus Fragment, and Intraocular Lens: A Hospital – Based Study

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ABSTRACT

Purpose: To evaluate the visual outcomes and complications of pars plana vitrectomy performed for dropped nucleus, nuclear fragments, and intraocular lenses.

Study Design: Interventional case series.

Place and Duration of Study: Layton Rahmatulla Benevolent Trust Hospital, Karachi from January 2024 to December 2024.

Methods: A total of 50 patients of either gender, categorized into three age groups (<50 years, 50–70 years, and >70 years), were included in the study based on predefined inclusion and exclusion criteria. Frequencies and percentages were calculated for qualitative variables. The Wilcoxon signed-rank test, a non-parametric method, was used to compare paired groups. The chi-square test was employed to assess associations between categorical variables. A p-value of ≤0.05 was considered statistically significant for all analyses.

Results: The mean age of the patients was 57.20±16.27 years. The best-corrected visual acuity before and after the PPV was 1.06±0.71 (range 0.30-3.00) and 0.57±0.37 (range 0.30-2.00), respectively. The difference in best-corrected visual acuity before and after the procedure was significant (p<0.001).The results also showed that there is no significant association of post-procedure complications with age group (p=0.688), gender (p=1.000), eye laterality (p=0.324), surgical technique (p=0.999), drop of nuclear fragment, nucleus, and IOL (p=0.310), location of IOL placement (p=0.359), the timing of pars plana vitrectomy (p=0.783), nucleus removal method (p=0.977).

Conclusion: Pars plana vitrectomy significantly improves visual outcomes in patients with dropped nucleus, nuclear fragments, or intraocular lenses, with no significant association between post-procedure complications and demographic or surgical variables.

Keywords: Pars-Plana vitrectomy, Nucleus, Intraocular lens, Cataract.

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INTRODUCTION

Cataract is one of the commonest causes of preventable blindness and is more prevalent in developing countries.[1] Cataract surgery has evolved from intra-capsular cataract extraction (ICCE) to extracapsular cataract extraction (ECCE) with intraocular lens (IOL) implantation, to small incision cataract extraction (SICS), and eventually to phacoemulsification with implantation of foldable intraocular lenses.[2] Phacoemulsification is the most

contemporary and widely used surgical technique employed for cataract removal.[3] Increased frequency of phacoemulsification technique accounts for the rise in the incidence of intraoperative surgical complications, the most common of which is posterior capsule rupture leading to vitreous loss, nucleus drop, fragment of nucleus drops, or IOL drop into vitreous cavity over the retina.[4,5] The reported frequency of nucleus fragments and nuclei dislocation during phacoemulsification is between 0.3% and 1.1%.[6]

Risk factors contributing to complications of Nucleus drop, fragments of nucleus drop, IOL drop encompasses various conditions and circumstances including the operating surgeon's experience, especially during the early learning curve of training, the presence of pseudoexfoliation, zonular dehiscence, small pupils, brunescent cataract, posterior polar cataract, floppy iris syndrome, high myopia and prior vitrectomized eye.[7] Retained lens matter, nucleus, or IOL can lead to severe intraocular inflammation, increased intraocular pressure (IOP), corneal oedema, cystoid macular oedema, retinal detachment, uveitis, and secondary glaucoma, which can result in decreased visual acuity if not treated.[8]

Standard three-port pars plana vitrectomy is an effective method for removing a Nucleus drop, a fragment of Nucleus, or an IOL drop with the use of either a Framatome for fragmentation of nucleus or with the use of heavy liquid Perfluorocarbon fluid (PFCL) to lift the nucleus, nuclear fragment or IOL upward into the vitreous cavity and removing it through the corneal tunnel or limbal incision.[4,9] Regarding the timing of Pars plana vitrectomy (PPV) surgery for nucleus drop, there is no effect on the final visual outcome.[10]

The placement of the IOL depends on capsular support where an IOL can be implanted in the bag or sulcus. In patients without capsular support, options include sutured or suture less scleral fixation IOL, anterior chamber IOL, and iris-claw IOL.[11]

Our study aims to evaluate the visual outcome and complications of PPV for dropped lens fragments, nucleus, and IOL in a tertiary care centre.

METHOD

This prospective descriptive study was conducted at the Vitreo-Retinal Department of Ophthalmology at Tertiary Teaching Eye Care Hospital Karachi, Pakistan from January 2024 to December 2024, after review and approval from the hospital's ethical review committee (**LRBT/TTEH/ERC/4613/04)**.

The study included all patients who had undergone cataract surgery in Tertiary Teaching Eye Care Hospital Karachi hospital or were referred from other ophthalmology centres with nucleus drop, fragment of a nucleus drops, or IOL. Eyes with coexisting pathology, such as advanced diabetic retinopathy, retinal detachment, macular disease, or advanced glaucoma, which could independently affect visual outcome, were excluded from the study. Informed consent was obtained for PPV. Data was collected for demographics, laterality of the eye and type of cataract surgery (ECCE, SICS, phacoemulsification). The time interval between complicated cataract surgery and PPV was categorized as early PPV (≤ 2 weeks) or late PPV (> 2 weeks). The procedure was performed with vitrectomy cutter, or perfluorocarbon fluid (PFCL). Best-corrected visual acuity (BCVA) before and after PPV at the postoperative follow-up visit was recorded using a Snellen chart and converted to the logarithm of the minimum angle of resolution (LogMAR) notation for statistical analysis. Placement of the IOL (in the posterior chamber, sulcus, anterior chamber, or scleral fixation) was recorded. Postoperative complications, including corneal oedema, increased IOP, cystoid macular oedema, uveitis, Hyphema, and retinal detachment were documented.

All patients underwent standard 25-gauge three-port PPV under local or general anaesthesia performed by a single experienced vitreoretinal surgeon. After the insertion of 25-gauge trocar cannulas, a core vitrectomy was performed. Posterior vitreous detachment was induced by staining with triamcinolone acetonide if it was not already present. Small nucleus fragments less than a quarter in size were removed with the vitreous cutter, and large nucleus fragments, whole nucleus, or dropped IOLs were removed using perfluorocarbon fluid (heavy fluid) to lift them upward in the vitreous cavity and then removed through limbal incision. Depending on the capsular support, an IOL was implanted. Postoperatively, topical antibiotics and dexamethasone drops were prescribed.

The sample size was calculated using the mean SD of BCVA (LogMAR),i.e. 1.3±0.5 9 preoperatively and 0.29±0.4 9 postoperatively. Open Epi Software is used for sample size calculation by taking power of test as 90% and confidence interval 95%, the total calculated sample was 10 patients.[11] The data was compiled and

analysed using the Statistical Package for Social Sciences (SPSS), version 27. All analyses were considered significant at a P-value of ≤0.05.

RESULTS

A total of 50 patients were enrolled in the study. The mean age was 57.20 ± 16.27 years. Age distribution showed that 12 patients (24%) were aged <50 years, 31 patients (62%) were between 50–70 years, and 7 patients (14%) were >70 years. The majority were male (31 patients, 62%), while 19 patients (38%) were female. Regarding eye laterality, 29 patients (58%) had right eye involvement, and 21 patients (42%) had left eye involvement. Based on surgical technique for cataract extraction, out of 50 patients,24(48%) underwent phacoemulsification, 16(32%) had extracapsular cataract extraction and 10(20%) had small incision cataract surgery. During the procedure nucleus fragment drops were reported in 22 patients (44%), whole nucleus drops in 15 patients (30%), and intraocular lens drops in 13 patients (26%). The timing of surgical intervention varied, most of the patients had PPV performed within 2 weeks 29(58%), while 21(42%) had PPV after more than 2 weeks. The clinical characteristics of the study sample is shown in Table 1. The best-corrected visual acuity before and after the PPV procedure was 1.06±0.71 with a range (0.30-3.00) and 0.57±0.37 with a range (0.30-2.00), respectively. We observed that the difference in best-corrected visual acuity before and after the procedure was highly significant (p<0.001), as presented in Table 02.

There was no significant association of post-procedure complications with age group (p=0.688), gender (p=1.000), eye laterality (p=0.324), surgical technique (p=0.999), drop of nuclear fragment, nucleus, and IOL (p=0.310), location of IOL placement (p=0.359), the timing of pars plana vitrectomy (p=0.783), nucleus removal method (p=0.977). The detailed results of associations with complications after the pars plana vitrectomy are presented in Table 03.

DISCUSSION

Pars plana vitrectomy is the standard treatment for dropped nucleus, nuclear fragments, and IOL drop during a complicated cataract surgery. Extraction of dropped residual lens fragments, nucleus, and IOL improves visual acuity, reduces inflammation, and lowers intraocular pressure (IOP), following appropriate management by the vitreoretinal surgeon.[12-14] The use of ultrasonic Framatome or perfluorocarbon can result in good outcome.[15]

Table 01: *Clinical characteristics of all the patients under study.*

Characteristics	n(%)
Age Group	
<50 years	12(24)
50-70 years	31(62)
>70 years	7(14)
Gender	
Male	31(62)
Female	19(38)
Eye Laterality	
Left	21(42)
Right	29(58)
Surgical Technique for Cataract removal	
ECCE	16(32)
SICS	10(20)
Phacoemulsification	24(48)
Reason of PPV	
Dropped Small nucleus fragment	22(44)
Nucleus drop	15(30)
IOL dislocation	13(26)
Placement of IOL	
In bag	18(36)
Anterior chamber	17(34)
Sulcus	9(18)
Scleral fixation	6(12)
Timing of PPV	
≤2 weeks	29(58)
>2 weeks	21(42)
Nucleus Removal Method	
Vitrectomy cutter	24(48)
PFCL with limbal removal	26(52)
Post PPV |Complications	
Corneal oedema	7(14)
Cystoid macular oedema	5(10)
Hyphema	4(8)
Retinal detachment	3(6)
Uveitis	1(2)
Increased IOP	3(6)

Table 02: *Comparison of best corrected visual acuity (LogMAR) before and after procedure.*

BCVA	Before PPV	After PPV	P-value
Mean±SD	1.06±0.71	0.57±0.37	
Median(IQR)	0.780(0.40)	0.300(0.48)	<0.001*
Range(Min-Max)	2.70(0.30-3.00)	1.70(0.30-2.00)	

Wilcoxon signed-rank test was applied.
*P-value ≤0.05 considered as Significant.
**Insignificant at p>0.05 levels.

In our study, most patients were above 50 years of age, with 31(62%) in the age group of 50–70 years. A

Table 03: *Association of different clinical characteristics with the complications.*

	Complications						
	Corneal Oedema	**CME**	**Hyphema**	**Retinal Detachment**	**Uveitis**	**Increased IOP**	**P-Value**
Age group							
<50 years	2(28.6)	2(50)	1(33.3)	0(0)	0(0)	0(0)	
50-70 years	3(42.9)	2(50)	1(33.3)	0(0)	2(66.7)	4(80)	0.688**
>70 years	2(28.6)	0(0)	1(33.3)	1(100)	1(33.3)	1(20)	
Gender							
Male	4(57.1)	2(50)	2(66.7)	1(100)	2(66.7)	3(60)	1.000**
Female	3(42.9)	2(50)	1(33.3)	0(0)	1(33.3)	2(40)	
Eye laterality							
Left	5(71.4)	1(25)	2(66.7)	0(0)	0(0)	2(40)	0.324**
Right	2(28.6)	3(75)	1(33.3)	1(100)	3(100)	3(60)	
IOL Placement							
In bag	4(57.1)	1(25)	0(0)	1(100)	1(33.3)	2(40)	
Sulcus	1(14.3)	0(0)	1(33.3)	0(0)	1(33.3)	0(0)	0.359**
Anterior chamber	2(28.6)	1(25)	2(66.7)	0(0)	0(0)	3(60)	
scleral fixation	0(0)	2(50)	0(0)	0(0)	1(33.3)	0(0)	
Reason for PPV							
Dropped nucleus fragment	4(57.1)	3(75)	0(0)	1(100)	0(0)	3(60)	
Nucleus Drop	2(28.6)	1(25)	3(100)	0(0)	2(66.7)	1(20)	0.310**
IOL Dislocation	1(14.3)	0(0)	0(0)	0(0)	1(33.3)	1(20)	
Surgical Technique							
ECCE	2(28.6)	1(25)	1(33.3)	1(100)	1(33.3)	2(40)	
SICS	1(14.3)	1(25)	1(33.3)	0(0)	1(33.3)	1(20)	0.999**
Phacoemulsification	4(57.1)	2(50)	1(33.3)	0(0)	1(33.3)	2(40)	
Timing of PPV							
≤2 weeks	4(57.1)	4(40)	2(40)	1(50)	4(66.7)	3(27.3)	0.783**
>2 weeks	3(42.9)	6(60)	3(60)	1(50)	2(33.3)	8(72.7)	
Nucleus removal method							
Vitrectomy cutter	3(42.9)	1(25)	1(33.3)	1(100)	1(33.3)	2(40)	0.977**
PFCL with limbal removal	4(57.1)	3(75)	2(66.7)	0(0)	2(66.7)	3(60)	

Chi-square test was applied.
*P-value ≤0.05 considered as Significant.
**Insignificant at p>0.05 levels.

significant improvement was found in the BCVA following the procedure (p<0.001). The mean BCVA in LogMAR was noted as 1.06±0.71 before the PPV procedure and 0.57±0.37 after the PPV procedure. A comparable study conducted by Lashgari et al, in 2018 reported similar findings, showing a statistically significant improvement in visual outcome for individuals who underwent pars plana vitrectomy for a dropped nucleus.[3] The mean pre and post-pars plana vitrectomy visual acuity was noted as 1.04±0.24 and 0.46±0.18, respectively (p<0.001).[3] Ozturk Y et al, also reported statistically significant improvement in BCVA after PPV.[11] The pre-operative mean BCVA was 1.3±0.5 LogMAR, which improved to 0.29±0.4 LogMAR.

Studies have shown no significant difference in visual outcomes based on the type or timing of IOL placement, indicating no meaningful correlation between these factors and postoperative visual results.[8,16,17] In our study IOL were placed in all cases at the time of vitrectomy, 18 (36%) positioned in the posterior capsular bag, 17(34%) in the anterior chamber, and 9 (18%) in the ciliary sulcus, 6 (12%) had scleral fixation done. A study conducted in south India found that an IOL was implanted in around 90% of cases, with the majority being inserted during the initial surgery and others after a subsequent vitrectomy. Only 7.0% of patients remained aphakic.[6] Previous publications showed that 77% of IOL lenses were placed during the initial treatment, requiring either removal or replacement during PPV surgery.[18]

The frequency of nucleus drops following cataract

surgery is rising, with an increasing adaptation towards phacoemulsification. Frequency of nucleus drop can be decreased by adequately managing complications during cataract surgery.

In our study, there was no significant difference in the frequency of nucleus drop between phacoemulsification and manual small-incision cataract surgery. Frequency of dropped nuclei was more during hydro dissection in both procedures, followed by sculpting and chopping in phacoemulsification or during nucleus delivery in manual small-incision cataract surgery.[6] In such situations, the availability of a vitreoretinal surgeon during the procedure enables the simultaneous execution of vitrectomy and lens insertion, offering considerable convenience in managing such cases.

There is no clear consensus on the optimal time for vitrectomy for IOL or nucleus removal. The timing of the vitrectomy, whether performed early or delayed, did not demonstrate any statistically significant differences in the final visual outcome. The results of a study by Vanner E A et al,[19] contradict the results of Kelkar AS, et al,[9] which concluded that early PPV following cataract surgery was advised for improved visual results. Glaucoma, chronic uveitis, and cystoid macular oedema could be avoided with an early vitrectomy conducted one to two weeks following cataract surgery.[20,21.]

Postoperative complications were corneal oedema, elevated IOP, cystoid macular oedema, uveitis, Hyphema, and retinal detachment. Javed EA, et al, found that 8 patients (22.8%) had raised IOP, 7(20%) patients had corneal haze, 2(5.71%) had cystoid macular oedema, 2(5.71%) retinal detachment and one (2.86%) had hyphema.[22] In another study, 56.9% had corneal oedema, 31.4% had uveitis, 19.6% had cystoid macular oedema, and 15.7% had rhegmatogenous retinal detachment.[1] They observed insignificant relationship of time duration with dropped nucleus ($p>0.05$).[23] Only corneal oedema was significantly associated with the dropped lens fragment or nucleus removal ($p=0.030$).

This study has several limitations. First, the sample size was small (n=50), which may limit the generalizability of the findings. Second, the study was conducted at a single centre, which may introduce institutional bias and limit the external validity of the results. Third, the study design was an interventional case series without a control group, restricting the ability to establish causal relationships or compare outcomes with alternative interventions. Additionally, follow-up duration was not specified, which may affect the assessment of long-term visual outcomes and complications.

CONCLUSION

This study provides valuable insights into the visual outcomes and complications following Pars-Plana vitrectomy for dropped IOLs, nuclei, and nucleus fragments. The results demonstrate a significant improvement in BCVA after PPV. This indicates that PPV can effectively address complications related to dropped nuclei and IOLs, leading to meaningful visual recovery.

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Patient's Consent: Researchers followed the guide lines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(LRBT/TTEH/ERC/4613/04)**.

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