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Short Communication

Short-term outcomes of implanting a retropupillary iris-claw intraocular lens in patients with lens and intraocular lens drops

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Abstract

Lens drop and intraocular lens (IOL) drop can occur after cataract or phacoemulsification surgery, where the IOL is dislocated from the capsular bag into the vitreous cavity. The aim of this study was to investigate the short-term outcomes of implanting a retropupillary iris-claw in patients with IOL drop and lens drop after phacoemulsification. A cross-sectional study was conducted at Santosa Hospital, Bandung, West Java, Indonesia, from January 2020 to December 2023. Patients were divided into two groups: IOL drop and lens drop groups. Total sampling was used, involving 51 patients in the present study, with 27 patients in the IOL drop group and 24 patients in the lens drop group. Data collected included age, sex, eye laterality, the onset of IOL drop or lens drop, intraocular pressure (IOP), uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), record of astigmatism change preoperative and postoperative, and postoperative pars plana vitrectomy (PPV) complications. Our data indicated that the UDVA significantly improved in both IOL drop and lens drop groups after PPV surgery (p<0.001). However, there were no significant changes in IOP or astigmatism following the surgery in either group. Over one month, both groups showed improved UDVA, decreased IOP, and changes in astigmatism, with no significant differences between groups. Similarly, there was no significant difference in CDVA between IOL drop and lens drop groups. Only four complications were recorded in the present study. Comparing IOL drop and lens drop groups, only an increase in IOP showed a significant difference (p=0.018). Corneal edema, IOL decentration, and pupil ovalization were not significantly different. In conclusion, retropupillary iris-claw IOL implantation is safe and effective for aphakic patients with complications from phacoemulsification, regardless of whether it is lens drop or IOL drop.

Keywords: Intraocular lens, lens subluxation, aphakia, vitrectomy, phacoemulsification

Introduction

Implanting a secondary intraocular lens (IOL) is crucial for restoring vision in patients with aphakia, where the natural lens is missing caused by surgical complication, trauma, or congenital condition [1,2]. IOL implantation options include anterior chamber IOL (ACIOL), scleral fixation of posterior chamber IOL (PCIOL), angle-supported anterior chamber, and iris fixation of PCIOL. ACIOL poses risks such as bullous keratopathy, glaucoma, and peripheral anterior synechiae. Scleral fixation of PCIOL involves longer surgery and risks such as IOL tilting, suture breakage, and ocular inflammation [2,3]. Recent advancements include IOL with haptics fixated to the iris

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using clips, specifically retropupillary iris-claw IOL implantation, which is safe and reliable with minimal complications [1,3-5].

Two primary types of iris-claw IOLs for secondary implantation are the prepupillary and retropupillary types [6]. Prepupillary iris-claw IOL implantation sits in the anterior chamber in front of the iris, which often causes higher rates of corneal endothelial cell loss and iris chafing. Retropupillary iris-claw IOL implantation is positioned behind the iris, fixed to its posterior surface, offering better centration and fewer complications [6,7].

Lens drop and IOL drop can occur after cataract or phacoemulsification surgery, where the IOL is dislocated from the capsular bag into the vitreous cavity [8]. The incidence varies by surgical techniques, IOL designs, and patient factors, ranging from 0.2% to 7.0% [8,9]. The aim of this study was to investigate the short-term outcomes of implanting a retropupillary iris-claw in patients with IOL drop and lens drop after phacoemulsification. By comparing visual acuity improvement and complications, the aim of this study was also to compare the effectiveness of retropupillary iris-claw IOL implantation in patients with IOL drop and lens drop after phacoemulsification.

Methods

Study design and setting

A cross-sectional study was conducted at Santosa Hospital, Bandung, West Java, Indonesia, from January 2020 to December 2023, involving patients who underwent pars plana vitrectomy (PPV) for IOL drop or lens drop after phacoemulsification. After PPV and exerting IOL or nucleus fragment from the posterior segment, an iris-claw IOL was inserted retropupillary through a corneal incision. Preoperative and one-month post-operative of uncorrected distance visual acuity (UDVA), intraocular pressure (IOP) and astigmatism changes between the IOL drop and lens drop group were recorded and compared. Corrected distance visual acuity (CDVA) one-month post-operative was compared between two groups. Any complications that occur within one month after PPV were documented.

Participant selection and sampling method

The inclusion criteria for this study were patients who underwent PPV and retropupillary iris-claw IOL implantation due to IOL drop or lens drop after phacoemulsification, with at least one month of follow-up. Patients with retinal pathology, iris abnormalities, other intraocular surgeries, history of corneal disease, ocular comorbidities affecting visual acuity, and diabetes mellitus were excluded. The participants were divided into two groups: the IOL drop group and the lens drop group. Total sampling was used, involving 51 patients in total, with 27 in the IOL drop group and 24 in the lens drop group.

Surgical procedures

After instilling 1% mydriatic eye drops, the patients underwent surgery under general anesthesia. A vitreoretinal surgeon performed PPV and retropupillary iris-claw implantation. In some cases, 1–2 mL of perfluorocarbon liquid was temporarily injected into the vitreous cavity to protect the macula. A liberty iris-claw lens ICA 5585 (Appasamy Associates Ltd., Tamil Nadu, India) was inserted through a corneal incision at 12 o'clock. The procedure was ended by a peripheral iridotomy and corneal suturing.

Study variables and data collection

Apart from demographic data (patient age and sex), eye laterality, onset of IOL drop or lens drop, IOP, UDVA, CDVA, astigmatism changes between preoperative and postoperative, and postoperative PPV complications were collected and assessed. Visual acuity from the Snellen chart was converted to logMAR for statistical analysis. UDVA and IOP were recorded before surgery and one week and one month after surgery. IOP was measured with a Topcon CT-80 non-contact tonometer and biometry was conducted using an IOL Master 700, IOL Master 500, or A-scan. CDVA was measured using the trial lens, looking at the Snellen chart at a distance of six meters. Postoperative PPV complications, including iris-claw decentration, corneal edema,

secondary high IOP, irregular iris shape, and macular edema, were recorded and compared between the two groups.

Each patient's information was anonymized and coded to ensure confidentiality. This process involved assigning a unique identifier to each patient to protect patient personal information while allowing for effective data analysis.

Statistical analysis

Descriptive data were expressed as frequency and percentage, and the data normality was tested with the Shapiro-Wilk test. Preoperative and postoperative IOP, UDVA, and astigmatism changes were analyzed using paired Student's t-test or Wilcoxon signed-rank test. Comparisons between groups were analyzed using a two-sample Student's t-test or Wilcoxon rank-sum test and postoperative PPV complications were analyzed with Fisher's exact test. A p-value of ≤0.05 was considered statistically significant. Statistical analysis was conducted using R version 4.2.2 (R Foundation, Vienna, Austria).

Results

Patient's characteristics

In total, 51 eyes from 51 patients were recorded and the characteristics of the patients are presented in **Table 1**. The mean age was 67 years for the IOL drop group and 64 years for the lens drop group. Most IOL drops occurred in males and the right eye, while lens drops occurred in females and the left eye. Demographic similarities were observed between IOL drop and lens drop groups in terms of average age, sex distribution, and eye laterality. However, significant differences in preoperative and postoperative IOP suggested a potential distinction in the underlying mechanisms or responses to surgical procedures between the two groups (**Table 1**).

Table 1. Characteristics of patients with intraocular lens (IOL) drop (n=27) and lens drop (n=24)

Patients' characteristics	IOL drop	Lens drop	p-value
	n (%)	n (%)	
Sex			0.134
Male	18 (66.67)	11 (45.83)	
Female	9 (33.33)	13 (54.17)	
Age, mean±SD (years)	67.67±8.77	64.62±7.47	0.180
40–50 years	1 (3.70)	1 (4.16)	
51–60 years	5 (18.52)	7 (29.17)	
61–70 years	21 (77.78)	16 (66.67)	
Eye laterality			0.322
Right eye	15 (55.56)	10 (41.67)	
Left eye	12 (44.44)	14 (58.33)	
Time to operate			1.000
<3 months	26 (96.30)	23 (95.83)	
>3 months	1 (3.70)	1 (4.17)	
Intraocular pressure, mean±SD (mmHg)			
Preoperative	13.28±7.97	17.50±10.45	0.034
Postoperative	11.17±3.67	14.75±7.13	0.028
Uncorrected distance visual acuity, mean±SD (logMAR)			
Preoperative	1.97±0.39	1.82±0.41	0.127
Postoperative	0.71±0.43	0.80±0.46	0.575
Astigmatism, mean±SD (diopters)			
Preoperative	2.36±2.16	1.69±1.21	0.443
Postoperative	2.64±2.14	2.05±1.26	0.513

Outcomes of implanting a retropupillary iris-claw intraocular lens

Our data indicated that UDVA significantly improved in both the IOL drop group (from 1.97±0.39 to 0.71±0.43) and the lens drop group (from 1.82±0.41 to 0.80±0.46) after PPV surgery (p<0.001) (**Table 2**). However, there were no significant changes in IOP or astigmatism following surgery in either group.

Table 2. Comparison of preoperative and postoperative results of uncorrected distance visual acuity, intraocular pressure, and astigmatism in intraocular lens (IOL) drop group (n=27) and lens drop group (n=24)

Groups and variables	Preoperative	Postoperative	*p*-value
IOL drop group			
Uncorrected distance visual acuity, mean±SD (logMAR)	1.97±0.39	0.71±0.43	<0.001
Intraocular pressure, mean±SD (mmHg)	13.28±7.97	11.17±3.67	0.262
Astigmatism, mean±SD (diopters)	2.36±2.16	2.64±2.14	0.504
Lens drop group			
Uncorrected distance visual acuity, mean±SD (logMAR)	1.82±0.41	0.80±0.46	<0.001
Intraocular pressure, mean±SD (mmHg)	17.50±10.45	14.75±7.13	0.321
Astigmatism, mean±SD (diopters)	1.69±1.21	2.05±1.26	0.065

Comparisons of outcomes between groups

Over one month, both groups showed improved UDVA, decreased IOP, and changes in astigmatism, with no significant differences between them. Similarly, there was no significant difference in CDVA between IOL drop and lens drop groups after one month (**Table 3**).

Table 3. Comparison of postoperative results after one month in both groups

Variables	IOL drop group	Lens drop group	*p*-value
Uncorrected distance visual acuity, mean±SD (logMAR)	-1.26±0.42	-1.02±0.52	0.083
Intraocular pressure, mean±SD (mmHg)	-2.11±6.47	-2.75±9.52	0.970
Astigmatism, mean±SD (diopters)	0.28±2.13	0.36±0.92	0.849
Corrected distance visual acuity, mean±SD (logMAR)	0.59±0.47	0.57±0.48	0.669

IOL: intraocular lens

Comparison of complications between groups

Only four complications were recorded in the present study. Comparing the IOL drop and the lens drop groups, only an increase in IOP showed a significant difference (p=0.018). Corneal edema, IOL decentration, and pupil ovalization were not significantly different (**Table 4**).

Table 4. Comparison of postoperative complications in both groups

Variables	IOL drop group, n (%)	Lens drop group, n (%)	*p*-value
Corneal edema	4 (80.0)	3 (30.0)	1.000
High intraocular pressure	0 (0.0)	5 (50.0)	0.018
Intraocular lens decentration	0 (0.0)	1 (10.0)	0.471
Pupil ovalization	1 (20.0)	1 (10.0)	1.000

IOL: intraocular lens

Discussion

Nucleus drop after cataract surgery occurs in 0.071%–0.12% of cases, with some reports ranging from 0.3%–1.1% and has decreased over time [10-12]. IOL dislocation or IOL drop, though rare, has an incidence of 0.2%–3% and can occur early or more than three months post-surgery following phacoemulsification [13,14]. The present study recorded 27 eyes with IOL drops and 24 eyes with lens drops, mostly occurring shortly after phacoemulsification.

In the present study, the average age was 66, with mostly males experiencing IOL drops and females experiencing lens drops. Nearly all patients underwent PPV surgery within three months of phacoemulsification complications. Other studies showed varying results [1,11,15,16]. For instance, Seo *et al.* found that IOL drops predominantly occur in males with age around 60.8 years old within two days after cataract surgery [15]. Conversely, Lee *et al.* suggested that IOL drops often happen in younger males [16]. Other studies indicate that lens drop is more common in males around 60 years old [1,11].

Several studies highlighted the importance of early vitrectomy following complications of cataract surgery, particularly phacoemulsification [17-19]. The timing can range from the same day to within three weeks post-phacoemulsification [17-19]. Early vitrectomy offers advantages such as reducing the risk of retinal detachment, elevated IOP, and inflammation [17-19]. In the

present study, almost all PPVs were conducted within three months (n=49), specifically within three weeks after phacoemulsification complications.

In the present study, postoperative UDVA significantly improved in both IOL drop and lens drop groups compared to preoperative values (p<0.001). CDVA also increased, though there was no significant difference between the two groups one month after PPV (p=0.669). Other studies have shown improvements in UDVA or CDVA after iris-claw IOL implantation, with visual acuity ranging from 20/200 to 20/20 with maximum correction, observed from the first week up to five years postoperatively [20,21].

Despite using a corneal incision for iris-claw IOL insertion in the present study, there were no significant differences in preoperative and postoperative astigmatism between the two groups. In contrast, Martinez and Gonzales observed a higher mean surgically induced astigmatism (2.49±1.36 D) in the corneal incision group compared to the scleral tunnel incision group [22]. Baykara *et al*. found an increase in mean astigmatism from -1.08 D preoperatively to -2.1 D six months postoperatively [23].

Complications following PPV and iris-claw IOL implantation, whether prepupillary or retropupillary, include uveitis, endothelial cell loss, cystoid macular edema, retinal detachment, transient intravitreal hemorrhage, secondary glaucoma, choroidal, and corneal edema [15,24-29]. The present study recorded four complications: corneal edema, elevated IOP, IOL decentration, and pupil ovalization. The incidence of elevated IOP in lens drop cases was higher than in IOL drop cases, which might be associated with intraocular inflammation influenced by the lens [28]. Pupil ovalization, a common issue after iris-claw IOL implantation, did not affect visual outcome or IOP [29].

Limitations of this study included a limited number of patients in both groups, the inability to measure endothelial cell count, and unknown outcomes for patients with complications due to a limited study period. Additionally, retrospective design and lack of randomization between IOL drop and lens drop groups were considered major limitations.

Conclusion

Retropupillary iris-claw IOL implantation is a safe and effective option for aphakic patients with complications following phacoemulsification, regardless of lens drop or IOL drop. Further research with longer follow-ups comparing both groups would provide valuable insight and enhance our understanding.

Ethics approval

The protocol of the present study was reviewed and approved by Ethical Committee of Health Research, Universitas Pasundan, Bandung, West Java, Indonesia (Approval number: 2405010002).

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

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