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Original Research

PARS PLANA VITRECTOMY MANAGEMENT OF DROPPED NUCLEUS OR DROPPED IOL AFTER CATARACT SURGERY AT CIPTO MANGUNKUSUMO NATIONAL GENERAL HOSPITAL IN INDONESIA

Karniela Ayuni Putri[1], Andi Arus Victor[2], Ari Djatikusumo[2], Gitalisa Andayani[2], Anggun Rama Yudantha[2], Mario Marbungaran Hutapea[2], Filza Amara Kamila Harlena[3]

[1]Department of Ophthalmology, Faculty of Medicine, Andalas University, M. Djamil General Hospital, West Sumatra, Indonesia ; [2]Department of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo National General Hospital, Jakarta, Indonesia ; [3]Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

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Corresponding author:
Ari Djatikusumo,
Department of Ophthalmology,
Faculty of Medicine,
Universitas Indonesia,
Cipto Mangunkusumo National General Hospital,
dr_djatikusumo@yahoo.com

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ABSTRACT

Introduction: Dropped nucleus or dropped intraocular lens (IOL) are two potential complications of cataract surgery that threaten visual acuity and require further intervention. The standard procedure for both conditions is pars plana vitrectomy (PPV).This retrospective study aimed to describe the demographic, clinical characteristics, and treatment outcomes of dropped nucleus or dropped IOL cases after PPV at Cipto Mangunkusumo National General Hospital between January 2023 and December 2024.

Methods: This retrospective descriptive study analyzed the medical records of 120 patients diagnosed with dropped nucleus or dropped IOL who underwent PPV. Data collected included demographics, visual acuity (logMAR), procedure characteristics, and postoperative complications.

Result: Out of 120 total cases (63 dropped nucleus, 57 dropped IOL), the patients were predominantly male with a mean age of 60 years old, ranging from 9 to 85 years old. Mean preoperative visual acuity was poor: 1.84 logMAR (0.10-2.70 logMAR) for dropped nucleus and 1.81 logMAR (0.10-2.70 logMAR) for dropped IOL The primary surgical management for dropped nucleus was vitrectomy with endofragmentation (53% of total cases) and for dropped IOL, the main procedure was vitrectomy with IOL explantation (41% of total cases). The management of most dropped nucleus cases (65.07%) was done within ≤1 month, while dropped IOL cases were often delayed. Postoperative complications were infrequent (92% complication-free), with increased IOP (4.76–5.26%) and retinal detachment (1.58–1.75%) being the most common. Mean postoperative visual acuity showed improvement for both groups (1.81 logMAR for dropped nucleus and 1.77 logMAR for dropped IOL).

Conclusion: PPV with appropriate adjunct procedures, such as endofragmentation or IOL explantation, is an effective and necessary treatment for dropped nucleus or dropped IOL, leading to an improvement in postoperative visual acuity outcomes with minimal to no postoperative complications.

Keywords : dropped nucleus, dropped IOL, pars plana vitrectomy, visual acuity, demographic characteristics

Introduction

Cataract surgery is the most common eye surgery performed worldwide. While it has a high success rate, complications can still occur. Two potential complications are dropped nucleus and dropped intraocular lens (IOL), both of which can threaten a patient's final visual acuity. A dropped nucleus happens when a piece of the lens breaks off and falls into the posterior chamber of the eye, often due to posterior capsule rupture during cataract extraction. A dropped IOL occurs when the IOL becomes dislocated and falls into the vitreous cavity, which can happen either during or after the surgery. Both of these conditions require further treatment to reduce the risk of blindness and restore vision.[1,2,3]

The incidence of dropped nucleus after cataract surgery is approximately 0.3% to 1.1%, while dropped IOL occurrence is about 0.1% to 0.2%. These complications occur depending on patient characteristics and the surgeon's skill. The risk is higher for patients with weak zonules or a history of ocular trauma. In Indonesia, accurate epidemiological data is still limited, but these cases are often linked to delayed diagnosis and access inequality to reach referral centers. Data from Vivin et al. showed 19 cases of dropped nucleus and dropped IOL in one year, with most occurring after phacoemulsification (94.7%).[4,5,6]

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The standard treatment for a dropped nucleus is pars plana vitrectomy (PPV) with endofragmentation, where the lens fragments are removed using a fragmatome.[7] The advancement of small-gauge technology (23G, 25G, 27G) in PPV has led to a lower risk of complications and quicker post-operative recovery. A study by Chen et al. on 500 cases showed the superiority of 27G PPV, with better visual acuity improvement (logMAR 0.32 vs 0.45), lower complications (8.2% vs 14.6%), and faster recovery (14 vs 21 days).[8] This system offers advantages like minimal tissue trauma, quicker recovery time, and a lower risk of complications.[9] For a dropped IOL, treatment options include PPV with IOL explantation if it can't be repositioned, or IOL repositioning with a secondary IOL implantation.[10]

Dropped nucleus or dropped IOL after cataract extraction surgery can lead to serious complications. Lens mass leftover in the posterior segment can cause uveitis, macular edema, glaucoma, retinal detachment, and corneal edema. Therefore, the timing of the surgery for a dropped nucleus or dropped IOL is a critical consideration. Any nucleus that has fallen into the vitreous cavity must be removed, even if it is small.[11,12]

This study aims to describe the treatment results of dropped nucleus and dropped IOL after pars plana vitrectomy. By understanding the factors that influence the final visual outcome, the objective is to improve the quality of patient care and provide further insights for future clinical practice.

Methods

This retrospective descriptive study was conducted at the Vitreo Retina Division, Department of Ophthalmology of Cipto Mangunkusumo National General Hospital, Jakarta, in May 2025 after the protocol received approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia (no. KET-784/UN2.F1/PPM.00.02/2025). Data were collected from the medical records of patients who met specific inclusion and exclusion criteria.

Patients were included if they were newly diagnosed with dropped nucleus and/or dropped IOL, underwent a PPV procedure, had their records between January 2023 and December 2024, and underwent a follow-up examination at 1 month post-operation. Meanwhile, the exclusion criteria involve having a history of macular abnormality/disorder, a history of pathological myopia, having undergone a previous vitrectomy procedure, and incomplete or untraceable medical records.

The collected data include information such as demographic characteristics (age at the time of the procedure, gender, and patient's address), clinical data (initial diagnosis, diagnosis during PPV, status of lens [e.g., phakic, pseudophakic], visual acuity and intraocular pressure before the procedure), and outcome data (post-operative complication).

The extracted data were organized into a master table and analyzed using descriptive statistics. Numerical variables were presented as mean with standard deviation or the median (minimum value – maximum value). Categorical variables were presented as proportions. Data were presented in the form of tables and graphs. All statistical analyses were performed using SPSS Statistics 15.0.

Results

During the period from January 2023 to December 2024, there were 120 cases consisting of 63 dropped nucleus cases and 57 dropped IOL cases that underwent PPV at Cipto Mangunkusumo National General Hospital.

Demographic and Clinical Characteristics

The demographic characteristics of the study patients are shown in Table 1. The mean age for patients with dropped nucleus was 60.89 ± 13.64 years, while for those with dropped IOL it was 59.80 ± 11.10 years. The proportion of male patients was higher in both groups (66.67% for dropped nucleus and 75.43% for dropped IOL) compared to female patients. For laterality, the left eye was more common for dropped nucleus cases (53.97%), whereas the right eye was dominant in dropped IOL cases (59.64%).

The average preoperative visual acuity was 1.84 ± 0.60 logMAR for dropped nucleus and 1.81 ± 0.47 logMAR for dropped IOL. The mean preoperative Intraocular Pressure (IOP) was found to be 15 mmHg (4-47 mmHg) for dropped nucleus and 13 mmHg (7-36 mmHg) for dropped IOL.

Table 1. Demographic and Clinical Characteristics

Variable	Dropped nucleus (n=63)	Dropped IOL (n=57)
Age (mean ± SD, years)	60.89 ± 13.64	59.80 ± 11.10
Gender n (%)		
Male	42 (66.67%)	43 (75.43%)
Female	21 (33.33%)	14 (24.56%)
Laterality n (%)		
Right Eye	29 (46.03%)	34 (59.64%)
Left Eye	34 (53.97%)	23 (40.35%)
Preoperative visual acuity (mean ± SD, LogMar)	1.84 ± 0.60	1.81 ± 0.47
Preoperative IOP (mean ± SD, mmHg)	15 (4 - 47)	13 (7 - 36)

Characteristics of Vitrectomy Surgery for Dropped Nucleus and Dropped IOL

In this study, vitrectomy with endofragmentation was performed in 53.33% of all cases (primarily in the dropped nucleus group), while the management for dropped IOL involved IOL explantation in 40.83% of cases and IOL repositioning in 5.83% of cases. The use of heavy fluid was limited to only 3.33% of cases. The most common tamponade agent used was air (95%), with silicone oil or SF 6 each used in 2.5% of cases. Endolaser was performed on 27.5% of patients, and intraocular corticosteroid injection was administered in 22.5% of cases, specifically triamcinolone in 18.33% and dexamethasone in 4.17%. These findings are presented in Table 2.

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Table 2. Characteristics of Vitrectomy Surgery

Variable (n=120)	Frequency (%)
VPP and Endofragmentation	63 (53.33%)
VPP with IOL Explantation	50 (40.83%)
VPP with IOL Repositioning	7 (5.83%)
Endolaser	
Yes	33 (27.5%)
No	87 (72.5%)
Use of Heavy Fluid	
Yes	4 (3.33%)
No	116 (96.67%)
Dexamethasone Injection	5 (4.17%)
Triamcinolone Injection	22 (18.33%)
No injection	93 (77.5%)
Tamponade Used	
Silicone Oil	3 (2.5%)
SF 6	3 (2.5%)
Air	114 (95%)

Characteristics of Lens Status and Postoperative Complications in Study Patients

The majority of patients were aphakic after the procedure (Table 3), both in the dropped nucleus group (76.19%) and the dropped IOL group (85.96%). Most patients did not experience postoperative complications (93.65% for dropped nucleus and 91.22% for dropped IOL).

Table 3. Characteristics of Lens Status Postoperative

Variable	Dropped nucleus (n=63)	Dropped IOL (n=57)
Pseudophakic	15 (23.80%)	8 (14.03%)
Aphakic	48 (76.19%)	49 (85.96%)

Post operative complication occurred in 6.35% of dropped nucleus patients and 8.78% of dropped IOL patients. Post-surgical complications included raised IOP, retinal detachment, and endophthalmitis as seen in Table 4.

Table 4. Postoperative Complication

Variable	Dropped nucleus (n=63)	Dropped IOL (n=57)
Increased IOP	3 (4.76%)	3 (5.26%)
Retinal Detachment	1 (1.58%)	1 (1.75%)
Endophthalmitis	0 (0%)	1 (1.75%)
No complication	59 (93.65%)	52 (91.22%)

The interval until PPV (Table 5) showed a significant difference between the two groups. For dropped nucleus cases, 65.07% were managed within ≤1 month, while 34.92% were managed after >1 month. Although the finding was not statistically significant (p=0.233), intervention performed within ≤1 month tended to provide better functional results compared to management after >1 month.

Table 5. Interval of PPV Procedure

Variable	Dropped nucleus (n=63)	Dropped IOL (n=57)
≤ 1 month	41 (65.07%)	26 (45.61%)
> 1 month	22 (34.92%)	31 (54.38%)

The visual acuity outcomes (Table 6) showed interesting results. The mean preoperative visual acuity was 1.84 ± 0.61 logMAR for the dropped nucleus group and 1.81 ± 0.47 logMAR for the dropped IOL group. Postoperatively, the mean visual acuity improved to 1.81 ± 0.68 logMAR for the dropped nucleus group and 1.77 ± 0.58 logMAR for the dropped IOL group.

Table 6. Visual Acuity Outcomes Pre and Post Operative

Variable	Preoperative	Postoperative	p value
Dropped nucleus (n=63)	1.84 ± 0.61	1.81 ± 0.68	0.13
Dropped IOL (n=57)	1.81 ± 0.47	1.77 ± 0.58	

Analysis of the change in visual acuity showed improvement in 12.5% of cases (especially those with a PPV interval of ≤1 month), relatively no change in 39.16% of cases, and worsening in 4.16% of cases.

Table 7. Visual Acuity Changes Based on PPV Interval

Variable	Improvement	No change	Worsening	p value
PPV Interval ≤ 1 month	15 (12.5%)	47 (39.16%)	5 (4.16%)	0.233
PPV Interval > 1 month	6 (5%)	42 (35%)	5 (4.16%)	

DISCUSSION

Demographic and Clinical Characteristics

This study involved 120 patients with the complications of dropped nucleus (52.5%) and dropped IOL (47.5%). The mean age of the patients (60.89 ± 13.64 years for dropped nucleus and 59.80 ± 11.10 years for dropped IOL) is consistent with the study by Kumar et al., which reported a mean age of 61.2 years in similar cases.[13] Older age is associated with a more fragile posterior capsule and an increased risk of intraocular complications.

The dominance of male patients (66.67% for dropped nucleus and 75.43% for dropped IOL) aligns with the study by Sharma et al., which found a male-to-female ratio of 2:1. A risk factor for this is heavy physical labor, which carries a high risk of trauma.[7] This finding is also consistent with the study by Vivin et al., which reported a male proportion of 58.5% in similar cases.[14] The study by Rho et al. further supports this finding, suggesting that males have a higher risk of phacoemulsification complications due to strenuous visual activity and potentially limited access to healthcare services.[15]

This study showed a difference in preoperative Intraocular Pressure (IOP) characteristics between the dropped nucleus and dropped IOL groups. In the dropped nucleus group, the mean IOP reached 15 mmHg with a wide range (4-47 mmHg), whereas in the dropped IOL group, the mean was lower at 13 mmHg (7-36 mmHg). This variation in IOP values can be explained by different pathophysiological mechanisms. In dropped nucleus cases, the more significant IOP increase is suspected to be affected by the larger mass of the lens, accompanied by an inflammatory reaction to the lens material.[16] In dropped IOL cases, the mechanism of IOP elevation is more chronic, involving a more gradual disruption of aqueous humor outflow.[17]

Characteristics of Vitrectomy Surgery for Dropped Nucleus and Dropped IOL

Vitrectomy with endofragmentation was the procedure of choice for dropped nucleus cases. This is a standard approach in PPV, using a fragmatome to efficiently remove nucleus fragments from the vitreous cavity. This supports the study by Sharma et al., which indicated that this technique provides good visual acuity and anatomical results while reducing the risk of complications.[7] A study by Chen et al. showed that the use of a fragmatome in PPV resulted in an anatomical success rate of 93% and a final visual acuity of logMAR<1.0 in 61% of patients.[8]

For dropped IOL cases, the surgery performed was vitrectomy, with IOL explantation in most cases. This is consistent with reports by Mansouri and Mozaffari et al., who found that IOL explantation is the primary procedure for posterior IOL dislocation due to the difficulty of IOL refixation in patients with zonular weakness.[9]

IOL repositioning is performed if the capsulorhexis is intact, the sulcus is adequate, and the zonules are still sufficient to support the IOL. Using a three-piece IOL with the haptics in the sulcus but the optic behind the capsulorhexis can provide IOL positional stability.[15] According to Cionni et al., repositioning using a scleral fixation technique offers long-term stability with relatively low complications (less than 10%).[18]

IOL explantation with or without IOL exchange is typically performed when the IOL cannot be repositioned due to haptic damage, inappropriate optic size, or total dislocation accompanied by retinal complications. The techniques used for IOL exchange vary depending on the condition of the capsular support, including the use of an iris claw or scleral fixation.[15]

Intravitreal steroid injection may also be administered after PPV in these cases. This study reinforces the findings of Mozaffari et al. regarding the importance of intravitreal steroids after PPV to control inflammation, even though only a small fraction of patients in this study received triamcinolone injections.[19]

Heavy Fluid (HF) was used in only 3.33% of cases in this study. HF can increase the efficiency and safety of the PPV procedure in dropped nucleus cases.[20] The effectiveness of HF in protecting the macula during endofragmentation was demonstrated by Tan et al. in a retrospective study of 120 cases, where HF reduced the risk of retinal trauma by 40%.[21]

Additional procedures, such as endolaser and tamponade, were performed based on intraoperative indications, including the presence of a retinal tear or potential for retinal detachment. In this study, endolaser was performed in 27.5% of cases. This aligns with the report by Rodrigues et al., which showed that prophylactic endolaser significantly reduced postoperative retinal detachment after vitrectomy for dropped nucleus cases.[22]

Characteristics of Lens Status and Postoperative Complications in Study Patients

The results showed that the majority of patients were aphakic postoperatively (76.19% in the dropped nucleus group and 85.96% in the dropped IOL group), with only a small portion being pseudophakic (23.80% and 14.03%).

This high rate of aphakia is consistent with the studies by Mansouri and Mozaffari et al., who linked it to extensive zonular damage in posterior dislocation cases. Comparison with other studies reveals that the aphakia rate in this research is higher than in the study by Park et al. (2025) in Korea (65-70%), reflecting a difference in preference for secondary IOL implantation.[23]

Postoperative complications included increased IOP (4.76% in dropped nucleus, 5.26% in dropped IOL), retinal detachment (1.58% in dropped nucleus, 1.75% in dropped IOL), and endophthalmitis (1.75% only in dropped IOL). The rise in IOP is suspected to be related to the inflammatory response to residual lens material. The lower rate of retinal detachment compared to a study by Rodrigues et al. may be due to the use of prophylactic endolaser.[22] The mechanism for retinal detachment and endophthalmitis after PPV for dropped nucleus or dropped IOL involves several pathophysiological aspects.

Retinal detachment occurs due to retinal tears caused by vitreoretinal traction. Lens fragments or an IOL falling into the vitreous cavity can create mechanical traction on the peripheral retina. Furthermore, intraocular manipulation during the use of the fragmatome can injure the retina. Traction on the incompletely cleared vitreous base or the presence of lattice degeneration also contributes to this process. Rodrigues et al. reported that the risk of retinal detachment after vitrectomy for retained lens fragments is up to 8%, and interventions such as prophylactic endolaser and the use of HF can significantly reduce this risk (by up to 40%).[22]

Endophthalmitis is closely linked to intraocular contamination by microorganisms during or after the PPV procedure. Contamination can occur from non-sterile surgical instruments, exposure of the vitreous cavity to environmental flora, or from microorganisms on the ocular surface entering during IOL explantation. Retained lens fragments or IOLs can also become a medium for bacterial growth, especially if removal is delayed. The accompanying inflammatory reaction can worsen the disease course and accelerate damage to intraocular tissue. Studies by Chen et al. and Riazi-Esfahani et al. indicate that the risk of endophthalmitis increases with longer operation duration and delayed management of residual lens material.[11]

Interval of PPV and Visual Acuity Outcomes

The research findings indicate that 65.07% of dropped nucleus cases were managed within ≤1 month, while 54.38% of dropped IOL cases required >1 month for intervention. This aligns with the study by Wong et al., which reported that delaying vitrectomy beyond 4 weeks significantly increases the risk of macular edema.[24] However, the difference in visual outcomes between quick and delayed intervention in this study did not reach statistical significance (p=0.233), a finding that differs from several previous studies. This might be influenced by factors such as variations in lens fragment size, adequate preoperative medical management, and limitations in visual acuity measurement methods for cases with very poor vision.[25]

The results show that the mean preoperative visual acuity was 1.84 ± 0.61 logMAR for the dropped nucleus group and 1.81 ± 0.47 logMAR for the dropped IOL group. Postoperatively, the mean visual acuity improved to 1.81 ± 0.68 logMAR for dropped nucleus and 1.77 ± 0.58 logMAR for dropped IOL, although this improvement was not statistically significant. These results are consistent with the study by Sharma et al. (2022), which reported visual improvement after PPV in 60-70% of dropped nucleus cases, but lower than the study by Chen et al., which used 27G PPV with a final mean visual acuity of 0.32 logMAR.[7,8]

Ideally, a secondary IOL is immediately placed at the time of vitrectomy procedure, both for dropped nucleus and dropped IOL cases. This method was applied at the hospital in Wasim S et al. (2025) study, which reported significant improvement in visual acuity before (1.06±0.71 logMAR) and after (0.57±0.37 logMAR) the procedure.[26] However, in our hospital, IOL reimplantation were not done in the primary vitrectomy procedure, but later in a separate surgery by a corneal and refractive surgeon, due to limitation of national health insurance coverage. Consequently, the majority of patients remained aphakic, though IOL repositioning was performed in a small number of cases when feasible (Table 3). The fact that the most patients had the same lens status before and after surgery explains why there was no significant difference in the visual acuity outcome (Table 6).

These findings align with Shroff K et al. (2022), where 46% of the postoperative lens status were kept aphakic. Although their study overall showed a significant improvement in visual outcomes (preoperative visual acuity 2.30 logMAR vs. postoperative 1.20 logMAR, p value < 0.0001), they noted poorer results in the aphakic subgroup. Specifically, 61.5% of aphakic patients had a final visual acuity worse than 1.82 logMAR, compared to only 13.3% in the pseudophakic group.[27]

Several studies state that delaying vitrectomy can increase the risk of inflammation, secondary glaucoma, and corneal endothelial damage due to exposure to foreign materials like a nucleus or IOL falling into the vitreous cavity. Studies by Ramezani et al. and Vanner et al. reported that intervention within ≤7 days resulted in significantly better visual improvement compared to delayed intervention.[14,28]

A recent study by Farrahi et al. (2022) also showed that earlier vitrectomy (<1 week) correlated with statistically better final visual acuity, with a mean logMAR of 0.41 compared to 0.62 in delayed interventions ($p<0.05$).[28]

This research supports those findings, particularly in dropped nucleus cases, where intervention is clinically performed sooner due to the potential toxicity of the nucleus to the retina. Patients in this group were more frequently treated within a short period (≤1 month) and showed an improved mean follow-up visual acuity (1.81 logMAR).

CONCLUSION

PPV with appropriate adjunct procedures, such as endofragmentation or IOL explantation, is an effective and necessary first aid treatment for dropped nucleus or dropped IOL. Although minor, it improves postoperative visual acuity with minimal complication. Importantly, PPV also prevents serious sequelae. Further research with a larger sample size and well-documented best corrected visual acuity (BCVA) is needed to reduce data variability and enrich the result.

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