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Original Research Article

Clinical Characteristics and Outcomes of Retained Lens Fragments in the Anterior Chamber Following Phacoemulsification

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Abstract:

Background: Visual results may be impacted by problems such corneal edema, intraocular inflammation, and elevated intraocular pressure (IOP) that can result from retained lens fragments in the anterior chamber after phacoemulsification. To reduce problems and enhance prognosis, early detection and suitable treatment are essential.

Aim: This study aims to evaluate the clinical features, management strategies, and visual outcomes of patients with retained lens fragments in the anterior chamber after phacoemulsification.

Methods: A prospective observational study was conducted on 100 patients with retained lens fragments post-phacoemulsification at Katihar Medical College, Bihar. Clinical presentation, management approaches (conservative vs. surgical), and postoperative outcomes were assessed. Data were analyzed using SPSS version 23.0, with statistical significance set at $p < 0.05$.

Results: The mean age of the participants was 65.4 ± 8.3 years, with a male-to-female ratio of 1.2:1. The most common presenting symptoms were blurred vision (78%) and increased IOP (46%). Management strategies included topical therapy (35%), anterior chamber washout (47%), and pars plana vitrectomy (18%). At 3 months, best corrected visual acuity (BCVA) improved significantly ($p < 0.001$), with 65% achieving good vision (BCVA ≤ 0.3 LogMAR). Postoperative complications were observed in 24% of cases, with persistent corneal edema (10%) being the most frequent.

Conclusion: Retained lens fragments in the anterior chamber can significantly impact postoperative recovery. Early surgical intervention, particularly anterior chamber washout, is correlated with better visual outcomes. Although complications occur, most patients achieve satisfactory vision recovery with appropriate management.

Recommendations: Routine postoperative examination should be emphasized for early detection of retained lens fragments. Timely surgical intervention is recommended for cases with persistent inflammation or increased IOP.

Keywords: Retained lens fragments, phacoemulsification, anterior chamber, visual outcomes, intraocular pressure.

Introduction

The most popular cataract surgery performed globally is phacoemulsification, which has a lower rate of complications and a quicker visual recovery. However, serious surgical morbidity can result from issues like retained lens fragments (RLFs) in the anterior chamber (AC). Retained lens material can result from incomplete cortical cleanup, zonular dehiscence, or intraoperative posterior capsule rupture, potentially leading to prolonged inflammation, corneal decompensation, and secondary glaucoma [1]. The incidence of RLFs following phacoemulsification is estimated to range from 0.1% to 1.1% depending on surgical expertise, cataract density, and underlying ocular conditions [2].

The clinical presentation of RLFs varies widely. While some cases remain asymptomatic and self-resolving, others present with anterior segment inflammation, elevated (IOP), corneal edema, and even cystoid macular edema (CME) [3]. Persistent lens fragments can incite a foreign body inflammatory response, characterized by anterior chamber reaction, fibrin deposition, and, in severe cases, hypopyon formation [4]. Moreover, prolonged exposure to lens proteins may exacerbate phacoanaphylactic endophthalmitis, necessitating urgent intervention [5].

The management of retained lens material remains a subject of debate, as the decision to intervene is influenced by factors such as fragment size, correlated inflammation, and IOP control. Small cortical remnants may be managed conservatively with topical corticosteroids and IOP-lowering agents, whereas larger nuclear fragments or persistent inflammation may require surgical removal via anterior chamber washout or pars plana vitrectomy (PPV) [6]. Recent studies indicate that early surgical removal within two weeks leads to better visual outcomes and fewer complications, whereas delayed intervention is correlated with increased corneal endothelial loss and secondary glaucoma [7].

Advancements in surgical techniques, including refined phacoemulsification strategies and the use of intraoperative anterior segment optical coherence tomography (AS-OCT), have improved the detection and management of RLFs [8]. Moreover, the role of intracameral steroids and anti-inflammatory agents in modulating postoperative inflammation is increasingly recognized [9]. This study aims to evaluate the clinical features, management strategies, and visual outcomes of patients with retained lens fragments in the anterior chamber after phacoemulsification.

Methodology

Study Design

This study is a prospective observational study.

Study Setting

The study is conducted at Katihar Medical College, a tertiary care center equipped with advanced ophthalmic surgical facilities. The research is carried out in the Department of Ophthalmology over a defined period from July 2020 to September 2023.Sa

Participants

A total of 100 patients diagnosed with retained lens fragments in the anterior chamber after phacoemulsification are included in the study.

Inclusion Criteria

- Patients undergoing phacoemulsification for cataract surgery.
- Cases with documented retained lens fragments in the anterior chamber postoperatively.
- Patients aged 40 years and above.
- Those who provide informed consent to participate in the study.

Exclusion Criteria

- Patients with pre-existing corneal or retinal pathologies affecting vision.
- Cases with intraoperative complications unrelated to retained lens fragments.
- Patients lost to follow-up within the study period.
- Those with a history of prior ocular trauma or surgery.

Bias

Enrolling consecutive patients who satisfy the inclusion criteria reduces selection bias. Observer bias is reduced by ensuring that clinical assessments and outcome measurements are conducted by multiple trained ophthalmologists. Additionally, confounding factors such as pre-existing ocular conditions are accounted for in the data analysis.

Data Collection

Relevant clinical data, including patient demographics, intraoperative findings, management strategies, and postoperative visual outcomes, are collected using standardized case report forms. Follow-up visits are scheduled at 1 week, 1 month, and 3 months postoperatively to assess complications and visual improvement.

Procedure

All phacoemulsification procedures are performed using standard surgical techniques under local anesthesia. In cases where retained lens fragments are identified postoperatively, management options such as observation, medical therapy, or surgical intervention (anterior chamber washout or vitrectomy) are considered based on fragment size and location. The outcomes are documented systematically.

Statistical Analysis

SPSS version 23.0 is used to examine the data that was gathered. For demographic data, descriptive statistics like mean, standard deviation, and percentages are employed. When comparing various management strategies and their results, chi-square tests, independent t-tests, or ANOVA are used as necessary. Statistical significance is defined as a p-value of less than 0.05.

Results

This study comprised 100 patients who experienced residual lens fragments in the anterior chamber after phacoemulsification. With a male-to-female ratio of 1.2:1 (55 males, 45 females), the participants' average age was 65.4 ± 8.3 years.

Table 1: Demographic and Clinical Characteristics of the Participants

Variable	Mean ± SD / n (%)
Total Patients	100
Age (years)	65.4 ± 8.3
Gender	
- Male	55 (55%)
- Female	45 (45%)
Diabetes Mellitus	34 (34%)
Hypertension	41 (41%)
Pre-existing Ocular Pathology	12 (12%)
Axial Length (mm)	23.7 ± 1.4

This table summarizes the baseline characteristics of the study population. The majority of patients were aged 60 and above. A significant proportion of the patients had systemic comorbidities such as diabetes (34%) and hypertension (41%), which could influence the healing process.

Clinical Presentation of Retained Lens Fragments

The most common symptoms reported by patients were blurred vision (78%), ocular discomfort (52%), and increased intraocular pressure (IOP) (46%). The mean time for detection of retained fragments was 2.8 ± 1.2 days post-surgery.

Table 2: Clinical Presentation and Management Approach

Clinical Feature	n (%)
Symptoms	
- Blurred Vision	78 (78%)
- Ocular Discomfort	52 (52%)
- Increased IOP (>21 mmHg)	46 (46%)
Management Approach	
- Conservative (Topical Therapy)	35 (35%)
- Anterior Chamber Washout	47 (47%)
- Pars Plana Vitrectomy	18 (18%)

Most patients presented with blurred vision, while increased IOP was observed in 46% of cases. Management varied based on the severity and size of the retained fragments, with 47% requiring an anterior chamber washout and 18% needing a pars plana vitrectomy.

Postoperative Visual Outcomes

At the **3-month follow-up**, (BCVA) improved significantly in most patients.

Table 3: Visual Outcomes at 3 Months Postoperatively

BCVA (LogMAR)	Preoperative (n)	Postoperative (n)	p-value
≤ 0.3 (Good Vision)	12	65	<0.001
0.4 – 0.6 (Moderate)	30	20	
≥ 0.7 (Poor Vision)	58	15	

Before intervention, only 12% of patients had good vision (BCVA ≤ 0.3), while 58% had poor vision (BCVA ≥ 0.7). At 3 months post-treatment, 65% of patients had good vision, and only 15% remained in the poor vision category. This improvement was statistically significant ($p < 0.001$).

Complications Observed

Postoperative complications were noted in 24 patients (24%), with persistent corneal edema (10%) being the most common.

Table 4: Postoperative Complications

Complication	n (%)
Persistent Corneal Edema	10 (10%)
Recurrent Inflammation	7 (7%)
Secondary Glaucoma	5 (5%)
Retinal Detachment	2 (2%)

Despite successful management, 24% of patients experienced complications, with persistent corneal edema being the most frequent. However, only **2% developed retinal detachment**, requiring further intervention.

A significant improvement in BCVA was noted at 3 months postoperatively ($p < 0.001$).

Patients who underwent surgical removal of fragments (anterior chamber washout or vitrectomy) had better visual outcomes

compared to those managed conservatively ($p = 0.02$).

Increased IOP (>21 mmHg) at presentation was significantly correlated with worse final visual outcomes ($p = 0.03$).

Discussion

In this study, 100 patients with retained lens fragments in the anterior chamber after phacoemulsification were examined for clinical characteristics, management strategies, and results. Males made up slightly more of the participants (55%) than females (45%), with a mean age of 65.4 years. Comorbid conditions such as diabetes (34%) and hypertension (41%) were commonly observed, which could have influenced postoperative healing. The most frequently reported symptoms included blurred vision (78%), ocular discomfort (52%), and increased intraocular pressure (46%), with retained fragments typically detected within 2.8 days post-surgery.

Management strategies varied depending on the severity and location of retained fragments. While 35% of patients were managed conservatively with topical therapy, 47% required anterior chamber washout, and 18% underwent pars plana vitrectomy. Patients who underwent surgical intervention showed better visual recovery compared to those managed conservatively ($p = 0.02$). These findings emphasize the importance of individualized treatment approaches based on clinical presentation.

At 3-month follow-up, there was a statistically significant improvement in (BCVA) ($p < 0.001$). The proportion of patients with good vision (BCVA ≤ 0.3 LogMAR) increased from 12% preoperatively to 65% postoperatively, while those with poor vision (BCVA ≥ 0.7 LogMAR) decreased from 58% to 15%. Notably, higher intraocular pressure at presentation was correlated with worse final visual outcomes ($p = 0.03$), indicating the need for close monitoring of IOP in these patients.

Despite overall good recovery, 24% of patients developed postoperative complications, with persistent corneal edema (10%) being the most common. Other complications included recurrent inflammation (7%), secondary glaucoma (5%), and retinal detachment (2%). The relatively low incidence of severe complications suggests that early detection and timely intervention can minimize long-term visual impairment.

Retained lens fragments in the anterior chamber following phacoemulsification are a rare but clinically significant complication that can lead to corneal edema, inflammation, and (IOP). Norton and Goyal [10] conducted a retrospective study analyzing 19 patients who developed retained nuclear fragments after uneventful phacoemulsification. Most patients (79%) presented with corneal edema and anterior chamber inflammation, with fragments predominantly located in the inferior angle. The mean time to removal was 34.7 days, and final corrected distance visual acuity (CDVA) ranged from 20/20 to 20/400. Notably, three patients developed cystoid macular edema (CME), and two experienced corneal complications after fragment removal. The study suggested that myopia, steep corneas, and shallow anterior chamber depth (ACD) may be risk factors for retained lens fragments.

Moshirfar et al. [11] further examined risk factors associated with retained lens fragments in a cohort of 24 patients. Older age (mean 76 years) and shallow ACD (3.1 mm vs. 3.33 mm, $p = 0.01$) were found to be significant risk factors. Patients with poor initial uncorrected distance visual acuity (UDVA $\leq$ 20/150) experienced greater postoperative improvement in visual acuity than those with better preoperative vision (logMAR 0.46 vs. 0.05). Additionally, the study found no significant difference in the incidence of retained lens fragments based on

phacoemulsification techniques, such as Divide-and-Conquer versus Horizontal Chop.

Matarazzo et al. [12] analyzed 122 cases of retained lens fragments out of 98,467 uneventful cataract surgeries, reporting an incidence of 0.124%. The mean CDVA improved significantly after fragment removal (0.32 to 0.26 logMAR, $p = 0.001$). However, 4.9% of cases developed persistent corneal edema requiring endothelial keratoplasty (EK) within a mean of 13 months post-fragment removal. Risk factors for EK included α-receptor blocker use (OR = 6.75, 95% CI: 1.069–42.63) and delayed fragment removal.

Helayel et al. [13] conducted a 10-year retrospective study in Asian eyes, identifying diabetes ($p < 0.001$), prior intravitreal injections ($p = 0.001$), and dense nuclear sclerosis as significant risk factors for retained lens fragments. Among the 282 eyes studied, 73.4% maintained their preoperative vision or improved by one line, while 5.3% gained more than one line of vision. Cases performed by trainee surgeons showed a higher risk of complications.

Akram et al. [14] highlighted the role of (AS-OCT) in detecting retained lens fragments. Their case report described a patient with pseudophakic bullous keratopathy (PBK) who underwent AS-OCT after conventional slit lamp and gonioscopy exams failed to detect a retained lens fragment. The fragment was subsequently identified and removed, though the patient later required EK due to corneal decompensation.

Conclusion

In conclusion, this study demonstrates that prompt recognition and appropriate management of retained lens fragments can lead to favorable visual outcomes. Surgical intervention, particularly anterior chamber washout and vitrectomy, was beneficial in improving BCVA, while conservative management was effective in select cases. These results emphasize that in order to maximize patient outcomes after phacoemulsification, careful postoperative monitoring and a customized strategy are required.

References

1. Chang DF, Braga-Mele R, Henderson BA, Mamalis N, Vasavada A. Complications of phacoemulsification: Retained lens material. *J Cataract Refract Surg.* 2019;45(3):356-364.
2. Masket S, Fram NR, Yoo SH. Retained lens fragments: Incidence, management, and outcomes. *Ophthalmology.* 2020;127(5):687-693.
3. Aslan F, Aslankurt M, Aksoy A, Özdemir M, Yüksel E. Clinical outcomes of retained lens fragments in the anterior chamber. *Int J Ophthalmol.* 2021;14(7):1024-1030.
4. Lee JY, Kim KH, Kim WS. Anterior chamber inflammation due to retained lens material following cataract surgery. *Korean J Ophthalmol.* 2019;33(2):155-161.
5. Werner L, Chew J, Mamalis N. Lens-induced inflammation and phacoanaphylaxis: Pathophysiology and management. *Surv Ophthalmol.* 2022;67(1):84-95.
6. Kim T, Lee DH, Lee HJ. Surgical outcomes of retained lens fragment removal in cataract surgery. *Am J Ophthalmol.* 2023;246:134-142.
7. Vasavada AR, Raj SM, Johar SRK, Nanavaty MA. Outcomes of early versus late removal of retained nuclear fragments. *Eye (Lond).* 2022;36(1):74-81.
8. Gibbons A, Patel DV, McGhee CN. The role of AS-OCT in managing retained lens material. *Clin Exp Ophthalmol.* 2020;48(8):1143-1150.
9. Jabs DA, Nussenblatt RB, Rosenbaum JT. Standardization of uveitis nomenclature for reporting clinical data: Results of the First International Workshop. *Am J Ophthalmol.* 2018;246(2):193-202.

10. Norton J, Goyal S. Patient characteristics and outcomes of retained lens fragments in the anterior chamber after uneventful phacoemulsification. J Cataract Refract Surg. 2018;44(7):848-855.
11. Moshirfar M, Lewis AL, Ellis J, McCabe S, Ronquillo Y, Hoopes P. Anterior chamber retained lens fragments after cataract surgery: A case series and narrative review. Clin Ophthalmol. 2021;15:2625-2633.
12. Matarazzo F, Phylactou M, Aiello F, Gallo Afflitto G, Sim SY, Maurino V. Incidence and complications of retained lens fragment in the anterior chamber after uneventful cataract surgery in a United Kingdom tertiary center. J Cataract Refract Surg. 2021;47(8):1064-1070.
13. Helayel H, Alyahya A, Al Owaifeer AA, Khan AM, Al Zahrani A, Badawi AH, et al. Risk factors, complications, and outcomes of phacoemulsification cataract surgery complicated by retained lens fragments in Asian eyes: A 10-year retrospective study. Saudi J Ophthalmol. 2022;36:171-176.
14. Akram H, Gunasekera CD, Roberts H, Myerscough J. Anterior segment optical coherence tomography (AS-OCT) as a useful tool to identify retained lens fragments in the anterior chamber. BMJ Case Rep. 2021;14.