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Incidence of Visually Significant Pseudophakic Macular Edema after Uneventful Clear Corneal Phacoemulsification

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KEYWORDS

Pseudophakic macular edema, phacoemulsification, visual acuity, OCT, cataract surgery.

ABSTRACT:

Background: Pseudophakic macular edema (PME) is a known cause of delayed visual recovery following cataract surgery, even in cases with uneventful phacoemulsification. This study aimed to determine the incidence of visually significant PME in a low-risk population using optical coherence tomography (OCT).

Methods: This prospective observational study was conducted in the Department of Ophthalmology at Dr. Sirajul Islam Medical College & Hospital Ltd, Dhaka and Bangladesh Eye Hospital Malibagh, Dhaka, Bangladesh, from March 2023 to February 2024. A total of 130 patients aged ≥50 years undergoing uneventful clear corneal phacoemulsification with posterior chamber intraocular lens (IOL) implantation were enrolled consecutively. Patients with pre-existing macular disease, diabetic retinopathy, glaucoma, uveitis, or intraoperative complications were excluded. Postoperative follow-up was conducted up to 6 weeks, and OCT was used to detect PME. Visually significant PME was defined as a reduction of ≥2 lines in best-corrected visual acuity (BCVA).

Results: The mean age of participants was 62.4 ± 8.9 years, with 54.6% males. Diabetes mellitus and hypertension were present in 21.5% and 30.8% of patients, respectively. OCT detected PME in 6 patients (4.6%), of which 3 (2.3%) were visually significant. Mean BCVA improved from 0.82 ± 0.21 logMAR preoperatively to 0.16 ± 0.11 logMAR at 6 weeks. PME cases showed delayed visual recovery. All PME cases were managed with topical corticosteroids and NSAIDs; five fully recovered and one had partial improvement.

Conclusion: The incidence of visually significant PME following uncomplicated phacoemulsification was 2.3%. Early OCT detection and conservative treatment resulted in favorable outcomes.

Introduction

Cataract remains the leading cause of reversible blindness worldwide, and phacoemulsification with intraocular lens (IOL) implantation has become the standard of care due to its safety, rapid visual recovery, and excellent outcomes [1]. Despite its success, some

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patients experience suboptimal visual improvement postoperatively, even in the absence of intraoperative complications. [2] One important cause of such unexpected visual impairment is pseudophakic macular edema (PME), also known as Irvine–Gass syndrome, which results from the accumulation of fluid in the macula following cataract surgery [3].

PME is characterized by cystoid changes in the macula, which are best visualized on optical coherence tomography (OCT) [4]. Although the exact pathophysiology remains incompletely understood, it is believed that postoperative inflammation leads to the release of inflammatory mediators such as prostaglandins, which increase vascular permeability in the perifoveal capillaries, resulting in fluid accumulation [5]. While most cases of PME are self-limiting and resolve spontaneously or with medical therapy, a subset of patients develops visually significant PME, defined by a measurable reduction in best-corrected visual acuity (BCVA) that affects daily functioning and quality of life [6].

The incidence of PME varies in the literature, ranging from 0.1% to 2% for visually significant cases and up to 10% or more for subclinical or OCT-detected PME [7]. The variability in incidence depends on the definition used, the patient population studied, surgical technique, and the sensitivity of the diagnostic methods employed. OCT has greatly enhanced the ability to detect subtle retinal changes and is now considered the gold standard for diagnosing and monitoring macular edema [8].

Although advanced surgical techniques and anti-inflammatory regimens have reduced the incidence of PME in recent years, it continues to be a concern, particularly in high-risk groups such as diabetics and patients with prior retinal disease [9]. However, even in patients without known risk factors and with uneventful surgery, PME can still occur and may delay visual recovery [10]. Early identification and timely management are crucial to prevent long-term visual compromise.

Data on the incidence of visually significant PME following uncomplicated phacoemulsification are limited [11]. Most available studies have focused on broader postoperative outcomes, and few have used OCT-based criteria to define PME. Therefore, a focused evaluation of this condition using objective measures is necessary to inform clinical practice, optimize postoperative care, and counsel patients accurately about expected visual outcomes [12].

This study was undertaken to determine the incidence of visually significant pseudophakic macular edema following uneventful clear corneal phacoemulsification using OCT as a diagnostic tool. By restricting the sample to patients with no pre-existing retinal pathology or intraoperative complications, this study aimed to provide a more accurate estimate of PME in low-risk cases and to evaluate visual outcomes following appropriate treatment. The findings will contribute to local and regional data, help improve patient counseling, and guide postoperative follow-up protocols in similar settings.

Methodology & Materials

This prospective observational study was conducted in the Department of Ophthalmology, Dr. Sirajul Islam Medical College & Hospital Ltd, Dhaka and Bangladesh Eye Hospital Malibagh, Dhaka, Bangladesh, over a period of one year, from March 2023 to February 2024. The objective was to determine the incidence of visually significant pseudophakic macular edema (PME) following uneventful clear corneal phacoemulsification. A total of 130 patients were enrolled consecutively based on predefined inclusion and exclusion criteria. Patients aged 50 years or older with visually significant senile cataract undergoing planned phacoemulsification with posterior chamber intraocular lens (IOL) implantation were included. Only cases with uncomplicated surgery and without pre-existing macular pathology, diabetic retinopathy, uveitis, glaucoma, retinal vein occlusion, or history of ocular trauma were considered eligible. Patients with intraoperative complications such as posterior capsule rupture or vitreous loss were excluded. All surgeries were performed under peribulbar anesthesia using a standard technique of clear corneal phacoemulsification and foldable posterior chamber IOL implantation. Postoperative care included topical antibiotics and corticosteroids for 4 weeks, with nonsteroidal anti-inflammatory drops added in some cases. Patients were followed up at 1 week, 4 weeks, and 6 weeks postoperatively. At each visit, best-corrected visual acuity (BCVA) was recorded using the Snellen chart and converted to logMAR for analysis. Optical coherence tomography (OCT) was performed at 1 month and 6 weeks postoperatively to detect macular changes.

PME was defined as the presence of cystoid macular edema on OCT, while visually significant PME was defined as PME associated with a reduction in BCVA of

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two or more lines from the best recorded postoperative vision. Data were analyzed using descriptive statistics, and results were presented as frequencies, percentages, means, and standard deviations. Statistical analysis was performed using SPSS software version 16.0

Results

Table 1: Baseline Characteristics of Study Population (N = 130)

Variable	Frequency (n)	Percentage (%)
Age (mean ± SD, years)	62.4 ± 8.9	
Gender		
Male	71	54.6
Female	59	45.4
Diabetes Mellitus	28	21.5
Hypertension	40	30.8
Preoperative BCVA (logMAR)	0.82 ± 0.21	
Intraocular Lens Type		
Foldable Monofocal	125	96.2
Rigid/Other	5	3.8
Duration of Surgery (mean ± SD)	12.3 ± 3.5 min	
Intraoperative Complications	None	

Table 1 shows the baseline characteristics of the 130 patients included in the study. The mean age of the participants was 62.4 ± 8.9 years. Among them, 54.6% were male and 45.4% were female. Diabetes mellitus and hypertension were present in 21.5% and 30.8% of patients, respectively. The average preoperative best-corrected visual acuity (BCVA) was 0.82 ± 0.21 logMAR. A majority of patients (96.2%) received foldable monofocal intraocular lenses, while only 3.8% received rigid or other types of lenses. The mean duration of surgery was 12.3 ± 3.5 minutes, and no intraoperative complications were reported in any of the cases.

Table 2: Incidence of Pseudophakic Macular Edema (PME)

Outcome	Frequency (n)	Percentage (%)
Any PME (OCT evidence)	6	4.6
Visually Significant PME (↓ ≥2 Snellen lines)	3	2.3
Non-significant PME	3	2.3
No PME	124	95.4

Table 2 shows the incidence of pseudophakic macular edema (PME) among the study population. Out of 130 patients, PME was detected in 6 cases (4.6%) based on optical coherence tomography (OCT) findings. Among these, 3 patients (2.3%) developed visually significant PME, defined as a reduction of two or more Snellen lines in best-corrected visual acuity. The remaining 3 cases (2.3%) had non-significant PME without substantial visual decline. No signs of PME were observed in 124 patients (95.4%).

Table 3: Visual Acuity Changes over Time (Mean logMAR ± SD)

Time Point	Mean logMAR VA	Improvement vs. Pre-op
Preoperative	0.82 ± 0.21	—
1 Week Post-op	0.48 ± 0.20	Significant
1 Month Post-op	0.22 ± 0.15	Significant
6 Weeks Post-op	0.16 ± 0.11	Significant
Patients with PME	0.48 ± 0.09	Delayed improvement

Table 3 shows the changes in best-corrected visual acuity (BCVA) over time, expressed as mean logMAR ± standard deviation. The average preoperative BCVA was 0.82 ± 0.21 logMAR. Significant improvement in visual acuity was observed at all postoperative time points: 0.48 ± 0.20 at 1 week, 0.22 ± 0.15 at 1 month, and 0.16 ± 0.11 at 6 weeks. Patients who developed pseudophakic macular edema (PME) showed delayed visual improvement, with a mean BCVA of 0.48 ± 0.09 logMAR at 6 weeks, indicating slower recovery compared to those without PME.

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Table 4: Response to Treatment among PME Patients (n = 6)

Treatment Modality	Number of Patients	Visual Recovery at 3 Months
Topical NSAIDs + Steroids	6	5 improved, 1 partial
Intravitreal Injection	0	—

Table 4 shows the response to treatment among the six patients who developed pseudophakic macular edema (PME). All patients were managed with a combination of topical nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids. At the 3-month follow-up, five patients showed complete visual improvement, while one patient had only partial recovery. None of the patients required intravitreal injection therapy.

Discussion

This study aimed to determine the incidence of visually significant pseudophakic macular edema (PME) following uneventful clear corneal phacoemulsification in a Bangladeshi population using optical coherence tomography (OCT) as a diagnostic tool. Among the 130 patients included, the incidence of any PME was 4.6%, and that of visually significant PME was 2.3%. These findings are consistent with previously reported incidence rates, which generally range from 1% to 3% in uncomplicated cataract surgery when OCT is employed as a diagnostic standard [13, 14].

PME remains a significant cause of delayed visual recovery despite advances in surgical techniques. Although the pathogenesis is multifactorial, it is primarily attributed to postoperative inflammation leading to disruption of the blood-retinal barrier and increased vascular permeability [15, 16]. In our study, patients who developed PME had delayed improvement in best-corrected visual acuity (BCVA) compared to those without PME, emphasizing the functional impact of this complication.

The importance of OCT in detecting subclinical macular edema has been well demonstrated in the literature. Ching et al., used OCT to monitor retinal thickness changes postoperatively and found that subclinical edema can be present even in asymptomatic patients [13]. Similarly, Biro et al., reported measurable increases in foveal thickness post-phacoemulsification, which supports the utility of OCT in routine postoperative follow-up when visual recovery is not as expected [14].

Our study excluded high-risk patients such as those with diabetic retinopathy or uveitis, yet PME still occurred in a small subset. This underscores that PME can also develop in low-risk eyes, aligning with findings by Mathys and Cohen, who observed macular thickening even in patients at low risk for cystoid macular edema [17]. Therefore, awareness and early OCT evaluation remain important, even in uneventful surgeries.

All PME cases in our cohort were managed conservatively using topical corticosteroids and NSAIDs, which led to full or partial recovery without requiring intravitreal therapy. This management approach aligns with standard practices described by Reis et al., who demonstrated the utility of cyclooxygenase-2 inhibitors in reducing macular edema, and Singh et al., who showed that nepafenac was effective in preventing PME in diabetic patients [18, 19]. Though our study population included relatively few diabetics and none developed visually significant PME, topical NSAIDs were effective in all diagnosed cases.

Our findings also resonate with Cervantes-Coste et al., who emphasized the dual benefit of NSAIDs in preventing both intraoperative miosis and postoperative PME [20]. These pharmacologic strategies are especially important in resource-constrained settings like Bangladesh, where access to intravitreal therapies or advanced interventions may be limited.

Interestingly, Bozkurt et al., evaluated the influence of intracameral epinephrine on postoperative macular thickness and concluded that surgical factors may influence subtle retinal changes [21]. In our study, all surgeries were performed using a standardized technique without intracameral additives, which supports the interpretation that inflammation-induced changes, rather than surgical variables, were the likely cause of PME.

Although our PME incidence was modest, this study contributes valuable regional data and supports findings from other low- and middle-income countries. There is a paucity of local data from Bangladesh regarding OCT-confirmed PME, and our study bridges that gap. It highlights the importance of postoperative monitoring and raises awareness among ophthalmologists about the potential for visual impairment even after routine cataract surgery.

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Limitations of the study

Some limitations should be acknowledged. Our sample size, though adequate for incidence estimation, was insufficient to perform subgroup analysis based on comorbidities such as diabetes. The relatively short follow-up duration of 6 weeks may have underestimated late-onset PME or the full extent of visual recovery in some cases. Additionally, we did not perform quantitative OCT thickness measurements or central macular thickness comparison, which could have provided more objective insight into subclinical changes. Despite these limitations, the study reinforces that even in the absence of risk factors or surgical complications, a small but significant proportion of patients may develop PME. Early diagnosis using OCT and timely intervention with anti-inflammatory agents can lead to favorable visual outcomes without the need for invasive treatments.

Conclusion

This study demonstrates that pseudophakic macular edema (PME), including visually significant cases, can occur even after uneventful clear corneal phacoemulsification in patients without known risk factors. The incidence of visually significant PME was 2.3%, and early detection using OCT combined with timely medical management using topical corticosteroids and NSAIDs resulted in favorable visual outcomes. These findings highlight the importance of vigilant postoperative monitoring to ensure optimal recovery and patient satisfaction, even in routine cataract surgery.

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Conflicts of interest

There are no conflicts of interest.

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