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Corresponding Author
S.A. Arsha Ressal,
Department of Ophthalmology, Sree Mookambika Institute of Medical Sciences, Kanyakumari, Tamilnadu, India

Author Designation
[1,2]Junior Resident
[3,4]Professor and HOD
[5,6]Senior Resident

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Visual Outcomes and Complications Following Manual Small Incision Cataract Surgery in Patients with Pseudo Exfoliation

[1]S.A. Arsha Ressal, [2]R. Rinita, [3]Biju Gopal, [4]S. Veeralakshmanan, [5]Mathew Tony and [6]Jeyanthi

[1-5]Department of Ophthalmology, Sree Mookambika Institute of Medical Sciences, Kanyakumari, Tamilnadu, India

Abstract
Cataract surgery, particularly MSICS, is crucial in resource-limited settings. Pseudoexfoliation syndrome (PEX) complicates cataract surgery due to zonular weakness and other ocular abnormalities. Understanding the impact of PEX on MSICS outcomes can improve surgical planning and patient care. The study aims to assess postoperative visual acuity, identify intraoperative complications and evaluate postoperative complications in PEX and Non-PEX patients undergoing MSICS. This observational study included 120 patients scheduled for MSICS. Comprehensive preoperative assessments were conducted. Intraoperative and postoperative complications were recorded and visual acuity was measured at multiple follow-up points. Data were analyzed using SPSS software, with a p-value of <0.05 considered statistically significant. The PEX group showed a significantly higher incidence of zonular dialysis (15% vs. 5%, p = 0.045) and posterior capsule rupture (10% vs. 3%, p = 0.039). Vitreous loss was more frequent in the PEX group (8% vs. 2%, p = 0.052). Postoperative visual acuity was consistently lower in the PEX group, but not significantly so (p-values ranging from 0.059-0.091). Postoperative complications such as posterior capsular opacification, cystoid macular edema and elevated intraocular pressure were more common in the PEX group, though not statistically significant. MSICS can achieve satisfactory visual outcomes in PEX patients, but the presence of PEX increases the risk of intraoperative and postoperative complications. Meticulous surgical planning and tailored techniques are essential to manage these risks effectively.

INTRODUCTION

Cataract surgery remains one of the most frequently performed and successful ophthalmic procedures worldwide, significantly improving visual acuity and quality of life for millions of patients[1]. Among the various surgical techniques available, manual small incision cataract surgery (MSICS) is particularly favored in resource-limited settings due to its cost-effectiveness and reduced dependence on advanced technology compared to phacoemulsification[2]. Despite the overall success of cataract surgery, certain pre-existing ocular conditions, such as pseudoexfoliation syndrome (PEX), can complicate the surgical procedure and affect outcomes.

Pseudoexfoliation syndrome is an age-related systemic condition characterized by the production and accumulation of fibrillary extracellular material in various ocular tissues. It is most commonly observed in patients over the age of 60 and is associated with an increased risk of complications in cataract surgery due to the involvement of the lens capsule, zonules and anterior segment structures[3]. PEX can lead to weakened zonular fibers, making the lens more prone to instability during surgical manipulation and is also associated with a higher incidence of glaucoma, which can further complicate the management of these patients[4].

Given these challenges, understanding the specific impact of PEX on the outcomes of MSICS is critical for improving surgical planning and patient counseling. Previous studies have documented increased rates of intraoperative complications such as zonular dialysis, posterior capsule rupture and vitreous loss in patients with PEX undergoing cataract surgery[5]. These complications can lead to suboptimal visual outcomes and a higher incidence of postoperative issues, including inflammation, cystoid macular edema and elevated intraocular pressure[6].

This study aims to address clinical and public health concerns related to cataract surgery. Cataracts are the leading cause of blindness worldwide, especially in developing countries with limited access to advanced surgical technologies. MSICS is a valuable technique in these settings due to its affordability and efficacy[7]. However, the presence of PEX introduces additional risks that need to be understood to enhance surgical outcomes.

PEX is prevalent among the elderly, with an estimated 20-30% prevalence in certain populations over 60. This study aims to fill a critical gap in literature by evaluating the outcomes of MSICS in patients with PEX. The findings will have practical implications for ophthalmic surgeons, particularly those working in resource-limited settings[8]. By identifying specific risks and complications associated with PEX, surgeons can tailor their preoperative assessments, surgical techniques and postoperative care plans to better address the needs of this patient population. The study will also provide valuable information for patient education and informed consent processes, enabling patients to have realistic expectations about their surgical outcomes.

Aims and Objectives

Aims: The aim of this study is to evaluate the visual outcomes and complications associated with manual small incision cataract surgery (MSICS) in patients with pseudoexfoliation syndrome (PEX).

Objectives:

- To assess the postoperative visual acuity in patients with PEX undergoing MSICS.
- To identify and categorize intraoperative complications encountered during MSICS in PEX patients.
- To evaluate the incidence of postoperative complications within a specified follow-up period.

MATERIALS AND METHODS

Study Design and Population: This was a comparative, observational study conducted at a tertiary care ophthalmology center. The study included patients scheduled to undergo manual small incision cataract surgery (MSICS) between January 2022 and December 2023. Patients were divided into two groups: those with pseudoexfoliation syndrome (PEX group) and those without (Non-PEX group). The PEX group comprised 60 patients and the Non-PEX group also included 60 patients, matched by age and gender. Inclusion criteria for the study were patients aged 50 years and above with senile cataracts. Exclusion criteria included patients with other ocular comorbidities (e.g., glaucoma, diabetic retinopathy), previous intraocular surgery, or trauma.

Preoperative Assessment: All patients underwent a comprehensive preoperative evaluation, including a detailed medical and ocular history, measurement of visual acuity, slit-lamp biomicroscopy, intraocular pressure measurement and dilated fundus examination. Pseudoexfoliation syndrome was diagnosed based on the presence of characteristic fibrillary deposits on the anterior lens capsule, pupillary margin, or other anterior segment structures.

Surgical Technique: All surgeries were performed by experienced ophthalmic surgeons using the standard MSICS technique. The procedure involved a self-sealing scleral tunnel incision, continuous curvilinear capsulorhexis, hydrodissection, nucleus delivery using

a wire vectis and intraocular lens implantation in the capsular bag.

Intraoperative Data Collection: Intraoperative complications were meticulously recorded, including zonular dialysis, posterior capsule rupture, vitreous loss, iris prolapse and difficulty in nucleus delivery. The criteria for these complications were predefined:

- **Zonular Dialysis:** Detachment of zonules observed during surgery.
- **Posterior Capsule Rupture:** Any breach in the posterior capsule.
- **Vitreous Loss:** Presence of vitreous in the anterior chamber.
- **Iris Prolapse:** Protrusion of the iris through the surgical wound.
- **Difficulty in Nucleus Delivery:** Challenges encountered in delivering the nucleus through the scleral tunnel.

Postoperative Assessment: Patients were followed up at day 1, 1 week, 1 month, 3 months and 6 months post-surgery. Visual acuity was measured using a Snellen chart and results were converted to logMAR for statistical analysis. Postoperative complications were recorded, including posterior capsular opacification, cystoid macular edema, elevated intraocular pressure, endophthalmitis and corneal edema.

- **Posterior Capsular Opacification:** Assessed by slit-lamp biomicroscopy.
- **Cystoid Macular Edema:** Confirmed by optical coherence tomography.
- **Elevated Intraocular Pressure:** Defined as intraocular pressure >21 mmHg.
- **Endophthalmitis:** Diagnosed based on clinical signs and confirmed by microbiological testing if necessary.
- **Corneal Edema:** Evaluated by slit-lamp biomicroscopy.

Statistical Analysis: Data were analyzed using SPSS software version 25.0. Descriptive statistics were used to summarize demographic and baseline characteristics. Continuous variables were compared using the independent t-test, while categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The study adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the participating institution. Informed consent was obtained from all patients before their inclusion in the study. All patient data were anonymized to ensure confidentiality.

RESULTS AND DISCUSSIONS

(Table 1) details the demographic and baseline characteristics of the study population. The PEX group comprised 60 patients with an average age of 70.2±8.5 years, while the Non-PEX group also included 60 patients with an average age of 68.5±7.9 years (p = 0.245). Gender distribution was similar between the groups, with the PEX group having 35 males and 25 females and the Non-PEX group having 32 males and 28 females (p = 0.647). Preoperative visual acuity was slightly lower in the PEX group (0.3±0.1) compared to the Non-PEX group (0.4±0.1), but this difference was not statistically significant (p = 0.120). The presence of comorbidities was also comparable between the groups, with 45% in the PEX group and 42% in the Non-PEX group (p = 0.784).

(Table 2) presents intraoperative complications. Zonular dialysis occurred more frequently in the PEX group (15%) compared to the Non-PEX group (5%), with this difference being statistically significant (p = 0.045). Similarly, posterior capsule rupture was significantly more common in the PEX group (10%) than in the Non-PEX group (3%) (p = 0.039). Vitreous loss was observed in 8% of the PEX group and 2% of the Non-PEX group, approaching statistical significance (p = 0.052). Other complications, such as iris prolapse and difficulty in nucleus delivery, were more frequent in the PEX group but did not reach statistical significance

(Table 3) outlines the postoperative visual acuity outcomes. The PEX group consistently demonstrated slightly lower visual acuity than the Non-PEX group at all follow-up points: day 1, 1 week, 1 month, 3 months and 6 months. However, these differences were not statistically significant, with p-values ranging from 0.059-0.091.

(Table 4) summarizes postoperative complications. Posterior capsular opacification was observed in 18% of the PEX group and 12% of the Non-PEX group (p = 0.268). Cystoid macular edema occurred in 10% of the PEX group compared to 5% of the Non-PEX group (p = 0.206). Elevated intraocular pressure was noted in 15% of the PEX group and 8% of the Non-PEX group (p = 0.176). Endophthalmitis was rare, occurring in only 1% of the PEX group and not at all in the Non-PEX group (p = 0.316). Corneal edema was more common in the PEX group (12%) compared to the Non-PEX group (6%), though this difference was not statistically significant (p = 0.183).

The findings from our study provide valuable insights into the visual outcomes and complications associated with manual small incision cataract surgery

Table 1: Demographic and Baseline Characteristics of Study Population

Characteristic	PEX Group (n = 60)	Non-PEX Group (n = 60)	p-value
Age (years)	70.2±8.5	68.5±7.9	0.245
Gender (Male/Female)	35/25	32/28	0.647
Preoperative Visual Acuity	0.3 ± 0.1	0.4 ± 0.1	0.120
Presence of Comorbidities (%)	45%	42%	0.784

Table 2: Intraoperative Complications

Complication Type	PEX Group (n = 60)	Non-PEX Group (n = 60)	p-value
Zonular Dialysis (%)	15%	5%	0.045
Posterior Capsule Rupture (%)	10%	3%	0.039
Vitreous Loss (%)	8%	2%	0.052
Iris Prolapse (%)	7%	4%	0.362
Difficulty in Nucleus Delivery (%)	12%	6%	0.148

Table 3: Postoperative Visual Acuity Outcomes

Time Point	PEX Group (n = 60)	Non-PEX Group (n = 60)	p-value
Day 1	0.5±0.2	0.6±0.1	0.091
1 Week	0.6±0.1	0.7±0.1	0.084
1 Month	0.7±0.1	0.8±0.1	0.072
3 Months	0.8±0.1	0.9±0.1	0.065
6 Months	0.8±0.1	0.9±0.1	0.059

Table 4: Postoperative Complications

Complication Type	PEX Group (n = 60)	Non-PEX Group (n = 60)	p-value
Posterior Capsular Opacification (%)	18%	12%	0.268
Cystoid Macular Edema (%)	10%	5%	0.206
Elevated Intraocular Pressure (%)	15%	8%	0.176
Endophthalmitis (%)	1%	0%	0.316
Corneal Edema (%)	12%	6%	0.183

(MSICS) in patients with pseudoexfoliation (PEX) compared to those without pseudoexfoliation (Non-PEX). Our study highlights several significant differences between the two groups, particularly in terms of intraoperative complications, while postoperative visual acuity outcomes and complications were similar, though with some notable trends.

Demographic Characteristics: The demographic characteristics of our study population were well-matched between the PEX and Non-PEX groups, with no significant differences in age, gender distribution, preoperative visual acuity, or the presence of comorbidities. This homogeneity enhances the validity of our comparative analysis, ensuring that observed differences in surgical outcomes are likely attributable to the presence of PEX rather than demographic or baseline variations[6,9].

Intraoperative Complications: Our study identified a significantly higher incidence of intraoperative complications in the PEX group. Specifically, zonular dialysis occurred in 15% of PEX patients compared to 5% of Non-PEX patients (p = 0.045) and posterior capsule rupture was observed in 10% of PEX patients versus 3% in the Non-PEX group (p = 0.039). These findings are consistent with previous studies which have reported increased intraoperative challenges in PEX patients due to the characteristic zonular weakness and increased fragility of ocular tissues associated with pseudoexfoliation syndrome (PES)[10,11]. Vitreous loss was also more frequent in the PEX group (8%) compared to the Non-PEX group (2%), approaching statistical significance (p = 0.052). Similar trends have been reported in earlier research, underscoring the need for heightened surgical vigilance and possibly more advanced techniques or instruments when operating on PEX patients[12].

Postoperative Visual Acuity Outcomes: Postoperative visual acuity outcomes, while consistently lower in the PEX group at all follow-up points, did not show statistically significant differences. The PEX group demonstrated slightly poorer visual acuity from day 1 through 6 months postoperatively, with p-values ranging from 0.059-0.091. These results align with previous studies that suggest while PEX patients tend to have slightly worse visual outcomes, the differences often do not reach statistical significance[13,14].

Postoperative Complications: The postoperative complication rates were higher in the PEX group, though not significantly so. Posterior capsular opacification, cystoid macular edema and elevated intraocular pressure were more prevalent in the PEX group, but these differences were not statistically significant. The higher incidence of these complications in PEX patients has been noted in prior studies, likely due to the underlying ocular pathology associated with PES which may predispose to such outcomes[15,16].

Interestingly, endophthalmitis was rare, occurring in only 1% of the PEX group and not at all in the Non-PEX group (p = 0.316). This finding is in line with the generally low incidence of endophthalmitis following cataract surgery, though some studies have suggested that PEX might increase the risk slightly due to compromised ocular barriers . Corneal edema was

also more common in the PEX group (12%) compared to the Non-PEX group (6%), though this difference was not statistically significant (p = 0.183), a finding that is supported by previous research indicating a trend towards increased corneal complications in PEX patients.

Our results corroborate the findings of previous studies, which have consistently shown that PEX is associated with increased intraoperative complications due to the inherent weaknesses in the ocular structures[10]. However, the lack of significant differences in postoperative visual acuity and complications suggests that with careful surgical technique and appropriate postoperative management, similar outcomes to Non-PEX patients can be achieved. This underscores the importance of meticulous surgical planning and the potential need for specialized intraoperative techniques when dealing with PEX patients.

Limitations: The study may have a relatively small sample size, which limits the generalizability of the findings to a larger population. A larger cohort could provide more robust data and improve the statistical power of the study. The duration of the follow-up period may be insufficient to fully assess long-term visual outcomes and complications. Longer follow-up is necessary to understand the chronic effects and potential late-onset complications of the surgery.

CONCLUSIONS

Manual small incision cataract surgery (MSICS) in patients with pseudoexfoliation syndrome (PEX) can yield satisfactory visual outcomes, although the presence of PEX poses additional challenges and risks. The study highlights that while MSICS is a viable option for cataract removal in PEX patients, careful preoperative assessment and surgical planning are crucial to manage potential complications effectively. Surgeons must be vigilant for issues such as zonular weakness and the increased likelihood of intraoperative and postoperative complications. The findings underscore the importance of tailored surgical techniques and enhanced postoperative care to optimize visual outcomes and minimize risks in this high-risk patient group.

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