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Original Research Article

EVALUATION OF INTRAOPERATIVE CHALLENGES AND VISUAL OUTCOMES OF MANUAL SMALL INCISION CATARACT SURGERY IN PSEUDOEXFOLIATION SYNDROME

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ABSTRACT

Background: Pseudoexfoliation syndrome (PEX) is an age-related disorder characterized by the deposition of fibrillar extracellular material on various ocular tissues. It is associated with poor pupillary dilatation, zonular weakness, and increased risk of complications during cataract surgery. Manual Small Incision Cataract Surgery (MSICS) is widely practiced in developing countries and remains an effective technique for managing cataracts in eyes with pseudoexfoliation. **Aim:** To evaluate the intraoperative challenges and visual outcomes of Manual Small Incision Cataract Surgery in patients with pseudoexfoliation syndrome.

Materials and Methods: This prospective observational study included 100 eyes of 100 patients with pseudoexfoliation syndrome and visually significant cataract who underwent MSICS. All patients underwent detailed preoperative evaluation including visual acuity assessment, slit-lamp examination, intraocular pressure measurement, and cataract grading. Intraoperative events, postoperative complications, visual outcomes, and intraocular pressure were recorded during follow-up and analyzed using appropriate statistical methods.

Results: The majority of patients were aged 61–80 years, with a slight female predominance. Mature senile cataract and advanced nuclear sclerosis were the most common cataract types. Most surgeries were completed without major complications. The common intraoperative challenges included floppy iris , iris prolapse, zonular dialysis and posterior capsular rupture. Striate keratopathy, Descemet membrane folds, and corneal edema were the most frequent postoperative complications. Most patients with uncomplicated surgery showed improvement in postoperative visual acuity, while eyes with significant intraoperative complications had comparatively poorer visual outcomes.

Conclusion: Pseudoexfoliation syndrome presents significant surgical challenges during MSICS. Careful preoperative assessment, meticulous surgical technique, and appropriate intraoperative management contribute to favorable visual outcomes with an acceptable complication rate, making MSICS a safe and effective surgical option in patients with pseudoexfoliation syndrome.

Keywords: Pseudoexfoliation syndrome, Manual Small Incision Cataract Surgery, MSICS, Cataract, Visual outcomes, Intraoperative challenges, Zonular dialysis.

INTRODUCTION

Cataract is the leading cause of reversible blindness worldwide and remains a major public health problem, particularly in developing countries such as India. Cataract surgery is one of the most commonly performed ophthalmic procedures and has evolved significantly with advances in surgical techniques and intraocular lens implantation. Manual Small Incision Cataract Surgery (MSICS) has gained widespread acceptance in resource-limited settings because it is cost-effective, provides excellent visual outcomes, and is particularly suitable for dense and mature cataracts.

Pseudoexfoliation syndrome (PEX) is an age-related systemic disorder characterized by the progressive production and deposition of abnormal fibrillar extracellular material on various ocular tissues, including the anterior lens capsule, pupillary margin, iris, zonules, ciliary body, corneal endothelium, and trabecular meshwork. It was first described by the Finnish ophthalmologist John G. Lindberg in 1917. Although primarily recognized as an ocular condition, pseudoexfoliation is now considered a systemic microfibrillopathy affecting multiple organs.[1]

The prevalence of pseudoexfoliation syndrome varies widely across different populations, ranging from 2% to over 25%, depending on age, ethnicity, and geographic location. The incidence increases significantly with advancing age and is more commonly observed in individuals over 60 years. It is an important cause of secondary open-angle glaucoma and is frequently associated with cataract formation.

Pseudoexfoliation syndrome poses unique challenges during cataract surgery because of the structural alterations it produces within the eye. Deposition of pseudoexfoliative material on the iris and ciliary body leads to poor pupillary dilatation due to iris atrophy and sphincter fibrosis. Degeneration and weakening of the zonular fibers result in zonular instability, phacodonesis, lens subluxation, and an increased risk of capsular rupture or vitreous loss during surgery. In addition, reduced corneal endothelial cell density makes these eyes more susceptible to postoperative corneal edema and delayed visual recovery.

Manual Small Incision Cataract Surgery remains an effective technique for managing cataracts in eyes with pseudoexfoliation syndrome. Compared with phacoemulsification, MSICS requires less dependence on expensive equipment and may offer certain advantages in eyes with hard cataracts and compromised zonules. However, surgeons often encounter several intraoperative challenges, including inadequate pupillary dilatation, floppy iris, zonular dialysis, posterior capsular rupture, vitreous loss, iris prolapse, and difficulty in nucleus delivery. These complications may influence postoperative visual outcomes if not recognized and managed appropriately.[2,3]

Despite these challenges, meticulous preoperative evaluation, careful surgical planning, appropriate use of adjunctive techniques such as sphincterotomies or capsular support devices, and meticulous postoperative care can significantly improve surgical safety and visual rehabilitation in patients with pseudoexfoliation syndrome. Although several studies have evaluated cataract surgery in pseudoexfoliation syndrome, most have focused on phacoemulsification. There is comparatively limited literature evaluating the intraoperative challenges and visual outcomes of Manual Small Incision Cataract Surgery in patients with pseudoexfoliation syndrome, especially in the Indian population where MSICS continues to be the preferred surgical technique for a large proportion of cataract surgeries.[4]

Therefore, the present study aims to evaluate the intraoperative challenges encountered during Manual Small Incision Cataract Surgery in eyes with pseudoexfoliation syndrome and to assess the postoperative visual outcomes. The findings of this study may help identify common surgical difficulties, facilitate better preoperative risk assessment, optimize surgical planning, and improve visual outcomes in this challenging group of patients.

MATERIALS AND METHODS

Study Design

This was a prospective observational hospital-based study conducted to evaluate the intraoperative challenges and visual outcomes of Manual Small Incision Cataract Surgery (MSICS) in patients with Pseudoexfoliation Syndrome (PEX)**.**

Study Setting

The study was conducted in the Department of Ophthalmology at Government Medical College Sanga Reddy and Mediciti Institute of Medical Sciences, Medchal. The study was conducted over a period of 10 months from August 2025 to May 2026.

Study Population

The study included patients diagnosed with Pseudoexfoliation Syndrome associated with visually significant cataract who underwent Manual Small Incision Cataract Surgery at the study center during the study period.

Sample Size

Among the 2450 patients with age above 40 years who presented to the Outpatient department, 104 patients had cataract and pseudoexfoliation in which 4 patients data not available so a total of 100 eyes of 100 patients fulfilling the inclusion criteria were enrolled in the study.

Sampling Method

Consecutive sampling was employed, wherein all eligible patients presenting during the study period were included until the required sample size was achieved.

Inclusion Criteria: Patients aged 40 years and above, presence of clinically diagnosed pseudoexfoliation syndrome, visually significant senile cataract requiring surgery and patients willing to undergo manual small incision cataract surgery.

Exclusion Criteria: traumatic cataract, congenital or developmental cataract, cataract associated with uveitis, previous intraocular surgery, lens subluxation unrelated to pseudoexfoliation, corneal opacity interfering with visualization, advanced glaucoma with severe optic nerve damage, retinal pathology affecting visual prognosis (diabetic retinopathy, retinal detachment, age-related macular degeneration, macular scar, etc.) and optic nerve diseases affecting vision

Diagnostic Criteria for Pseudoexfoliation Syndrome

Pseudoexfoliation syndrome was diagnosed clinically on slit-lamp examination based on the presence of characteristic pseudoexfoliative material and associated anterior segment findings. Diagnostic features included white flaky pseudoexfoliative material deposited over the anterior lens capsule, pseudoexfoliative deposits along the pupillary margin, iris transillumination defects, Sampaolesi's line on gonioscopy, and pigment dispersion over the trabecular meshwork. The presence of one or more characteristic clinical findings was considered supportive of the diagnosis in the appropriate clinical setting.

Preoperative Evaluation

All enrolled patients underwent a detailed history and comprehensive ophthalmic examination. The history included age, gender, duration of diminished vision, presenting ocular complaints, systemic illnesses, previous ocular diseases, history of ocular trauma, previous ocular surgery, and current or previous drug use.

Visual acuity was assessed using a Snellen visual acuity chart, and best corrected visual acuity (BCVA) was recorded. Slit-lamp examination was performed to assess the type and grade of cataract, presence and distribution of pseudoexfoliative material, degree of pupillary dilatation, corneal status, anterior chamber depth, iris abnormalities, and the presence of phacodonesis or iridodonesis.

Intraocular pressure (IOP) was measured using a non-contact tonometer. Gonioscopy was performed when indicated to assess the anterior chamber angle, degree of trabecular pigmentation, and presence of Sampaolesi's line. Fundus examination was performed using direct ophthalmoscopy, indirect ophthalmoscopy, and 90-diopter slit-lamp biomicroscopy. In eyes where the fundus could not be adequately visualized because of dense cataract, B-scan ultrasonography was performed to exclude significant posterior segment pathology.

Keratometry and axial length measurements were obtained using standard keratometric assessment and A-scan biometry, respectively. Intraocular lens (IOL) power was calculated using the SRK-II or SRK-T formula, depending on the biometric parameters and clinical requirements.

Surgical Procedure

All surgeries were performed under peribulbar anesthesia by experienced cataract surgeons using a standardized MSICS technique. A superior fornix-based conjunctival flap was created, followed by construction of a 6–6.5 mm scleral tunnel incision. The anterior chamber was entered through the scleral tunnel, following which capsulotomy was performed using either continuous curvilinear capsulorhexis or the can-opener technique, depending on the individual case and degree of pupillary dilatation.

Hydrodissection and hydrodelineation were subsequently performed, followed by prolapse of the nucleus into the anterior chamber. The nucleus was delivered using an irrigating vectis. Cortical matter was aspirated using a Simcoe irrigation-aspiration cannula. A posterior chamber IOL was implanted in the capsular bag whenever adequate capsular and zonular support was available. In cases with inadequate capsular support, sulcus implantation was performed when appropriate. The wound was hydrated at the conclusion of surgery and was left unsutured whenever adequately self-sealing; sutures were placed when required for wound stability or management of intraoperative complications.

Intraoperative Assessment

The following intraoperative parameters were systematically documented: maximum pupillary dilatation achieved, presence of a small pupil, occurrence of floppy iris or iris prolapse, zonular dialysis, posterior capsular rupture and other intraoperative complications. The requirement for additional surgical interventions, including sphincterotomy and mechanical pupil enlargement, was recorded. The requirement for wound suturing and the final site of IOL implantation, whether in the capsular bag or sulcus, were also documented.

Postoperative Evaluation

Patients were examined on postoperative day 1, at one week, four weeks (one month), and six weeks following surgery. At each follow-up visit, uncorrected visual acuity (UCVA) and BCVA were assessed. Slit-lamp examination was performed to evaluate the cornea, anterior chamber, iris, pupil, IOL position, and other postoperative findings. IOP was measured at each follow-up visit using a non-contact tonometer. Fundus examination was performed after adequate pupillary dilatation whenever media clarity permitted.

Postoperative complications, including corneal edema, striate keratopathy, Descemet's membrane folds, persistent inflammation, IOL-related complications, macular edema, and other clinically relevant findings, were documented during follow-up.

Outcome Measures

The primary outcome measure was best corrected visual acuity at six weeks following MSICS. Secondary outcome measures included the frequency and type of intraoperative complications,

postoperative complications, changes in IOP following surgery, and factors associated with poor postoperative visual outcome.

Statistical Analysis

The collected data were entered into Microsoft Excel and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were summarized using frequencies and percentages. Appropriate statistical tests were applied to assess associations between clinical variables and surgical or visual outcomes, wherever applicable. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of the participating institutions. Written informed consent was obtained from all participants before enrollment in the study. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Patient confidentiality was maintained throughout the study, and the collected data were used solely for the purposes of research and analysis.

RESULTS

A total of 100 eyes of 100 patients who underwent cataract surgery were included in the present study. The age of the patients ranged from 41 to 81 years, with the majority belonging to the elderly age group (>60 years). Females constituted a slightly higher proportion of the study population.

Table 1: Age and gender Distribution

Age Group (Years)	Number	Percentage
41-50	3	3%
51–60	28	28%
61–70	51	51%
71–80	16	16%
>80	2	2%
Total	100	100%
Gender		
Male	42	42%
Female	58	58%

Most patients (51%) were above 60 years of age. Female patients were more commonly affected than males.

Table 2: Presenting Visual Acuity

Visual acuity	Number	Percentage
PL Positive	18	18%
Hand Movements	16	16%
CFCF	15	15%
CF 1 m to 2m	18	18%
CF 3 m to 4m	18	18%
CF 5 m	10	10%
6/60	5	5%

Nearly two-thirds of patients presented with profound visual impairment.

Table 3: Morphology of Cataract

Cataract Type	Number	Percentage
Mature Senile Cataract (MSC)	28	28%
Hypermature Senile Cataract (HMSC)	5	5%
Mature Intumescent Cataract	3	3%
NS Grade 1	5	5%
NS Grade 2	20	20%
NS Grade 3	18	18%
NS Grade 4	17	17%
NS Grade 5	1	1%
Total	**100**	**100%**

MSC and advanced nuclear sclerosis (Grade 3 and Grade 4) together accounted for nearly two-thirds of all cataracts.

Table 4: Presence of Phacodonesis

Finding	Number	Percentage
Present	3	3%
Absent	97	97%

Preoperative zonular weakness was uncommon.

The preoperative IOP ranged from **8–26.1 mmHg**.Mean IOP was approximately **16.5 ± 3.2 mmHg**. Most patients had normal intraocular pressure.

Table 5: Comorbidities

Disease	Number	Percentage
None	30	30%
Hypertension	25	25%
Diabetes Mellitus	23	23%
Hypertension + Diabetes	12	12

Hypertension was the most common systemic illness.

Table 6: Preoperative Pupil Dilatation

Pupil Size	Number	Percentage
3 mm	4	4%
4 mm	15	15%
5 mm	34	34%
6 mm	39	39%
7 mm	8	8%

Nearly three-fourths of patients achieved a pupil dilatation of 5–6 mm.

Table 7: Intraoperative Complications

Complication	Number	Percentage
None	74	74%
Zonular dialysis	5	5%
Floppy iris	6	6%
Iris prolapse	4	4%
Posterior capsular rupture	2	2%
Aphakia	3	3%
Iridodialysis	1	1%

The majority of surgeries (74%) were uneventful. Floppy iris was the commonest intraoperative complication.

Table 8: Postoperative Complications

Complication	Number
Striate keratopathy	24
Descemet membrane folds	6
Corneal edema	5
Irregular pupil	3
Hyphaema	2
Aphakia	3
Residual cortical matter	3
Macular oedma	3
Optic atrophy	2

Table 9: Postoperative visual acuity at 6 weeks

Visual acuity	No. of patients (%)
6/6 to 6/18	71(71%)
6/24 to 6/60	20(20%)
<6/60	9(%)

DISCUSSION

Pseudoexfoliation syndrome (PEX) is an age-related systemic disorder characterized by the accumulation of abnormal fibrillar extracellular material in the anterior segment of the eye. Its presence is associated with poor pupillary dilatation, zonular weakness, phacodonesis, increased surgical manipulation, and a higher risk of intraoperative and postoperative complications during cataract surgery. The present study evaluated the clinical profile, intraoperative challenges, postoperative complications, and visual outcomes following Manual Small Incision Cataract Surgery (MSICS) in patients with PEX.

Age Distribution

In the present study, the majority of patients belonged to the 61–80-year age group, with an overall age range of 38–81 years. The predominance of elderly patients is consistent with the recognized age-related nature of PEX. Warjri GB et al,[5] reported a mean age of approximately 70 years among patients with PEX undergoing cataract surgery, with most patients being older than 60 years. Similarly, Naresh Desinayak et al,[6] observed that the majority of PEX patients undergoing MSICS were elderly. The age distribution in the present study is therefore broadly comparable with these previous reports.

The predominance of older patients is clinically relevant because age-related changes in the iris, zonules, lens, and corneal endothelium may coexist with PEX and further increase the technical difficulty of cataract surgery. Thus, the advanced age of the study population may partly explain the occurrence of poor pupillary dilatation, zonular instability, and postoperative corneal changes observed in the present series.

Gender Distribution

Females constituted a slightly higher proportion of patients in the present study. This finding is consistent with the observations of Desinayak N et al,[6] who reported a female predominance among patients with PEX. Avramides et al,[7] similarly reported a higher prevalence of PEX among females. Thus, the female predominance observed in the present study agrees with these previous reports.

However, the reported gender distribution of PEX has not been completely uniform across populations. Differences may be related to demographic characteristics, life expectancy, healthcare-seeking behavior, and geographical variation in the prevalence of PEX. Therefore, although the present study demonstrated a female predominance, this finding should be interpreted in the context of the demographic characteristics of the study population.

Cataract Morphology

The majority of eyes in the present study had mature senile cataract or advanced nuclear sclerosis (Grade III–IV). This finding is consistent with the advanced stage of cataract commonly encountered in patients presenting for MSICS in developing-country settings. Shivkumar C et al,[8] reported that approximately 58% of eyes had Grade II or III nuclear sclerosis, while nearly 27% had mature cataracts. Compared with their study, the present series showed a greater proportion of advanced cataracts, suggesting relatively delayed presentation in our population.

The higher proportion of mature and advanced cataracts in the present study may be related to delayed healthcare-seeking behavior, rural background, limited awareness regarding cataract surgery, and restricted access to ophthalmic services. Advanced cataracts also increase the technical difficulty of surgery and may contribute to the higher frequency of intraoperative complications. In addition, mature or hypermature cataracts may obscure preoperative fundus visualization, potentially resulting in previously undiagnosed glaucoma or posterior segment pathology being recognized only after cataract extraction.

Pupillary Dilatation

Poor pupillary dilatation is one of the characteristic surgical challenges associated with PEX. In the present study, most eyes achieved a pupil size of 5–6 mm following pharmacological dilatation, while a proportion had a pupil size of ≤4 mm and required additional intraoperative interventions such as synechiolysis, mechanical stretching with Kuglen hooks, and sphincterotomies.

Shivkumar C et al,[8] reported small pupils in 32.2% of eyes with PEX undergoing MSICS, with some requiring intraoperative measures to achieve adequate surgical exposure. Rajendran S et al,[9] also identified inadequate mydriasis as one of the most important intraoperative challenges in PEX. The findings of the present study are therefore consistent with the established association between PEX and poor pupillary dilatation.

The mechanism underlying poor dilatation is thought to include iris sphincter fibrosis, iris stromal atrophy, and degenerative changes in the iris vasculature. In practical terms, inadequate pupillary dilatation increases the difficulty of capsulotomy, nucleus delivery, cortical aspiration, and intraocular lens implantation. The need for mechanical or surgical pupil enlargement in the present study highlights the importance of anticipating this problem during preoperative assessment.

Phacodonesis and Zonular Weakness

Preoperative phacodonesis was observed in approximately 3% of eyes in the present study, although zonular dialysis was encountered intraoperatively in several eyes. This apparent difference between preoperative phacodonesis and intraoperative zonular dialysis emphasizes the limitation of detecting zonular weakness clinically before surgery.

Shivkumar C et al,[8] reported zonular dialysis in approximately 3.3% of eyes undergoing MSICS, while Pranathi et al,[10] reported a frequency of approximately 3.8%. The incidence observed in the present study is therefore within the range reported in these previous studies.

The occurrence of zonular dialysis despite relatively infrequent preoperative phacodonesis may be explained by the progressive and sometimes clinically occult degeneration of zonular fibers in PEX. Zonular weakness may become evident only during hydrodissection, nucleus manipulation, or cortical aspiration. Consequently, surgeons should maintain a high index of suspicion for zonular instability in PEX, particularly in eyes with phacodonesis, lens subluxation, iridodonesis, or advanced cataract.

Intraoperative Complications

Although the majority of surgeries in the present study were completed without major complications, floppy iris, iris prolapse, zonular dialysis, and posterior capsular rupture constituted the principal intraoperative complications.

The findings are broadly consistent with those reported by Shivkumar C et al,[8] who documented zonular dialysis in 3.3%, posterior capsular rupture in 0.7%, and iridodialysis in 0.7% of eyes undergoing MSICS. Naresh Desinayak et al,[6] similarly reported a higher frequency of intraoperative complications in PEX eyes compared with non-PEX controls, although satisfactory surgical outcomes were achieved with appropriate surgical precautions.

The occurrence of floppy iris and iris prolapse in the present study can be attributed to the structural and

vascular abnormalities associated with PEX. Iris stromal atrophy, sphincter abnormalities, and poor pupillary dilatation can make iris handling more difficult. In the present series, iris prolapse was managed by wound closure with 10-0 nylon suturing, demonstrating that most such complications could be appropriately managed without compromising the overall surgical outcome.

Posterior capsular rupture is particularly important because PEX-associated zonular weakness can result in instability of the capsular bag during nucleus manipulation and cortical aspiration. The relatively high frequency of intraoperative complications observed in the present study may also be related to the greater proportion of mature and advanced cataracts. Dense nuclei require greater manipulation and may increase stress on already compromised zonular structures.

Thus, although PEX itself represents an important risk factor, the combination of PEX, advanced cataract, small pupil, and delayed presentation probably contributed collectively to the surgical difficulties observed in the present study.

Postoperative Complications

Striate keratopathy was the most frequent postoperative complication in the present study, followed by Descemet membrane folds and corneal edema. Desinayak N et al,[6] similarly reported corneal edema as the commonest early postoperative complication following MSICS in PEX eyes. The similarity between these findings suggests that transient corneal endothelial dysfunction is an important early postoperative issue in PEX patients.

The increased susceptibility to corneal edema may be related to pre-existing endothelial dysfunction associated with PEX, in addition to the endothelial trauma caused by intraoperative manipulation. Small pupils, dense cataracts, prolonged surgical manipulation, and repeated instrument entry into the anterior chamber may further increase endothelial stress.

In the present study, most of these corneal changes were transient and did not prevent eventual visual rehabilitation in the majority of patients. Nevertheless, careful surgical handling, adequate anterior chamber maintenance, minimization of unnecessary endothelial contact, and appropriate use of viscoelastic substances are particularly important in PEX eyes.

Intraocular Pressure

The mean preoperative IOP in the present study was within the normal range, and postoperative IOP remained stable in the majority of patients. This finding is clinically important because PEX is associated with an increased risk of ocular hypertension and pseudoexfoliative glaucoma.

Zamani M et al,[11] demonstrated a gradual reduction in IOP following MSICS, with mean IOP decreasing from 14.39 mmHg preoperatively to 12.53 mmHg at three months. Similarly, Naresh Desinayak et al,[6] reported a postoperative reduction in IOP, particularly among eyes with pseudoexfoliation glaucoma. The stable postoperative IOP observed in the present study is therefore consistent with the overall trend reported in previous studies.

The reduction in IOP following cataract extraction may be related to improved aqueous outflow following removal of the crystalline lens and changes in anterior chamber configuration. However, patients with PEX require long-term IOP surveillance because cataract surgery does not eliminate the underlying risk of pseudoexfoliative glaucoma.

Visual Outcome

Visual rehabilitation represents the most important measure of the success of cataract surgery. In the present study, 71% of patients achieved a visual acuity of 6/6–6/18 at six weeks postoperatively, while 20% achieved 6/24–6/60 and 9% remained worse than 6/60.

These results indicate that despite the increased surgical challenges associated with PEX, satisfactory visual rehabilitation can be achieved following MSICS in the majority of patients. Islam QU et al,[12] reported an even higher proportion of patients achieving good visual outcomes, with 98.7% attaining BCVA of 6/12 or better by three months. The somewhat lower proportion of good visual outcomes at six weeks in the present study may be explained by differences in follow-up duration, cataract severity, pre-existing ocular comorbidities, and the proportion of eyes experiencing intraoperative complications.

Aravind et al,[13] similarly concluded that MSICS provides satisfactory postoperative visual outcomes in patients with advanced cataracts, including those with PEX. The present findings therefore support the effectiveness of MSICS despite the increased surgical complexity associated with PEX.

Among the nine patients who had visual acuity worse than 6/60 at six weeks, three had persistent corneal edema, three were left aphakic because of intraoperative complications, two had glaucomatous optic neuropathy diagnosed after cataract surgery, and one had persistent macular edema. These causes demonstrate that poor postoperative vision was not attributable solely to the surgical procedure but was frequently related to pre-existing or surgery-associated ocular pathology.

The identification of glaucomatous optic neuropathy after cataract surgery is particularly noteworthy. In eyes with mature or hypermature cataracts, preoperative visualization of the optic disc and macula may be difficult or impossible. Consequently, underlying glaucoma or posterior segment disease may remain undiagnosed until after lens removal. This emphasizes the importance of carefully assessing the optic nerve, macula, and retinal status whenever adequate visualization is possible and counselling patients regarding the possibility of limited visual recovery due to coexisting ocular disease.

Three patients remained aphakic because of intraoperative complications, which represents an important limitation to immediate visual

rehabilitation. Similarly, persistent macular edema may substantially limit postoperative visual acuity despite successful cataract extraction. In the present study, patients with aphakia and persistent macular edema were appropriately referred to the retinal service for further management. Two patients with macular edema showed subsequent improvement in visual acuity to 6/9 and 6/24 following medical treatment, indicating that some causes of poor early postoperative vision were potentially reversible.

The findings of the present study demonstrate that PEX increases the technical complexity of MSICS, particularly because of poor pupillary dilatation and zonular instability. The frequency of zonular dialysis observed in the present study was comparable with previously reported rates of 3.3% by Shivkumar C et al,[8] and approximately 3.8% by Pranathi et al.[10] Similarly, the occurrence of small pupils and the requirement for mechanical or surgical pupil enlargement were consistent with observations reported by Shivkumar C et al,[8] and Rajendran S et al.[9]

Despite these challenges, the majority of surgeries in the present study were completed successfully, and most patients achieved satisfactory visual rehabilitation. The visual outcomes were broadly consistent with previous reports demonstrating that MSICS can provide good visual recovery in patients with PEX and advanced cataract.[12,13]

The relatively greater frequency of advanced cataracts and postoperative corneal complications in the present study may reflect delayed presentation and the characteristics of the study population. Importantly, the causes of poor visual outcome in the small proportion of patients with vision worse than 6/60 were multifactorial, including corneal edema, aphakia, glaucomatous optic neuropathy, and macular edema.

Overall, the present study supports the use of MSICS as a safe, effective, economical, and practical surgical technique for cataract patients with PEX, particularly in settings where advanced cataracts are common and access to more resource-intensive surgical approaches may be limited. However, successful outcomes depend on meticulous preoperative assessment, anticipation of small pupils and zonular weakness, appropriate intraoperative pupil management, gentle manipulation of the iris and lens, preparedness to manage zonular dialysis and capsular complications, and careful postoperative monitoring of IOP, corneal status, macular function, and optic nerve status.

Limitations of the study: The surgeries were performed by multiple surgeons with variable experience creating bias. There was no comparison between phacoemulsification which is another limitation of the study. The other limitation were short follow up period upto 6 weeeks and limited resources like CTR which would have given better visual outcomes.

CONCLUSION

Pseudoexfoliation syndrome is associated with increased intraoperative challenges during Manual Small Incision Cataract Surgery due to poor pupillary dilatation and zonular weakness. Despite these challenges, careful preoperative evaluation, meticulous surgical technique, and timely management of complications result in satisfactory visual outcomes in the majority of patients. Manual Small Incision Cataract Surgery remains a safe, effective, and economical option for cataract management in patients with pseudoexfoliation syndrome.

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