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ORIGINAL RESEARCH

Visual Outcomes and Complications of Secondary Retro-pupillary Iris-Claw Intraocular Lens Implantation in Surgical Aphakia: A Retrospective Observational Study

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ABSTRACT

Background: Retro-pupillary fixation of an iris-claw intraocular lens (IOL) is a sutureless, relatively quick option for visual rehabilitation of aphakic eyes that lack adequate capsular support. We evaluated visual outcomes and early postoperative complications after secondary retro-pupillary iris-claw IOL implantation in eyes left aphakic after cataract surgery. **Methods:** This single-centre retrospective study reviewed the records of eyes that underwent secondary retro-pupillary iris-claw IOL implantation between June 2025 and March 2026 at a teaching hospital in southern India. Of 32 eligible eyes, two with pre-existing glaucomatous optic neuropathy were excluded, leaving 30 eyes of 30 patients. Best-corrected visual acuity (BCVA) was recorded with a Snellen chart, converted to logarithm of the minimum angle of resolution (logMAR) units, and compared before surgery and at 1 and 6 months. Complications were extracted from routine follow-up records. **Results:** Mean BCVA improved from 1.93 ± 0.24 logMAR before surgery to 0.56 ± 0.56 logMAR at 1 month and 0.22 ± 0.29 logMAR at 6 months. The change over time was assessed using the Friedman test (χ^2 = [tentatively 120.4], $P < 0.001$), followed by pairwise Wilcoxon signed-rank tests with Bonferroni correction (adjusted $P < 0.001$ for all pairwise comparisons). At 6 months, 27 eyes (90.0%) had BCVA of 6/18 or better. Pupil ovalisation was the most frequent finding (6 eyes, 20.0%), followed by raised intraocular pressure (4 eyes, 13.3%). Severe (grade 4+) anterior-chamber reaction, hyphaema and cystoid macular oedema each occurred in 3 eyes (10.0%), and iris atrophy in 1 eye (3.3%). One eye with hyphaema and raised intraocular pressure required an anterior-chamber washout. **Conclusion:** Secondary retro-pupillary iris-claw IOL implantation was followed by marked improvement in BCVA over 6 months in selected eyes with surgical aphakia and sufficient iris tissue, with complications that were mostly manageable medically. The small retrospective sample, the absence of a comparison group and the short follow-up limit the strength of these conclusions.

Keywords: Aphakia; Cataract surgery; Iris-claw intraocular lens; Retro-pupillary fixation; Secondary intraocular lens; Visual acuity

INTRODUCTION

Aphakia, the absence of the crystalline lens from its normal position, abolishes accommodation and causes high hypermetropia; when unilateral, it produces marked anisometropia [1]. In current practice, surgical aphakia most often results from cataract surgery complicated by posterior capsule rupture or zonular weakness, in which a conventional posterior-chamber IOL cannot be safely placed in the capsular bag or ciliary sulcus. Although it is uncommon after modern cataract surgery, it can impose a considerable functional burden [2].

Aphakia can be corrected with spectacles or contact lenses, but both have important drawbacks. Aphakic spectacles cause image magnification, aniseikonia, optical aberrations and restriction of the visual field, which make them unsuitable for unilateral aphakia, while long-term contact lens wear may be limited by poor tolerance, difficulty with handling and corneal complications [3–5]. Secondary IOL implantation is therefore usually preferred, particularly when aphakia is unilateral.

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In eyes without adequate capsular support, the main options are angle-supported anterior-chamber IOLs, scleral-fixated posterior-chamber IOLs and iris-fixated IOLs. Each has specific anatomical requirements and risks. Anterior-chamber IOLs may cause corneal endothelial cell loss, damage to the angle and secondary glaucoma [6]. Scleral fixation places the lens in a more physiological position but is technically more demanding and may be complicated by hypotony, haemorrhage, retinal detachment, haptic or suture exposure and suture breakage [7].

Retro-pupillary fixation of an iris-claw IOL, popularised by Mohr and colleagues, places the optic behind the iris and secures the haptics by enclavating mid-peripheral iris stroma from the posterior side [8]. The technique does not require scleral sutures, is relatively quick, and keeps the lens away from the corneal endothelium and the angle, and it can provide good centration and visual rehabilitation when sufficient iris tissue is present [3]. Reported complications include anterior-chamber inflammation, transient rise in intraocular pressure (IOP), hyphaema, pupil ovalisation, disenclavation and cystoid macular oedema (CMO) [3,9–11].

The aim of this study was to evaluate the visual outcomes and short-term safety of secondary retro-pupillary iris-claw IOL implantation in eyes with surgical aphakia after cataract surgery. The specific objectives were to measure the change in best-corrected visual acuity (BCVA) from before surgery to 1 and 6 months after implantation; to describe the frequency and pattern of early postoperative complications; to assess the anatomical stability of the IOL during 6 months of follow-up; and to record any additional medical or surgical treatment required for complications.

MATERIALS AND METHODS

Study design, setting and ethics

This single-centre retrospective observational study was based on a review of medical records in the Department of Ophthalmology, Viswabharathi Medical College and General Hospital, Kurnool, Andhra Pradesh, India. The records of patients who developed surgical aphakia after cataract surgery at the institution and subsequently underwent secondary retro-pupillary iris-claw IOL implantation between June 2025 and March 2026 were reviewed. The study is reported in accordance with the STROBE guidelines [12].

The study was conducted in accordance with the Declaration of Helsinki [13] and was approved by the Institutional Ethics Committee of Viswabharathi Medical College and General Hospital with approval number VBMC/IEC/131/2024. Because only existing clinical records were reviewed and no patient underwent any research-specific procedure, the Committee waived the requirement for informed consent. Records were de-identified before analysis.

Study population

During the study period, 1,100 cataract operations were performed at the institution. Thirty-two eyes with surgical aphakia subsequently underwent secondary retro-pupillary iris-claw IOL implantation, corresponding to 2.9% (32/1,100) of these operations. The records of all 32 eyes were screened and no sampling was undertaken. Two eyes were excluded because pre-existing glaucomatous optic neuropathy could independently limit visual recovery. The analysis therefore included 30 eyes of 30 patients, with one eye per patient (Figure 1).

Eyes were included if they had surgical aphakia after cataract surgery at the institution because posterior capsular or zonular support was inadequate for a posterior-chamber IOL; underwent secondary retro-pupillary iris-claw IOL implantation; had sufficient iris tissue for enclavation of both haptics; and had documented clinical data, including BCVA, before surgery and at 1 and 6 months. Eyes were excluded if they had insufficient iris tissue, corneal decompensation or clinically significant corneal opacity, active ocular inflammation or infection at the time of secondary implantation, pre-existing glaucomatous optic neuropathy, other retinal or optic nerve disease likely to limit visual recovery, incomplete records or less than 6 months of documented follow-up.

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Data collection

Demographic, clinical and operative data were extracted from inpatient case records, operative notes, investigation reports and outpatient follow-up records using a structured data-extraction form. The variables recorded were age, sex, laterality, type of primary cataract surgery, reason for the lack of capsular support, interval between primary surgery and secondary implantation, BCVA, IOP, anterior- and posterior-segment findings, IOL power, operative details, postoperative complications and any additional treatment.

Preoperative assessment

Uncorrected and best-corrected visual acuity were measured with a Snellen chart, with aphakic refraction and high-plus correction as clinically indicated. Snellen values were converted to logMAR units for analysis [14]. For eyes with visual acuity below the measurable Snellen range, counting-fingers, hand-movements and light-perception vision were assigned predefined logMAR-equivalent values according to the conversion method adopted for the study. The same conversion method was applied consistently at all assessment time points. Slit-lamp biomicroscopy was used to assess corneal clarity, anterior-chamber reaction, pupil shape, residual iris tissue and capsular support. IOP was measured by Goldmann applanation tonometry, and the posterior segment was examined with a 90-dioptre lens after pupil dilation; B-scan ultrasonography was used when media opacity prevented an adequate view of the fundus.

IOL power was calculated from keratometry and A-scan ultrasonographic axial length using the SRK/T formula [15] with an A-constant of 117.0, within the range of 116.7–117.5 reported for retro-pupillary placement of iris-claw IOLs [16]. Secondary implantation was generally planned 2–4 weeks after the primary surgery, once corneal oedema and anterior-chamber inflammation had settled.

Intraocular lens and surgical technique

A single-piece, non-foldable, biconvex polymethyl methacrylate iris-claw IOL designed for iris fixation (Liberty) with a 5.0-mm optic and an overall length of 8.5 mm was used.

All operations were performed by one experienced anterior-segment surgeon under peribulbar anaesthesia using a standard institutional technique. Depending on the integrity of the primary incision, the previous scleral tunnel was reopened or a new superior corneoscleral tunnel of adequate width was created. Two paracenteses were made approximately 180° apart. Anterior vitrectomy was performed when vitreous was present in the anterior chamber, and an ophthalmic viscosurgical device (OVD) was used to maintain the anterior chamber and protect the corneal endothelium.

The IOL was introduced into the anterior chamber with holding forceps and oriented horizontally. One haptic was passed behind the iris, and the overlying mid-peripheral iris stroma was enclavated through the adjacent paracentesis with an enclavation needle or dialler; the manoeuvre was repeated on the opposite side. Symmetrical fixation and stability were confirmed by the appearance of the characteristic iris dimples. A peripheral iridectomy was performed at approximately the 11 or 1 o’clock position with De Wecker scissors, the OVD was removed completely, and the wounds were checked for leakage and sutured when required. The conjunctiva was repositioned with bipolar cautery where applicable.

Postoperative treatment and follow-up

Postoperative treatment comprised topical moxifloxacin 0.5% four times daily for 2 weeks and prednisolone acetate 1% six times daily, tapered over about 6 weeks according to the degree of inflammation. Cycloplegic, IOP-lowering or topical non-steroidal anti-inflammatory drugs were added when indicated. At the 1-month and 6-month visits, BCVA, IOP, corneal clarity, anterior-chamber reaction, pupil shape, IOL position and posterior-segment findings were recorded. Optical coherence tomography (OCT) was performed when CMO was suspected clinically.

Outcomes and definitions

The primary outcome was the change in BCVA (logMAR) from before surgery to 6 months after secondary implantation. Secondary outcomes were the change in BCVA from before surgery to 1 month and from 1 to 6 months; IOL centration

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and stability; postoperative IOP; anterior-chamber inflammation; hyphaema; pupil ovalisation; iris atrophy; CMO; and any additional medical or surgical treatment for complications.

Lower logMAR values indicate better visual acuity. Raised IOP was defined as a recorded IOP greater than 21 mmHg or the start of IOP-lowering treatment. Anterior-chamber cells were graded according to the Standardization of Uveitis Nomenclature (SUN) scale [17]. Hyphaema was defined as clinically visible blood in the anterior chamber, and pupil ovalisation as a postoperative deviation from a round pupil attributed to iris enclavation. CMO was diagnosed from compatible clinical findings, confirmed by OCT where available. Complications were counted per eye, and an eye could have more than one complication.

Statistical analysis

Data were analysed with IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). Categorical variables are summarised as numbers and percentages, and continuous variables as mean ± standard deviation or median and interquartile range, according to their distribution. Because BCVA was measured repeatedly in the same eyes, logMAR values before surgery and at 1 and 6 months were compared with the Friedman test, followed, if significant, by pairwise Wilcoxon signed-rank tests with Bonferroni correction (significance threshold 0.0167). Mean paired differences in logMAR were calculated with 95% confidence intervals. All other tests were two-sided, with $P < 0.05$ considered significant. Missing values were not imputed.

RESULTS

Participant characteristics

Of 32 eligible eyes, 2 were excluded, and 30 eyes of 30 patients were analysed (Figure 1). Patients were aged 52–76 years (mean 64.3 ± 6.7 years); 17 (56.7%) were women and 13 (43.3%) men, and 16 right and 14 left eyes were included. The primary cataract operation was manual small-incision cataract surgery in 18 eyes (60.0%) and phacoemulsification in 12 (40.0%). Aphakia resulted from posterior capsule rupture in 21 eyes (70.0%), zonular dialysis or insufficiency in 6 (20.0%) and other intraoperative causes in 3 (10.0%) (Table 1). The mean interval between primary cataract surgery and secondary retro-pupillary iris-claw IOL implantation was 12 ± 3.5 weeks (Table 1).

Table 1. Demographic and baseline clinical characteristics (n = 30 eyes of 30 patients)

Characteristic	Category	n (%) or mean ± SD
Age, years	Mean ± SD (range)	64.3 ± 6.7 (52–76)
Age group	52–59 years	7 (23.3)
	60–69 years	15 (50.0)
	70–76 years	8 (26.7)
Sex	Female	17 (56.7)
	Male	13 (43.3)
Operated eye	Right	16 (53.3)
	Left	14 (46.7)
Primary cataract surgery	Manual small-incision cataract surgery	18 (60.0)
	Phacoemulsification	12 (40.0)
Cause of aphakia	Posterior capsule rupture	21 (70.0)
	Zonular dialysis or insufficiency	6 (20.0)
	Other intraoperative cause	3 (10.0)
Interval to secondary implantation	mean ± SD, weeks	12.0 ± 3.5

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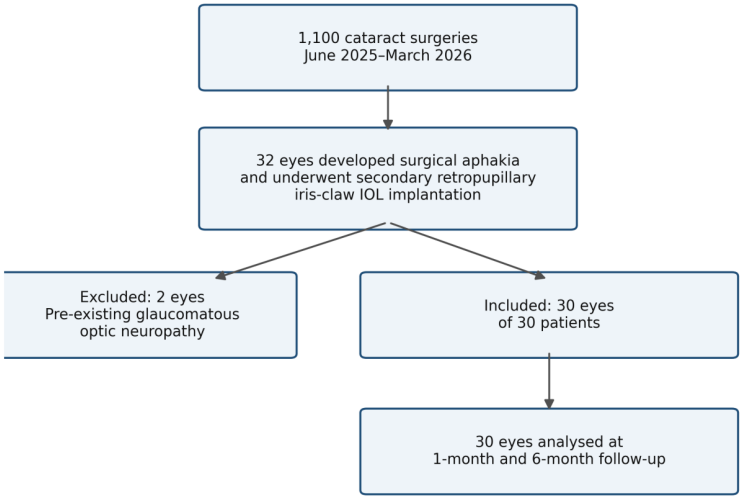

Figure 1. *Flow of records through eligibility assessment and inclusion in the analysis. IOL, intraocular lens.*

Visual outcomes

Mean BCVA improved from 1.93 ± 0.24 logMAR before surgery to 0.56 ± 0.56 logMAR at 1 month and 0.22 ± 0.29 logMAR at 6 months (Table 2; Figure 2). The change over time was assessed with the Friedman test ($\chi^2 = 120.4$, $P < 0.001$). Pairwise Wilcoxon signed-rank tests with Bonferroni correction gave adjusted $P < 0.001$ (preoperative vs 1 month), < 0.001 (preoperative vs 6 months) and < 0.001 (1 vs 6 months). The mean improvement from baseline to 6 months was 1.71 logMAR (95% CI 1.57 to 1.85).

Before surgery, 29 eyes (96.7%) had BCVA worse than 6/60. At 1 month, 19 eyes (63.3%) had BCVA of 6/18 or better, and at 6 months 27 eyes (90.0%) did so; one eye (3.3%) remained worse than 6/60 at 6 months.

Postoperative complications

Pupil ovalisation was the most frequent postoperative finding (6 eyes, 20.0%), followed by raised IOP (4 eyes, 13.3%). Grade 4+ anterior-chamber reaction, hyphaema and CMO each occurred in 3 eyes (10.0%), and iris atrophy in 1 eye (3.3%) (Table 3). Two eyes had both grade 4+ anterior-chamber reaction and hyphaema. During the 6-month follow-up period, no IOL decentration, disenclavation, or dislocation was documented. One eye with hyphaema and raised IOP required an anterior-chamber washout; the remaining eyes with raised IOP were managed medically with topical IOP-lowering medication, such as timolol maleate 0.5% and brimonidine tartrate 0.2%, as clinically indicated, with IOP monitored during follow-up. All three eyes with limited visual improvement at 1 month had CMO. Two of them improved by 6 months with topical nepafenac 0.1%, whereas the third showed delayed and limited recovery.

Table 2. Best-corrected visual acuity before and after retro-pupillary iris-claw IOL implantation (n = 30)

Assessment	BCVA, logMAR, mean ± SD	6/6–6/18, n (%)	6/24–6/60, n (%)	<6/60, n (%)
Preoperative	1.93 ± 0.24	0 (0.0)	1 (3.3)	29 (96.7)
1 month	0.56 ± 0.56	19 (63.3)	8 (26.7)	3 (10.0)
6 months	0.22 ± 0.29	27 (90.0)	2 (6.7)	1 (3.3)

BCVA, best-corrected visual acuity; logMAR, logarithm of the minimum angle of resolution; SD, standard deviation. Snellen categories are shown for clinical interpretation; analyses used logMAR values.

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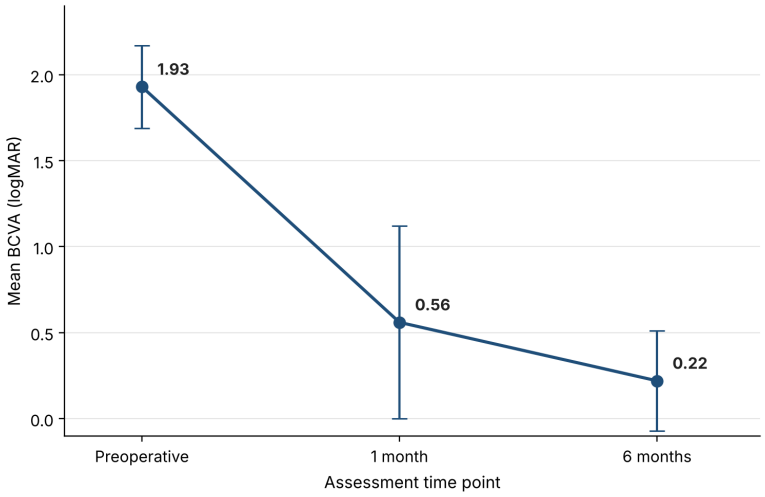

Figure 2. *Mean best-corrected visual acuity (BCVA) before surgery and at 1 and 6 months after retro-pupillary iris-claw intraocular lens implantation. .*

Error bars indicate standard deviation. Lower logMAR values indicate better visual acuity

Table 3. Postoperative complications (n = 30 eyes)

Complication	Eyes, n (%)
Pupil ovalisation	6 (20.0)
Raised intraocular pressure (>21 mmHg)	4 (13.3)
Grade 4+ anterior-chamber reaction	3 (10.0)
Hyphaema	3 (10.0)
Cystoid macular oedema	3 (10.0)
Iris atrophy	1 (3.3)
IOL decentration, disenclavation or dislocation	0 (0.0)
Additional surgical intervention (anterior-chamber washout)	1 (3.3)

IOL, intraocular lens. Categories are not mutually exclusive; two eyes had both grade 4+ anterior-chamber reaction and hyphaema.

DISCUSSION

In this retrospective series, secondary retro-pupillary iris-claw IOL implantation in eyes with surgical aphakia was followed by marked improvement in BCVA, from a mean of 1.93 logMAR before surgery to 0.56 logMAR at 1 month and 0.22 logMAR at 6 months, with 90% of eyes reaching 6/18 or better. Most of the improvement occurred in the first month, and visual acuity continued to improve between 1 and 6 months as postoperative inflammation settled and most cases of CMO resolved.

These results are broadly consistent with published series. In a long-term retrospective analysis of 320 eyes followed for a mean of 5.3 years, Forlini et al. reported sustained visual rehabilitation after retro-pupillary iris-claw implantation for aphakia of various causes; disenclavation occurred in 0.9% of eyes and complete posterior dislocation in one, underlining the need for prolonged surveillance [18]. Jayamadhury et al., in 61 aphakic eyes followed for 1 year, reported improvement in visual acuity with pupil ovalisation in 9.8%, CMO in 11.5% and iris atrophy in 6.6% of eyes [19]; their CMO rate was close to ours (10.0%), whereas our rate of pupil ovalisation was higher. Hsing and Lee found that 58% of eyes followed for at least 6 months achieved a visual acuity of 6/12 or better and concluded that the technique was useful when iris support was adequate [20], and in 137 eyes Gonnermann et al. reported an improvement in mean corrected distance visual acuity from 0.65 to 0.38 logMAR [21]. The larger change in our series reflects the much poorer preoperative acuity of uncorrected aphakic eyes at baseline rather than a better final result.

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Comparative studies help to place the technique among the alternatives. Madhivanan et al. found that visual recovery at 1 month was slower after retro-pupillary iris-claw than after scleral-fixated IOL implantation (0.7 ± 0.5 versus 0.3 ± 0.2 logMAR), but that visual outcomes were similar at 1 year (0.4 ± 0.4 versus 0.3 ± 0.2 logMAR); iritis, IOP spikes and pupil ovalisation were more frequent in the iris-claw group [22]. In a 5-year comparison of 180 eyes, Toro et al. found similar improvement in visual acuity and similar overall complication rates after anterior and retro-pupillary iris-claw fixation, with pigment precipitates on the IOL more frequent after anterior fixation [23]. In a large retrospective series of secondary IOL implantation, Vounotrypidis et al. reported good refractive predictability with iris-claw IOLs but more frequent anterior-chamber haemorrhage after iris fixation [24], which is consistent with the hyphaema observed in three of our eyes.

The 10.0% rate of CMO in this series matches the rate of 10% (3 of 30 eyes) reported by Bypareddy et al. [10]. Differences between published series probably reflect case selection, surgical technique, diagnostic criteria, the routine use of OCT and the duration of follow-up. Because OCT was performed only when CMO was suspected clinically, subclinical CMO may have been missed in our series. Two of the three affected eyes recovered by 6 months with topical nepafenac, but one recovered only partially.

Pupil ovalisation occurred in 20.0% of eyes. Reported rates vary widely, from 9.8% in the series of Jayamadhury et al. [19] and 16% in that of Madhivanan et al. [22] to 25% reported by Panchbhai et al., 40% by Bypareddy et al. and 44.4% by Sumitha et al. [9–11]. The amount and symmetry of enclavated iris tissue, the orientation of the haptics and the definition used for clinically relevant distortion probably account for much of this variation. Pupil ovalisation is often regarded as a cosmetic finding, but altered pupil dynamics after iris fixation may affect glare, dysphotopsia and contrast sensitivity [25]; these patient-reported outcomes were not captured in our review.

Severe anterior-chamber reaction occurred in 10.0% of eyes and raised IOP in 13.3%, and one eye with hyphaema and raised IOP required an anterior-chamber washout. These findings emphasise the importance of complete anterior vitrectomy, gentle iris handling, thorough removal of the OVD and close early monitoring of inflammation and IOP after surgery. A peripheral iridectomy was performed in all eyes in this series to reduce the risk of pupillary block.

This study has several limitations. Its retrospective single-centre design depended on the completeness of routine clinical records, and the sample was small. There was no comparison group, so the outcomes cannot be compared directly with those of other techniques. Follow-up was limited to 6 months, which is too short to detect late complications such as disenclavation, IOL dislocation, endothelial decompensation or chronic glaucoma. Eyes with glaucomatous or posterior-segment disease were excluded, which may have favoured better visual outcomes. Endothelial cell density, refractive outcome, contrast sensitivity and patient-reported outcomes were not systematically recorded. Larger prospective comparative studies with longer follow-up and standardised assessment of visual, anatomical and patient-reported outcomes are needed.

CONCLUSION

In this series of eyes with surgical aphakia and inadequate capsular support, secondary retro-pupillary iris-claw IOL implantation was followed by substantial improvement in BCVA over 6 months, from 1.93 to 0.22 logMAR. Pupil ovalisation (20.0%) and raised IOP (13.3%) were the most frequent postoperative findings, and CMO (10.0%) was associated with delayed visual recovery. Retro-pupillary iris-claw implantation appears to be an effective option for visual rehabilitation in appropriately selected aphakic eyes with sufficient iris tissue, but larger prospective studies with longer follow-up are needed to confirm its long-term safety.

DECLARATIONS

Ethics approval: Approved by the Institutional Ethics Committee of Viswabharathi Medical College and General Hospital, Kurnool. The requirement for informed consent was waived because of the retrospective design.

Consent for publication: Not applicable; no identifiable patient information is presented.

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Competing interests: The authors declare no competing interests.

Data availability: De-identified data are available from the corresponding author on reasonable request, subject to institutional and ethical approval.

Postoperative complications

Pupil ovalisation was the most frequent postoperative finding (6 eyes, 20.0%), followed by raised IOP (4 eyes, 13.3%). Grade 4+ anterior-chamber reaction, hyphaema and CMO each occurred in 3 eyes (10.0%), and iris atrophy in 1 eye (3.3%) (Table 3). Two eyes had both grade 4+ anterior-chamber reaction and hyphaema. During the 6-month follow-up period, no IOL decentration, disenclavation, or dislocation was documented. One eye with hyphaema and raised IOP required an anterior-chamber washout; the remaining eyes with raised IOP were managed medically with topical IOP-lowering medication, such as timolol maleate 0.5% and brimonidine tartrate 0.2%, as clinically indicated, with IOP monitored during follow-up. All three eyes with limited visual improvement at 1 month had CMO. Two of them improved by 6 months with topical nepafenac 0.1%, whereas the third showed delayed and limited recovery.

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