

Surgical outcome of retropupillary iris-claw lens implantation: a retrospective review

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Abstract

Introduction: Intraocular lens (IOL) selection, especially in cases with insufficient capsular and/or zonular support has increasingly become a challenge to surgeons. Retropupillary iris-claw IOLs (RP- ICIOL) have gained popularity in recent years. Purpose: This study aimed to review the outcomes of RP-ICIOL implantation in two tertiary eye centres.

Study design: Retrospective review.

Methods: This is a retrospective study of 14 eyes of 14 patients who underwent Artisan RP-ICIOL implantation between November 2018 and December 2020 in two tertiary eye centres in Malaysia.

Results: The mean age of patients was 51.5 ± 17.4 years with the range between 18 and 77 years old. There were ten (71.4%) males and four (28.6%) females. The IOL was implanted primarily in three eyes (21.43%) and as a secondary procedure in eleven eyes (78.6%). Mean preoperative best-corrected visual acuity (BCVA) was logMAR 1.32 ± 0.82 , while mean postoperative BCVA was logMAR 0.56 ± 0.42 ($p = 0.010$). Visual improvement of two or more lines in BCVA was observed in nine eyes (64.3%), no improvement in two eyes (14.3%), and worsening in three eyes (21.4%). There were no complications observed during the surgery. All our patients had a well-centred IOL at the 1-month postoperative follow-up. Mean preoperative

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intraocular pressure was 16.8 ± 2.0 mmHg and postoperative intraocular pressure was 15.7 ± 5.1 mmHg ($p = 0.430$).

Conclusion: RP-ICIOL implantation is safe and provides the optical advantage of a more biologically appropriate retropupillary position, ensuring a favourable functional visual outcome with low risk of complications.

Keywords: Artisan intraocular lens, capsular support, cataract surgery, retropupillary iris-claw intraocular lens

Penghasilan pembedahan katarak dengan implantasi kanta cakar iris retropupillari: tinjauan retrospektif

Abstrak

Pengenalan: Pemilihan kanta intraokular (IOL) kini semakin mencabar kepada pakar oftalmologi, terutamanya dalam kes dimana terdapat kekurangan sokongan kapsul dan/atau zonular. Kanta cakar iris retropupillari (RP-ICIOL) menjadi popular sejak kebelakangan ini.

Tujuan: Tujuan kajian ini adalah untuk mengkaji penghasilan pembedahan katarak dengan implantasi RP-ICIOL di dua pusat perubatan tertiri.

Reka bentuk kajian: Tinjauan retrospektif.

Kaedah: Tinjauan retrospektif ini melibatkan 14 mata daripada 14 pesakit yang menjalani pembedahan katarak dengan implantasi Artisan RP-ICIOL di antara November 2018 dan Disember 2020 di dua pusat perubatan tertiri di Malaysia.

Keputusan: Purata umur pesakit yang terlibat adalah 51.5 ± 17.4 tahun dengan julat antara 18 hingga 77 tahun yang terdiri dari sepuluh (71.4%) lelaki dan empat (28.6%) perempuan. Implantasi RP-ICIOL sebagai prosedur primer telah melibatkan tiga mata (21.43%) dan sebagai prosedur sekunder dalam sebelas mata (78.6%). Purata ketajaman penglihatan terbaik (BCVA) sebelum pembedahan ialah logMAR 1.32 ± 0.82 berbanding dengan purata BCVA selepas pembedahan ialah logMAR 0.56 ± 0.42 ($p = 0.010$). Sembilan mata (64.3%) menunjukkan penambahbaikan BCVA sebanyak dua garisan atau lebih, dua mata (14.3%) tiada menunjukkan peningkatan BCVA dan tiga mata (21.4%) menunjukkan kemerosotan penglihatan. Tiada komplikasi diperhatikan semasa pembedahan. Kesemua RP-ICIOL didapati berkedudukan stabil selepas pembedahan dan semasa rawatan susulan. Purata tekanan intraokular (IOP) sebelum pembedahan ialah 16.8 ± 2.0 mmHg, dan IOP selepas pembedahan ialah 15.7 ± 5.1 mmHg ($p = 0.430$).

Kesimpulan: Pembedahan katarak dengan implantasi RP-ICIOL adalah selamat dan

mengembalikan kedudukan kanta pada ruang retropupillari, memberikan ketajaman penglihatan yang baik selepas pembedahan serta mempunyai risiko komplikasi yang rendah.

Kata kunci: kanta intraokular artisan, kanta intraokular cakar iris retropupillari, pembedahan katarak, sokongan kapsul

Introduction

Intraocular lens (IOL) selection, especially in cases with insufficient capsular and/or zonular support, has increasingly become a challenge to surgeons. It is one of the main determining factors that influence a patient's final visual outcome.¹

Loss of capsular or zonular support can be due to congenital or secondary causes, which include trauma: ocular pathologies such as pseudoexfoliation syndrome, Marfan syndrome, and lens coloboma; complicated cataract surgery such as iatrogenic zonulodialysis; and intraoperative posterior capsule rupture.² Choices for IOL implantation in these cases include angle-supported anterior chamber IOL (ACIOL), scleral-fixated IOL (SFIOL), and iris-claw IOL (ICIOL).³

Conventionally, ACIOL and SFIOL implantation are commonly practiced in Malaysia in cases of insufficient capsular and/or zonular support. The ACIOL was first introduced by Baron in 1952.⁴ Closed-loop ACIOLs gained popularity in the 1970s due to their various flexible designs that were thought to alleviate problems with sizing.⁵ However, the sharp edges eroded uveal tissue and released inflammatory mediators, causing a variety of complications such as pseudophakic corneal decompensation, pigment dispersion, chronic iritis, cystoid macular oedema (CMO), and uveitis glaucoma hyphaema syndrome.⁶ Subsequent generations of ACIOLs in the 1990s with improved design in terms of reducing fixation to three or four points, well-polished, and haptic without holes have demonstrated good surgical outcomes and a reduction in the above-mentioned complications.⁷ However, IOL sizing is still one of the major drawbacks of angle-supported ACIOLs.⁸ Complications associated with incorrect ACIOL sizing are common due to the limited availability of different diameters. A small-diameter ACIOL increases the risk of rotation and dislocation, which may lead to corneal endothelial and anterior chamber angle damage. A large-diameter ACIOL poses a risk of peripheral anterior synechiae formation, raised intraocular pressure (IOP), and glaucoma due to excessive pressure on the angle structures.^{9,10}

The sutured SFIOL was first described by Girard in 1981 and later modified by Malbran and colleagues in 1986.¹¹ This method can be used in patients who are contraindicated for ACIOL implantation, such as glaucoma patients or patients with inadequate iris support or low corneal endothelial cell count. However, SFIOL is technically challenging and requires longer operative times. Besides, it is associated

with complications such as suture breakage, resulting in IOL tilt or decentration, dislocation of the IOL into the vitreous, suture erosion and exposure, CMO, retinal detachment, and endophthalmitis.¹² In addition, this method is limited by the availability of surgical skills and steep learning curve.

In recent years, the iris-claw intraocular lens (ICIOL) has gained popularity in Malaysia. ICIOLs can be implanted either in the anterior chamber or the retropupillary space. Worst *et al.* first described the iris-clip IOL, which required sutures to be fixed to the iris, in 1972.¹³ In the 1980s, Amar first proposed the fixation of an iris-claw lens at the posterior surface of the iris. The implantation of retropupillary ICIOLs (RP-ICIOL) is less invasive and requires a shorter surgical duration with faster visual recovery compared to SFIOLs.¹⁴ Hence, RP-ICIOLs have emerged as a viable option for secondary IOL implantation in recent years. A recent meta-analysis by Liang *et al.* revealed that RP-ICIOL may perform better with greater IOP reduction and reduced incidence of CMO.¹⁵

The knowledge regarding outcomes of RP-ICIOL implantation is still limited in Malaysia. The purpose of this study was to evaluate the various indications, complications, and visual outcomes of RP-ICIOL implantation in eyes with insufficient or absent capsular/zonular support.

Material and methods

This is a retrospective review including 14 eyes of 14 patients who underwent Artisan aphakic IOL (Ophtec BV, Groningen, Netherlands) implantation between November 2018 and December 2020 in two tertiary eye centres in Malaysia. This study was conducted in accordance with the Declaration of Helsinki for human research. Informed consent was obtained from all individual participants included in the study.

We included both primary and secondary RP-ICIOL implantations performed during the study period. Eyes with dislocated/subluxated IOL or crystalline lens and post-lens aspiration aphakia for traumatic cataract were included in this study. Exclusion criteria were eyes with no light perception, corneal decompensation, advanced glaucoma, iris neovascularization, and aniridia. Snellen visual acuity values were expressed as the logarithm of the minimum angle of resolution (logMAR) for statistical analysis. Visual acuity of light perception was set at 2.9 logMAR, hand movement at 2.6 logMAR, and counting fingers at 2.3 logMAR.

Records and operative reports of patients who underwent RP-ICIOL implantation were reviewed.

Preoperative data collected were demographics, causes of aphakia, previous ocular surgeries, pre-existing ocular pathologies, IOP, and best-corrected visual acuity (BCVA). Postoperative data regarding BCVA, IOP, and complications were collected at 1 month postoperative. Patient evaluation comprised objective and

subjective refraction, BCVA, slit-lamp examination, IOP measurement by Goldmann applanation tonometry, indirect fundus examination, and A-scan ultrasound biometry.

All data were entered into the Statistical Program for Social Science (SPSS) version 26.0 software. Data were checked and cleaned to ensure accurate documentation and to eliminate any missing or erroneous values. The SPSS and Statistical Data Analysis (STATA) version 26.0 software was used for the statistical analysis.

Results

A total of 14 eyes were included in our study. The mean age of patients was 51.5 ± 17.42 years with a range between 18 and 77 years old. There were ten (71.4%) males and four (28.6%) females. Of the 11 patients, five were Malays, eight were Chinese, and one was Indian. There were six left eyes (42.9%) and eight right eyes (57.1%). The IOL was implanted primarily in three eyes (21.4%) and as a secondary procedure in eleven eyes (78.6%). The indications for primary surgery were subluxated/dislocated crystalline lens ($n = 3$, Marfan syndrome: 1, trauma: 2). For secondary IOL implantation, the indications were dislocated posterior chamber IOL (PCIOL) ($n = 3$), IOL exchange for subluxated PCIOL ($n = 4$), IOL exchange for subluxated SFIOL ($n = 1$), and post-lens aspiration aphakia for traumatic cataract ($n = 3$) (Fig. 1).

Four eyes had pre-existing primary open-angle glaucoma, four eyes had pre-existing high myopia and one of these had myopic maculopathy, one eye had pre-existing proliferative diabetic retinopathy with secondary glaucoma, one eye had pre-existing aphakic secondary glaucoma, one eye had ocular hypertension, and one eye had a corneal scar.

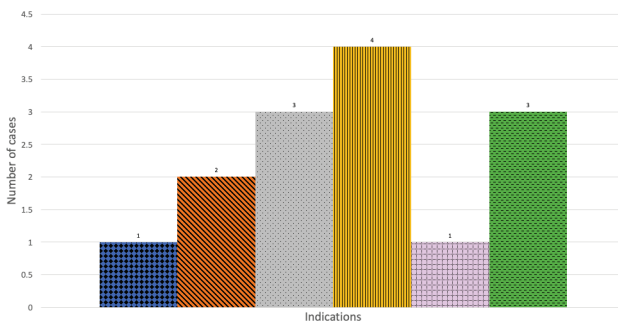


Fig. 1. Indications for retropupillary iris-claw intraocular lens implantation.

Table 1. Comparison of pre-operative and post-operative BCVA

Patient	Preoperative BCVA (logMAR)	Postoperative BCVA (logMAR)	BCVA difference
1	2.3	0.3	-2.0
2	1.0	0.2	-0.8
3	2.3	1.5	-0.8
4	2.6	0.5	-2.1
5	0.2	0.5	0.3
6	0.8	0.8	0
7	1.0	0.2	-0.8
8	2.3	0.1	-2.2
9	0.6	0.8	0.2
10	1.8	0.3	-1.5
11	0.7	1.3	0.6
12	0.5	0.2	-0.3
13	0.6	0.6	0
14	1.8	0.6	-1.2
Mean of differences			-0.76
Standard deviation of differences			0.936
p-value			0.010*

BCVA: best corrected visual acuity

*p-value based on paired t-test

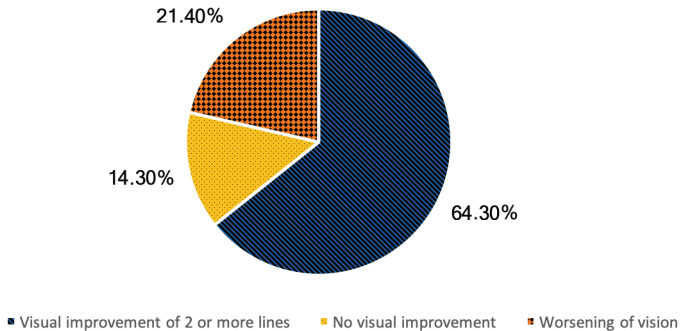


Fig. 2. Visual outcomes of retropupillary iris-claw intraocular lens implantation at 1-month follow-up.

Table 2. Comparison of preoperative and postoperative IOP

Patient	Preoperative IOP	Postoperative IOP	IOP difference
1	14	12	-2
2	20	8	-12
3	14	14	0
4	18	18	0
5	16	15	-1
6	17	20	3
7	18	29	11
8	16	12	-4
9	16	14	-2
10	16	14	-2
11	20	18	-2
12	14	12	-2
13	18	20	2
14	18	14	-4
Mean of differences			-1.07
Standard deviation of differences			4.922
p-value			0.430*

IOP: intraocular pressure

*p-value based on paired t-test

Mean best-corrected visual acuity (BCVA) improved from logMAR 1.32 ± 0.823 preoperatively to logMAR 0.56 ± 0.420 postoperatively ($p = 0.010$) (Table 1). Visual improvement of two or more lines in BCVA was observed in nine eyes (64.3%), no improvement in two eyes (14.3%) and worsening in three eyes (21.4%) at 1 month postoperatively (Fig. 2). Causes of worsening of visual acuity were due to secondary glaucoma, pre-existing corneal scar, and diabetic retinopathy.

All surgeries were uneventful without complications. IOLs were noted to be well centred at the 1-month postoperative follow-up. Mean preoperative IOP was 16.8 ± 2.01 mmHg, and postoperative IOP was 15.7 ± 5.09 mmHg (Table 2); the difference was not statistically significant ($p = 0.430$). No serious complications were observed postoperatively except for one patient who developed secondary steroid-induced glaucoma requiring long-term IOP-lowering agents.

Discussion

IOL selection in cases with insufficient or absent of capsular/zonular support is an emerging surgical dilemma that presents a challenge to most ophthalmologists. To date, there is still no established consensus on the best choice of IOL selection for the treatment of eyes insufficient capsular/zonular support.¹⁶ All available options have their own risks and complications.

In our study, 64.3% of the eyes had improved BCVA postoperatively, which is comparable to a study by Labeille *et al.* (68.8%).¹⁷ Our study showed that RP-ICIOL provided statistically significant improvement in visual acuity with mean postoperative BCVA of logMAR 0.56 ± 0.420 compared to mean preoperative BCVA of logMAR 1.32 ± 0.823 ($p = 0.010$). Of 14 eyes, two eyes (14.3%) showed no improvement in BCVA while three eyes (21.4%) showed worsening visual acuity. Deterioration of vision was attributed to secondary glaucoma, pre-existing corneal scar, and diabetic retinopathy status.

RP-ICIOL implantation better preserves the anatomic characteristics of the anterior segment with respect to the iridocorneal angle, thus avoiding angle closure and pupillary block.¹⁸ In our study, mean preoperative IOP was 16.8 ± 2.01 mmHg and mean postoperative IOP was 15.7 ± 5.09 mmHg ($p = 0.430$). Despite the concerns regarding IOP elevation after RP-ICIOL implantation, IOP was not elevated in most cases in our study. Postoperatively, only one eye developed secondary glaucoma (steroid-induced) requiring long-term IOP-lowering agents, similar to the study by Schallenberg *et al.* where one patient had raised IOP.¹⁹

Our study indicates that RP-ICIOL implantation is effective in the treatment of cases without sufficient capsular/zonular support by improving visual acuity without serious intraoperative or postoperative complications. There were no intraoperative complications noted in our cases. Postoperatively, none of our cases showed chronic anterior chamber inflammation, which is similar to the results of a study conducted by Forlini *et al.*²⁰ Iris ovalization and atrophy are common problems after RP-ICIOL implantation, but have no influence on visual or refractive outcomes or IOP.

The limitations of this study include its retrospective design, heterogeneous ophthalmic history and comorbidities, small sample size, and short follow-up. Further studies with larger sample sizes and longer follow-up are required to compare the results of primary RP-ICIOL implantation with those of other IOL implantation methods, with a focus on IOL stability and long-term outcomes such as postoperative chronic inflammation and corneal endothelial cell count reduction.

Conclusion

In conclusion, RP-ICIOL implantation provides optical and physiological advantages of more biologically appropriate retropupillary position, ensuring a good refractive outcome in patients with insufficient or absence of capsular/ zonular support. It is relatively less invasive and safe with minimal risk of complication. Therefore, this type of IOL implantation should be considered especially in patients who are contraindicated for angle-supported ACIOL implantation, such as glaucoma patients or patients with low corneal endothelial cell count.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki for human research. Informed consent was obtained from all individual participants included in the study. All patients provided their consent for the clinical information to be reported in the journal. Institutional review board approval was not required for the present study due to its retrospective nature.

Competing interests

None to declare.

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