ORIGINAL ARTICLE

Visual Outcomes and Complications of Intraocular Lens Placement in the Absence of Capsular Support in a Philippine Tertiary Hospital

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ABSTRACT

Background. Surgical correction of aphakia without capsular support continues to be a challenge. Improvements in the technology of cataract surgery have provided advancements in techniques in surgical management of aphakia. Locally, we have limited data on the outcomes of the different intraocular lenses used in aphakia.

Objective. This study aimed to determine visual outcomes and complications associated with different techniques of intraocular lens implantation in the absence of capsular support.

Methods. We reviewed the medical charts of 207 patients who underwent intraocular lens implantation without capsular support. Excluded were patients with incomplete follow up, pediatric patients, and lost records. Best corrected visual acuity at day 1, 1st month, 3rd month and 6th month postoperatively, and the complications were noted.

Results. Mean age was 60 and 51% (n=105) were females. The mean follow-up time was 9.33 ± 0.71 months. Loss of capsular support was most frequently caused by intraoperative complication (n=146, 70%) and trauma. Retropupillary fixation iris claw intraocular lens was frequently used (n=93, 44.9%). Across all patients, visual acuities showed excellent outcomes with 20/50 or better. Across IOL types, the most frequent postoperative complication was increase in IOP. Statistically significant results were set at P <0.05.

Conclusion. There is a notable preference towards iris claw retropupillary lenses through time. Iris claw lenses showed the shortest operative time. All intraocular lenses used in aphakia showed comparably good postoperative visual acuities, except for the superior visual acuity trend seen among retropupillary iris claw and anterior chamber IOL groups. Complications included elevated intraocular pressures, corneal edema, and pigment dispersion.

Keywords: aphakia, retropupillary iris claw, anterior chamber lens, Philippines

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INTRODUCTION

The advent of modern equipment and techniques has employed rapid improvements in the field of surgical management of lenticular opacities. The idea of surgical removal of cataract is with respect to the original placement of the natural lens. The goal of surgery is to replace the cataract with an intraocular lens placed in its natural, intact posterior capsular bag. Successful intraocular lens (IOL) placement in cataract surgery is equivalent to the IOL being placed in the capsular bag, and this maximizes the chances of optimal surgical and refractive outcomes.[1,2] However, as in any surgery, complications are unavoidable, and this can cause distress both to the surgeon and the patient. Certain causes to compromised capsular integrity result from a

myriad of conditions, such as ocular traumas, inherent zonular weaknesses, and complicated cataract surgeries. In such cases of inadequate capsular support, the surgeon must be able to maneuver and use alternative surgical techniques or approaches to place an IOL in the eye, and not leave a patient aphakic.

There is no standard rule with regard to the refractive correction of aphakia in the absence of capsular support. The following are a few surgical options available for IOL implantation in a local institution in the Philippines: anterior chamber intraocular lens,[3] retropupillary fixation intraocular lens,[4] transscleral-sutured intraocular lens, glued intraocular lens,[1] and iris-sutured intraocular lens. Locally, we have limited data on the outcomes of these different techniques following intraocular lens implantation without capsular support.

OBJECTIVES

This study aimed to determine the visual outcomes and complications associated with different techniques of intraocular lens implantation in the absence of capsular support. Specifically, this study aimed to describe the demographics of patients based on age, gender, and laterality. Etiologies for the loss of capsular support (e.g., intraoperative complication, inherent zonulysis, trauma), and intraoperative (e.g., iatrogenic zonulysis, large posterior capsular rent) risk factors affecting visual outcomes were identified. Postoperative complications (i.e., increased intraocular pressure (IOP), corneal edema, corneal decompensation, intraocular lens decentration, retinal detachment, pigment dispersion and others) were noted.

METHODS

We reviewed the medical charts of 207 patients who underwent intraocular lens implantation in the absence of capsular support. Our study was approved by the University of the Philippines-Manila Ethics Review Board prior to the conduct of the study. Patients with preexisting retinal pathology, glaucoma, corneal, and optic nerve pathology were included, however they were excluded in the analyses of visual outcomes. Exclusion criteria were patients with less than two months of follow up, pediatric patients, and lost and incomplete medical records.

The following parameters were recorded: best corrected visual acuity (BCVA) at day 1, 1st month, 3rd month, and 6th month postoperatively, and the complications. Primary variables including demographics (age, gender, laterality), type of cataract surgery, type of IOL implanted, and correlation between the parameters mentioned were recorded. Surgical duration was retrieved by mean duration in minutes. Only secondary implantations were considered in the reporting of duration in order to eliminate the durations spent by the surgeon in the primary surgery itself.

Data collected were subjected to statistical analyses. Frequencies and percentages were determined for categorical variables. Descriptive statistics namely mean, mode, and standard deviations were reported for numeric variables. Snellen BCVA was converted into logarithm of the minimal angle of resolution (logMAR) units for analysis. Chi-square and Fisher's exact tests were used to determine the possible relation between two categorical variables. Analysis of Variance (ANOVA) were used to compare averages of numeric variables by IOL type and surgical duration. Data were analyzed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Released 2011, Armonk, NY, USA). $P < 0.05$ was considered statistically significant.

RESULTS

A total of 207 eyes from 205 patients were included in the study, with a mean age of 60, and more than half of the patients being above 60 years of age (n = 110). The patients were almost equally distributed between males (n=102, 49%) and females (n=105, 51%). There were more patients operated on the right (n=114, 55%). Demographics of patients are seen in Table 1.

Table 2 showed that loss of capsular support was most frequently encountered in eyes with intraoperative complications (n=138, 63.3%), followed by inherent zonulysis (n=43, 19%) and traumatic zonulysis (n=37, 17.0%). The intraocular lens implantation was performed as either primary (same

Table 1. Demographics of Patients who Underwent Intraocular Lens Implantation in the Absence of Capsular Support

	Patients, n (%)	Mean	Mode
Age		60 ± 15.36	64
19 – 40	28 (13.5%)		
41 – 60	69 (33.3%)		
>60	110 (53.1%)		
Sex			
Male	102 (49.3%)		
Female	105 (50.7%)		
Laterality			
Right	114 (55.1%)		
Left	92 (44.4%)		
Intraocular lens implantation			
Primary	106 (51.2%)		
Secondary	101 (48.8%)		

Table 2. Etiologies for Loss of Capsular Support

	Eyes, n (%)
Intraoperative Complication	138 (63.3%)
Phacoemulsification	118 (54.13%)
Extracapsular Cataract Extraction	20 (9.17%)
Inherent zonulysis secondary to underlying ocular pathology	
Marfan's Syndrome	23 (10.55%)
Pseudoexfoliation Syndrome	20 (91.7%)
Traumatic zonulysis	37 (17.0%)

sitting with lens extraction) or secondary (staged procedure) with almost equal frequencies (n=106, 51%, n=101, 49%).

Comprising the highest number of lenses implanted, retropupillary fixation iris claw intraocular lens was used in 93 eyes (44.9%), followed by transscleral-sutured intraocular lens in 64 eyes (30.9%), and anterior chamber intraocular lens in 48 eyes (23.2%). One patient had iris-sutured intraocular lens. In this study, the trends of intraocular lens preferences by the surgeons were determined. Figure 1 depicted an increasing preference towards use of iris claw intraocular lenses from 2015 to 2019 in the institution. The opposite was true for anterior chamber intraocular lenses, as there was a declining number starting 2016. Figure 2 showed that there is a preference towards anterior chamber IOLs in ECCEs, iris claw IOLs in phacoemulsifications, and transscleral IOLs in intracapsular lens extractions.

Excluding eyes with pathologies, the visual acuities, as denoted in logarithm of the minimal angle of resolution (logMAR), improved through time (Figure 3). All intraocular lenses used provided better visual acuities compared to the preoperative best corrected visual acuity (BCVA), with the steepest improvement from anterior chamber intraocular lenses, and gradual improvements with retropupillary and transscleral intraocular lenses.

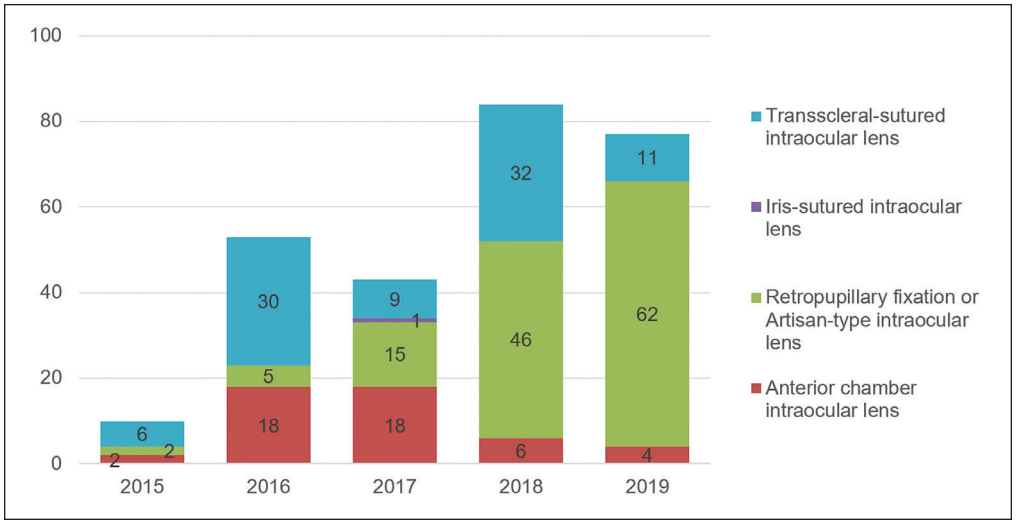

Figure 1. Trends of intraocular lenses used per year. This figure summarizes an increasing preference towards using retropupillary fixation iris claws from 2015 to 2019, whereas an opposite decreasing trend was seen with anterior chamber intraocular lenses.

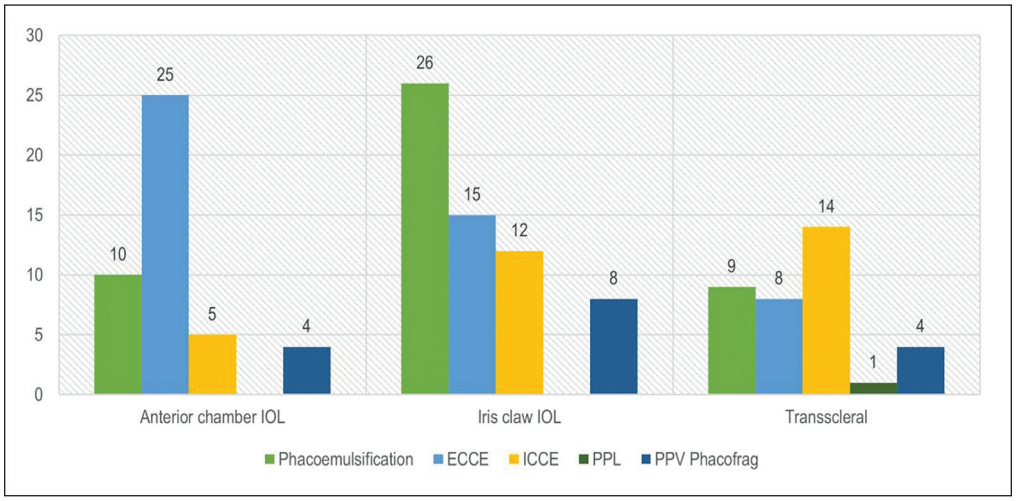

Figure 2. Type of intraocular lenses used per procedure. A preference to a certain type of intraocular lens was evident with respect to the performed surgery.

Legend: ECCE – extracapsular cataract extraction, PPV – pars plana vitrectomy, PPL – pars plana lensectomy, ICCE – intracapsular cataract extraction.

Comparing the preoperative from postoperative outcomes, there was a significant visual acuity improvement across all IOL types at different periods of follow up: day 30, day 90 and day 180 (Table 3). Across different follow up periods, the trend of visual acuity for eyes with anterior chamber intraocular lenses and retropupillary fixation iris claw lenses were generally significantly higher than transsclerally-sutured intraocular lenses (p-value = 0.0024). Follow up periods in the study differed across different groups. Retropupillary iris claws and anterior chamber IOLs showed shorter follow up periods compared to TSS IOL group.

Table 4 showed that regardless of IOL type, the most frequently encountered postoperative complication was a high intraocular pressure rise, with 47 eyes (32%). For this study,

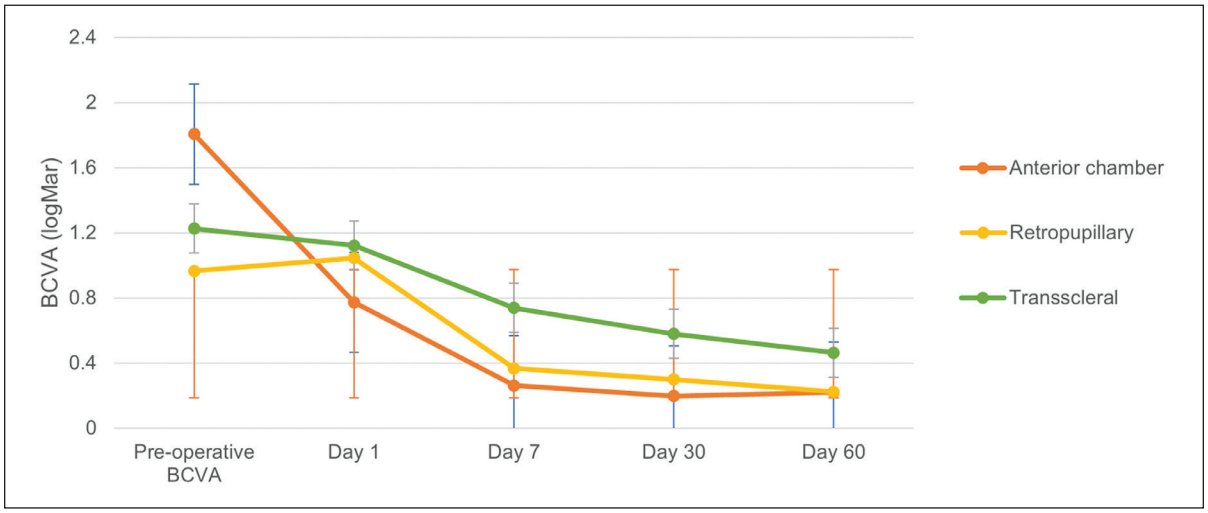

Figure 3. Best correction visual acuity preoperatively and postoperatively. A comparison among the different IOLs show the outcomes in terms of visual acuity.

Table 3. Best Corrected Visual Acuity (BCVA) at Preoperative and Postoperative Day 1, Day 30, Day 90, and Day 180 per intraocular lens

	Anterior chamber intraocular lens (n = 27)	Retropupillary fixation iris claw intraocular lens (n = 62)	Transsclerally-sutured intraocular lens (n = 34)	p-value[a]	p-value[b]
Preoperative	1.81 ± 1.141	0.97 ± 0.926	1.23 ± 1.071		
Day 1	0.77 ± 0.909	1.05 ± 0.976	1.12 ± 0.75	0.3216	0.0835
Day 30 *(1 month)*	0.26 ± 0.274	0.37 ± 0.416	0.74 ± 0.697	0.0003	<0.001
Day 90 *(3 months)*	0.2 ± 0.181	0.3 ± 0.452	0.58 ± 0.573	0.0025	<0.001
Day 180 *(6 months)*	0.22 ± 0.233	0.22 ± 0.308	0.46 ± 0.527	0.0303	<0.001
Mean follow-up period *(months)*	6 ± 0.32	7 ± 0.714	15 ± 0.445		

[a] Comparison across IOL types, [b] Comparison of postoperative day vs preoperative

Table 4. Postoperative Complications across Different Intraocular Lenses used in Aphakia

Complications	Anterior chamber intraocular lens	Retropupillary fixation iris claw intraocular lens	Transscleral-sutured intraocular lens
High IOP rise	7 (23.3%)	21 (30%)	19 (45.2%)
Corneal edema	7 (23.3%)	19 (27.1%)	6 (14.3%)
Transient (<2 weeks)	6	15	5
Persistent (≥2 weeks)	1	4	1
Pigment dispersion	3 (10%)	1 (1.4%)	
Corneal decompensation	1 (3.3%)		1 (2.4%)
IOL dislocation		3 (6.5%)	
Total	18 (20.45%)	44 (50%)	26 (29.54%)

**IOL – intraocular lens, IOP – intraocular pressure*

Table 5. Intraoperative Surgical Duration of Secondary Intraocular Lens Implantation

Surgical Duration	Mean Duration (minutes)	p-value[a]	p-value[b]
Anterior chamber intraocular lens	46 ± 0.112	0.1035	0.0972
Retropupillary fixation iris claw intraocular lens	37 ± 0.445	0.0835	0.0944
Transscleral-sutured intraocular lens	112 ± 0.445	0.0773	0.0571

[a] Comparison across IOL types
[b] Comparison with presence of postoperative complications

a high IOP rise was set to more than or equal to 25 mmHg. From these 47 eyes, 10 eyes progressed to glaucoma. Mean intraocular pressure was 25 mmHg. For eyes with anterior chamber intraocular lens, seven eyes (23%) experienced corneal edema, three eyes (10%) experienced pigment dispersion and one had corneal decompensation occurring after six months. Corneal edema, in this setting, was set as either transient, occurring less than two weeks, and persistent if more than or equal to two weeks. Shown in the table are the frequencies of occurrences of corneal edema across the different IOL types. Among eyes implanted with retropupillary fixation iris claw intraocular lens and transscleral-sutured intraocular lens, a high IOP rise together with corneal edema comprised the highest number of postoperative complications.

Prolonged time in the surgical field was evaluated. Table 5 showed that the shortest duration for IOL implantation was retropupillary iris claw group, followed by anterior chamber IOL group, with the longest duration from TSS IOLs. A comparison of the duration with postoperative complications showed no significant correlations ($p \geq 0.0571$).

DISCUSSION

Various techniques of addressing the clinical dilemma of placing an intraocular lens in the absence of capsular support are well-studied across the globe.[1-6] However, through time, different trends and preferences of surgeons shifted in placing an intraocular lens in these aphakic cases were observed. In the absence of other ocular pathologies, visual prognosis was generally excellent,[1-6] and complications were manageable and preventable. Most studies generally noted similar postoperative complications present: high IOP rise, corneal edema, pigment dispersion, and rarely, IOL dislocation.

In the Philippines, aphakic correction also relies on the available intraocular lenses that are regulated by the government. Commonly available local intraocular lenses were anterior chamber intraocular lenses, iris claw (either anterior or retropupillary) lenses, and transscleral compatible lenses. Through time, because of its convenience and relatively easier implantation, iris claw retropupillary lenses gradually changed the trends of aphakic correction. Locally, a study done by Villanueva et al. from 2010 to 2015 showed more preference towards use of anterior chamber intraocular lenses.[7] The most common type of IOL used were the anterior chamber IOL (n=50, 45.45%) and transscleral-sutured IOL (n=42, 38.18%). However, this was the time that only anterior chamber IOLs and transscleral IOLs were commercially available. Our study showed that in more recent years, a shift towards implantation of iris claw intraocular lenses was seen. It was also evident that from 2010, glued, sutured, and transscleral intraocular lenses were preferred, but comparing this with 2015, almost all surgeries used anterior chamber intraocular lenses and iris claw IOLs. The reason for the change of preference was that iris claw intraocular lenses provided the surgeons with the most convenient approach, fastest surgical time (Table 5), relatively smaller incisions compared to anterior chamber IOLs resulting to better refractive results, and placement of the IOL near the sulcus and bag approximated an almost similar refractive result with that of in-the-bag placement and availability. Longer OR duration and highly specialized skills involved in glued or sutured transscleral IOLs equated to more risks of complications for beginning surgeons.

Visual acuity-wise, we saw a significantly improved vision in all eyes across different intraocular lenses. This was a common observation seen across several studies. A study done by Huang et al. in 2011[8] on outcomes of cataract surgery in Guangzhou, China showed that visual outcomes were noted to significantly improve by at least 6/18, or 20/63. Results revealed favorable visual outcomes with almost 50 percent of the population underwent phacoemulsification surgery, and the rest was shared by extracapsular and intracapsular methods of cataract extraction. Another study by Mohammadi in 2015[9] in Iran revealed almost 90 percent of the eyes from the population study who underwent phacoemulsification with intraocular lens implantation and had favorable visual outcome results of BSCVA of ≥ 20/25 in 50% out of 405 eyes. In our study, a significant difference in the visual outcomes was seen comparing the three IOLs across different follow up time points: 1 month ($p = 0.0003$), 3 months ($p = 0.0025$), and 6 months ($p = 0.0303$). Comparing the three groups, transscleral-sutured IOL group had inferior visual outcomes. The reason could be attributed to the more complicated cases (e.g., post-intracapsular extraction patients, longer duration surgery, more ocular structures manipulated such as the sclera) handled for those implanted with TSS IOLs. A shorter follow up duration was seen among iris claws and anterior chamber IOLs groups because of relatively shorter time to achieve a good visual outcome (Figure 3), compared to TSS IOLs where a longer follow up duration is required, and oftentimes warrants frequent monitoring for possible late-onset complications (Table 5).

Complications varied across studies.[8-12] Our study was comparable to other studies where increased IOP (n=47, 53.41%) and corneal edema (n=32, 36.36%) had the highest numbers. Generally, the highest number of posteroperative complications were seen in retropupillary iris claw-implanted eyes (n=44, 50%). This could be attributable to the learning

curve of this newly introduced intraocular lens to the institution. Mohamaddi et al.[9] in 2015 reported that the leading contributory reasons for unfavorable outcome, in descending order were maculopathy, corneal opacity, and degenerative myopia. Olawoye et al.[13] in 2011 performed an observational descriptive, longitudinal study showing that the most common complication reported was increase in intraocular pressure leading to glaucoma. A study done by Vounotrypidis in 2018[14] reported complications were IOL dislocation (75%), followed by IOL opacifications (6%). Villanueva et al.[7] reported corneal edema and increased intraocular pressure were the most common postoperative complication in all types of intraocular lens implantation. This study also looked into the correlation of prolonged surgery time with postoperative complications. Considering the high numbers of postoperative IOP rise and corneal edema seen, there was no significant correlation.

CONCLUSION

There was a notable preference towards iris claw retropupillary lenses through time. Iris claw lenses showed the shortest operative time. All intraocular lenses used in aphakia showed comparably good postoperative visual acuities, except for the superior visual acuity trend seen among retropupillary iris claw and anterior chamber IOL groups. Complications included elevated intraocular pressures, corneal edema, and pigment dispersion. Knowledge on the outcomes maximizes the chances of optimal surgical and visual outcomes.

Statement of Authorship

ABTJ contributed in the conceptualization of work, acquisition of data, drafting, and manuscript writing. NSC contributed in the drafting and revising, manuscript writing and final approval of the version to be published.

Author Disclosure

Both authors declared no conflict of interest.

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