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Journal
Journal of Cataract and Refractive Surgery, 44(9)

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Publication Date
2018-09-01

DOI
10.1016/j.jcrs.2018.06.022

Peer reviewed

Published in final edited form as:
J Cataract Refract Surg. 2018 September ; 44(9): 1109–1115. doi:10.1016/j.jcrs.2018.06.022.

Complication rates of resident-performed cataract surgery: Impact of early introduction of cataract surgery training

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Abstract

Purpose: To determine the effect of the early introduction of cataract surgery training on the complication rates of residentperformed cataract surgery.

Setting: University of California San Diego, San Diego, California, USA.

Design: Retrospective case series.

Methods: Two classes of ophthalmology residents were examined, one class with a late introduction of cataract surgery and one with an early introduction of cataract surgery. All cataract cases in which residents acted as primary surgeon were included. Patient charts were reviewed to collect data on patient characteristics, surgical details, and intraoperative and postoperative complications.

Results: The late-introduction cohort comprised 3 residents who performed 540 cataract cases, all during their final year of residency. The early-introduction cohort comprised 4 residents who performed 780 cataract cases beginning in the first year of residency. The late-introduction cohort had higher rates of major intraoperative complications than the early-introduction cohort (8.5%

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Presented at the annual meeting of the Association of University Professors of Ophthalmology, San Diego, California, USA, January 2017.

Supplemental material available at www.jcrsjournal.org.

OTHER CITED MATERIAL

versus 3.1%) and of anterior vitrectomy (7.6% versus 2.1%) (both $P < .001$). Examination of the anterior vitrectomy rate as a function of experience showed the early-introduction cohort had a stable anterior vitrectomy rate of 1% to 2% throughout training, while the late-introduction cohort had a peak anterior vitrectomy rate of 12% at approximately case 20. Multivariable regression analysis showed the early-introduction cohort was independently associated with a lower rate of anterior vitrectomy (hazard ratio, 0.49; 95% confidence interval, 0.36–0.66) after adjusting for differences in patient characteristics and surgical complexity.

Conclusions: Early introduction of cataract surgery training significantly decreased the rate of major intraoperative complications, specifically anterior vitrectomy, in resident-performed cataract surgeries.

In 2010, the National Eye Institute estimated that 24.4 million people in the United States were affected by cataract, and this number is expected to double to approximately 50 million U.S. residents by the year 2050.[A] Given the growing incidence of cataract, cataract surgery training is becoming an increasingly important component of ophthalmology residency. This is reflected by the 2007 changes implemented by the Accreditation Council for Graduate Medical Education (ACGME), in which the minimum requirement for cataract surgery cases nearly doubled (from 45 to 86).[B] The ACGME and the American Board of Ophthalmology have also recently changed residency assessments from an experience-based system to a competency-based system.[1] New generations of ophthalmology residents must not only meet the required minimum procedures but must also show competency in their surgical skills.

With these changes, many residency programs are looking for ways to improve their surgical training. In addition to changing their surgical curriculum and introducing new teaching tools, residency programs are introducing cataract surgery earlier in training.[2–4] Traditionally, residents spent their first year observing surgery and their second year assisting surgery before assuming the role of primary surgeon in their final year. However, Woodfield et al.[5] found that second-year residents achieved complication rates comparable to those of third-year residents and went on to suggest that even first-year residents can safely learn phacoemulsification. Findings in other studies[6–8] also suggest that complication rates are more dependent on the number of operations performed than on the year of training. A recent publication[2] reported that today more than 90% of programs are introducing cataract surgery in the second year and up to 33% of programs introduce cataract surgery in the first year. This is a significant increase from a 2013 study[9] reporting that only 79% and 18% of programs introduced cataract surgery in the second year and first year, respectively.

In 2011, the University of California San Diego (UC San Diego) Ophthalmology Residency Program began to introduce first-year ophthalmology residents to the role of primary surgeon in carefully selected cataract cases. Certain faculty at the university believed that

A. National Eye Institute. Cataracts, 2010. Available at: https://www.nei.nih.gov/eyedata/cataract. Accessed June 15, 2018

B. Accreditation Council for Graduate Medical Education. Required Minimum Number of Procedures for Graduating Residents in Ophthalmology, 2013. Available at: http://www.acgme.org/Portals/0/PFAssets/ProgramResources/240_Oph_Minimum_Numbers.pdf?verZ2015-11-06-120652-043. Accessed June 15, 2018 first-year residents could safely perform cataract surgery and argued that early introduction of cataract surgery training would decrease the phacoemulsification learning curve, resulting in improved surgical proficiency and decreased complications. This study evaluated the impact of early introduction of cataract surgery training on the complication rates of residentperformed cataract surgery.

MATERIALS AND METHODS

This retrospective cohort study was designed to identify the incidence of complications in resident-performed cataract surgeries and to evaluate the effect of early introduction of cataract surgery training, specifically focusing on the rate of anterior vitrectomy. Institutional review board approval was obtained from UC San Diego and the San Diego Veterans Affairs Health System. All procedures and data collection were performed in a manner compliant with the U.S. Health Insurance Portability and Accountability Act of 1996 and in accordance with the tenets of the Declaration of Helsinki.

Cohort and Case Selection

University of California San Diego began implementing early introduction of cataract surgery in 2011. This study examined the 2 classes closest to this change, without overlapping the change; therefore, the class of 2010 and the class of 2015 were selected to represent the late introduction and early introduction of cataract surgery training, respectively. For each class, all cataract surgery cases for which the resident acted as the primary surgeon were reviewed, including cases in which patients had an additional minor procedure, such as limbal relaxing incisions or an intravitreal injection. Combined cases with more extensive procedures, such as trabeculectomy or retinal detachment (RD) repair, were excluded. Cases were identified through the surgical schedule logs from the San Diego Veterans Affairs Hospital, Hillcrest Medical Center, and Shiley Eye Institute in conjunction with UC San Diego Ophthalmology Residency Program records.

Cataract Surgery Curriculum and Changes

The class of 2010 (late-introduction cohort) began to perform cataract surgery as primary surgeon in the final year of residency. They were trained using a step-by-step method, learning specific steps of cataract surgery during their first 2 years. In contrast, the class of 2015 (early-introduction cohort) was trained using a 1-step method, performing approximately 10 complete cataract cases per year in their first 2 years. There were no other changes to the surgical curriculum, including lectures and wet labs, over the study period. However, a residency position was added to the program in 2012. All residents trained on Alcon Infiniti phaco machines and followed a similar surgical plan as follows: temporal clear corneal incisions, with 80% to 90% of cases using divide-andconquer and the introduction of chop toward the end of training. In first-year and second-year cases in the early-introduction cohort, a smaller 2.40 mm corneal incision was used, while both cohorts used a 2.75 mm corneal incision in third-year cases. Both cohorts trained under the same faculty. However, all firstyear cases were supervised by the same attending physician (C.W.H.), who did not supervise cases in the late-introduction cohort. The late-introduction cohort still had extensive exposure to this attending physician in their first-year and second-year rotations.

Data Collection

For each case, the preoperative, operative, and postoperative notes were thoroughly reviewed. Data were collected on patient demographics, patient characteristics, surgical details, intraoperative complications, and postoperative complications. Important patient characteristics included cataract classification and severity, significant ocular history, previous ocular surgeries, a history of benign prostatic hyperplasia medications, floppy iris, small pupil, and zonular fiber pathology. Cases were classified as having complex surgical techniques if trypan blue, iris hooks, a Malyugin ring, or capsular tension rings were used or if synechialysis was required. Intraoperative complications included anterior capsule tear, posterior capsule tear, anterior vitrectomy, conversion to extracapsular cataract extraction, dropped nucleus fragment, and pars plana vitrectomy. Postoperative complications included macular edema, retained cortical material, epithelial defect, malpositioned intraocular lens (IOL), wound leak, anterior uveitis, endophthalmitis, vitreous hemorrhage, RD, and return to the operating room.

Patient Risk Stratification

To evaluate differences in the complexity of caseloads between the 2 cohorts, patients were stratified into 4 risk groups using a modified version of the risk stratification system developed by Muhtaseb et al.,[10] which has been validated by other groups.[11,12] The scoring system in this study differed slightly from the published version. It did not include points for a shallow anterior chamber or for posterior capsule plaque because of the lack of data on these variables, corneal scar was expanded to include other corneal pathology, and phacodonesis was expanded to include a history of trauma and zonular fiber laxity (Figure 1). Patients were categorized into the following risk groups based on their risk score: no added risk (0 points), low risk (1 to 2 points), medium risk (3 to 5 points), and high risk (>5 points).

Statistical Analysis

The Welch 2-sample t test and Pearson chi-square test with Yates' continuity correction were used to compare patient characteristics and complication rates between the 2 cohorts. A P value of 0.05 or less was considered to represent a statistically significant difference. Binomial generalized mixed-effects modeling was also performed to compare complication rates and other variables between cohorts using a probit link function with surgeon included as a random effect to take into account correlations in outcomes for individual surgeons. Variables with borderline association with anterior vitrectomy occurrence ($P < .1$) were then fitted into a multivariable generalized mixed-model analysis to evaluate the difference between the 2 cohorts independent of other risk factors. This model was refined by removing variables until Akaike's information criterion was minimized. Given the sample size of 1320 cases and assuming an average complication rate of 4% based on a literature review, the study was powered to be able to detect differences in complication rates between the 2 cohorts of 2% or greater with over 90% power.

RESULTS

Number of Surgeries and Patient Characteristics

The late-introduction cohort consisted of 3 residents from the class of 2010 who performed a total of 540 cataract cases (mean 180 cases per resident; range 156 to 217 cases), all during their final year of training. The early-introduction cohort consisted of 4 residents from the class of 2015 who performed a total of 780 cataract cases (mean 195 cases per resident; range 167 to 230 cases). The earlyintroduction cohort performed a mean of 9 cases (range 7 to 10 cases) in the first year and 9 cases (range 7 to 11 cases) in the second year, with all residents completing a minimum of 17 cases in the first 2 years. The mean age of the patients was 70.8 years in the late-introduction cohort and 71.2 years in the early-introduction cohort ($P = .444$). Other patient demographics were similar between the 2 cohorts; however, there were significant differences in patient risk stratification and surgical techniques. The early-introduction cohort had more medium and high-risk patients and more cases with complex surgical techniques (Table 1; details in Table S1, available at http://jcrsjournal.org).

Complication Rates

Table 2 shows the intraoperative and postoperative complication rates by cohort. Overall, the 2 cohorts had similar rates of minor intraoperative complications ($P = .152$) and major postoperative complications ($P = .204$). The early-introduction cohort had lower rates of major intraoperative complications ($P < .001$) and minor postoperative complications ($P = .007$) (Figure S1, available at http://jcrsjournal.org).

The early-introduction cohort also had a significantly lower rate of anterior vitrectomy than the lateintroduction cohort ($P < .001$). When the anterior vitrectomy rate was evaluated as a function of experience, residents in the early-introduction cohort maintained a low anterior vitrectomy rate throughout residency (Figure 2), with an anterior vitrectomy rate of 1.0% (n = 2) and 2.0% (n = 4) over the first 50 surgeries and last 50 surgeries, respectively. The anterior vitrectomy rate in the lateintroduction cohort decreased from 11.3% (n = 17) over the first 50 cases to 6.0% (n = 9) over the last 50 cases (Figure 2, B). The overall anterior vitrectomy rates of individual residents in the late-introduction cohort were 10.9% (n = 17), 7.2% (n = 12), and 5.5% (n = 12), while residents in the early-introduction cohort had overall anterior vitrectomy rates of 2.7% (n = 5), 2.4% (n = 4), 2.2% (n = 5), and 1.0% (n = 2) (Figure 2, A). Across cohorts, anterior vitrectomy was significantly associated with the following postoperative complications: RD, return to the operating room, macular edema, retained cortex, malpositioned IOL, and other minor postoperative complications (Table 3).

Multivariable Binomial Mixed-Modeling Analysis

Multivariable binomial mixed-modeling analysis showed that the early-introduction cohort was independently associated with a lower anterior vitrectomy rate (hazard ratio, 0.49; 95% confidence interval, 0.36–0.66) (Table 4). Other factors independently associated with a higher anterior vitrectomy rate were: patient classification as high risk, zonular pathology, presence of severe posterior subcapsular cataract, and severe cortical cataract.

DISCUSSION

As the demand for cataract surgery continues to rise, ophthalmology residency programs are tasked with producing the next generation of skilled cataract surgeons. However, teaching surgery is inherently difficult because novice residents must be allowed to build their skills and confidence in the operating room without compromising patient outcomes. Microsurgery comes with an additional set of challenges. With cataract surgery, residents must learn to manipulate their instruments within the confined space of the anterior chamber, where movements too far anteriorly damage the corneal endothelium and movements too far posteriorly risk the integrity of the posterior capsule. In such a restrictive operating space, there is room for a single surgeon only, requiring the supervising attending physician to be acutely aware of every move the trainee makes and anticipate complications before they occur. As Dreyer and Volpe aptly commented, "[T]eaching residents requires a cast iron stomach, nerves of steel, veins filled with ice water, and an optimistic attitude."[13]

These challenges drive ophthalmology residency programs to continually seek ways to optimize resident education. Current areas of development include better assessment of surgical performance,[3,4] identification of patient risk factors,[10–12,14,15] surgical simulators,[3,16,17] and structured curriculum.[3,18,19] Only a few of these tools have been shown to significantly improve surgical performance. Tsinopoulos et al.[12] found decreased rates of posterior capsule rupture and anterior vitrectomy (from 5.4% to 2.7%) after implementing a patient risk stratification system to more appropriately assign resident cases. The benefit of surgical simulators remains controversial. Studies suggest only a slight decrease in the phacoemulsification learning curve with no significant change in overall complication rates.[3,16,17] On the other hand, structured surgical curriculums that include wet labs and/or surgical simulators have been shown to improve resident surgical performance.[18–21] Notably, Rogers et al.[19] achieved a significant decreased in anterior vitrectomy rates (from 7.17% to 3.77%) after implementing a structured surgical curriculum.

At UC San Diego, we sought to improve our resident education by introducing first-year residents to the role of primary surgeon in cataract surgery. Our results show that first-year residents can take on the role of primary surgeon safely and successfully. Residents in the early-introduction cohort had no cases of anterior vitrectomy in their first year and only a single case of anterior vitrectomy during their second year. The resulting anterior vitrectomy rate of 1.4% over the first 2 years is well below reported anterior vitrectomy rates for resident-performed cataract surgery, which range from 2.3% to 10.6%.[14,15,19,22,23] Furthermore, early introduction of cataract surgery resulted in a significant decrease in the overall anterior vitrectomy rate, from 7.6% to 2.1%. No other major intraoperative complications differed significantly between the 2 cohorts. The earlyintroduction cohort had lower rates of anterior capsule tear (without posterior capsule tear or anterior vitrectomy) and lower rates of posterior capsule tear (without vitreous loss); however, these differences did not reach statistical significance. The reported decrease in postoperative complication rates could be a result of the deceased anterior vitrectomy rate because anterior vitrectomy is known to increase the risk for postoperative complications. We found anterior vitrectomy to be significantly associated with RD, return to the operating room, macular edema, retained cortex, and malpositioned IOL, all of which were decreased in the early-introduction cohort, although only the last 2 showed statistical significance. The only complication that was significantly increased in the early-introduction cohort was postoperative epithelial defect.

We confirmed that the early-introduction cohort was independently associated with a lower anterior vitrectomy rate using multivariable binomial mixed-modeling regression analysis. The early-introduction cohort achieved a lower anterior vitrectomy rate despite having more patients classified as medium or high risk and more cases with complex surgical techniques. We postulate that this is because residents who begin training early have more time to develop surgical confidence, allowing them to take on more difficult cases during the final year of training. Early introduction to cataract surgery not only resulted in lower overall anterior vitrectomy rates but also significantly decreased the phacoemulsification learning curve, as shown by the relatively stable anterior vitrectomy rate of the earlyintroduction cohort. In contrast, the anterior vitrectomy rate in the late-introduction cohort decreased by nearly 50% from the first 50 cases to the last 50 cases. Furthermore, these results were achieved with a relatively small number of early cases, a mean of only 9 cases during each of the first 2 years of training. This is particularly significant because it suggests that early introduction of cataract surgery would also benefit smaller residency programs with more limited surgical numbers.

In considering how such a small number of surgeries early in training can have such a large effect on resident surgical performance, we can turn to the literature on learning and the development of expertise. It is now commonly accepted that experience alone is not sufficient to build expertise, but rather it is the quality of practice that matters.[24] This deliberate practice requires a high level of concentration and is best achieved when training sessions are limited in length and distributed in time.[24,25] Beginning training with a limited number of cases allows residents to focus on a single case at a time, increasing their ability to concentrate during the first cases when the learning curve is the highest. We believe early surgical experience also allows residents to gain more from their time observing and assisting. Although observing attending physician cases is a crucial part of surgical training, experienced surgeons often make challenging steps of the surgery appear simple. Early surgical experience enables residents to more precisely follow the attending surgeon’s movements, essentially allowing them to perform their own more accurate mental rehearsal of the surgery when observing attending cases. This type of mental rehearsal, or imaginary practice, has been shown to greatly enhance the development of expertise.[26] Later in training, as surgical volume increases, residents are able to focus more on the nuances of the procedure and ask more sophisticated questions, allowing them to take full advantage of the expertise of their supervising attending surgeons.

Early introduction of cataract surgery was implemented using a 1-step training method, while the lateintroduction cohort was trained using a step-by-step method. This is a potential confounding factor. Tzamalis et al.[27] found the 1-step method significantly decreased rates of posterior capsule tear and anterior vitrectomy (from 17.3% to 7.25%) compared with the step-by-step method. Schaverien[25] also supports the use of the 1-step method in surgical training, likening step-by-step training to contextual interference, a practice that is useful in learning simple skills but detrimental when learning complex skills that require integrated understanding of the whole task. It is impossible to determine whether our findings are a result of using a 1-step method rather than the result of early introduction of cataract surgery. However, we believe the 1-step method was integral to our implementation of early cataract surgery training because it provided significantly more opportunities for residents to perform complete cataract cases in the first 2 years of training, when their time must be distributed between several subspecialty rotations.

Another important potentially confounding factor was differences in supervising surgeons between the 2 cohorts. The skill and comfort level of the supervising attending surgeon has been shown to significantly affect complications rates,[28] and in our study all of the first-year cases in the early-introduction cohort were supervised by the same attending, who did not supervise any cases in the late-introduction cohort. However, residents in the late-introduction cohort still had significant exposure to cataract surgery training with this attending surgeon during the first 2 years of residency. Following the step-by-step training method, these residents observed, assisted, or completed specific steps of cataract cases under the guidance of this attending surgeon, but did not perform complete cases that would have been included in this study. Furthermore, during the third year the bulk of the cases from both classes were supervised by the same small set of attending surgeons and all teaching attending surgeons had a similar level of experience, including the attending surgeon who supervised the first-year cases.

Other limitations of this study stem from its retrospective nature and relatively small sample. Our results are unlikely to be the effect of a single outlying resident because all 3 residents in the late-introduction cohort had higher anterior vitrectomy rates than residents in the early-introduction cohort (range 5.5% to 10.9% versus 1.0% to 2.7%). However, we cannot rule out a cohort effect, and future studies including additional resident classes will help confirm our findings. Despite these limitations, our data clearly show that under careful supervision and with carefully selected cases, first-year residents are able to complete cataract surgery cases with a low complication rate. Furthermore, our data strongly suggest that early introduction of cataract surgery has the potential to lower the phacoemulsification learning curve and reduce complication rates of residentperformed surgeries.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Supported in part by the National Institutes of Health (NIH) (grant TL1TR001443), Bethesda, Maryland, USA, through the University of California San Diego Clinical and Translational Research Institute. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

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WHAT WAS KNOWN

- Several studies have shown that second-year ophthalmology residents can perform cataract surgery with complication rates comparable to those of third-year residents.

WHAT THIS PAPER ADDS

- First-year ophthalmology residents can safely and successfully perform cataract surgery in appropriately selected cases.
- Early introduction of cataract surgery training decreased the phacoemulsification learning curve and resulted in a lower rate of anterior vitrectomy in resident-performed cataract surgery.

Risk Point Assignment

1 point each

- Previous vitrectomy
- Corneal pathology*
- Small pupil and/or floppy iris
- Age >88 years
- High ametropia†
- Posterior polar pataract
- Other significant ocular history‡

3 points each

- Dense, white, or brunescent cataract
- Pseudoexfoliation
- Phacodonesis, zonular instability, or history of trauma

*Included corneal scar, corneal dystrophies, and keratoconus

†Considered to be >6.0 diopters of myopia or hyperopia, or axial length >26.0 mm or <21.0 mm

‡Included narrow angle, anisocoria, posterior synechiae, and pigment dispersion syndrome

Figure 1.

Scoring system for patient risk stratification.

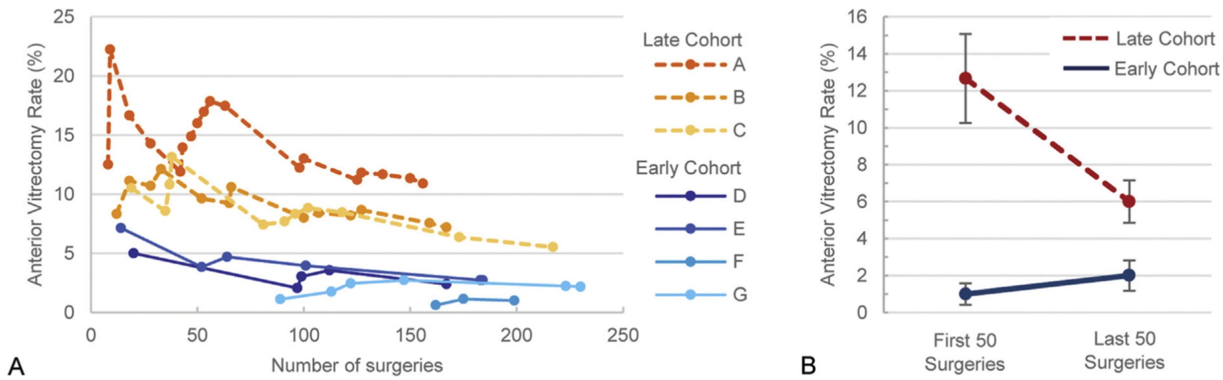

Figure 2.

Anterior vitrectomy rate over time. A: Anterior vitrectomy rate for each resident as a function of the number of surgeries performed; datapoints generated for each incidence of anterior vitrectomy. B: Change in average anterior vitrectomy rate between the first 50 cases and the last 50 cases by cohort. Bars represent standard error.

Table 1.

Patient demographics, risk stratification, and surgical techniques by cohort.

Variable	Number (%)		*P* Value
	Late Introduction (n = 540)	Early Introduction (n = 780)	
Male sex	520 (96.3)	728 (93.3)	.027 *
Ethnicity			.112
White	425 (78.7)	573 (73.5)	
Black	36 (6.7)	67 (8.6)	
Asian	24 (4.4)	51 (6.5)	
Native Hawaiian/Pacific Islander	11 (2.0)	15 (1.9)	
American Indian	11 (2.0)	9 (1.2)	
Other/unknown	33 (6.1)	65 (8.3)	
Right eye	278 (51.4)	372 (47.7)	.194
Patient risk group			<.001 *
No added risk	303 (56.1)	350 (44.9)	
Low risk	109 (20.2)	140 (17.9)	
Medium risk	121 (22.4)	272 (34.9)	
High risk	7 (1.3)	18 (2.3)	
Complex surgical techniques	117 (21.7)	246 (31.5)	<.001 *

* Statistically significant (P < .05)

Table 2.

Intraoperative and postoperative complication rates by cohort.

Complication	Number (%)		*P* Value
	Late Introduction (n = 540)	Early Introduction (n = 780)	
Major intraoperative	46 (8.5)	24 (3.1)	<.001[‡]
Anterior vitrectomy	41 (7.6)	16 (2.1)	
Due to posterior capsule tear	35 (6.5)	15 (1.9)	
Due to zonular dehiscence	6 (1.1)	1 (0.1)	
Conversion to ECCE	2 (0.4)	0 (0.0)	
Dropped nucleus	3 (0.6)	5 (0.6)	
Pars plana vitrectomy	0 (0.0)	3 (0.4)	
Minor intraoperative	18 (3.3)	15 (1.9)	.152
Anterior capsule tear[*]	10 (1.9)	7 (0.9)	
Posterior capsule tear[†]	8 (1.5)	8 (1.0)	
Major postoperative	18 (3.3)	16 (2.1)	.204
Endophthalmitis	1 (0.2)	1 (0.1)	
Vitreous hemorrhage	1 (0.2)	2 (0.3)	
Retinal detachment	2 (0.4)	0 (0.0)	
Return to OR	11 (2.0)	13 (1.7)	
Other	3 (0.6)	0 (0.0)	
Minor postoperative	104 (19.3)	106 (13.6)	.007[‡]
Macular edema	15 (2.8)	14 (1.8)	
Retained cortex	29 (5.4)	15 (1.9)	
Epithelial defect	5 (0.9)	25 (3.2)	
IOL malpositioning	15 (2.8)	3 (0.4)	
Anterior uveitis	6 (1.1)	17 (2.2)	
Wound leak	2 (0.4)	10 (1.3)	
Other	32 (5.9)	22 (2.8)	

ECCE = extracapsular cataract extraction;

IOL = Intraocular lens;

OR = operating room

[*]Anterior capsule tear without posterior capsule tear or vitreous loss

[†]Posterior capsule tear without vitreous loss

[‡]Statistically significant ($P < .05$)

Table 3.

Postoperative complications associated with anterior vitrectomy.

Complication	Number (%) No AV (n = 1263)	AV (n=57)	*P* Value
Major postoperative			
Endophthalmitis	2 (0.2)	0 (0.0)	.150
Vitreous hemorrhage	3 (0.2)	0 (0.0)	.292
Retinal detachment	0 (0.0)	2 (3.5)	<.001 *
Return to OR	9 (0.7)	15 (26.3)	<.001 *
Other	3 (0.2)	0 (0.0)	.292
Minor postoperative			
Macular edema	23 (1.8)	6 (10.5)	<.001 *
Retained cortex	30 (2.4)	14 (24.6)	<.001 *
Epithelial defect	26 (2.1)	4 (7.0)	.045
IOL malpositioning	10 (0.8)	8 (14.0)	<.001 *
Anterior uveitis	22 (1.7)	1 (1.8)	.610
Wound leak	12 (1.0)	0 (0.0)	.980
Other	37 (2.9)	17 (29.8)	<.001 *

AV = anterior vitrectomy; IOL = Intraocular lens; OR = operating room

*Statistically significant (P < .05)

Table 4.

Multivariable binomial mixed-modeling regression analysis.

Variable	**Hazard Ratio**	**95% CI**	***P* Value**
Ethnicity (white)	0.84	0.62, 1.13	.246
Right eye	0.78	0.60, 1.02	.065
Patient risk group			
No risk vs low risk	1.09	0.74, 1.61	.661
No risk vs medium risk	1.12	0.79, 1.58	.539
No risk vs high risk	2.48	1.18, 5.20	.016[†]
Complex surgical techniques	1.20	0.88, 1.64	.255
Cataract classification			
Cortical			
Mild-moderate	0.97	0.70, 1.34	.840
Severe	1.53	1.01, 2.33	.045[†]
PSC			
Mild-moderate	1.30	0.93, 1.83	.125
Severe	1.65	1.20, 2.47	.016[†]
Severe[*]	0.89	0.59, 1.35	.588
Zonular fiber pathology	2.02	1.21, 3.37	.008[†]
Floppy iris	1.46	0.91, 2.36	.121
Early introduction	0.49	0.36, 0.66	<.001[†]

CI = confidence interval;

PSC = posterior subcapsular cataract

[*]Of any classification

[†]Statistically significant (P !.05)