Visual Outcomes and Intraoperative Complication Rates of Phacoemulsification Cataract Surgery by Third Year Ophthalmology Residents in the UP-Philippine General Hospital

Richard C. Kho and Maria Angelica DF. Villano

Department of Ophthalmology and Visual Sciences, Sentro Oftalmologico Jose Rizal, Philippine General Hospital, University of the Philippines Manila

ABSTRACT

Background. Phacoemulsification is the most important cataract surgical procedure performed by ophthalmology residents. There is an increasing and consistent trend in international studies on decreased complication rates and more efficient surgical techniques with more surgeries performed. The data collected from this study can be used to quantitatively assess the cataract surgery training of Ophthalmology residents in the country and can help to improve the quality of cataract surgeries taught and performed in the training programs.

Objectives. To analyze outcomes of phacoemulsification cataract surgeries and to determine the intraoperative complication rates of third-year residents of the University of the Philippines - Philippine General Hospital (UP-PGH).

Methods. Retrospective chart review of phacoemulsification cases done by eight third-year ophthalmology residents at the UP-PGH from January 1 to December 31, 2017. Outcomes measured included postoperative best corrected visual acuity (BCVA), intraoperative complications (posterior capsular rent and vitreous loss), and adjusted phacoemulsification times (total phacoemulsification time multiplied by phacoemulsification power used).

Results. Four hundred ninety-two (492) cases were analyzed. Postoperative mean BCVA was 20/25. There were no significant differences in visual acuity outcomes over the course of training. Intraoperative complications occurred in 33 cases, with fewer cases with posterior capsule rent and vitreous loss later in training after the first 50 cases. There was a downward trend of adjusted phacoemulsification time throughout training, with a significant difference between the first 50 and 100 cases.

Conclusion. Good visual outcomes are achievable throughout the resident's phacoemulsification learning curve. Surgical competency in phacoemulsification, as measured by complication rates and phacoemulsification efficiency, still improves significantly with an increasing number of cases and experience beyond the first 100 cases.

Key Words: phacoemulsification, outcomes, complications, residents, Philippines

INTRODUCTION

The University of the Philippines - Philippine General Hospital (UP-PGH) is the premier tertiary hospital with the largest ophthalmology residency program in the Philippines. One of the most common surgeries performed by ophthalmologists is cataract surgery. Phacoemulsification is the technique of choice for cataract surgery in the Philippines and other countries. Phacoemulsification is one of the most important surgical procedures learned and performed by ophthalmology residents. The number of phacoemulsification surgery done by a resident widely varies

Corresponding author: Richard C. Kho, MD
Department of Ophthalmology and Visual Sciences
Sentro Oftalmologico Jose Rizal
Philippine General Hospital
University of the Philippines Manila
Taft Avenue, Manila 1000, Philippines
Email: rich_kho@yahoo.com

from 50 to 300 cases,[1] and complication rates range from 1.8 to as much as 10.2%.[2-15] There has been a consistent trend in various researches that supports decreased complications and more efficient surgical techniques with more surgeries performed.[3-4]

The past few decades have seen large advancements in phacoemulsification surgery techniques and technology, but several complications still put the patients' vision at a compromise. Posterior capsule rent and subsequent vitreous loss are the most common complications that affect final visual acuity, and the incidence is understandably higher during residency training.[5] It has been said that acceptable incidence should be under 3%.[6]

Ophthalmology residents in the UP-PGH learn phacoemulsification during their third year of training. Residents average about 100 to 160 phacoemulsification surgeries completed during the residency training program. This is the first study in the Philippines to document and assess the outcomes of phacoemulsification performed by residents. The data collected can be used to assess the training program of the Department of Ophthalmology and Visual Sciences of UP-PGH. It can help to improve the quality of cataract surgery in the residency training program.

MATERIALS AND METHODS

Study Design

This is a retrospective cross-sectional study conducted at the Sentro Oftalmologico Jose Rizal at the University of the Philippines - Philippine General Hospital (UP-PGH). All phacoemulsification surgeries performed by third-year ophthalmology residents of UP-PGH from January to December 2017 were collected and analyzed while incomplete surgical data and cases with ocular comorbidities that may affect final best corrected visual acuity (any type of advanced glaucoma, neuro-ophthalmologic disease, anterior segment disease other than cataract, uveitis, and macular and retinal disease) were not included in the data collection and analysis.

Methods

Preoperative, intraoperative and postoperative data were collected. Pre-operative data included the age and sex of the patient, eye laterality, uncorrected and best corrected visual acuity, grade of cataract using the LOCS classification system, concomitant eye disease (eg. pseudoexfoliation, glaucoma, retinal pathology), concomitant systemic disease (eg. diabetes mellitus) and use of alpha-blockers for benign prostatic hypertrophy.

Intraoperative data included cumulative dissipated energy (CDE), surgical time, anterior and posterior capsular rent and vitreous loss.

Post-operative data included uncorrected and best corrected visual acuity and refraction at 1-month postoperative period.

Study Outcomes

Primary Outcomes

Best corrected visual acuity and intraoperative complication rates (posterior capsular rent and vitreous loss) of phacoemulsification cataract surgery performed by the residents were obtained.

Secondary Outcomes

Preoperative data were correlated with the incidence of intraoperative complications in phacoemulsification surgery performed by the residents.

Statistical Considerations

All data were tabulated and summary statistics calculated using simple cross-tabulations. Fisher exact test and chi-square test were used to evaluate complication rate according to preoperative risk. The complication rate was computed per 100 surgeries. The level of significance was set at 0.05.

RESULTS

A total of 863 cases were identified; of these, 492 (57%) were included in the final analysis. 371 cases (43%) were excluded, including 330 (88.9%) because of insufficient data and 41 (11.1%) because of ocular comorbidities limiting the final BCVA. Most of the excluded cases had preoperative retinal abnormalities (Table 1). Mean (SD) patient age at the time of surgery was 60 years (range, 4 - 86 years); 231 cases (47%) were male and 261 cases (53%) were female. Mean preoperative BCVA was 20/250 (logMar 1.1) (range, hand movement with good light projection to 20/25), and mean (SD) MRSE was +0.6 diopters (D) (range, -6.75 to +2.75 D).

There was an even case distribution among residents with regard to patient age, sex, and operative eye. Eight residents performed phacoemulsification during the study period under the guidance of 16 attending surgeons (mean [SD] number of cases, 108; range, 88 to 130).

Table 1. Cases Excluded from the Final Analysis

Exclusion Criteria	No (%) (n=371)
Insufficient data	330 (88.9)
Ocular co-morbidities	41 (11.1)
Advanced glaucoma	10 (2.7)
Retinal complications	29 (7.3)
Age-related macular degeneration	1 (0.3)
Diabetic complications	20 (5.4)
Epiretinal membrane	1 (0.3)
Macular hole	1 (0.3)
Macular thinning	4 (0.9)
Retinal detachment	1 (0.3)
Retinitis pigmentosa	2 (0.6)
Vaso-occlusive disease	1 (0.3)

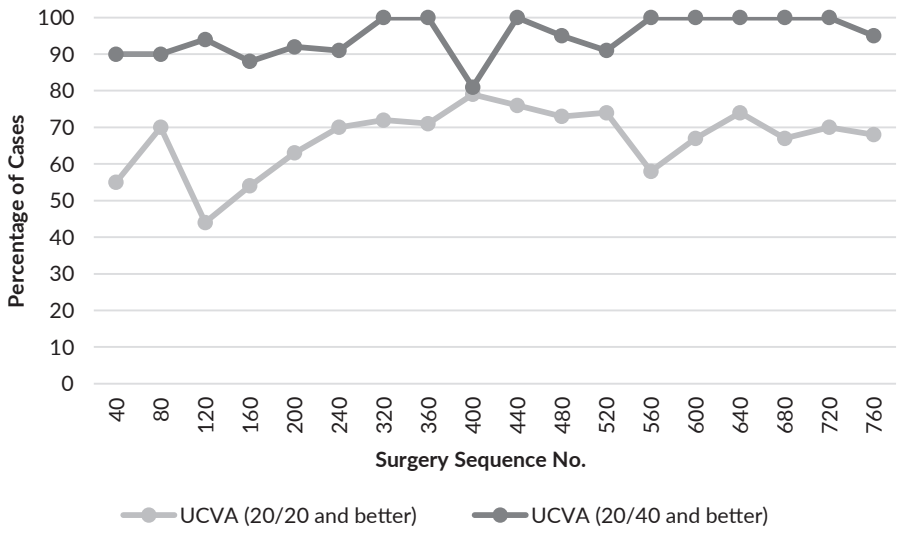

Figure 1. Uncorrected visual acuity outcomes stratified by surgical case number.

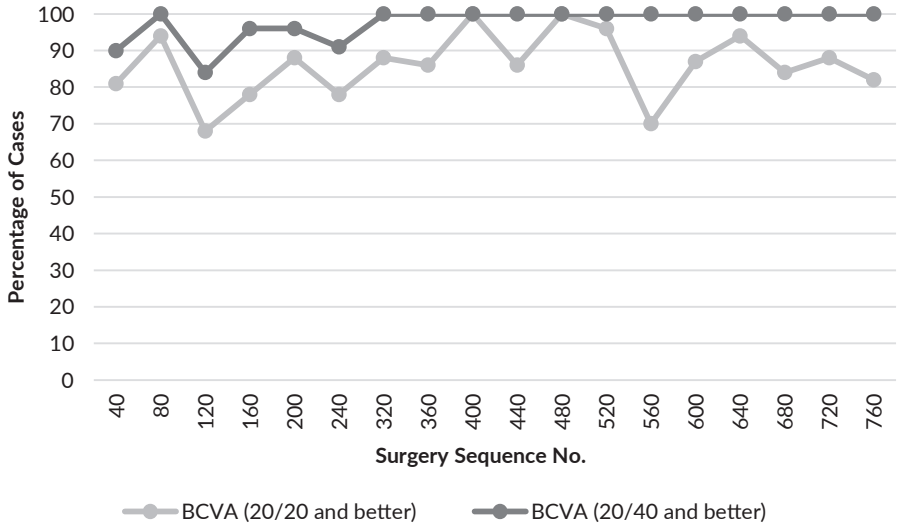

Figure 2. Best corrected visual acuity outcomes stratified by surgical case number.

Mean postoperative UCVA was 20/25 (logMar 0.12); UCVA was 20/20 or better in 59.2% of cases and 20/40 or better in 89%. Mean BCVA improved from 20/250 preoperatively to 20/25 (log Mar 0.07) postoperatively; BCVA was 20/20 or better in 80% of cases, and was 20/40 or better in 94.3%. Mean manifest refraction spherical equivalent (MRSE) improved from +0.6 D to -0.14 D. On average, eyes gained 7.9 lines of BCVA postoperatively (range, 16 lines gained to 9 lines lost). There were no significant changes in UCVA or BCVA outcomes during the entire duration of training (Figures 1 and 2).

Overall, intraoperative complications occurred in 33 cases (6.7%), with some cases experiencing more than one complication. These included 24 cases (4.9%) with posterior capsule rent, 15 (3%) with vitreous loss, and 9 (1.8%) with retained lens fragments. When resident cases 1 through 50 (400 cases) were compared with cases 51 through 100 (400 cases), there were fewer cases with posterior capsule rent (7% vs 3.8%) and significantly fewer cases with vitreous loss (4.6% vs 0%) later in training. Posterior capsule rent and vitreous loss rates show a decrease in trend throughout residency training (Figure 3). There were significant differences in UCVA [20/125 (logMar 0.75) vs 20/25 (logMar 0.12) or BCVA [20/80 (logMar 0.57) vs 20/20 (logMar 0.04) between cases with and without vitreous loss.

Mean (SD) adjusted phacoemulsification time was 11.3 minutes. When resident cases 1 through 45 were compared with cases 46 through 90, there was a significant reduction in adjusted phacoemulsification time (14.93 vs 7.66 minutes) later in training. Adjusted phacoemulsification times continued to decrease throughout residency training (Figure 4).

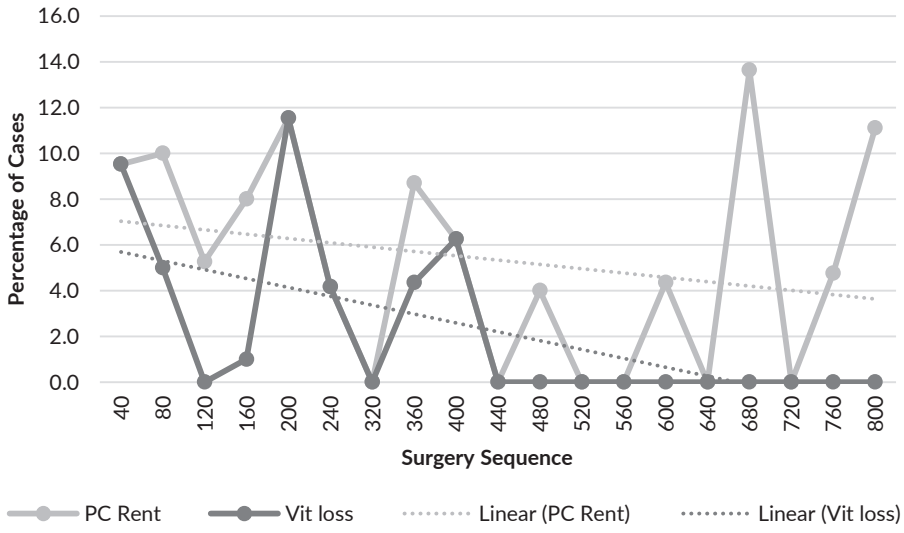

Figure 3. Posterior capsule rent and vitreous loss rates stratified by surgical case number.

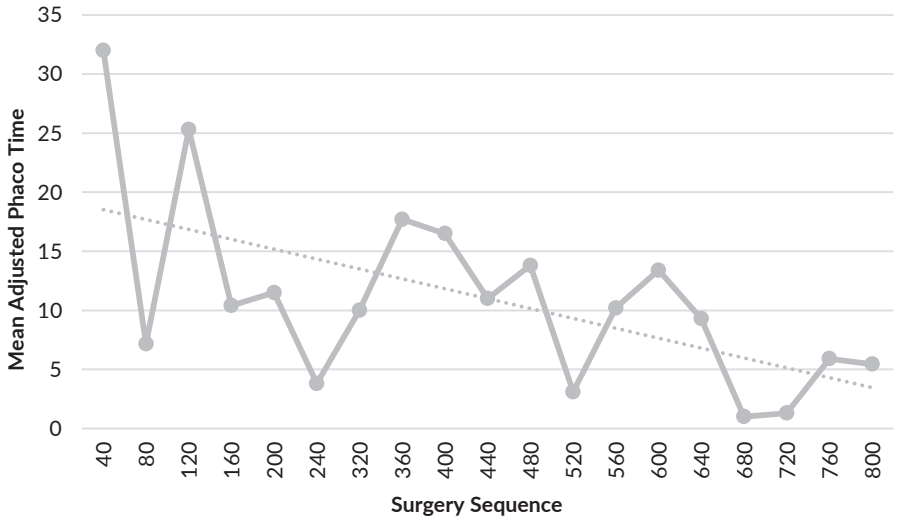

Figure 4. Phacoemulsification efficiency (adjusted phacoemulsification time in minutes) stratified by surgical case number.

DISCUSSION

Visual Acuity Outcomes

Most of the eyes operated on achieved 20/40 or better UCVA and BCVA after phacoemulsification, as shown in Figures 1 and 2. This is consistent with studies done overseas previously.[3,8,9,15] Visual acuity outcomes are stable and do not differ significantly over time. This implies that good visual outcomes can still be achieved earlier in the course of training despite the length of surgery and total phacoemulsification power used. Moreover, this gives the beginning surgeon relief and reassurance during his/her first cases in the learning curve.[14]

Surgical Competency

Intraoperative Complications

Posterior capsular rent and vitreous loss are dreaded intraoperative complications of phacoemulsification surgery, as they mean access of the posterior segment (vitreous and retina) from the anterior chamber. This connotes higher incidences of dropped lens material or intraocular lens to the posterior segment, and more devastatingly, complications leading to irreversible vision loss, such as endophthalmitis, vitreous tugging and hemorrhage, development of retinal tears, and subsequent retinal detachment. Hence, rates of intraoperative complications that include posterior capsular rent and vitreous loss are important criteria for assessing competency in phacoemulsification.

There are decreasing rates of posterior capsular rent and vitreous loss throughout phacoemulsification training, as shown in Figure 3. Despite this trend, posterior capsular rent still occurs significantly even after the first 50 cases, and even after the first 100 cases. On the other hand, the overall rate of vitreous loss has diminished significantly after the first 50 cases of a single surgeon. This is consistent with studies done overseas.[3,9,10,15,16] Data proposes that the learning curve for posterior capsule rent extends beyond the first 100 cases, but that for vitreous loss has been greatly diminished after the first 45 cases and may be approaching that of proficient phacoemulsification surgeons. Data shows that final visual acuity outcomes have been significantly affected in the limited cases of vitreous loss we included for analysis.

Phacoemulsification Efficiency

Adjusted phacoemulsification time has been used in this study as a marker for surgical efficiency during training, as we believe that it is a reflection of improved surgical technique in a population where cases are randomized and cataract grading and density are stable through time.[16] As shown in Figure 4, there is a downward trend in the adjusted phacoemulsification time throughout the training. Furthermore, there are significant differences between the residents' first 50 cases and 100 cases. This implies that surgical efficiency continues to increase and goes beyond the trainee's first 100 cases.[17]

Resident Phacoemulsification Learning Curve

Currently, the number of cataract cases required by the Philippine Board of Ophthalmology (PBO) is 50. Our data suggest that the phacoemulsification learning curve extends way beyond the first 50 cases. Hence, it would be significantly beneficial for a resident learning phacoemulsification to do more than the current required number of cases. Specifically, the resident might require at least 100 cases to achieve competent surgical skills. This study suggests that increasing the minimum number of phacoemulsification cases required by the PBO will greatly impact the competency of future general ophthalmologists. This also recommends that residency programs should maximize efforts to increase the number of phacoemulsification cases of their residents.

CONCLUSION

Good visual outcomes are achievable throughout the resident's phacoemulsification learning curve. Surgical competency in phacoemulsification, as measured by intraoperative complication rates and phacoemulsification efficiency, still improves significantly with increasing number of cases and experience beyond the first 100 cases.

Statement of Authorship

All authors approved the final version submitted.

Author Disclosure

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