

Impact of a Formal Presurgical Curriculum on Resident Cataract Outcomes

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Introduction

- Many studies have found that simulator training leads to reduction in ophthalmology resident cataract complications.¹⁻²
- Few studies have investigated the effect of a wet lab-based presurgical curriculum on decreasing rates of posterior capsule tears and vitreous loss,³⁻⁴ and none examine the impact on other types of complications, operative time, or patient visual acuity.
- Our study seeks to address these gaps by investigating the impact of our institution's formal presurgical curriculum on resident cataract safety and efficacy.

Our Institution's Presurgical Curriculum

- Implemented in 2013
- Held during the PGY-2 year from September to June
- Forty 2.5-hour sessions with direct faculty supervision (faculty to resident ratio: usually 1:4 and sometimes 2:4)
- 80% of sessions dedicated to cataract surgery and 20% to other surgical procedures related to cornea, glaucoma, pediatrics, and oculoplastics
- Use of various eye models and real operating room equipment and phacoemulsification machines
- Residents have access to a surgical simulator and are encouraged to complete all modules over the course of the year, but there is no formal requirement

Methods

We performed a retrospective review of operative reports and office visit notes for primary cataract cases performed by residents before and after implementation of our presurgical curriculum.

Case Selection

Inclusion Criteria:

- Resident as primary surgeon
- First 90 primary cases per resident's ACGME log

Exclusion Criteria:

- Combined cases with glaucoma/retina services
- Duplicate cases
- Case not found in EMR or with no resident involvement in operative note

Primary outcome measures:

- Operative time
- Overall complication rate
- Individual intraoperative and postoperative complication rates
- Patient visual acuity

Statistical Analyses

- Continuous variables were described in means with standard deviations and medians with quantiles as appropriate. Counts and percentages were used to describe categorical variables.
- T-tests, Wilcoxon rank sum tests, and Chi-square tests were used to compare clinical characteristics between groups.
- Multivariable linear and logistic regression analyses were used to assess differences in visual acuity, operative time, and complications between groups, while controlling for case difficulty, resident correlation (using generalized estimating equations), and pre-existing visual problems, if applicable.

Results

- 1,811 cataract cases were reviewed.
- 815 cases were from 11 residents in the pre-wet lab group and 996 cases were from 12 residents in the post-wet lab group.
- Cases performed in the post-wet lab period were more likely to be older patients with better baseline visual acuity and seen at our county hospital.
- Overall case difficulty did not differ between groups, but cases in the post-wet lab period were more likely to have mature cataracts and require iris hooks/rings.

Table 1: Case Demographics and Clinical Characteristics

Factor	Overall (N=1,811)		Pre-wet lab (N=815)		Post-wet lab (N=996)		p-value
	N	Statistics	N	Statistics	N	Statistics	
Age (years)	1,811	64.1 ± 12.3	815	61.8 ± 12.7	996	66.0 ± 11.6	<0.001 ^a
Patient gender (male)	1,809	715 (39.5)	813	340 (41.8)	996	375 (37.7)	0.071 ^c
Case Location	1,811		815		996		<0.001 ^c
County Hospital		1,064 (58.8)		419 (51.4)		645 (64.8)	
Eye Institute		747 (41.2)		396 (48.6)		351 (35.2)	
Operative eye (left)	1,804	905 (50.2)	811	416 (51.3)	993	489 (49.2)	0.39 ^c
Type of anesthesia	1,805		811		994		<0.001 ^c
MAC with retrobulbar		502 (27.8)		356 (43.9)		146 (14.7)	
MAC with topical		783 (43.4)		288 (35.5)		495 (49.8)	
MAC with peribulbar		12 (0.66)		9 (1.1)		3 (0.30)	
Local/topical only		332 (18.4)		67 (8.3)		265 (26.7)	
Retrobulbar block only		77 (4.3)		40 (4.9)		37 (3.7)	
General		99 (5.5)		51 (6.3)		48 (4.8)	
Pre-op BCVA: 20/____	1,465	40.0 [30.0, 70.0]	499	50.0 [30.0, 100.0]	966	40.0 [30.0, 60.0]	<0.001 ^b
Pre-op best corrected ETDRS VA	1,465	69.9 [57.8, 76.2]	499	65.1 [50.1, 76.2]	966	69.9 [61.1, 76.2]	<0.001 ^b
Follow-up time (days)	1,541	69.0 [34.0, 132.0]	545	75.0 [34.0, 125.0]	996	63.5 [36.0, 141.5]	0.86 ^b
Case Difficulty							
Any factor causing a difficult case	1,811	470 (26.0)	815	197 (24.2)	996	273 (27.4)	0.12 ^c
Prior vitrectomy	1,811	26 (1.4)	815	14 (1.7)	996	12 (1.2)	0.36 ^c
4+ Dense/White/Brunescent Cataract	1,811	198 (10.9)	815	74 (9.1)	996	124 (12.4)	0.022 ^c
Use of Trypan	1,811	254 (14.0)	815	117 (14.4)	996	137 (13.8)	0.71 ^c
Use of Iris Hooks/Rings	1,811	111 (6.1)	815	39 (4.8)	996	72 (7.2)	0.031 ^c
Pre-existing zonular dialysis/phacodonesis	1,811	16 (0.88)	815	8 (0.98)	996	8 (0.80)	0.69 ^c
Pseudoexfoliation	1,811	7 (0.39)	815	4 (0.49)	996	3 (0.30)	0.52 ^c

Statistics presented as Mean ± SD, Median [P25, P75], N (column %).

p-values: a=Satterthwaite t-test, b=Wilcoxon Rank Sum test, c=Pearson's chi-square test.

Patients from the post-wet lab group had more pre-existing visual problems

Table 2: Case Clinical Characteristics: Visual problems

Factor	Overall (N=1,811)	Pre-wet lab (N=815)	Post-wet lab (N=996)	p-value
	Statistics	Statistics	Statistics	
Any pre-existing visual problem	160 (8.8)	57 (7.0)	103 (10.3)	0.013^c
Proliferative diabetic retinopathy	53 (2.9)	20 (2.5)	33 (3.3)	0.28 ^c
Severe stage glaucoma	21 (1.2)	4 (0.49)	17 (1.7)	0.016^c
Optic neuropathy	2 (0.11)	2 (0.25)	0 (0.00)	0.12 ^c
Amblyopia	13 (0.72)	4 (0.49)	9 (0.90)	0.30 ^c
Pre-op diabetic macular edema	29 (1.6)	7 (0.86)	22 (2.2)	0.023^c
Pre-op cystoid macular edema	4 (0.22)	1 (0.12)	3 (0.30)	0.42 ^c
Geographic atrophy	5 (0.28)	3 (0.37)	2 (0.20)	0.50 ^c
Hx of retinal detachment	17 (0.94)	5 (0.61)	12 (1.2)	0.19 ^c
Retinal vein occlusion	7 (0.39)	3 (0.37)	4 (0.40)	0.91 ^c
Retinal arterial occlusion	3 (0.17)	0 (0.00)	3 (0.30)	0.12 ^c
Hx of macular hole	8 (0.44)	5 (0.61)	3 (0.30)	0.32 ^c
Non-listed vision-impairing condition	21 (1.2)	9 (1.1)	12 (1.2)	0.84 ^c

Statistics presented as Mean ± SD, Median [P25, P75], N (column %).

p-values: a=Satterthwaite t-test, b=Wilcoxon Rank Sum test, c=Pearson's chi-square test.

Post-wet lab group has decreased operative time and intra-operative complications

Table 3. Comparison of Operative time, Visual acuity, and Complications Pre vs. Post wet lab

Factor	Overall N	N	Pre wet lab	N	Post wet lab	p-value
Operative time						
Total operative time (min)	1800	805	45.1 ± 21.6	995	34.3 ± 16.4	<0.001
Visual Acuity						
POM1 BCVA: 20/___	1410	480	25.0 [20.0, 30.0]	930	20.0 [20.0, 30.0]	0.29
POM1 best corrected ETDRS VA	1410	480	80.2 [76.2, 85.0]	930	85.0 [76.2, 85.0]	0.082
Change in ETDRS VA	1365	460	15.1 [6.2, 27.2]	905	11.1 [4.8, 19.9]	<0.001
Intra-op Complications						
Any intra-op complication	1811	815	71 (8.7)	996	36 (3.6)	<0.001
Posterior capsule tear	1811	815	43 (5.3)	996	26 (2.6)	0.001
Anterior capsule tear	1811	815	31 (3.8)	996	8 (0.80)	<0.001
Vitreous loss	1811	815	29 (3.6)	996	19 (1.9)	0.10
Retained lens fragment	1811	815	13 (1.6)	996	12 (1.2)	0.60
Descemet detachment	1811	815	0 (0.00)	996	2 (0.20)	N/A
Corneal wound burn	1811	815	0 (0.00)	996	0 (0.00)	N/A
Post-op Complications						
Any post-op complication	1238	445	25 (5.6)	793	38 (4.8)	0.48
Endophthalmitis	1235	443	1 (0.23)	792	2 (0.25)	0.97
IOL dislocation	1235	443	1 (0.23)	792	0 (0.00)	N/A
Cystoid macular edema	1238	445	25 (5.6)	793	38 (4.8)	0.48
Return to operating room	1235	443	10 (2.3)	792	11 (1.4)	0.46

Completion of the wet lab curriculum was associated with better patient BCVA one month after surgery

Table 4. Visual Acuity Parameters Post vs. Pre wet lab

Factor	Number of Observations Used	Estimate (95% CI)	p-value
POM1 best corrected ETDRS VA	1410	1.5 (0.07, 3.0)	<i>0.041</i>
Change in ETDRS VA	1365	-5.9 (-7.8, -4.0)	<i><0.001</i>

P-values from linear regression with adjustment for case difficulty, pre-existing visual problem and correlation

Completion of the wet lab curriculum was also associated with less improvement in visual acuity after cataract surgery, but this may be attributed to the fact that cases completed by the post-wet lab group had significantly better baseline visual acuity, so the absolute change in visual acuity is smaller.

Residents who did not complete the wet lab curriculum were more likely to have an anterior capsule or posterior capsule tear

Table 5. Odds of Intra-operative Complications Pre vs Post wet lab

Factor	N=1811	Odds Ratio (95% CI)	p-value
Any intra-op complication		2.6 (1.7,4.0)	<0.001
Anterior capsule tear		5.2 (2.1,12.6)	<0.001
Posterior capsule tear		2.1 (1.3,3.4)	0.001
Vitreous loss		1.9 (0.86,4.1)	0.11
Retained lens fragment		1.4 (0.51,3.9)	0.51

P-values from logistic regression with adjustment for case difficulty and correlation

Discussion and Conclusion

Discussion

- A formal presurgical wet lab curriculum was associated with a significant improvement in resident operative time by about 25% and a more than 50% reduction in posterior and anterior capsule tear rates.
- Our results are comparable to prior literature, which report posterior capsule tear rates before versus after wet lab course implementation of 5.2% vs. 2.44%.³ However, our study is unique in its study design, stringent inclusion criteria, and evaluation of operative time, a variety of complications, and visual acuity.
- Study Strengths:
 - Identifying the first 90 primary cases for each resident by ACGME logs and by surgical date
 - Minimizing confounders by controlling for case difficulty, resident correlation, and pre-existing visual problems
- Study Limitations:
 - Retrospective nature
 - Lack of visual acuity and follow-up data for a portion of the pre-wet lab cases
 - Most of this data was not transferred from paper charts to our current EMR during that period.

Conclusion

Implementation of a standardized presurgical curriculum in ophthalmology residencies may enhance resident cataract efficiency and safety early in training by reducing operative time and intraoperative complications.

References

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