

Evaluating Resident Training in Oculoplastic Surgery: A Case Series of 104 Eviscerations

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Abstract

Purpose The aim of this study is to evaluate resident surgical performance based on complications after ocular evisceration.

Methods A retrospective chart review of eviscerations performed between October 2011 and May 2017 by ophthalmology residents as the primary or assistant surgeon under the guidance of a single oculofacial plastic surgeon (M.O.G.) was completed. Data collected included reason for evisceration, resident participation in the case and resident's month of oculoplastic training, surgical technique, subsequent complications, and duration of follow-up.

Results There were no significant differences in complication rates or surgical sequelae in resident-led versus attending-led surgeries. The complication rate for all cases in total was 5.77%. A slight negative correlation existed between the resident's month of training and the presence of postoperative complications. The number of adverse events was found to be significantly correlated with the duration of patient follow-up.

Keywords

- ▶ anophthalmic surgery
- ▶ ocular evisceration
- ▶ ophthalmology resident performance
- ▶ oculoplastic training
- ▶ ophthalmology resident outcomes

Discussion Ocular eviscerations performed by ophthalmology residents as primary surgeons achieve outcomes equivalent to published reports, suggesting ocular eviscerations are a safe, effective procedure wherein residents can refine surgical skills. Some surgical sequelae may be linked to particular surgeons, implying evisceration outcomes can be used to assess resident surgical performance. Fewer adverse events arose as the resident's length of oculoplastic training increased, but this finding did not reach significance. Larger studies are needed to explore these trends.

Evisceration is the removal of the intraocular contents of the eye, leaving behind a scleral shell with preserved extraocular tissues. Evisceration is performed for several reasons, including trauma, phthisis bulbi, cosmesis, and blind, painful eyes. Compared with eye removal procedures like enucleation and exenteration, evisceration is considered technically easier,

preserves more tissue, offers improved implant motility, and boasts a better cosmetic result.^{1–7} Recent studies also suggest that eviscerations have a lower complication rate regarding postoperative infection and implant extrusion.^{2,8,9} Historically, evisceration was avoided due to concerns for an increased risk of sympathetic ophthalmia; however, recent

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literature suggests this risk is no greater than other eye removal procedures like enucleation.^{4,8,10} For these reasons, the frequency of ocular evisceration has increased over the years.^{11,12} Typical complications of evisceration include infection and wound dehiscence with implant exposure or extrusion, as well as minor surgical sequelae such as eyelid malposition, superior sulcus deformity, enophthalmos, and cyst formation.^{7,13–21} Current literature explores various surgical techniques, efforts to minimize complications, and long-term outcomes of anophthalmic sockets. Many of these published works arise from training institutions. However, there is a dearth of information regarding ophthalmology trainee performance and long-term outcomes in cases of ocular evisceration. As an increasingly common, technically easier procedure in a non-seeing eye, eviscerations are ideal cases for trainees. The aim of this study is to use patient outcomes and complications to evaluate the appropriateness of ophthalmology residents performing ocular evisceration, as well as using ocular evisceration procedures to enhance surgical training and evaluate resident surgical performance.

Methods

Data Acquisition

A retrospective chart review of eviscerations performed between October 2011 and May 2017 by ophthalmology residents as the primary or assistant surgeon under the guidance of a single oculofacial plastic surgeon was completed. Data collected included reason for evisceration, resident's role in the case and resident's month of oculoplastic training, surgical technique, size of implant, subsequent complications, and duration of follow-up.

Surgical Technique

On the day of surgery, the patient was placed under general anesthesia. Phenylephrine ophthalmic drops (10%) were applied to the operative eye, and the nonoperative eye was shielded. A 360-degree peritomy was performed, followed by conjunctival and Tenon's dissection into the quadrants at the 2, 4, 8, and 10 o'clock positions. The cornea was excised and the intraocular contents were removed. In all cases, the cornea and intraocular contents were submitted for histopathologic analysis. The internal scleral surface was scrubbed repeatedly with 100% alcohol to remove any uveal antigens, followed by copious irrigation with antibiotic solution. Four scleral petals were created from the limbus to the optic nerve at the 2, 4, 8, and 10 o'clock positions. An orbital sizer was used to determine an implant size that allowed for filling of the anophthalmic socket without placing undue tension when closing the scleral petals around the implant. The implant—a porous polyethylene spherical orbital implant (Medpor; Stryker, Kalamazoo, Michigan)—was soaked in a combination antibiotic and anesthetic solution, and was then placed into the scleral cavity. The superior and inferior scleral petals were closed with a combination of running and interrupted slow-absorbing sutures. The horizontal petals were similarly closed. Copious irrigation was again performed with antibiotic solution to allow for visual-

ization of Tenon's. In a portion of cases, slow-absorbing suture was used to close Tenon's in a running manner, followed by a separate closure of the conjunctiva with running absorbable suture. In the remainder of cases, Tenon's and conjunctiva were closed simultaneously with running absorbable suture. A combination antibiotic and steroid ointment was applied, an appropriately sized conformer was inserted, and a temporary tarsorrhaphy was placed using nonabsorbable suture. At the conclusion of the case, a retrobulbar injection of 0.75% bupivacaine with epinephrine (1:200,000) was administered, and a pressure patch and eye shield were placed. The tarsorrhaphy, pressure patch, and shield remained in place for 1 week, after which a combination antibiotic and steroid ointment was applied to the eye three times per day for the next 2 weeks.

Teaching Methodology

A single attending oculoplastic surgeon oversaw these cases. Early in the chart series, third-year residents were intermittently assigned to oculoplastic surgeries and taught in a modified "see one, do one" manner under direct supervision of the attending oculoplastic physician. Later in the chart review period, first-year residents were assigned to a 3-month intensive block of oculoplastic education, including time in clinic, the minor procedure room, and the operating room. In each learning environment, a baseline level of competency was established through previous interaction and direct evaluation of surgical technique in both wet laboratory and the operating room by the attending oculoplastic surgeon. Intraoperatively, a graduated, step-wise approach to mastering the procedure was employed. If a step was completed incorrectly, the resident was informed and tasked with repeating the step correctly on the spot under demonstrative guidance of the attending surgeon until the resident was able to perform more than 50% of the key steps of the procedure, at which point the case became a primary resident case.

Statistical Analysis

Data were collected and cross-checked for errors. Percentage, range, and average mean were calculated. Statistical analysis included chi-square test, Pearson's product-moment correlation coefficient, and odds ratio (OR) calculations. Significance was determined by $p < 0.05$.

Results

A total of 104 eviscerations were completed: 57 (54.8%) were completed with a resident as the primary surgeon, while 47 (45.2%) were completed with a resident as the assistant surgeon. Patient demographics were wide ranging (— **Table 1**). There were many similarities between attending and resident-led case demographics; however, attending cases had nearly twice the amount of patients with penetrating ocular trauma compared with resident cases. Reasons for evisceration included blind, painful eyes from multiple etiologies (such as end-stage glaucoma; 58.7%), endophthalmitis (12.5%), corneal perforation (10.6%), phthisis (9.6%), and

Table 1 Patient demographics

Demographic	Total (%)	Attending	Resident
Sex			
Female	37 (35.6%)	16 (34.0%)	21 (36.8%)
Male	67 (64.4%)	31 (66.0%)	36 (63.2%)
Age			
Range	10–97 y	14–92 y	10–97 y
Average	60.2 y	44.8 y	58.4 y
Laterality			
Right eye	42 (40.4%)	24 (51.1%)	18 (31.6%)
Left eye	62 (59.6%)	23 (48.9%)	39 (68.4%)
Follow-up			
Shortest	9 d	9 d	9 d
Longest	53 mo	53 mo	52 mo
Average	11.3 mo	14.2 mo	9.5 mo
Previous ocular surgery			
Patients (no.)	81 (77.9%)	36 (76.6%)	45 (78.9%)
Surgeries (no.)	138	61	77
History of penetrating trauma	28 (26.9%)	17 (36.2%)	11 (19.3%)
History of intraocular infection	29 (27.9%)	13 (27.8%)	16 (28.1%)

Notes: There were more male patients undergoing ocular evisceration. The average patient age was 60 years, and there was an incidental predominance of left eye evisceration. Follow-up was widely variable, with an average follow-up period of 11.3 months. Follow-up was slightly longer at 14.2 months in attending-led cases compared with 9.5 months in resident cases. The majority of patients had previous ocular surgery, which ranged from cataract extraction and glaucoma procedures to retinal detachment repairs, posterior pole vitrectomies, and repair of ruptured globes. There was nearly two times the number of patients with penetrating trauma in attending-led cases compared with resident cases.

trauma (7.7%; ► **Table 2**). There were nearly double the number of etiologic cases of endophthalmitis in attending cases (17.0% compared with 8.8% in resident cases), and chart review of attending trauma cases revealed more globally obliterative traumas than resident cases.

Duration of follow-up ranged from 9 days to nearly 5 years, with slightly longer follow-up for attending-led cases compared with resident cases (► **Table 1**). During this time, a total of six complications occurred. Complications were defined as wound dehiscence, implant exposure or extrusion, surgical site infection, and sympathetic ophthalmia. Of the six complications, one occurred in resident primary cases (1.8% of

resident primary cases) and five in resident-assist cases (10.6% of resident-assist cases). The complication rate for all cases in total was 5.77%. There were no cases of implant extrusion or sympathetic ophthalmia. Minor adverse events and long-term surgical sequelae included eyelid malposition, conjunctival cysts, pyogenic granuloma, implant migration, superior sulcus defect, and enophthalmos. Sequelae occurred with a near-equal incidence in both resident-led and attending-led cases (► **Table 3**). There was no incidence of implant migration, superior sulcus defect, or enophthalmos. There was no significant difference in the rate of complications ($\chi^2(1, N = 104) = 3.74, p = 0.05$), long-term

Table 2 Reasons for ocular evisceration

Reason for evisceration	% (n)	Attending	Resident
Blind, painful eye	58.7 (61)	48.9 (23)	66.7 (38)
Endophthalmitis	12.5 (13)	17.0 (8)	8.8 (5)
Corneal perforation	10.6 (11)	10.6 (5)	10.5 (6)
Phthisis	9.6 (10)	12.8 (6)	7.0 (4)
Trauma	7.7 (8)	8.5 (4)	7.0 (4)
Other	0.9 (1)	2.1 (1)	0.0 (0)

Notes: Trauma occurred within the preceding 3 months to qualify as the reason for evisceration. Attending trauma cases tended to have more globally disruptive trauma than resident cases. Blind, painful eyes occurred from several pathologies, including end-stage glaucoma and keratitis. Evisceration is absolutely contraindicated in cases of intraocular malignancy, and there was no intraocular malignancy present on histopathologic analysis of eviscerated tissue.

Table 3 Complications, sequelae, and surgical variables after ocular evisceration

Number of eviscerations (n = 104)	Resident role	
	Primary surgeon (n = 57)	Assistant surgeon (n = 47)
Major complications	1	5
Implant exposure	0	3
Wound dehiscence	1	1
Infection	0	1
Minor surgical sequelae	21	18
Ptosis	6	5
Other eyelid malposition	6	5
Conjunctival cyst	5	4
Other	4	4
Surgical variables		
Implant size (average)	19.6 mm	20.1 mm
Separate or combined closure of Tenon's and conjunctiva	40 separate 16 combined	44 separate 3 combined

Notes: As a case series of 104 ocular eviscerations, the overall complication rate was 5.77%. The major complication rate was 1.8% in resident primary cases and 10.6% in resident-assist cases. Minor surgical sequelae occurred with a near-equal incidence of 36.8% in resident primary and 38.3% in resident-assist cases. Other sequelae included one case each of fornix shortening (in the setting of an initial alkali burn), persistent pain (in a patient with neuropathic pain syndrome), symblepharon formation, pedunculated benign conjunctival lesion, pyogenic granuloma (occurring twice in the same patient), and chronic discharge. No significant differences were observed among surgical variables. The orbital implant size ranged from 16 to 22 mm, with the average size being a 19.9-mm implant. There was no statistical difference in choice of implant size ($\chi^2(1, N = 104) = 0.86, p = 0.35$) or adverse events ($\chi^2(1, N = 104) = 0.09, p = 0.76$) between these two groups. Additionally, there was no correlation between the type of conjunctiva and Tenon's closure (whether closed separately or simultaneously) with postoperative complications ($\chi^2(1, N = 103, \text{ due to exclusion of one patient who lacked conjunctiva}) = 1.11, p = 0.292$; Fisher's exact test yielded $p = 0.2857$ in resident surgeries, and $p = 0.2920$ in attending-led surgeries), similar to a recently published report.²¹

sequelae ($\chi^2(1, N = 104) = 1.53, p = 0.22$), or total adverse events (complications of surgery and minor or long-term sequelae ($\chi^2(1, N = 104) = 0.01, p = 0.91$) between resident- and attending-led cases. An infectious etiology for evisceration was associated with a slightly increased risk of experiencing a major complication in both attending- and resident-led cases (OR = 1.23). There was a larger risk for complications in patients who had a history of previous ocular surgery (OR = 3.35 in attending cases; the single complication in resident cases was insufficient to calculate this for resident-led surgeries).

A Pearson product-moment correlation coefficient revealed a slight negative correlation between the resident's month of training and the presence of postoperative compli-

cations, though this was not significant ($r = -0.23, n = 40, p$ [one-tailed] = 0.08). There was a small but significant positive correlation between the occurrence of all adverse events (complications and long-term sequelae) and duration of follow-up ($r = 0.029, n = 104, p$ [one-tailed] = 0.001).

Discussion

Ocular evisceration is employed in patients with cosmetic, painful, infectious, or other pathologic processes that compromise ocular integrity. Historically, enucleation was the preferred anophthalmic procedure in these patients, as it was believed that enucleation had a lower risk of sympathetic ophthalmia and better postoperative pain control.²²⁻²⁶ The frequency of eviscerations has increased in the past few decades,^{11,12} in part because evisceration is considered a technically easier procedure and now has a known low rate of sympathetic ophthalmia.^{4,8,10,27} As such, ocular evisceration is an ideal procedure for ophthalmology trainees. However, review of the current literature reveals a lack of information regarding ophthalmology resident performance and outcomes in cases of ocular evisceration. In this study, we found that not only were trainees capable of safely performing ocular eviscerations with a complication rate similar to published reports but also that a trainee's surgical skills could be both taught and evaluated by performance of ocular evisceration procedures and assessing postoperative complications.

Our rate of complications (1.8% in resident primary cases and 10.6% in resident-assist cases) falls within published reports, suggesting that evisceration surgery is a safe procedure for ophthalmology residents to learn and practice surgical skills. A review of the literature shows complication rates after evisceration range from 0 to 53.8%.^{2,3,6,7,9,13-21} The wide range of complication rates reported is likely due to variability in patient demographics, underlying ocular pathology, surgical technique (including type and size of implant, wrapping material, and presence or absence of sclerotomies), and duration of follow-up (with longer follow-up being associated with a higher incidence of complications).^{6,9,13,14,16,21} Collectively, recent reports have an average incidence of 8.6% for implant exposure, 1.0% for surgical site infection, and 2.5% for superior sulcus deformity.^{2,3,6,7,9,13-21} Our study found that primary resident cases had a below-average incidence of complications. There were no superior sulcus defects or enophthalmos noted in our study. This is likely due to follow-up of less than 5 years in the majority of resident cases, and longer follow-up may reveal the development of sulcus or socket deformities. Similar to published reports, our study did find complication rates directly correlated to the length of follow-up. Of note, the power of our study to compare resident to attending outcomes is low (~60%, confidence interval [CI] = 95%), and expanding the number of cases reviewed in the future will increase the applicability of our findings.

Minor and surgical sequelae occurred at nearly equal rates between resident-led and resident-assist surgeries. Of note, our rate of these minor and surgical sequelae seems higher than previously published reports. In the current work, 10.5%

of resident primary cases exhibited eyelid malposition (entropion, ectropion, or blepharoptosis), and 8.8% developed conjunctival cysts. Similarly, 10.6 and 8.5% of resident-assist cases displayed similar findings, respectively. Published data show an average incidence of 7.4% for eyelid malposition and 2.2% for conjunctival cysts.^{7,9,14,16,17,19,21} Not all reports include these sequelae in their follow-up, and it is possible that current publications do not accurately represent the overall incidence of these sequelae. It is also possible that variations in surgical technique, underlying pathology, or presence of trauma account for the discrepancy, or that our sample is too small to reveal representative rates.

Our work is the first to propose that not only can resident surgeons safely perform ocular evisceration, but also that evisceration outcomes can be used as a marker for evaluating resident performance. For example, three of the five conjunctival cysts in resident primary cases occurred in cases performed by the same resident. Conjunctival cysts occur from erroneous implantation of conjunctiva in posterior layers like Tenon's capsule. These cases had no history of ocular trauma; as such, the occurrence of conjunctival cysts in these patients is likely a direct reflection of surgical technique and can be used to assess resident surgical performance. It is acknowledged that this assessment has more utility for short-term complications when surgical assessment and teaching occurs during residency.

This study is also the first to demonstrate that complications in resident evisceration cases are inversely correlated with the number of months the resident spent on the oculoplastic service. While a nonsignificant trend in this study, this finding is consistent with previously published work in ophthalmology surgical training. Surgical training—including length of training—predicts performance and outcomes, though not necessarily transferability, across subspecialties.^{28–34}

Limitations of this study include the small number of residents assessed ($n = 12$) and differences in oculoplastic training. Early in the years of this retrospective chart review, residents did not have an immersive oculoplastic training period. Later, residents underwent an immersive 3-month-long oculoplastic rotation. This allowed for better evaluation of skills and interpretation of those skills in patient outcomes. Some residents continued to perform oculoplastic cases after completion of their 3-month block, and those with contiguous months of oculoplastic performance were included in this study's data analysis. Those without a known block of contiguous months of oculoplastic training were omitted from those portions of the data analysis. This results in less statistical power, and is a source of improvement in future work. Several tools have been developed to measure resident physician technical skills,^{35–37} including a proposed curriculum for oculoplastic training,³⁸ and perhaps ocular eviscerations should be considered as a safe, formalized teaching and evaluation tool for resident surgical skills.

Future directions would also include increasing the sample size and duration of follow-up studied. With a confidence interval of 5%, the current work gives us a power of approxi-

mately 60% when comparing resident to attending outcomes. A larger sample size is needed to improve the power of this work. In addition, while some patients were followed up to 5 years, the majority have been followed up only for approximately 2 years to date. This is insufficient time to see complications like superior sulcus deformity and enophthalmos. Thus, larger studies with longer follow-up and an increased number of resident surgeons may be necessary to further support the findings of this study.

The goals of this project were multiple: (1) to compare resident evisceration outcomes to those in published reports; (2) to assess outcomes after ocular evisceration; and (3) to look for correlation between surgical outcomes and duration of resident's oculoplastic training. This study supports the ACGME goal of enhancing resident physician education in surgical competency, assessment of resident performance, and utilizing outcomes for improving resident education.³⁹ This study shows that not only are ocular eviscerations safe for resident surgeons to perform, but they are also a procedure that is ideal for training and evaluating resident surgical performance.

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Conflict of Interest

None declared.

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