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Comparison of Regional vs. General Anesthesia for Surgical Repair of Open-Globe Injuries at a University Referral Center

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Purpose: This study compares the clinical features and physician selection of 2 types of anesthesia—regional anesthesia (peribulbar or retrobulbar block) with monitored anesthesia care (RA-MAC) and general anesthesia (GA)—for open-globe injury repair.

Design: A nonrandomized, comparative, retrospective case series at a university referral center.

Participants: All repairable open-globe injuries in adult patients receiving primary repair between January 1, 2004, and December 31, 2014 (11 years). Exclusion criteria were patients <18 years of age and those treated with primary enucleation.

Methods: Data were gathered via retrospective chart review.

Main Outcome Measures: Data collected from each patient were age, gender, injury type, location, length of wound, presenting visual acuity, classification of anesthesia used, duration of the procedure performed, months of clinical follow-up, and final visual acuity. Open globe injuries were classified into zone 1 (cornea and limbus), zone 2 (≤5 millimeters posterior to the limbus), and zone 3 (>5 millimeters posterior to the limbus).

Results: During the 11-year study period, 448 patients with open-globe injuries and documented information on zone of injury were identified. Globe-injury repair was performed using RA-MAC in 351 of these patients (78%) and GA in 97 patients (22%). Zone 1, 2, and 3 injuries were recorded in 241, 135, and 72 patients, respectively. The rates of RA-MAC vs. GA in specific zones were as follows: zone 1, 213 of 241 patients (88%) vs. 28 of 241 patients (12%); zone 2, 104 of 135 patients (77%) vs. 31 of 135 patients (23%); and zone 3, 34 of 72 patients (47%) vs. 38 of 72 patients (53%). Open-globe injuries repaired under RA-MAC had significantly shorter wound length ($P < 0.001$), more anterior wound location ($P < 0.001$) and shorter operative times ($P < 0.001$). RA-MAC cases also had a better presenting and final visual acuity ($P < 0.001$). Neither class of anesthesia conferred a greater visual acuity improvement ($P = 0.06$). The use of GA did not cause any delay in the time elapsed from injury until surgical repair ($P = 0.74$).

Conclusions: RA-MAC is a reasonable alternative to GA for the repair of open-globe injuries in selected adult patients. RA-MAC was selected more often for zone 1 and zone 2 injuries. For eyes with zone 3 injuries, there are equal selection ratio for RA-MAC and GA. *Ophthalmology Retina 2016;■:1–4 © 2016 by the American Academy of Ophthalmology*

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Open-globe injuries are among the more challenging emergent conditions that ophthalmologists encounter. General anesthesia (GA) has been conventionally preferred for primary closure because of the concern of extrusion of intraocular contents from the displacement of volume caused by regional anesthesia (peribulbar or retrobulbar block) with monitored anesthesia care (RA-MAC) in the fixed space of the orbit.[1] However, the emergent nature of the treatment of these injuries may preclude the use of GA.[2] Conversely, there are a number of factors associated with the use of GA that can likewise cause increases in intraocular pressure. These include direct pressure on the globe during manual ventilation, rapid sequence induction on patients without empty stomach,[3,4] laryngoscopy, and placement of an endotracheal tube,[5] as well as coughing, bucking on the endotracheal tube, emesis, or Valsalva retinopathy. For these reasons, controversy exists regarding the preferred modality of anesthesia.[6–8] A review of the current literature revealed few reports of using RA-MAC compared with the traditional GA for open-globe injuries.

The current study compares the clinical features and outcomes in a large series of patients with open-globe injuries repaired under RA-MAC vs. GA in eyes that did not undergo enucleation at time of primary closure for open-globe injury.

Methods

The current study is a nonrandomized, comparative, retrospective case series. A search identifying all cases of open-globe injury between January1, 2004 and December 31, 2014 (11 years) was

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Table 1. Demographics, Wound Characteristics, and Visual Outcomes of Patients with Open-Globe Injury Who Did Not Undergo Enucleation at Time of Primary Closure for Open-Globe Injury, 2004–2014

	Regional Anesthesia	General Anesthesia
Number of patients, n/N (%)	351/448 (78)	97/448 (22)
Average age, yrs (range)	51.8±22.2 (18–98)	49.3±20.3 (18–95)
Male : Female	244:107	69:28
Average wound length, millimeters	7.0±5.6 (n = 351)	11.9±6.6 (n = 97)
Zone of injury* (N = 448)	(n = 351)	(n = 97)
Zone 1: 241/448 eyes	213/351 (61%)	28/97 (29%)
Zone 2: 135/448 eyes	104/351 (30%)	31/97 (32%)
Zone 3: 72/448 eyes	34/351 (10%)	38/97 (39%)
Mean final visual acuity (N = 290)		
(Included VA of patients with ≥2 mos follow-up)		
≥20/400 (n/N = 173/290), number (%)	155/173 (90)	18/173 (10)
<20/400 (n/N = 117/290), number (%)	84/117 (72)	33/117 (28)
Follow-up, mos	12.7±18.9 (n = 307)	8.5±14.2 (n = 82)

VA = visual acuity.
*The injury zones are defined as follows: zone 1, cornea and limbus; zone 2, <5 millimeters posterior to the limbus; zone 3, >5 millimeters posterior to the limbus.

performed within a computerized database at the Bascom Palmer Eye Institute. Medical records, including clinical and operative notes, were reviewed in retrospect. This study protocol was approved by the institutional review board of the University of Miami Miller School of Medicine, Miami, Florida, and was compliant with the Health Insurance Portability and Accountability Act. All patients gave informed consent for treatment, and the study protocol adhered to declaration of Helsinki requirements.

Inclusion criteria were a diagnosis consistent with an open-globe injury (from the operative report) and one of the following codes from the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM): 360.5—retained intraocular foreign body magnetic, 360.6—retained intraocular foreign body nonmagnetic, 871—open wound of eyeball, 918.1—injury of cornea. Patients younger than 18 years and those receiving primary enucleation were excluded from the study. Such exclusions were made because of the necessity of GA in the pediatric population and the inherent lack of postoperative visual acuity in those treated with primary enucleation. Patients with closure of open-globe injuries prior to referral were not included in the current study.

Demographics of age and gender were obtained for each patient. Open-globe injuries were characterized by the type (blunt rupture, sharp laceration, retained intraocular foreign body, perforation, or mixed mechanism), location (zone 1, cornea and limbus; zone 2, ≤5 millimeters posterior to the limbus; or zone 3, >5 millimeters posterior to the limbus), and length of wound,[9] as well as the initial presenting visual acuity. Operative data obtained included the classification of anesthesia used and the duration of the procedure performed, from the initial incision to the completion of closure. Postoperative data included months of clinical follow-up and final visual acuity. Final visual acuity data was not recorded for patients with <2 months of follow-up.

Regional anesthesia was accomplished with a peribulbar or retrobulbar block of a 1:1 mixture of 0.75% bupivacaine and 2% to 4% lidocaine with ≤75 units of hyaluronidase. This was administered preoperatively in the holding area just before the patient was taken into the operating room. Volumes were variable, starting with a minimal peribulbar injection and supplementing with additional volumes until satisfactory anesthesia was achieved. All uses of regional anesthesia were accompanied by monitored anesthesia care with intravenous conscious sedation administered by the anesthesia staff. In accordance with the patient's needs, selected cases received a supplemental block that was administered during the surgical procedure with a blunt cannula after conjunctival peritomy.

Visual acuity was converted to logMAR values for data analysis. Visual acuities recorded as counting fingers, hand motions, light perception, and no light perception were converted to logMAR values of 2, 2.3, 3, and 3.2, respectively, for the purposes of statistical analysis. Statistical analysis was performed to compare each of the observed variables between patients who received RA-MAC and those who received GA. The *t* test was used for continuous variables, and the chi-square test was used for categorical variables.

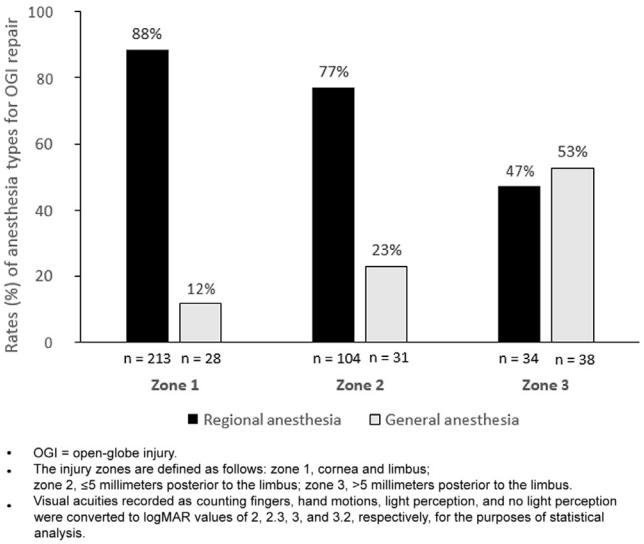

Figure 1. Frequency of regional anesthesia (peribulbar or retrobulbar block) with monitored anesthesia care vs. general anesthesia use by zone of injury, 2004–2014. Regional anesthesia was the preferred anesthesia type for zone 1 injuries (88% vs. 12%) and zone 2 injuries (77% vs. 23%), but both anesthesia types (regional and general anesthesia) were used equally in zone 3 injury (47% vs. 53%).