Validation of the Retinal Detachment after Open Globe Injury (RD-OGI) Score as an Effective Tool for Predicting Retinal Detachment

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Purpose: The Retinal Detachment after Open Globe Injury (RD-OGI) Score is a clinical prediction model that was developed at the Massachusetts Eye and Ear Infirmary to predict the risk of retinal detachment (RD) after open globe injury (OGI). This study sought to validate the RD-OGI Score in an independent cohort of patients.

Design: Retrospective cohort study.

Participants: The predictive value of the RD-OGI Score was evaluated by comparing the original RD-OGI Scores of 893 eyes with OGI that presented between 1999 and 2011 (the derivation cohort) with 184 eyes with OGI that presented from January 1, 2012, to January 31, 2014 (the validation cohort).

Methods: Three risk classes (low, moderate, and high) were created and logistic regression was undertaken to evaluate the optimal predictive value of the RD-OGI Score. A Kaplan–Meier survival analysis evaluated survival experience between the risk classes.

Main Outcome Measures: Time to RD.

Results: At 1 year after OGI, 255 eyes (29%) in the derivation cohort and 66 eyes (36%) in the validation cohort were diagnosed with an RD. At 1 year, the low risk class (RD-OGI Scores 0–2) had a 3% detachment rate in the derivation cohort and a 0% detachment rate in the validation cohort, the moderate risk class (RD-OGI Scores 2.5–4.5) had a 29% detachment rate in the derivation cohort and a 35% detachment rate in the validation cohort, and the high risk class (RD-OGI scores 5–7.5) had a 73% detachment rate in the derivation cohort and an 86% detachment rate in the validation cohort. Regression modeling revealed the RD-OGI to be highly discriminative, especially 30 days after injury, with an area under the receiver operating characteristic curve of 0.939 in the validation cohort. Survival experience was significantly different depending upon the risk class ($P < 0.0001$, log-rank chi-square).

Conclusions: The RD-OGI Score can reliably predict the future risk of developing an RD based on clinical variables that are present at the time of the initial evaluation after OGI. *Ophthalmology 2017;■:1–5 © 2017 by the American Academy of Ophthalmology*

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Open globe injury (OGI) is a common cause of severe vision loss, with more than 200 000 cases occurring worldwide every year.[1,2] The visual prognosis of an OGI depends on several factors, and many studies have shown that retinal detachment (RD) is associated with a poor visual outcome.[3–5] Recently, Stryjewski et al[5] demonstrated that nearly one-third of eyes with an OGI will develop an RD. Furthermore, through the use of a simple predictive tool, termed the Retinal Detachment after Open Globe Injury (RD-OGI) Score, the risk of having an RD can be easily quantified by the ophthalmologist at the time of initial evaluation.[5] The most widely used predictive model in ocular trauma is the validated Ocular Trauma Score, which predicts final visual potential after OGI.[6] However, because the presence of RD is an input into the Ocular Trauma Score, a separate model is still needed to estimate the risk of RD itself, a role the RD-OGI Score can fulfill. The ability to reliably predict the likelihood of a patient developing an RD after OGI has implications for expectation setting, counseling, follow-up, and surgical planning. The RD-OGI Score is composed of 3 variables: presenting visual acuity (VA), zone of injury, and presence or absence of vitreous hemorrhage (VH).

The purpose of this study was to validate the RD-OGI Score in an independent cohort of patients, as well as to make recommendations on how the RD-OGI Score can be used in clinical decision making, in research, and in the counseling of eye trauma patients regarding the likelihood of RD development.

Methods

A retrospective review of 231 patients with an OGI who presented to the Eye Trauma Service of the Massachusetts Eye and Ear Infirmary (MEEI) from January 1, 2012, to January 31, 2014, was conducted. Data were abstracted from patients for a 12-month follow-up period. The study period of 1 year was chosen based on prior findings that 95% of post-OGI RDs occur within 1 year after the initial injury.[5]

Data Collection

Demographic and clinical data from these charts were entered into a database. Variables abstracted included age at presentation, gender, date of injury, and the following initial clinical findings: VA at presentation, zone of injury, and presence of VH. A zone I injury is isolated to the cornea (including the limbus), a zone II injury involves the sclera no more than 5 mm posterior to the limbus, and a zone III injury involves the sclera more than 5 mm posterior to the limbus.[7] In addition, date of RD diagnosis and the last date of follow-up were recorded. Those patients who did not develop RD were censored at the last follow-up date or 365 days after initial presentation, whichever occurred first.

Participants

Participants were excluded if they had severe vision impairment at baseline before their injury, had a bilateral injury, had an insufficient work-up where an RD could not be reliably excluded, or had a history of scleral buckle, given the controversial role of scleral buckling for prevention of RD after OGI. Finally, patients lost to follow-up within 7 days and patients missing any component of the RD-OGI data (VA, zone, or VH) from their record were excluded, as well.

Derivation Cohort

The RD-OGI Score was initially created from a series of 893 eyes with an OGI in patients who had presented to the MEEI between 1999 and 2011, and 255 of these eyes developed an RD during the follow-up period (29% at 1 year). Details of these cases were previously reported.[5] The validation cohort examined in this study was compared with this benchmark group.

Statistical Analysis

To evaluate the optimal predictive value of the RD-OGI, unconditional logistic regression was undertaken. The receiver operating characteristic (ROC) curves and area under the curve (AUC) were the main considerations for model fit. The AUC is a measure of overall predictive discrimination, defined as the ability to separate those patients who had an RD from those who did not. An ROC curve area of 0.5 indicates no discrimination, and an ROC curve area of 1.0 indicates perfect discrimination. The time period of the model with the highest AUC was selected as the time period for which the RD-OGI Score is the best predictor ("optimal time period"). Additionally, the sensitivity, specificity, positive predictive value, and negative predictive value were calculated for each RD-OGI Score cut point at the optimal time period. Distribution of patients at each score level was analyzed and the risk of RD development was assessed per each score individually at days 30, 90, 180, and 365. RD-OGI Scores were then classified into 3 classes: low risk, moderate risk, and high risk of RD. Kaplan—Meier survival analysis for time to RD was plotted for the entire sample and also was stratified by risk classification using the 90-day end point. A log-rank test was used to test differences in survival experience between risk classes. Alpha was set at 0.05. All statistical analyses were performed using R^2. The pROC[3] library was used to generate ROC curves, and the survival library was used to generate Kaplan—Meier plots. This study was approved by the Institutional Review Board for the Protection of Human Subjects at MEEI.

Results

Of 231 patients who presented to the MEEI from January 2012 to January 2014 with an OGI, a total of 184 (80%) had data that met the inclusion criteria and were analyzed as the validation cohort.

Table 1. Characteristics of Patients Presenting with Open Globe Injury (Derivation and Validation Cohorts)

		Derivation Cohort		Validation Cohort	
Finding at Presentation	**RD-OGI Points**	*Eyes That Did Not Develop Retinal Detachment (N = 638)*	*Eyes That Developed Retinal Detachment (N = 255)*	*Eyes That Did Not Develop Retinal Detachment (N = 118)*	*Eyes That Developed Retinal Detachment (N = 66)*
Men	—	509 (80)	198 (78)	91 (77)	53 (80)
Age (yrs), mean (standard deviation)	—	38 (23)	46 (23)	41 (21)	48 (23)
Vision better than count fingers	0	303 (47)	8 (3)	72 (61)	0 (0)
Count fingers	1	62 (10)	9 (4)	13 (11)	5 (8)
Hand motion	2	117 (18)	62 (24)	18 (15)	14 (21)
Light perception	2.5	98 (15)	129 (51)	13 (11)	32 (49)
No light perception	3.5	9 (1)	33 (13)	2 (2)	15 (22)
Visual acuity missing	—	49 (8)	14 (5)	0 (0)	0 (0)
Zone I (highest)	0	309 (48)	31 (12)	66 (56)	7 (11)
Zone II (highest)	0.5	193 (30)	80 (31)	43 (36)	20 (30)
Zone III (highest)	2	83 (13)	125 (49)	9 (8)	39 (59)
Zone missing	—	53 (8)	19 (7)	0 (0)	0 (0)
No vitreous hemorrhage	0	433 (68)	38 (15)	82 (69)	9 (14)
Vitreous hemorrhage	2	205 (32)	217 (85)	36 (31)	57 (86)
Vitreous hemorrhage missing	—	0 (0)	0 (0)	0 (0)	0 (0)

RD-OGI = retinal detachment after open globe injury.
Results are n (%), unless specified.