

The retinal detachment open globe injury score is highly effective in prediction of retinal detachment after open globe injury

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ABSTRACT

Purpose: The purpose of this study is to determine the validity of the retinal detachment open globe injury (RD-OGI) Score in the prediction of RD development after OGI as well as to make recommendations on how to use the RD-OGI Score for clinical decision-making, research and counselling eye trauma patients regarding likelihood of RD development.

Design: Cohort study.

Participants: 231 patients who presented to Eye Trauma Service of the Western Eye Hospital (London,UK), King's College Hospital (London,UK) and Massachusetts Eye and Ear Infirmary (Boston,USA) from 1 January 2012 to 31 January 2014 with open globe injury.

Methods: A validation cohort was established by retrospectively reviewing the outcomes of 231 open globe injuries. The unconditional logistic regression was undertaken to evaluate optimal predictive value of RD-OGI Score. The sensitivity, the specificity, positive predictive value (PPV),

negative predictive value (NPV) and probability of RD development were assessed for each RD-OGI Score cut point. RD-OGI Scores were stratified into three risk classes: Low Risk, Moderate Risk, and High Risk of RD development. Kaplan-Meier survival analysis for time to RD was plotted. A log-rank test was used to test differences in survival experience between risk classes.

Main Outcome Measure: Progression to retinal detachment.

Results: A total of 66 eyes were ultimately diagnosed with RD after open globe trauma in the validation cohort at 365 days. Regression modelling indicated that RD-OGI Score performs the best in predicting RD for the 30-day follow-up time point (AUC=0.939, AIC=108.8). However, this Score also performed extremely well at every other time point. The Low Risk Class was designated to be RD-OGI Score 0-1.5 and none of the patients developed RD in Low Risk Class over 365 days. Moderate Risk Class was designated as RD-OGI Scores 2.0 through 4.0 with probability of RD of 11-20% at all time points, and High Risk Class at scores 4.5 through 7.5 with probability 66-78% at all time points. Survival experience was statistically significantly different depending upon the risk stratification (Log-rank chi-square = 110 on 2 degrees of freedom, $p = 0.0000$).

Conclusions: The RD-OGI score can reliably predict the future development of detachment based on clinical variables that are seen at the time of initial presentation after traumatic injury. The Score can be stratified into three risk classes: Low, Moderate and High with different probabilities of RD development, RD prevalence and survival experiences among classes.

Key words: retinal detachment, open globe injury, RD-OGI score.

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Despite advances in vitreoretinal surgery, open globe injury (OGI) still remains a common cause of visual loss with more than 200 000 such injuries occurring each year worldwide¹ and 3.81 per 100,000 people in the United States². Prognosis of an OGI depends on several factors, and many studies have shown that retinal detachment (RD) is associated with especially poor visual outcome³⁻⁵. Roughly, every third patient with OGI will subsequently develop retinal detachment (RD), with 27% retinas detached within 24 hours 47% detached within 1 week, and 72% detached within 1 month of primary open globe repair⁵.

The heterogeneity of the injuries of ocular trauma makes it difficult to interpret the results with respect to prediction and prevention of further complications. Stryjewski et al.⁵ described the Retinal Detachment after Open Globe Injury (RD-OGI) Score, a simplified categorical system for standardized assessment of development of retinal detachment after OGI. The score is composed of 3 variables assessed at the time of presentation: visual acuity (VA), zone of injury and presence or absence of vitreous haemorrhage (VH).

The purpose of this study is to determine the validity of RD-OGI Score in the prediction of RD development after OGI as well as to make recommendations on how to use the RD-OGI Score for clinical decision-making, research and counselling eye trauma patients regarding likelihood of RD development.

METHODS

A retrospective review of 231 charts of patients that presented to the Eye Trauma Service of the Western Eye Hospital (London,UK), King's College Hospital (London,UK) and Massachusetts Eye and Ear Infirmary (MEEI) from 1 January 2012 to 31 January 2014 with open globe trauma was conducted. Data were abstracted for patients for a 12-month period (e.g. data from patients from presenting in January 2012 were recorded through December 2012) except for patients who presented to clinic between August 2013 and January 2014, whose data were included in the study up to July 2014. The study period of 1-year was established based on literature that demonstrates 95% of post-trauma RD occurs within one year after OGI⁵ and 97% of patients that develop RD within 1 year after OGI are identified within 6 months (unpublished data).

DATA COLLECTED

Demographic and clinical data from these charts were abstracted entered into a database (Medisoft in UK centres) in Microsoft Excel. Variables abstracted included age at presentation, sex, date of injury, and the following initial clinical

findings: VA at presentation, zone of injury, presence of VH. How these were assessed clinically has been published elsewhere⁵. In addition, date of RD diagnosis was recorded if RD took place during the study period. Dates and indications for secondary surgery and last date of follow-up were also recorded. Cases of RD were clinically followed after RD diagnosis, but since RD was the endpoint in this analysis, the time after RD was not included as follow-up in this study. Those who did not develop RD were censored at last follow-up date or at 365 days post-presentation, whichever was earlier.

PARTICIPANTS

Participants were excluded from the analysis if they met certain exclusion criteria. Patients who were blind before OGI (as defined as NLP before injury, complicated past ocular history and ocular comorbidities) were not included in the analysis. Patients suffering bilateral injury were also excluded from the analysis due to incomparability with the rest of the sample, as were patients with very severe eye damage (workup not pursued). Patients with current scleral buckle were excluded because they may have a different level of risk for RD. In addition, patients who could not be assessed for the components of the RD-OGI (e.g., due to dementia, some paediatric patients) were also excluded. Finally, patients lost to follow-up within 7 days, and patients missing any component of the RD-OGI (VA, zone, or VH) from their record were excluded from the analysis.

STATISTICAL ANALYSIS

The RD-OGI Score was calculated for all patients meeting criteria; those missing any component of the RD-OGI were removed from the dataset. Descriptive statistics about the components of the RD-OGI and of other variables were considered. Baseline characteristics of original and validation cohorts were compared. For survival analysis, an optimal time period needed to be selected. To choose the optimal time period, predictive value of the RD-OGI at the several time points was compared, and the time point where the RD-OGI was most accurate at prediction of RD development was selected.

Typical time points for follow-up appointments who sustained OGI are: post-operation day 1 (POD1), post-operation week 1 (POW1), POW3, POW6, post-operation month 1 (POM1), POM3, POM6 and POM12. For logistic regression modelling, the following time points were chosen that closely correspond with some of the above-mentioned follow-up time points: 30 days post-presentation (corresponding closely with POM1), 60 days, 90 days (corresponding with POM3), 120 days, 180 days (corresponding with POM6), and 365 days post-presentation (corresponding with POM12). Because primary globe repair typically occurred

within hours of the patients presenting to the hospital, the time to diagnosis calculations remained virtually unchanged if “time of presentation” or “time of globe repair” was chosen as the starting time.

In order to evaluate the optimal predictive value of the RD-OGI, unconditional logistic regression was undertaken and the predictive value at several time points was compared with the following equation:

where p is the proportion of patients with RD by the end of the time period and x as the RDOGI score.

Receiver-operator curves (ROC) and area under the curves (AUC) were the main considerations for model fit. The area under the ROC curve is a measure of overall predictive discrimination, which is defined in this study as the ability to separate those patients who had RD from those that 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 RD-OGI Score is the best predictor (“optimal time period”). Next, the sensitivity, the specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated for each RD-OGI Score cut point at the optimal time period. Sensitivity is proportion of actual positive cases correctly identified by test while specificity measures proportion of negatives correctly identified as such. Perfect predictor would be 100% sensitive and 100% specific. Distribution of patients at each score level was analyzed and probability for RD development was assessed per each score individually at day 30, 90, 180 and 365. RD-OGI Scores were then classified into three classes: Low Risk, Moderate Risk, and High Risk of RD. Selection of cut points for risk stratification was made considering sensitivity, specificity, probability of RD development in each class, RD prevalence as well as clinical considerations.

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 endpoint. A 90-day window for the plot was chosen because nearly all cases of RD occurred within 90 days of trauma and day 90 corresponds to a follow-up time point 3 months after globe repair (POM3). 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 R2. The pROC3 library was used to generate ROC curves, and the survival library was used to generate Kaplan-Meier plots.

RESULTS

Of 231 patients who presented to the Western Eye Hospital, King's College Hospital and MEEI from January 2012 to January 2014 with open globe trauma, a total of 184 (80%) had data that met criteria and were included in the analysis. Demographic characteristics are presented in Table 1. Of all patients analyzed, 78% were men and 22 % were women; mean age was 44.3 years (\pm SD 22.6 years). Patient diagnosed with RD were on average older (mean age 48.9 vs 41.7). Mean follow-up time for all participants was 124.8 days (\pm SD 128.8 days, see Table 1); mean follow-up for patients who developed RD was 17.0 days (\pm SD 23.7 days), and for those who did not develop RD, mean follow-up time was 185.0 days (\pm SD 124.0). Since the outcome in our study was RD, follow-up time for subjects diagnosed with RD was not included in this analysis for the period after they were diagnosed, which explains shorter follow-up interval in this group reported in Table 1.

Table 1. Demographic Characteristics of Population

Variable	All patients	No RD	RD
All (n, %)	184 (100%)	118 (64%)	66 (36%)
Men (n, %)	144 (78%)	91 (77%)	53 (80%)
Women (n, %)	40 (22%)	27 (23%)	13 (20%)
Age, years (mean, SD)	44.3 (22.6)	41.7 (21.7)	48.9 (23.5)
Mean time (days) to RD or follow-up (mean, SD)	124.8 (128.8)	185 (124)	17 (23.7)

RD-OGI Score gives points based on the three clinical findings observed at the time of initial presentation: VA, zone of injury, and presence or absence of VH (see Table 2). The score 0 is associated with VA better than Count Finger (CF), Zone I of injury and absence of VH. Vision of CF gives 1 point, Hand Motion (HM) 2 points, Light Perception (LP) 2.5 point and No Light Perception (NLP) 3.5 point. Zone II gives 0.5 point and Zone III, 2 points. If VH is present, 2 points are counted. The lowest possible score, 0, is when there is no VH, Zone I of injury and VA better than CF; the highest possible score is 7.5: NLP vision, Zone III injury, and presence of VH. Components of the RD-OGI Score as well as baseline characteristics of validation and original cohorts are also presented in Table 2. Additionally, Table 2 shows the prevalence of particular components of the RD-OGI Score in the original and validation cohorts. It is notable that in terms of these components, the original and validation cohorts are very comparable, suggesting that the validation cohort is appropriate for this study.

Table 2. Components of RD-OGI Risk Score and Baseline Characteristics of Original and Validation Cohorts.

RD-OGI Scoring		Validation cohort			Original Cohort
Finding on presentation	RD-OGI points	No RD, n (%)	RD, n (%)	Total, n (%)	Total, n (%)
≥20/40 and <20/200	0.0	72 (100%)	0 (0%)	72 (39%)	311 (35%)
Count Fingers	1.0	13 (72%)	5 (28%)	18 (10%)	71 (8%)
Hand Motion	2.0	18 (56%)	14 (44%)	32 (17%)	179 (20%)
Light Perception	2.5	13 (29%)	32 (71%)	45 (24%)	227 (25%)
No Light Perception	3.5	2 (12%)	15 (88%)	17 (9%)	42 (5%)
VA Missing	NA	0 (0%)	0 (0%)	0 (0%)	63 (7%)
Zone I	0.0	66 (90%)	7 (10%)	73 (40%)	340 (38%)
Zone II	0.5	43 (68%)	20 (32%)	63 (34%)	273 (31%)
Zone III	2.0	9 (19%)	39 (81%)	48 (26%)	208 (23%)
Zone Missing	NA	0 (0%)	0 (0%)	0 (0%)	72 (8%)
Vitreous Hemorrhage	0.0	82 (90%)	9 (10%)	91 (49%)	422 (47%)
No Vitreous Hemorrhage	2.0	36 (39%)	57 (61%)	93 (51%)	471 (53%)
VH Missing	NA	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Additional characteristics of validation cohort are also presented in Table 2. At presentation, patients who developed RD were more likely to have poorer VA (LP or NLP), less likely to have VA ≥20/40, more likely to have higher Zone of injury (Zone III) or VH present when compared to patients who did not develop RD. Those observations are in agreement with observations from original cohort.

Although the validation cohort was followed up to a year, RD usually occurred within several weeks after the injury. In fact, the longest time to RD in our cohort was 133 days. The results of logistic regression models comparing different time points are provided in Table 3. Regression modelling indicated that RD-OGI Score performs the best in predicting RD for the 30-day follow-up time point (AUC=0.939, AIC=108.8). However, this Score also performed extremely well at every other time point up to 365 days with minimal differences in AUC (60-day AUC=0.936, 90-day AUC=0.935, 120-day AUC=0.935, 180-day AUC=0.935 and 360-day AUC=0.935). Of note, since no RD occurred in validation cohort after 133 day, outcomes for the 180- and 365-day models in this study are identical.

The ROC curve for the model for the 30-day follow-up time point is presented in Figure 1.

Table 3. Unconditional Logistic Regression Models at Different Time Points.

Period of Analysis	Intercept	Estimate	SE	p-value	Null Deviance	Residual Deviance	Deviance Difference Chi-sq*	AIC	AUC
30-day	-6.06	1.21	0.20	<0.001	221	105	0.000	108.8	0.939
60-day	-5.12	1.12	0.17	<0.001	235	113	0.000	117.1	0.936
90-day	-4.96	1.11	0.17	<0.001	238	114	0.000	118.3	0.935
120-day	-4.92	1.11	0.17	<0.001	239	114	0.000	118.1	0.935
180 or 365-day	-4.88	1.12	0.17	<0.001	240	114	0.000	117.9	0.935

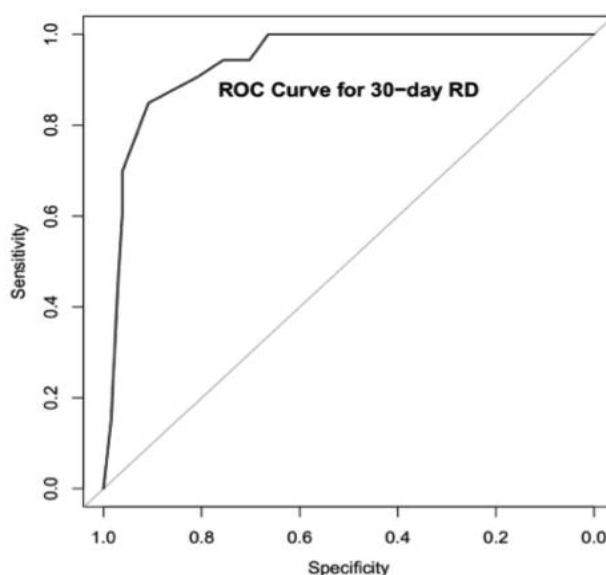


Figure 1: ROC Curve for 30-days Follow-up Time Point (AUC=0.939).

RD-OGI Score was calculated individually for each patient, and since the RD-OGI Score predicts RD the best at 30 days, sensitivity, specificity, PPV and NPV were calculated for each RD-OGI Score level at 30 days (see Table 4). Sensitivity, specificity, PPV and NPV were also calculated for other time points, but because they demonstrated very minimal differences compared to 30-day calculations, they are not included. Number and percentage of patients per each score level is provided. Table 4 shows also the Risk Score Class stratification. Table 5 shows number of patients (n) and probability (%) of RD development at particular time point of 30, 90 and 365 day per each score level and per Score Class. The Low Risk Class was designated to be RD-

OGI Score 0-1.5. This is because all patients in this class did not develop RD and because of high sensitivity (100%) and high accuracy since NPV, ability to correctly identify population not at risk, was noted to be 100%. It is true that all patients scoring exactly 2.0 in RD-OGI also did not develop RD in our cohort, but because a patient can get a score of 2.0 simply from having VH (see Table 2), the score of 2.0 was not included in Low Risk, because VH itself is a strong risk factor for RD.

Moderate Risk class was designated as RD-OGI Scores 2.0 through 4.0, and High Risk was designated 4.5 through 7.5. The cut point for High Risk was set at 4.5 because this yielded a high prevalence of RD and high probability of getting RD at all time points (66% - 78%, see Table 5), while keeping the prevalence and probability of getting RD in the Moderate Risk Class much lower (11% to 20%). Additionally cut point 4.5 yielded relatively high specificity (91%) and sensitivity (81%). PPV in High Risk Class was noted to be 66-88% depending on score level. At 30-day, 9% of all patients who developed RD were classified in Moderate Risk Class and 91% in High Risk Class, at 365-day 15% and 85% respectively. Interestingly, all patients that developed RD after 365 days were identified and RD-OGI Scores were calculated; all those patients were identified as Moderate or High Risks Class on initial presentation (ongoing project).

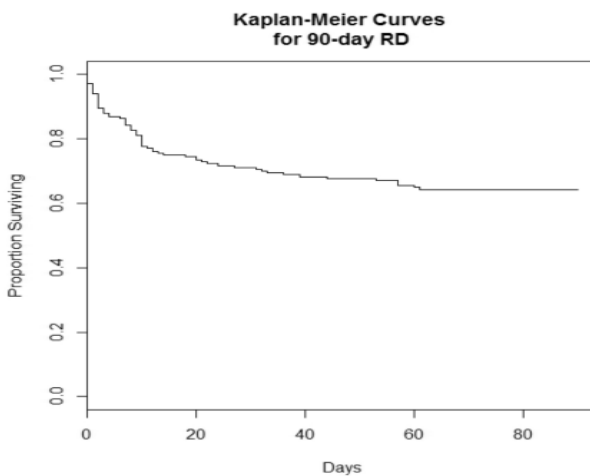
Table 4. Sensitivity, Specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) for each Score Level at 30 days. Score Classes of Low, Moderate and High Risk for RD Development after OGI.

Risk Class (RD-OGI Score Range)	RD-OGI Score	Patients per score, n (%)	Sensitivity	Specificity	PPV	NPV
Low Risk (0-1.5)	0.0	0	NA	NA	NA	NA
	0.5	0	100%	32%	37%	100%
	1.0	0	100%	45%	42%	100%
	1.5	0	100%	50%	45%	100%
Moderate Risk (2-4)	2.0	0	100%	50%	45%	100%
	2.5	0	100%	60%	50%	100%
	3.0	0	100%	50%	45%	100%
	3.5	0	94%	70%	56%	97%
	4.0	0	94%	76%	61%	97%
High Risk (4.5-7.5)	4.5	9	91%	81%	66%	95%
	5.0	11	85%	91%	79%	94%
	5.5	48	70%	96%	88%	89%
	6.0	55	60%	96%	86%	86%
	6.5	57	47%	97%	86%	89%
	7.0	57	15%	98%	80%	74%
	7.5	57	15%	98%	80%	74%

Table 5. Score Classes of Low, Moderate and High Risk for RD development after OGI at particular time points; number of patients (n), and probability of RD development (%) per score level and Score Class included.

Risk Class (RD-OGI Score Range)	RD-OGI Score	30-day n (%)	90-day n (%)	365-day n (%)	30-day n (%)	90-day n (%)	365-day n (%)
Low Risk (0-1.5)	0.0	0	0	0	0 (0%)	0 (0%)	0 (0%)
	0.5	0	0	0	0 (0%)	0 (0%)	0 (0%)
	1.0	0	0	0	0 (0%)	0 (0%)	0 (0%)
	1.5	0	0	0	0 (0%)	0 (0%)	0 (0%)
Moderate Risk (2-4)	2.0	0	0	0	0 (0%)	0 (0%)	0 (0%)
	2.5	0	0	0	0 (0%)	1 (13%)	1 (13%)
	3.0	5	9	9	3 (38%)	3 (38%)	3 (38%)
	3.5	0	0	0	0 (0%)	2 (29%)	2 (29%)
	4.0	2	2	2	2 (22%)	3 (33%)	3 (33%)
High Risk (4.5-7.5)	4.5	3	8	8	3 (19%)	6 (38%)	8 (50%)
	5.0	8	11	11	8 (53%)	11 (73%)	11 (73%)
	5.5	48	55	57	5 (100%)	5 (100%)	5 (100%)
	6.0	55	57	57	7 (88%)	8 (100%)	8 (100%)
	6.5	57	57	57	17 (89%)	17 (89%)	17 (89%)
	7.0	57	57	57	8 (80%)	8 (80%)	8 (80%)
	7.5	57	57	57	8 (80%)	8 (80%)	8 (80%)

Since one of follow-up time points at our clinic is 3 months after surgery (POM3) and majority of the patients who developed RD were diagnosed within 3 months after injury, Kaplan-Meier survival curves are presented for 90 days after ocular trauma (see Figure 2). Figure 2a shows the survival curve for the entire cohort, while Figure 2b shows the different survival experience by Risk Class stratification. Importantly, survival experience was statistically significantly different depending upon risk stratification into Low, Moderate and High Risk Class (Log-rank chi-square = 110 on 2 degrees of freedom, p = 0.0000).



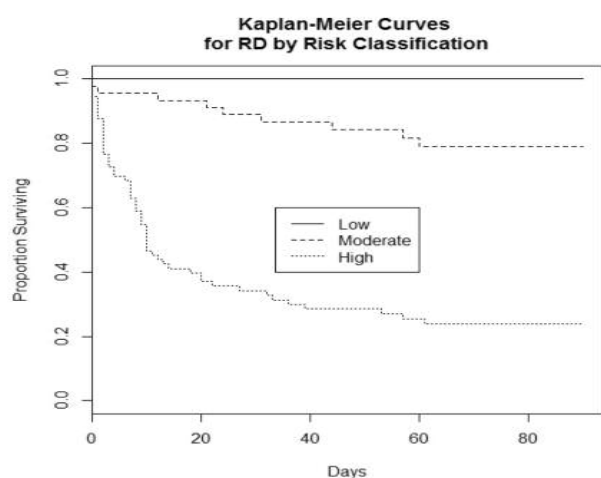


Figure 2: Kaplan-Meier Curve for 90 Days (2a) – Entire cohort and (2b) – stratified by Risk Classes: Low Risk, Moderate Risk and High Risk Class

DISCUSSION

The RD-OGI Score is valid for predicting RD development after OGI in a cohort of patients presenting to the Western Eye Hospital, King's College Hospital and Massachusetts Eye and Ear Infirmary. RD-OGI Score also can be a useful addition to other clinical information to guide decision-making and counselling eye trauma patients, and lends itself to future research.

Clinical options are available for ocular trauma patient, but under which circumstances to recommend procedures is left to clinical judgment. The significant differences that occur with each individual injury make it very difficult to independently assess potential risk factors or treatment variances for functional and anatomic outcome. Severe ocular trauma with open-globe injury remains a significant cause of blindness in the United States and worldwide, and RD has been identified as strong risk factor for poor visual outcomes after OGI⁶⁻⁹. Roughly every third patient with OGI will subsequently develop retinal detachment (RD)^{5,10}, but the challenge is to correctly identify population at high risk at the time of the initial presentation. These features of OGI and RD make it critically important for patients and ophthalmologists to have a risk assessment as early as possible reliable regarding the expected outcome of serious eye injury and the possibility of RD development.

Our team validated a simple and practical tool to predict development of RD after OGI. The model includes zone of injury, visual acuity and presence of VH as significant variables assessed by general ophthalmologist at or soon after

the initial presentation. The use of our score in the emergency room provides the clinician with quick and reliable predictor of outcome very soon after the patient's arrival, based on readily available clinical data.

In our study, we evaluated various time points from presentation to RD in order to establish the time point of the strongest predictive value of the RD-OGI Score. We found that the RD-OGI Score predicts RD development the best at 30 days after OGI; however, it predicts it exceptionally well at every other examined time point up to 365 days (with no difference between 180 days and 365 days). In a practical sense, that suggests our score can predict RD reasonably well at any future time point based on only initial presentation. Additionally, future prospective clinical trials of a preventive RD intervention after OGI could use the RD-OGI Score as inclusion criteria, and our analysis suggests that a follow-up time of 30 days would be sufficient to evaluate the effectiveness of the intervention.

The risk score provides a simple method to stratify a patient's risk of RD development at the time of initial hospital presentation into three Risk Classes: Low, Moderate, and High. The Low Risk Class, 0 through 1.5, had 36% of the patients, and excluded development of RD within 1 year with 100% certainty. Roughly 24% of patients were classified into Moderate Risk Class, which included scores 2 through 4, and 20% of these patients developed RD over the follow-up period. Finally, 39% of all patients were classified into High Risk Class, which were scores 4.5 and higher, and 86% of these patients developed RD. The relatively low rate of RD in the Moderate Risk Class compared to the relatively high rate in the High Risk Class suggests that there is the potential for much clinical and research utility in this predictive measure.

From a clinical standpoint, a reliable stratification of a patient's risk of future RD allows early triage, and provides healthcare workers at initial presentation, the most important time point for critical decision-making, with valuable predictive information. For example, patients in the Low Risk Class would be considered good candidates for continuing currently implemented clinical management and follow-up schedules. In clinically managing the two other Risk Classes, Moderate and High Risk, benefit may be seen from implementing accelerated follow-up appointments. If a clinical appointment is not possible, a phone call inquiring about any symptoms of RD could be a less labor-intensive alternative.

A reasonable question would be when in the course of clinical management these accelerated follow-up appointments should take place. Based on our subgroup analysis, we would propose to add additional follow-up appointments at the following times: (1) between POD2-7, (2) between POW1-3, (3) at POM1 and (4) at POM2 for High Risk

Class. It may also be beneficial to apply accelerated follow-up to the Moderate Risk Class if possible for a particular clinic. We recommend these time points because post-hoc subgroup analysis showed that 5 (9%) High Risk Class patients developed RD in the time interval of 3 to 5 days after injury; 11 (19%) developed RD at between 10 and 18 days after surgery; 4 (7%) developed RD 26 to 36 days after surgery; and 3 (5%) developed RD 51 to 75 days after surgery. This pattern was also similar for Moderate Risk Class, where 1 patient (11%) developed RD around POM1, and 2 (22%) patients developed RD around POM2.

The current literature regarding prevention of RD after OGI does not provide sufficient information to strongly support prophylactic treatment (reviewed in^{11,12}). The lack of definitive guidelines relates to the marked variability from patient to patient and injury to injury. Some reports suggest that some patients may benefit from primary or secondary scleral buckle placement or early or delayed vitrectomy^{8,13,14}. Given the large number of patients at risk of visual impairment due to ocular trauma, a randomised clinical trial is warranted to more definitively answer these question. Patients with eyes scoring in the High Risk Class are at high risk for RD and should be prioritized for such studies. Prospective randomized trials of treatment for patients with eyes with a high risk of later detachment should offer the appropriate patients the best opportunity for retinal salvage. There is also the possibility that more aggressive surgical intervention to save the eyeball, or adjuvant treatment with 5-fluorouracil and heparin, might contribute to a better outcome for patients who are felt to be higher risk.

Proper patient counselling is critical in helping the patients to make informed treatment decisions, and also in relieving their anxiety. Our score would provide information to patients and their families about the expected outcome. This can enhance the patient's the ability to understand the situation better, and develop an awareness about the prognosis that can guide the patient through further clinical management. It may provide relief for the patient's anxiety about the prognosis via minimizing uncertainty, aid in the patient's decision-making regarding treatment plan, and also help the patient decide whether to participate in randomized clinical trials. Retinal detachment following OGIs often require multiple surgeries and result in poor vision, if not the eventual loss of the eye⁸. Counselling patients with expected future RD would help them make early arrangements for the multiple surgeries involved as well as emotionally prepare for the strong possibility of many procedures or high risk of blindness.

Having a useful guide in predicting RD in patients presenting with OGI has major significance for not only for the injured patient and the treating ophthalmologist, but also for public health professionals in the field of injury prevention

and control. Stratification of patients would facilitate reporting results in a standardized fashion to allow for a valid comparison. Public health workers would have a useful tool to analyze ocular injuries and plan and evaluate intervention strategies in a standardized fashion, as well as re-evaluate and re-assess the intervention.

Our risk assessment model has several distinguishing features. First, it is a simple and easy to use, and utilizes data available in the initial hours of OGI presentation. Thus, every ophthalmologist can easily use this model and calculate the risk score for RD development at only initial presentation using slit lamp and, in some instances, ultrasound. The OGI-RD Score consists of only 3 clinical variables, and stratifies patients into 3 risk groups. It may be a useful tool for triaging patients to appropriate levels of care based on initial risk.

Our study has a number of limitations. Because this was a retrospective study, our results are dependent upon the accuracy of the recorded data. Despite this limitation, however, the model covariates (e.g., VA, zone of injury) are likely to be accurately documented in medical records. It is a single center study with internal validation, so results may not be broadly generalizable. External validation is needed to be performed on independent datasets from other centers before the generalizability of our prediction model can be determined.

In conclusion, we developed a clinical risk score for incident RD events after OGI using routinely assessed variables. Strategies targeting high risk patients for specific preventive interventions, or the accelerated follow-up of high risk patients need further evaluation. Further study is warranted to determine whether this clinical prediction model can help ophthalmologists identify patients who may benefit from close monitoring and more aggressive treatment before implementing these changes in routine practice.

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