Are We Overoperating on Isolated Orbital Floor Fractures?

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PATIENT SAFETY

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RISK

Background: Orbital floor fracture defect size and inferior rectus (IR) rounding index are currently accepted indications for surgery to prevent late enophthalmos. The authors analyzed the positive predictive value (PPV) of these indications.

Methods: Twenty-eight patients with orbital floor fractures presenting without enophthalmos underwent Hertel exophthalmometry at presentation and at weeks 1, 2, 3, 6, 13, 26, and 52 or more after injury. Orbital defect size and IR rounding index were measured from computed tomographic scans, and PPVs of defects of 1.5 to 2 cm^2 or larger and IR rounding index of 1 or higher for enophthalmos (≥2 mm) were calculated.

Results: Nineteen patients had isolated orbital floor fractures (group A), three had noncontinuous orbital floor and medial wall fractures (group B), and six had continuous orbital floor with medial wall fractures (group C). Mean follow-up time was 440 days. Of all patients, 20 had a defect size of 1.5 cm^2 or larger, 12 had a defect of 2.0 cm^2 or larger, and 13 had an IR rounding index of 1 or higher. Of the 28 patients, only one from group A and two from group C developed enophthalmos of 2 mm only. The PPVs of orbital floor defect size of 1.5 cm^2 or larger and 2 cm^2 or larger (groups A and B only) for late enophthalmos were 6.7% and 0%, respectively. The PPV of IR rounding index of 1 or higher for late enophthalmos (all groups) was 0%.

Conclusions: For patients with orbital floor fractures presenting without enophthalmos, defects of 1.5 cm^2 or larger and 2 cm^2 or larger, and IR rounding index of 1 or higher, are weakly predictive of late enophthalmos. Furthermore, patients who do not develop enophthalmos within 3 weeks of injury are unlikely to develop significant (>2 mm) late enophthalmos. *(Plast. Reconstr. Surg.* 152: 629, 2023.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Risk, III.

Orbital floor fracture repair is a challenging operation, with reported morbidities of diplopia, enophthalmos, scarring, implant extrusion, ectropion, and blindness.[1–5] Despite some variability in the literature, certain absolute and relative indications for early surgical repair have become the mainstays of management.[1,5–8] Absolute indications include globe motility restriction with muscle entrapment, persistent oculocardiac reflex, and aesthetically bothersome

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acute enophthalmos of 2 mm or more (which may contribute to persistent diplopia). Relative indications include persistent diplopia on neutral gaze beyond 2 weeks, defect sizes of 1.5 to 2 cm^2 or larger, and IR rounding index (height-to-width ratio) of 1 or higher.[1,2,5,7,9–12] The latter two are thought to be predictive for the development of late enophthalmos (with or without concomitant diplopia), and they are included in the list of relative indications for early surgical management largely as a prophylactic measure to avoid the more technically challenging and risky secondary correction.[1,11,13]

Operating on patients with orbital floor fractures who present solely with large defect sizes and IR rounding in the absence of other surgical indications subjects them to the aforementioned surgical, and anesthetic,[3,14] risks. Furthermore, there is a paucity of information in the literature regarding the true incidence of late enophthalmos among those with orbital floor fractures presenting solely with large defect sizes (≥1.5 to 2 cm^2) and/or IR rounding (IR rounding index ≥1), raising the question of whether patients undergoing prophylactic surgery solely for these two relative indications are being subjected to unnecessary risk.

For these reasons, and the variable and sometimes unclear manner in which these relative indications are defined and measured in the literature,[15,16] deeper scrutiny of their characteristics and predictive value is warranted. The purpose of this prospective study was twofold: to determine the incidence of late enophthalmos among patients with orbital floor fractures and establish the value of defect size and IR rounding index in predicting its occurrence.

PATIENTS AND METHODS

Between 2016 and 2019, patients presenting to Sunnybrook Health Sciences Center with unilateral orbital floor fractures, confirmed by computed tomographic (CT) scan, were recruited to this prospective study. The Sunnybrook Health Sciences Center Research Ethics Board approval was obtained for this study. Patients with extraorbital fractures, ocular globe retrodisplacement of 2 mm or greater within 3 weeks of injury, and absolute indications for acute surgery, such as muscle entrapment and clinically evident enophthalmos, were excluded. All patients were assessed by clinical examination and Hertel measurements within 3 weeks of injury confirming absence of enophthalmos and then at 3, 6, 12, 26, and 52 weeks or more. Hertel measurements were carried out by an ophthalmologist (H.C.) blinded to the CT findings. Absence of enophthalmos within 3 weeks of presentation was confirmed by Hertel measurement of 1 mm or less. The ophthalmologist performed repeated Hertel measurements to determine intrarater reliability and assess patients for visual acuity, extraocular muscle movement, and diplopia.

Orbital floor defect size was calculated from coronal CT images by summing the areas of successive transverse rectangles spanning the defect. The width and length of each rectangle were CT slice interval and medial-to-lateral defect dimensions, respectively, for each CT interval exhibiting the orbital floor defect (Fig. 1). Orbital floor defects were defined as those lying between the inferomedial (uncinate process of maxilla) and inferolateral bony orbital struts.

Orbital floor defects involving the inferomedial bony orbital strut, and thus extending into the medial orbital wall, were considered nonmeasurable orbital floor defects and were grouped separately as continuous orbital floor with medial wall fractures (group C). Repeated measurements were performed by one of the authors (A.B.B.) to determine intrarater reliability for orbital floor defect size calculation.

Inferior rectus (IR) rounding index (height-to-width ratio) was calculated from the height and width of the muscle as it appeared on coronal image exhibiting maximal orbital floor defect width. Previous methodology does not, however,

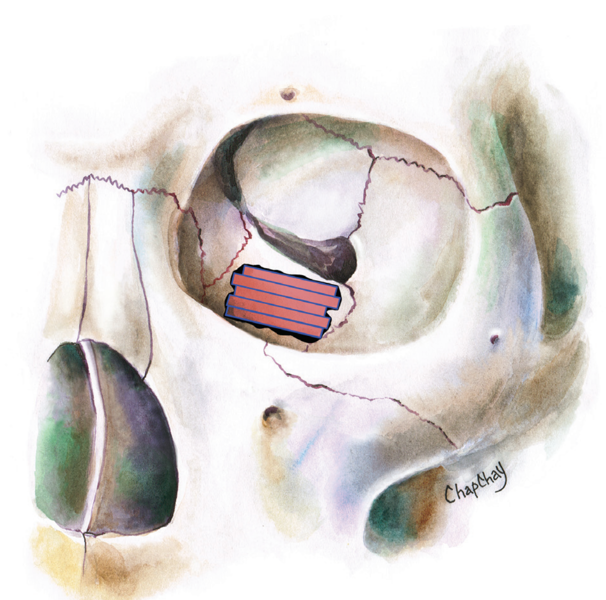

Fig. 1. Calculation of orbital floor defect area by summation of successive rectangles spanning the defect.

specify the criteria for reliably determining height and width axes for consistent and reproducible IR rounding index measurement. We established the following criteria for determining height and width IR axes based on the anatomical rounding that occurs as a result of IR displacement into the maxillary sinus, progressively altering its coronal CT shape from a normal horizontal ellipse lying parallel to the intact orbital floor, through a circle and, ultimately, in the case of very significant herniation, into a vertical ellipse. If the major axis of the IR muscle on coronal slice fell within 30 degrees of the absolute vertical (to account for minor variation around the absolute vertical), that line would be considered height and a line perpendicular to that would be considered width. If the longest bisection of the IR muscle on coronal slice did not fall within 30 degrees of the absolute vertical, that line would be considered width and a line perpendicular to that would be considered height. [**See Figure, Supplemental Digital Content 1**, which demonstrates IR muscle height and width measurements; longest bisection of the IR ellipse (*yellow line*) is considered height only if it is angled up to 30 degrees off the absolute vertical (within the *red lines*) and, in such circumstances, a line perpendicular to that is width (*green line*), ***http://links.lww.com/PRS/G65***.] Repeated measurements of the axes were performed by one of the authors (A.B.B.) to determine intrarater reliability for IR rounding index calculation. Research ethics board approval for the study was obtained, and patients consented to participate knowing that if at any point during the study they were to develop absolute indications for repair, they would be offered surgical intervention.

Statistical Analysis

Descriptive statistics were calculated for all variables of interest. Continuous measures were summarized using medians, means, and standard deviations, whereas categorical measures were summarized using counts and percentages. Those lost to follow-up were compared with the study sample on defect size and IR rounding index using Wilcoxon rank sum tests with a value of $P \leq 0.05$ taken to denote statistical differences. P value tests used in Table 1 were analysis of variance for normally

Table 1. Summarized Patient Statistics for Each Group Separately and Pooled

Variable	Group A (%)	Group B (%)	Group C (%)	Groups A, B, and C (%)	*P*
Mean age ± SD, yr	43.9 ± 18.7	48.3 ± 19.5	45.0 ± 22.8	44.6 ± 18.9	0.93
Defect area, cm^2					<0.0001
Median	1.6	2.2	5.1	1.9	
IQR	1.4–2.0	1.8–3.4	4.4–6.0	1.5–3.7	
IR rounding index					
Affected side					0.88
Median	0.7	0.8	0.8	0.77	
IQR	0.5–1.4	0.5–1.2	0.6–1.3	0.60–1.3	
Unaffected side					0.85
Median	0.51	0.5	0.54	0.51	
IQR	0.45–0.52	0.4–0.6	0.46–0.54	0.46–0.54	
Follow-up time, days					0.44
Median	381	360	369	369.5	
IQR	361–500	193–385	359–373	359.5–435.0	
Sex					0.59
Female	9 (47)	1 (33)	4 (67)	14 (50)	
Male	10 (53)	2 (67)	2 (33)	14 (50)	
Mechanism of injury					0.35
Assault	4 (21)	2 (67)	3 (50)	8 (29)	
Fall	6 (32)	2 (67)	1 (17)	9 (32)	
MVA	9 (47)	0 (0)	2 (33)	11 (39)	
Side					0.72
Left	8 (42)	2 (67)	3 (50)	13 (46)	
Right	11 (58)	1 (33)	3 (50)	15 (54)	
Hertel at last follow-up visit, mm					0.38
0	13 (68)	2 (67)	3 (50)	18 (64)	
1	5 (26)	1 (33)	1 (17)	7 (25)	
2	1 (5)	0 (0)	2 (33)	3 (11)	

MVA, motor vehicle accident.

distributed continuous outcomes, Kruskal-Wallis test for nonnormal continuous outcomes, and chi-square test for categorical outcomes. For all of the study measures of interest, positive predictive values (PPVs), positive likelihood ratios, and their associated confidence intervals were calculated.

For Hertel (H.F.C.), orbital floor area (A.B.B.), and IR rounding index (A.B.B.) measurements, intrarater reliability was assessed using intraclass correlation coefficients. All analyses were carried out using SAS Version 9.4 (SAS Institute, Cary, NC).

RESULTS

Between 2016 and 2019, a total of 36 patients with orbital fractures and no measurable enophthalmos within 3 weeks of presentation, who also fit the remaining inclusion criteria, were enrolled in the study. Of these, eight patients were lost to follow-up earlier than 6 months and were therefore excluded. No significant difference in average defect size and IR rounding index was found between the eight lost to follow-up and those in the final cohort of 28 patients (Wilcoxon rank sum test, $P = 0.94$ and $P = 0.85$, respectively). In all of the remaining 28 patients, final ophthalmologic assessment showed no impairment of visual acuity, no restriction of extraocular muscle motility, and no presence of diplopia.

These 28 patients were divided into three groups, based on fracture pattern, to better elucidate the true-positive predictive values of orbital floor defect size and IR rounding for the appearance of late enophthalmos (Tables 1 and 2). (**See Appendix, Supplemental Digital Content 2**, which shows individual patient parameter values for groups A, B, and C, ***http://links.lww.com/PRS/G66***.)

Group A: Isolated Orbital Floor Fractures ($n = 19$)

This group consisted of nine male and 10 female patients, with a mean age of 44 ± 19 years. Median follow-up duration was 381 days [interquartile range (IQR), 361 to 500 days]. Of the 19 patients in this group, 12 had orbital floor defect size of 1.5 cm^2 or larger, four had orbital floor defect size of 2 cm^2 or larger, and nine had an IR rounding index of 1 or higher.

For defect size, the mean ± SD and median (IQR) were 1.83 ± 0.93 cm^2 and 1.6 cm^2 (1.1 to 2.0 cm^2), respectively. For the IR rounding index, the mean ± SD and median (IQR) were 1.0 ± 0.56 and 0.7 (0.5 to 1.4), respectively.

Maximal globe retrodisplacement for the group was 2 mm. This occurred in only one patient on follow-up day 365. This patient's orbital floor defect size and IR rounding index were 1.62 cm^2 and 0.5, respectively. The remaining 18 patients in this group (11 of whom had ≥1.5 cm^2 and nine of whom had an IR rounding index ≥1) had Hertel measurement of either 0 or 1 mm at their last follow-up visit (Fig. 2).

For the development of retrodisplacement of 2 mm or more at 6 months or longer following isolated orbital floor fracture, the PPV of floor defect size of 1.5 cm^2 or larger was 8.3% (95% CI, 0.2% to 40.2%), the PPV of floor defect size of 2.0 cm^2 or larger was 0% (95% CI, 0.0% to 60.4%), and the PPV of IR rounding index of 1 or higher was 0% (95% CI, 0.0% to 37.1%).

The likelihood ratio for developing enophthalmos of 2 mm or more in those with defects of 1.5 cm^2 or larger, defect size of 2.0 cm^2 or larger, and IR rounding index of 1 or more was 1.64 (95% CI, 1.03 to 2.24), 0.9 (95% CI, 0.0 to 4.15), and 0.4 (95% CI, 0.0 to 1.81).

Table 2. PPV of Orbital Floor Defect Size and IR Rounding Index for Hertel Measurements of 2 mm or More at Last Follow-Up Visit for Each Group Separately and Pooled

Group	No.	No. of Patients with Defect Size ≥1.5 cm^2	PPV of Defect Size ≥1.5 cm^2 for ≥2 mm Retrodisplacement at ≥6 Mo	No. of Patients with Defect Size ≥2.0 cm^2	PPV of Defect Size ≥2 cm^2 for ≥2 mm Retrodisplacement at ≥6 Mo	No. of Patients with IR Rounding Index ≥1	PPV of IR Rounding Index ≥1 for ≥2 mm Retrodisplacement at ≥6 Mo
A: floor only	19	12	8.3% (1/12)	4	0% (0/4)	9	0% (0/9)
A + B: floors only	19 + 3	15	6.7% (1/15)	6	0% (0/6)	10	0% (0/10)
C: continuous orbital floor and medial wall	6	—	—	6	33.3% (2/6)	2	0% (0/2)
A + B + C	28	21	14.3% (3/21)	12	16.6% (2/12)	12	0% (0/12)

Fig. 2. Patient 9 from group A presenting with orbital floor defect size of 1.83 cm^2 and an IR rounding index of 1.43 shown at her last follow-up visit on day 614. Globe retrodisplacement, as measured by Hertel exophthalmometry, was 1 mm.

Group B: Noncontiguous Orbital Floor and Medial Wall Fractures ($n = 3$)

This group consisted of two male patients and one female patient, with a mean ± SD age of 48 ± 20 years. Median follow-up duration was 360 days (IQR, 193 to 385 days). Of the three patients in this group, three had orbital floor defect size greater than 1.5 cm^2, two had orbital floor defect size greater than 2 cm^2, and one had an IR rounding index greater than or equal to 1.

For defect size, the mean ± SD and median (IQR) were 2.48 ± 0.79 cm^2 and 2.24 cm^2 (1.83 to 3.36 cm^2), respectively. For IR rounding index, the mean ± SD and median (IQR) were 0.85 ± 0.34 and 0.8 (0.53 to 1.21), respectively.

Maximal globe retrodisplacement was 1 mm. This occurred in only one patient measured on follow-up day 385. This patient's orbital floor defect size and IR rounding index were 1.83 cm^2 and 0.53, respectively. The remaining two patients in this group had

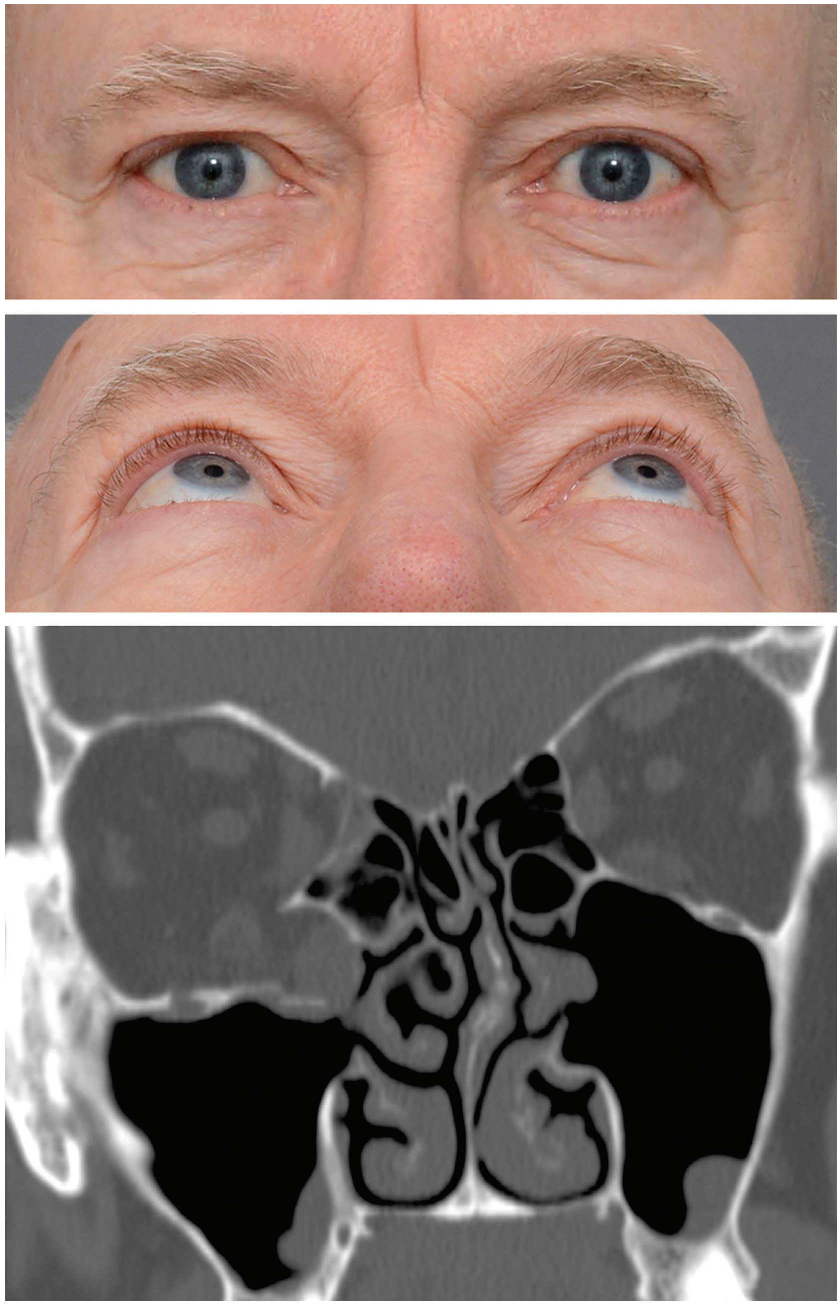

Fig. 3. Patient 2 from group B presenting with an orbital floor defect size of 3.36 cm^2 and an IR rounding index of 1.21 shown at his last follow-up visit on day 360. Globe retrodisplacement, as measured by Hertel exophthalmometry, was 0 mm.

Hertel measurement of 0 at their last follow-up visit (Fig. 3).

Given the small sample size, floor defect sizes of patients from this group were combined with those from group A (n = 3 + 19) for PPV calculation. For the development of 2 mm or more of retrodisplacement at 6 months or longer following orbital floor fracture, the PPV of floor defect size of 1.5 cm^2 or larger was 6.7% (95% CI, 0.2% to 34%), the PPV of floor defect size or 2.0 cm^2 or larger was 0% (95% CI, 0.0% to 48.3%), and the PPV of IR rounding index of 1 or higher was 0% (95% CI, 0.0% to 34.5%).

Group C: Contiguous Orbital Floor and Medial Wall Fractures (n = 6)

This group consisted of two male and four female patients, with a mean ± SD age of 45 ± 23 years. Median follow-up duration was 369 days (IQR, 359 to 373 days). Of the six patients in this group, all had combined orbital floor and medial wall defect size greater than 2 cm², and two had an IR rounding index greater than or equal to 1.

For defect size, the mean ± SD and median (IQR) were 4.81 ± 1.54 cm² and 5.08 cm² (4.39 to 6.04), respectively. For IR rounding index, the mean ± SD and median (IQR) were 0.94 ± 0.38 and 0.83 (0.6 to 1.33), respectively.

Maximal globe retrodisplacement was 2 mm. This occurred in two patients on follow-up days 359 and 373. These two patients' total defect size and IR rounding index were 6.27 cm² and 0.74, and 5.06 cm² and 0.91, respectively. The remaining four patients in this group had Hertel measurement of either 0 or 1 mm at their last follow-up visit.

For the development of retrodisplacement or 2 mm or more at 6 months or longer following orbital floor and medial wall fractures, the PPV of defect size of 2.0 cm² or larger was 33% (95% CI, 5.4% to 75.9%), and the PPV of IR rounding index of 1 or higher was 0% (95% CI, 0.0% to 80.2%). When combined with those from groups A and B ($n = 6 + 19 + 3$), PPV of IR rounding index of 1 or higher for the development of 2 mm or more of retrodisplacement at 6 months or longer following orbital floor and medial wall fractures was 0% (95% CI, 0.0% to 30.1%).

Groups A + B + C (Pooled, $n = 28$)

The pooled group consisted of 14 male and 14 female patients, with a mean age (±SD) of 45 ± 19 years. Median follow-up duration was 369.5 days (IQR, 359.5 to 435.0 days).

The mean (±SD) and median (IQR) defect size were 2.54 ± 1.6 cm² and 1.89 cm² (1.46 to 3.70 cm²), respectively. The mean (±SD) and median (IQR) IR rounding index were 0.97 ± 0.5 and 0.77 (0.57 to 1.31), respectively.

For the development of 2 mm or more of retrodisplacement at 6 months or longer following orbital floor and medial wall fractures, the PPV of defect size of 1.5 cm² or larger, defect size of 2.0 cm² or larger, and IR rounding index of 1 or higher was 0.14 (95% CI, 0.0 to 0.29), 0.16 (95% CI, 0.0 to 0.38), and 0 (95% CI, 0.0 to 0.10), respectively.

The likelihood ratio for developing enophthalmos of 2 mm or more in those with defect size of 1.5 cm² or larger, defect size of 2.0 cm² or larger, and IR rounding index of 1 or higher was 1.39 (95% CI, 1.05 to 1.73), 1.67 (95% CI, 0.11 to 3.22), and 0.16 (95% CI, 0.0 to 0.77), respectively.

Thus, for all groups, a total of three patients developed enophthalmos (defined as ≥2 mm) as measured by Hertel exophthalmometry on their last visit, to a maximum of 2 mm, yielding an incidence of 10.7% (95% CI, 2.8% to 29.4%). For Hertel (H.F.C.), orbital floor area (A.B.B.), and IR rounding index (A.B.B.) measurements, intrarater reliability was 100%, 90%, and 97%, respectively.

DISCUSSION

Correction of late enophthalmos is a technically challenging procedure, with outcomes that are less predictable and more prone to complications than acute orbital fracture repair.[1,11,13] As a result, surgeons have attempted to determine predictors for the development of late enophthalmos. Earlier publications have suggested that defect size and IR rounding are predictive of late enophthalmos.[1,2,5,7,9–12] However, there is a lack of clarity in these earlier studies, particularly in terms of patient sample inclusion criteria and the reproducibility of measuring techniques.

Orbital floor defect area has been measured with inconsistent methodology over the years,[17,18] and size criteria for early prophylactic surgical intervention among surgeons varies widely in the literature, from greater than 1.5 cm² to 50% of the orbital floor.[1,2,5,7,9–11] Earlier studies assumed that all orbital floor defect areas were elliptical in shape, with an area of $(\pi AB)/2$ (with A being maximal length of the fracture on sagittal view, and B being maximal fracture width on coronal view).[15,19] This approach does not accurately estimate the true nonelliptical shape of floor defects; however, it was used for surgical indications and management criteria.[19] With time, more accurate techniques have been used that better estimate the true area of the defect.[9,17–21] One such validated method is the summation of successive rectangular areas that span the defect (the width and length of each rectangle being the slice interval and coronal length of fracture, respectively) for every coronal CT slice exhibiting the fracture (Fig. 1). The current study used this method. Of the 22 patients with measurable orbital floor defect sizes (groups A and B), 15 had defect sizes greater than 1.5 cm², yet only one of these 15 patients developed retrodisplacement of the globe (2 mm) by their last follow-up visit (PPV, 6.7%). Two patients in group C with contiguous floor and medial wall defects of 6.27 and 5.06 cm² developed late retrodisplacement of the globe to a maximum of 2 mm. Consistent with the conclusions of previous studies, all three patients found 2 mm of retrodisplacement to be clinically insignificant and declined surgical correction.[3,11,22,23]

IR rounding index (ie, height-to-width ratio of the muscle on coronal slice exhibiting maximal fracture width) has also been proposed as a predictor of late enophthalmos.[5,7,10,12] The rationale for this is based on the theoretical correlation of decreased anatomical support and/or increased orbital volume leading to herniation of orbital contents, including the IR, into the maxillary sinus, signaling a decrease in anteroposterior length of the muscular cone and thus pending globe retrodisplacement. Accordingly, caudal displacement of the IR muscle results in an oblique orientation relative to the coronal plane, changing its shape on coronal CT scan from a transverse ellipse to a circle and ultimately to a vertical ellipse. However, previous studies attempting to correlate IR rounding to late enophthalmos did not provide clear criteria for delineating the vertical axis. In other words, at what angle, relative to which axis of reference, does the long axis of the IR become height? If, for instance, the IR long axis is at 45 degrees to the vertical axis of the head, is it considered height or width? This lack of clarity renders the designation of height and width for IR rounding index calculation somewhat arbitrary.

Taking into account the factors of gravitational pull and head position for our patient population, we determined that if the IR long axis fell within a 30-degree range of the absolute vertical to the skull, it was considered height. This was felt to reasonably account for variation in direction of IR muscle herniation. Of all patients from all three groups, 12 had IR rounding index of 1 or higher, yet none of them had developed 2 mm or more of globe displacement at their last follow-up visit. Thus, as with defect size greater than or equal to 1.5 to 2 cm^2, the positive predictive value of an IR rounding index of 1 or higher for the appearance of 2 mm or more of enophthalmos at 6 months or more after injury is weak (PPV, 0%).

Recent studies attempting to correlate defect size and IR rounding to the development of late enophthalmos largely do not include early Hertel measurements confirming absence of early enophthalmos. This makes the diagnosis of late enophthalmos unreliable, given that there are no early objective measurements against which to compare the late Hertel readings. In this study, frequent Hertel measurements were taken beginning in the acute period (thus documenting the absence of enophthalmos on presentation) and throughout the follow-up period. Although the incidence of late enophthalmos in this study was found to be similar to that previously reported in the literature (ie, 7% to 10%),[10,12,24] none of the cases in the current study were found to be clinically significant (ie, no patient in our study had globe retrodisplacement >2 mm).

One limitation of the current study was the inability to follow up all of the patients for at least 12 months. Two of the 28 subjects were lost to follow-up after 6 months but were included in the study, as there is precedent in the literature for a 6-month follow-up period to detect late enophthalmos.[10,12] Although IR rounding and defect size criteria have not been reported as indicators or predictors of late enophthalmos for orbital floor defects associated with medial wall fractures either in continuity or not, this study included patients with these fracture patterns to better delineate the incidence of late enophthalmos and the significance of defect size and IR rounding in that regard. This was based on the logical assumption that the value of defect size and IR rounding as predictors of the development of enophthalmos is predicated on their correlation with loss of structural support or, in the case of defect size, increased orbital volume. The presence of a concomitant medial wall defect should not lessen the likelihood of loss of globe support and would, in fact, increase orbital volume. Thus, if IR rounding is indicative of loss of support for the globe, an additional fracture of the medial wall should not weaken the predictive value of IR rounding. Nevertheless, when medial wall fractures were included in the analysis, the incidence of late enophthalmos and the predictive value of defect size and IR rounding remained low. Of interest, one-third of the patients with contiguous orbital floor and medial wall defects (group C) did develop retrodisplacement beyond the acute period, albeit to a maximum of 2 mm, supporting the theory that disruption of the uncinate process of the maxilla may be a predictor of the development of posttraumatic enophthalmos.

CONCLUSIONS

The current prospective study addresses uncertainties in the literature in an attempt to better delineate the role of orbital floor defect size and IR rounding index in predicting the development of late enophthalmos. This has been achieved by means of identifying the cohorts for analysis and confirming absence of acute enophthalmos on presentation, applying correct and reproducible measuring techniques for orbital floor defect size and IR rounding index calculation, and recording frequent, reliable Hertel measurements from presentation onward. Results of the current study show that in patients with orbital floor fractures either isolated or with concomitant but noncontinuous medial wall fractures, orbital floor defect area (≥1.5 to 2.0 cm^2) and IR rounding index (≥1) are weakly predictive for the development of late enophthalmos. These results, in conjunction with the very low incidence of enophthalmos occurring after 3 weeks in groups A and B, suggest that if patients presenting with isolated orbital floor fractures do not develop globe retrodisplacement within the first 3 weeks following injury, they are highly unlikely to do so over time and, if they do, that retrodisplacement is unlikely to exceed 2 mm. For these reasons, at our institution, asymptomatic patients presenting with isolated orbital floor defects without enophthalmos are followed up weekly for 6 weeks following injury. If they do not develop clinical enophthalmos or Hertel-confirmed globe retrodisplacement of 2 mm or more in that period, they are managed nonoperatively regardless of orbital defect size or the presence of IR rounding.

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DISCLOSURE

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