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**Title:** Orbital Roof Fractures as an Indicator for Concomitant Ocular Injury

**Authors:** Joseph Santamaria MD, Aditya Mehta MD, Donovan Reed MD, Brett Davies MD

**Abstract:**

**Purpose:** Orbital roof fractures are a significant cause of morbidity in trauma and are associated with a spectrum of orbital and ocular injuries. This study aims to characterize orbital roof fracture patterns and quantify the rate of acute intervention as compared to non-roof involving orbital wall fractures.

**Methods:** This study is a retrospective analysis of 340 orbital wall fractures diagnosed by CT imaging from August 2015 to October 2016. Orbital wall fractures were categorized as roof involving (N=50) and non-roof involving (N=290). Comparisons were made between these two groups to indicate a statistically significant difference in mechanism of injury, subjective symptoms, CT and exam findings, and final plan of care to include acute ophthalmologic intervention at the time of consultation.

**Results:** Assault (40.7%) was the most common cause of non-roof involving fractures while falls from height (20.0%) were associated with a higher rate of roof fractures. Roof involving orbital wall fractures were associated with a higher prevalence of corneal abrasions (16.3%), lid lacerations (23.4%), and traumatic optic neuropathy (10.4%). A reliable subjective exam on initial ophthalmic consultation was not achieved in a larger proportion of roof fracture patients (30%). Despite this, the rate of acute intervention in this group (34%) was almost double, including lateral canthotomy and cantholysis.

**Conclusion:** Concomitant ocular injury is common in roof involving orbital wall fractures, and may require more urgent ophthalmologic evaluation and acute intervention. As subjective patient data is often less readily available, a high index of suspicion and thorough investigation is warranted in caring for patients with roof involving orbital wall fractures.

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# Orbital Roof Fractures as an Indicator for Concomitant Ocular Injury

Joseph Santamaria MD, Aditya Mehta MD, Donovan Reed MD, Brett Davies MD

San Antonio Military Medical Center (SAMMC)



## Introduction

Orbital roof fractures are a significant cause of morbidity in trauma and are associated with a spectrum of orbital and ocular injuries. The force required to fracture these orbital walls often require ophthalmologists' attention and possible intervention to preserve vision. As the force required to fracture the orbital roof is substantial, it also has a high likelihood of also damaging the eye. Unfortunately, this can also injure a patient enough to warrant intubation with an ICU admission. As a result, they are unable to provide any subjective exam, though often times still need urgent intervention by an ophthalmologist to save future vision.

This study aims to characterize orbital roof fracture patterns and quantify the rate of acute intervention as compared to non-roof involving orbital wall fractures.

## Methods

**Inclusion criteria:** All patients diagnosed with an orbital wall fracture by CT presenting to SAMMC

**Exclusion criteria:** None

**Analysis:** This study is a retrospective analysis of 340 orbital wall fractures diagnosed by CT imaging from August 2015 to October 2016 at San Antonio Military Medical Center. Orbital wall fractures were categorized as roof involving (N=50) and non-roof involving (N=290). Comparisons were made between these two groups using Pearson's  $\chi^2$  test or Fisher's exact test to indicate a statistically significant difference in mechanism of injury, subjective symptoms, CT and exam findings, and final plan of care to include acute ophthalmologic intervention at the time of consultation.

## Results

Variable	Total (N=340)	Roof Involving (N=50)	Non-Roof Involving (N=290)	p Value
<b>Age (mean±SD)</b>	45.6±21.1	43.2±19.3	46.0±21.4	0.387
<b>Gender, Males</b>	258 (75.9%)	44 (88.0%)	214 (73.8%)	<b>0.033</b>
<b>Mechanism of Injury</b>				
<b>Assault</b>	130 (38.2%)	12 (24.0%)	118 (40.7%)	<b>0.025</b>
<b>Ground Level Fall</b>	75 (22.1%)	8 (16.0%)	67 (23.1%)	0.263
<b>Fall From Height</b>	26 (7.6%)	10 (20.0%)	16 (5.5%)	<b>&lt;0.001</b>
<b>MVC/MCC</b>	63 (18.5%)	14 (28.0%)	49 (16.9%)	0.062
<b>Other</b>	46 (13.5%)	6 (12.0%)	40 (13.8%)	0.732
<b>Associated Injury</b>				
<b>Open Globe</b>	5 (1.5%)	2 (4.0%)	3 (1.0%)	0.107
<b>Entrapment (CT)</b>	30 (8.8%)	2 (4.0%)	28 (9.7%)	0.192
<b>Entrapment (Clinical)</b>	9 (2.6%)	0 (0.0%)	9 (3.1%)	0.367
<b>Retrolbulbar Hemorrhage</b>	40 (11.8%)	9 (18.0%)	31 (10.7%)	0.138
<b>Both Eye Involvement</b>	17 (5.0%)	6 (12.0%)	11 (3.8%)	<b>0.019</b>
<b>Signs and Symptoms</b>				
<b>Visual Acuity Decrease</b>	56/293 (19.1%)	6/35 (17.1%)	50/258 (19.4%)	0.752
<b>Diplopia</b>	36/293 (12.3%)	2/35 (5.7%)	34/258 (13.2%)	0.207
<b>Motility Deficit</b>	57/306 (18.6%)	8/36 (22.2%)	49/270 (18.1%)	0.555
<b>Oculocardiac Reflex</b>	7/303 (2.3%)	1/35 (2.9%)	6/268 (2.2%)	0.819
<b>Hyphema</b>	6/335 (1.8%)	1/48 (2.1%)	5/287 (1.7%)	0.869
<b>APD</b>	11/333 (3.3%)	5/48 (10.4%)	6/285 (2.1%)	<b>0.003</b>
<b>Corneal Abrasion</b>	23/337 (6.8%)	8/49 (16.3%)	15/288 (5.2%)	<b>0.004</b>
<b>Lid Laceration</b>	45/335 (13.4%)	11/47 (23.4%)	34/288 (11.8%)	<b>0.031</b>
<b>No Subjective Exam</b>	47 (13.8%)	15 (30.0%)	32 (11.0%)	<b>&lt;0.001</b>
<b>Intervention (total)</b>	71 (20.9%)	17 (34.0%)	54 (18.6%)	<b>0.013</b>
<b>Canthotomy/Cantholysis</b>	9 (2.6%)	6 (12.0%)	3 (1.0%)	<b>&lt;0.001</b>

Table 1: Characteristics of patients with orbital wall fractures

Assault (40.7%) was the most common cause of non-roof involving fractures ( $p=0.025$ ) while falls from height (20.0%) were associated with a higher rate of roof fractures ( $p<0.001$ ). Roof involving orbital wall fractures were associated with a higher prevalence of corneal abrasions (16.3%,  $p=0.004$ ), lid lacerations (23.4%,  $p=0.031$ ), and traumatic optic neuropathy (10.4%,  $p=0.003$ ). A reliable subjective exam on initial ophthalmic consultation was not achieved (e.g. due to patient GCS) in a larger proportion of roof fracture patients (30%,  $p<0.001$ ). Despite this, the rate of acute intervention in this group (34%) was almost double, including lateral canthotomy and cantholysis ( $p<0.001$ ).

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## Discussion

Concomitant ocular injury is common in roof involving orbital wall fractures, and may require more urgent ophthalmologic evaluation and acute intervention. As subjective patient data is often less readily available, a high index of suspicion and thorough investigation is warranted in caring for patients with roof involving orbital wall fractures.

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