International Journal of Frontiers in
Medicine and Surgery Research
Journal homepage: https://frontiersrj.com/journals/ijfmsr/
ISSN: 2783-0489 (Online)

(RESEARCH ARTICLE)

Orbital fractures: Incidence and significance of imaging

Kevin Araujo [1,*], Pradeep PS [2] and Raghuveer Suhas Prasad [3]

[1] *Associate professor, Department of Radio-diagnosis, Dr Moopen's Medical College, Wayanad, Kerala, India.*
[2] *Professor, Department of Maxillofacial surgery and dentistry, Dr Moopen's Medical College, Wayanad, Kerala, India.*
[3] *Assistant professor, Department of Radiodiagnosis, Dr Moopen's Medical College, Wayanad, Kerala, India.*

International Journal of Frontiers in Medicine and Surgery Research, 2023, 03(02), 061–069

Publication history: Received on 01 July 2023; revised on 13 August 2023; accepted on 15 August 2023

Article DOI: https://doi.org/10.53294/ijfmsr.2023.3.2.0078

Abstract

Aim: To identify the incidence of various orbital wall fractures, their association with other facial fractures and their clinical significance.

Methods: This is a prospective observational study of patients presenting to the emergency department with symptoms of orbital fractures, and were assessed further by CT scan.

Results: Radiologic examination reveals a variety of findings in each case. Most of the orbital fractures in our study are comminuted and bilateral. The medial wall is the commonly fractured entity, followed by the floor. Associated findings frequently seen in in this study are zygomatic fractures, nasal bone fractures and hemosinus.

Conclusions: Even though orbital floor fractures are relatively less common, diagnosing orbital floor fractures and inferior rectus entrapment are essential in planning surgical intervention. This study also emphasizes the need for CT imaging in every case of orbital injury.

Keywords: Head and neck trauma; Computed tomography; Depressed fracture; Diplopia

1. Introduction

The orbital floor lies in close proximity to the inferior rectus muscle, which can have pathologic involvement in an adjacent fracture. When a blunt item strikes the eye that is equal in diameter to or larger than the orbital aperture, it may cause an orbital wall fracture, with or without associating with adjacent skeletal structure and soft tissue injury. [1,2] The globe typically does not burst, and the force that results propagates throughout the orbit, breaking the orbital floor. The signs and symptoms of orbital fractures include enophthalmos, diplopia, hypo-ophthalmia (also known as hypoglobus), and hypoesthesia of the face and upper gum on the affected side can range from asymptomatic with mild swelling and bruising to extremely severe. Injuries are treated according to their severity. [1]

Orbital floor fractures have an impact on the orbit and its contents. While indirect fractures of the orbital floor may not affect the orbital rim, direct fractures of the orbital floor may progress from fractures of the orbital rim. Elevated intraorbital pressure, which causes the orbital bones to fracture at their weakest location, is assumed to be the cause of the fracture. Usually, this is the medial orbital floor. Another hypothesis states that direct buckling of the orbital floor results from compression of the inferior orbital rim. In either scenario, orbital contents may be driven into the location of the fracture as well as into the maxillary sinus if the intraorbital pressure is high enough at the time of injury.[3,4]

* Corresponding author: Kevin Araujo; Email: kevinaraujo162@gmail.com

There might be no morbidity at all with simple blowout fractures, or the patient can complain of diplopia, enophthalmos, or hypoesthesia in the cheek and mouth. It is common to see transient edema and ecchymosis of the lids and periorbital area. Any sinus injury could result in air leaking into the orbit or subcutaneous tissues. It's known as orbital emphysema.

The inferior rectus muscle's perimuscular tissue may become trapped in the fracture site and result in vertical diplopia. Due to this, upward gaze is restricted and may be painful when it is attempted. Limited vertical motility may also result from injury to the inferior rectus muscle's third nerve branch. A more serious orbital haemorrhage or edema may be the cause of significant pain with restricted horizontal and vertical motions. [3]

In cases of ocular injuries, CT is typically the most important imaging modality to use. Radiography is less sensitive than computed tomography (CT) for detecting fractures, and CT's ability to do three-dimensional reformations after picture acquisition can occasionally be helpful in guiding eventual surgical treatment. The thin-sliced CT scan with a 1–2 mm cut through the orbit that is performed using a helical CT is the recommended procedure for the diagnosis of orbital trauma. The high resolution orbital helical CT has several advantages over the conventional CT, including the following: (1) a much shorter scanning time (30 s as opposed to >5 min with traditional protocol),3 (2) reduced motion artefact, (3) much lower radiation exposure, and (4) much more sensitivity in detecting soft tissue entrapment, particularly in paediatric patients [4].

Hence, it is important for us to analyze the various orbital blow-out fractures through imaging, as it aids in diagnosis as well as appropriate and timely management. This can help in preventing serious complications of enopthalmos, orbital haemorrhage and permanent loss of vision.

2. Material and methods

This was a prospective observational study that was conducted in tertiary care center associated with a medical college over a period of 15 months from Jun 2021 upto August 2022. Patients with suspected orbital fractures that presented to the emergency department that were haemodynamically stable were evaluated further with high resolution multiplanar computed tomography of the head and neck region.

Patients that were haemodynamically unstable and on mechanical ventilation were excluded from the study. A total of 100 study subjects were identified and evaluated.

Demographic details, clinical details, mode of injury and findings on imaging were recorded in a semi-structured proforma. The data was then entered into an MS excel spreadsheet, and analyzed using SPSS software v21.

Based on the imaging findings, patients were taken up for surgery or managed conservatively.

3. Results

This study included a 100 study participants from various social backgrounds that presented to the emergency department with orbital fractures. All these patients were evaluated once stabilized with CT scan of the head and neck region.

In this study, we observed that majority of the study participants were males in the age groups of 20-30 years. This is explained by the mode of the injury, which was most commonly RTA in our study.

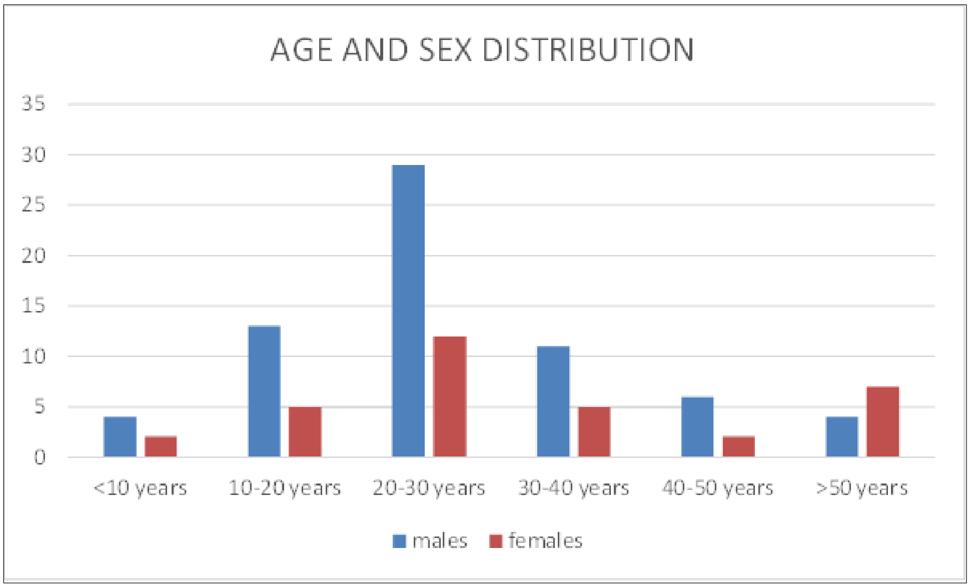

Figure 1 Age and sex distribution in the study population

The most common mode of injury in males and females was RTA, and this is consistent with the finding of other studies.

Average duration of presentation was 2.37 +/- 0.98 days.

Most common features associated with the orbital blowout fractures was periorbital ecchymosis (48.52%), edema over orbital region (34.11%), followed by hypoaethesia over maxilla (11.51%).

The most common site of involvement as identified on CT scan was medial wall, which is considered the weakest part of the orbit. This was then followed by the floor and lateral wall injuries. The floor and medial wall injuries are often comminuted and associated with injuries such as maxillary sinus hemosinus, zygomatic arch fracture and nasal bone fracture.

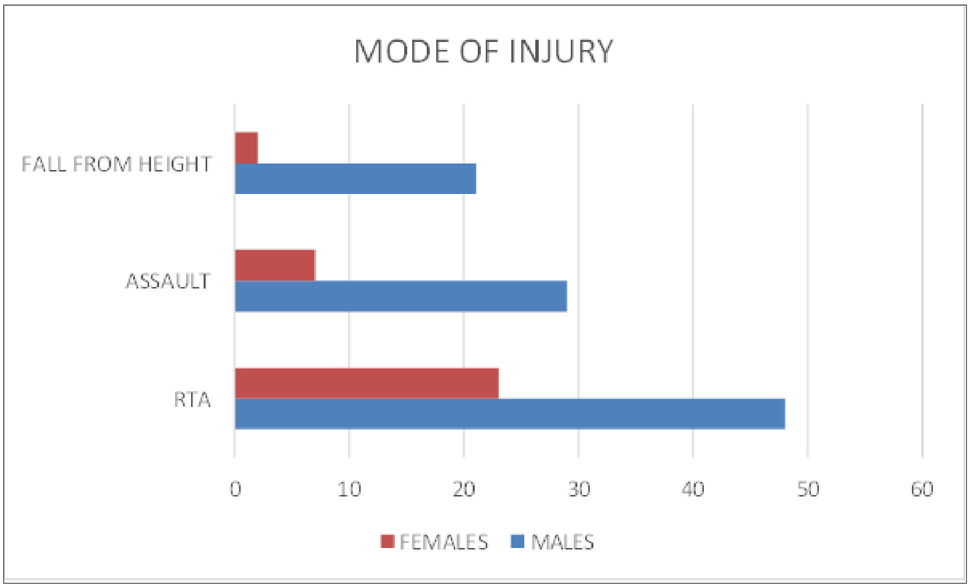

Figure 2 Mode of injury

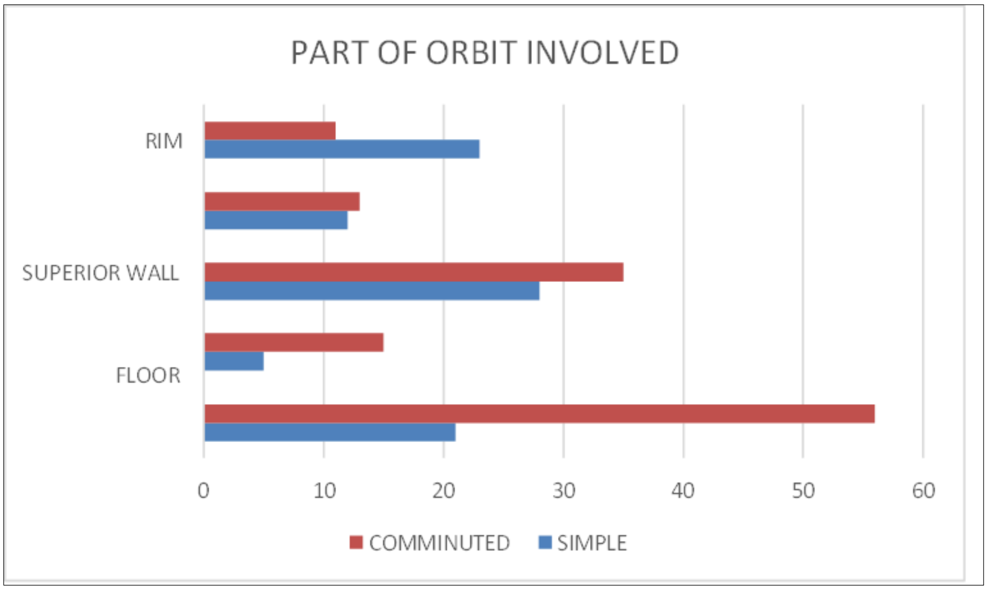

Figure 3 Part of the orbit involved

Table 1 Laterality of the injuries observed on CT scan

Associated injuries	Right	Left	Bilateral
Zygomatic arch fracture	26	12	28
Maxillary sinus injury with hemosinus	13	11	34
Nasal bone fracture	11	14	21
Cribriform plate fracture with csf rhinorrhoea	12	5	15
Ethmoid sinus with hemosinus	5	4	3
Inferior rectus entrapment	5	1	2

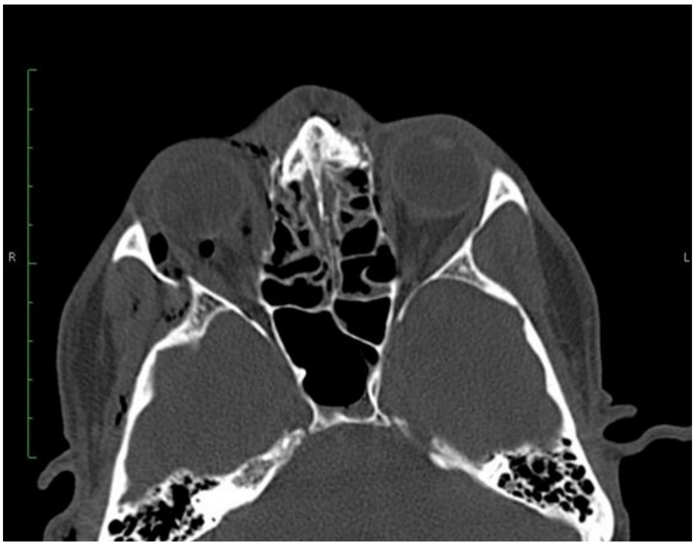

Figure 4 Axial CT image of the face reveals a fracture of the lateral wall of the right orbit. Also seen are fractures of the medial walls (frontal process of maxilla) of both orbits and intraorbital air pockets in the intraconal and extraconal compartments.

In 26.83% patients, there was associated intracranial bleeding, which was additionally identified by imaging. Patients with orbital fractures, especially simple fractures, often are managed conservatively. However, if there is a large intracranial haemorrhage, it can get missed during evaluation, thereby increasing the morbidity and mortality in such patients. This is identified promptly by timely imaging.

Figure 5 Coronal CT image of the face reveals a fracture of the lateral wall of the right orbit.

Figure 6 Coronal CT image of the face shows a fracture involving the floor of the left orbit. There is no entrapment of the inferior rectus muscle. Also seen is an undisplaced fracture through the lateral wall of the left maxillary antrum

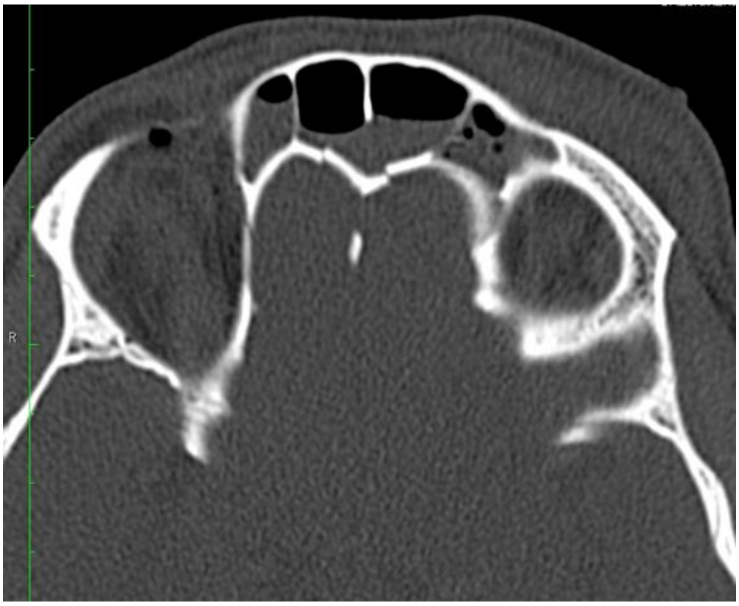

Figure 7 Axial CT image of the orbits shows an undisplaced fracture through the medial wall of the right orbit. Also seen are fractures through the posterior walls of the frontal sinuses with hemosinus.

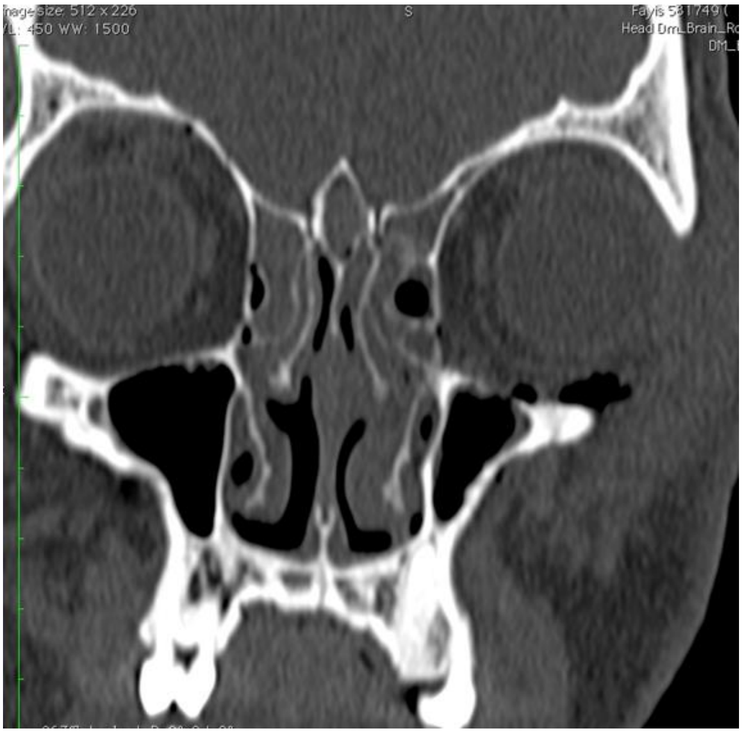

Figure 8 Coronal CT image of the face reveals undisplaced fractures through the medial wall of the right orbital roof and right lamina papyracea.

Figure 9 Axial CT image through the orbits reveals fractures through the roof of bilateral orbits with periorbital hematomas, orbital emphysema and subcutaneous emphysema in the left periorbital, temporal region.

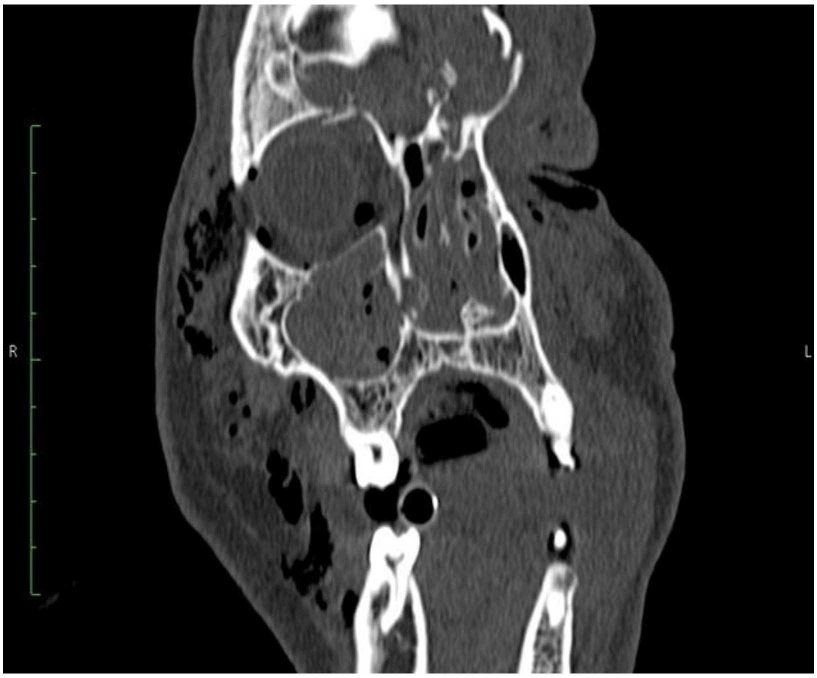

Figure 10 Coronal CT image through the face reveals a fracture through the roof of the right orbit. Multiple other facial fractures are also seen in addition to subcutaneous and orbital emphysema.

4. Discussion

Accidents involving motor vehicles, falls, and violent attacks are the most common traumatic events that lead to fractures of the face. Within the realm of daily imaging, the interpretation of orbital fractures is a common practice. [2]

The imaging study of choice now utilized for assessing acute and non-acute facial trauma is called multidetector computerized tomography (CT). It is common practice to get axial

submillimeter bone algorithm pictures along with sagittal, coronal, and three-dimensional

reformations. Oblique reformations can be helpful in some situations, such as when performing a detailed analysis of the orbit. The evaluation of complicated face abnormalities, as well as

preoperative planning and patient consultation, can benefit tremendously from the utilization of three-dimensional photographs. [3,5,9]

In our study, we found that majority of the patients were male, and the injury was bilateral and secondary to RTA.

When performing a CT evaluation, major indicators of chronic diplopia include the existence of soft tissue herniation through the defect as well as the extent of the fracture. Large floor fractures are more likely to produce entrapment, while smaller and medium-sized floor fractures that are accompanied by a soft tissue herniation are more probable to bring about entrapment. The inferior rectus muscle is in close proximity to the orbital floor and hence is prone to injury following a fracture of the orbital floor. [5] In our study, entrapment was identified in 8 cases.

When there are extensive fractures in the orbital floor and the contents of the orbit prolapse into the maxillary sinus, enophthalmos may develop. The enophthalmos may worsen if there is also a medial wall fracture because the contents of the orbit may prolapse into the ethmoid sinus. The sunken eye appearance will become increasingly noticeable over the course of the subsequent 1- 2 weeks as the edema subsides. Initial orbital edema that happens at the moment of damage may initially cover the enophthalmos. [5,7]

In addition to evaluating the orbital walls for fractures, the orbital apex, optic nerve complex, anterior chamber, lens and posterior globe should be evaluated for any injury. Any orbital herniations or dehiscence should also be promptly evaluated. Fractured fragments impinging on the optic nerve complex at the orbital apex can cause loss of vision which has to be duly diagnosed and addressed at the earliest.

Orbital fractures are not an ophthalmic emergency unless there is injury to the optic nerve or globe. Emergency surgical repair is only indicated for patients with persistent diplopia and enophthalmos. Even though it is not an emergency early imaging and diagnosis can help in proper management with reduced morbidity.

Imaging techniques such as radiography, ultrasonography (US), magnetic resonance imaging (MRI), and computed tomography are frequently used to examine the orbit and the eye. [10-12]

Radiography has a pretty high sensitivity for detecting fractures of the orbit, but it has a

relatively low sensitivity for detecting damage to soft tissues. The use of ultrasonography can be beneficial for the quick evaluation of the globe. Magnetic resonance imaging (MRI) , despite its superior capacity to discern between different types of soft tissues, is not advised for use in the initial evaluation of trauma patients and should be avoided in situations where there is a possibility of a metallic foreign body. [7,11,13]

Also, due to its high cost and financial constraints, incomplete evaluation of the globe is a limitation of this study.

5. Conclusion

Imaging plays an important role in not just the diagnosis, but helps in identifying a management strategy for such patients. Based on imaging, patients can be managed conservatively. On the contrary, an otherwise simple appearing orbital fracture may lead to loss of vision with extra-ocular muscle entrapment, enophthalmos and imaging can help in timely identification of such cases.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to declare.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Valencia, M. R. P., Miyazaki, H., Ito, M., Nishimura, K., Kakizaki, H., & Takahashi, Y. (2020). Radiological findings of orbital blowout fractures: a review. Orbit, 1–12.

[2] doi:10.1080/01676830.2020.1744670

[3] Bord S.P., Linden J. Trauma to the globe and orbit. Emerg Med Clin North Am. 2008;26:97–123. [PubMed] [Google Scholar]

[4] Kuhn F., Morris R., Mester V. Epidemiology and socioeconomics. Ophthalmo Clin North Am. 2002;15:145–151. [PubMed] [Google Scholar]

[5] Zammit-Maempel I., Chadwick C.L. Radiation dose to the lens of eye and thyroid gland in paranasal siinus multisclice CT. Br J Radiol. 2003;76:418–420. [PubMed] [Google Scholar]

[6] Lakets A., Prokesch R., Scholda C. Orbital helical computed tomography in the diagnosis and management of eye trauma. Ophthalmology. 1999;106:2330–2335. [PubMed]

[7] [Google Scholar]

[8] Burnsteine M. Clinical recommendations for repair of isolated orbital floor fractures: an evidence-based analysis. Ophthalmology. 2002;109:1207–1210. [PubMed] [Google Scholar]

[9] Cole P., Boyd V., Banerji S. Comprehensive management of orbital fractures. Plast Reconstr Surg. 2007;120:57S–63S. [PubMed] [Google Scholar]

[10] Cruz A.A., Eichenberger G.C. Epidemiology and management of orbital fractures. Curr Opin Ophthalmol. 2004;15:416–421. [PubMed] [Google Scholar]

[11] Rinna C., Ungari C., Saltarel A. Orbital floor restoration. J Craniofac Surg. 2005;16:968– 972. [PubMed] [Google Scholar]

[12] Manson P.N., Clifford G.M., Su C.T. Mechanisms of globe support and posttraumatic enophthalmos: the anatomy of the ligament sling and its relation to intramuscular cone orbital fat. Plast Reconstr Surg. 1986;77:193–202. [PubMed] [Google Scholar]

[13] Banerjee A., Moore C.C., Tse R. Rounding of the inferior rectus muscle as an indication of orbital floor fracture with periorbital disruption. J Otolaryngol. 2007;36:175–180. [PubMed] [Google Scholar]

[14] Gilbard S.M. Management of orbital blowout fractures: the prognostic significance of

[15] computed tomography. Adv Ophthalmic Plast Reconstr Surg. 1987;6:269–280. [PubMed] [Google Scholar]

[16] Lin, K. Y., Ngai, P., Echegoyen, J. C., & Tao, J. P. (2012). Imaging in orbital trauma. Saudi journal of ophthalmology : official journal of the Saudi Ophthalmological Society, 26(4), 427–432. https://doi.org/10.1016/j.sjopt.2012.08.002