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Clinical and Radiological Analysis of Orbital Blowout Fractures

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ABSTRACT

Aim: To analyse and characterize orbital blowout fractures according to epidemiology, clinical and radiological findings.
Materials and Methods: A descriptive study was performed on 14 patients diagnosed with orbital blowout fractures. The variables analyzedwere: patient age and gender, mode of injury, location and type of fracture, clinical findings and findings on computed tomography.
Results: Out of 201 patients, 14 were diagnosed with orbital blowout fractures. All were males and the peak incidence of the fracture was seen in the 3rd decade. The most common mode of injury was found to be road traffic accidents. The site of involvement showed equal frequency of distribution in both sides.Orbital fractures were associated with other concomitant maxillofacial fractures in 12 patients (85.7%) while 2 patients (14.3%) had pure blowout fractures. Fractures of isolated orbital floor were most common and they were mostly seen to extend till posterior third. Herniation of orbital contents was noted in a majority of patients.
Conclusion: The precise acquisition and evaluation of images in a timely and efficient manner is plays a crucial role in decision making with regards to management of the fracture. An understanding of the current trends in etiology, demographics and clinical findings of orbital fractures will help guide clinicians in efforts of prevention, assessment, and treatment.
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Keywords: Orbital fracture, blowout, clinical findings, computed tomography, extent of fracture

INTRODUCTION

Smith and **Regan** in 1957 first described blowout fractures as fractures of orbital floor not including orbital rim which were caused by a sudden increase in intraorbital pressure(1).The current description of blowout fractures includes any orbital wall fracture but essentially refers to the floor and medial wall(2).

Orbital fractures can result in dramatic consequences, which may include a spectrum of sequelae ranging from diplopia, loss of vision, loss of an eye to cosmetic concerns. Common symptoms of these fractures are diplopia, enophthalmos, ocular dystopia, paresthesia of the infraorbital nerve and soft tissue entrapment or herniation, leading to restriction of ocular movements(3). The indication for repair of orbital wall fractures is established by a combination of clinical and radiological findings.

The evaluation performed should include a comprehensive assessment of the possible risk of damage to orbital structures. Computed tomography is considered the imaging method of choice in the diagnosis of these fractures and the associated consequences of facial trauma due to its high sensitivity (4–6). Additionally, knowledge of epidemiology and clinical findings of these fractures may be a pertinent tool for clinical suspicion and targeted screening for orbital injury. The aim of this study is to analyse and characterizeorbital blowout fractures according to epidemiology, clinical and radiological findings.

MATERIALS AND METHODS

A descriptive study was conducted on patients attending the trauma and emergency unit of Goa Medical College & Hospital and OPD of Goa Dental College & Hospital from January 2020 to January 2021. All midface trauma CT scans from this period of timewere reviewed. All relevant medical records and clinical photographs were reviewed to identify cases of blowout fractures of the orbit. The analyzed variables were: patient age and gender, mode of injury, location and type of fracture location including side of injury, clinical findings and radiological findings (CT assessment).

CT scan analysis was done of pre operative CT scans using OsiriX MD software (US FDA Approved). The defects were classified using the following classifications

- Three Dimensional Computed Tomography Classification of Orbital wall fractures by Ahmed El Degwi et al(7)

Type I, isolated medial wall or floor fracture
Type II, medial wall and floor fractures
Type III, medial wall floor, and zygomatic (trimalar) fractures
Type IV, medial wall, floor, and complex fractures.

- Classification of orbital wall defects by Jaquiery et al(8)

Class I – Isolated defect of the orbital floor or the medial wall, 1-2cm2, in the anterior two-thirds
Class II – Defect of the orbital floor or medial wall, >2cm2, in the anterior two- thirds. Bony ledge preserved at the medial margin of the infraorbital fissure.
Class III – Defect of the orbital floor or medial wall, >2cm2, in the anterior two-thirds. Missing bony ledge medial to the infraorbital fissure.
Class IV – Defect of the entire orbital floor and the medial wall, extending into the posterior third. Missing bony ledge medial to the infraorbital fissure.
Class V – Same as class IV, defect extending into the orbital roof.

The size of the defect was also measured in mm^2 using the protocol by Ang et al(9)wherein 10 pairs of points of interests were marked in all the coronal images showing the fracture. Three-dimensional reconstructions of the orbital floor fracture using the 3D Surface Rendering tool was done to obtain its surface area.

Data was analysed using Microsoft Office Excel 2016 and SPSS Version 20. Descriptive statistics like mean, standard deviation, range, frequency and percentages were used to summarize the data.

RESULTS

During the study period, orbital CT scans were ordered for 201 patients; 14 were diagnosed with orbital blowout fractures. All 14 patients were males with a mean age of 28.21 ± 6.33 with a range of 19 and 42 years. The peak incidence of the fracture was seen in the 3rd decade.

Table no. 1 – Age distribution

Age (in years)	Frequency	Percentage
18-30	8	57.14%
30-40	5	35.71%
40-50	1	7.14%

Frequency distribution according to mode of injury is shownin figure 1. Frequency distribution according to the side involved and type of fracture are summarized in figures 2 and 3. The most common mode of injury was found to be road traffic accidents (RTA’s) followed by self falland trauma at workplace. The site of involvement showed equal frequency of distribution in both sides.

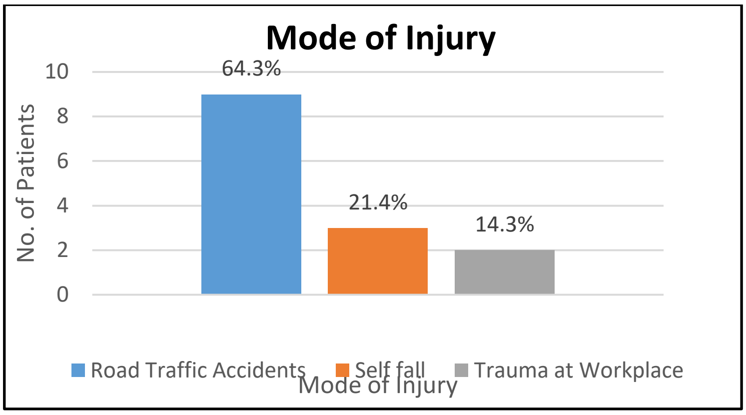

Fig no 1 – Mode of Injury

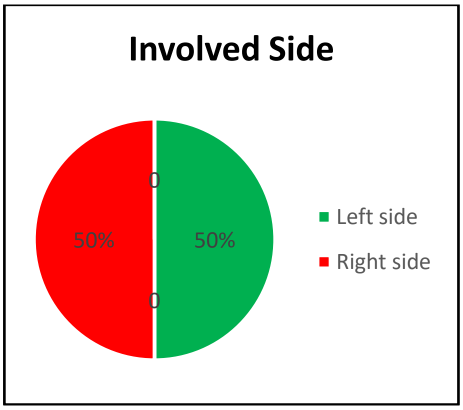

Fig no 2 – Distribution of involved side

Orbital fractures were associated with other concomitant maxillofacial fractures in 12 patients (85.7%) while 2 patients (14.3%) had pure blowout fractures.

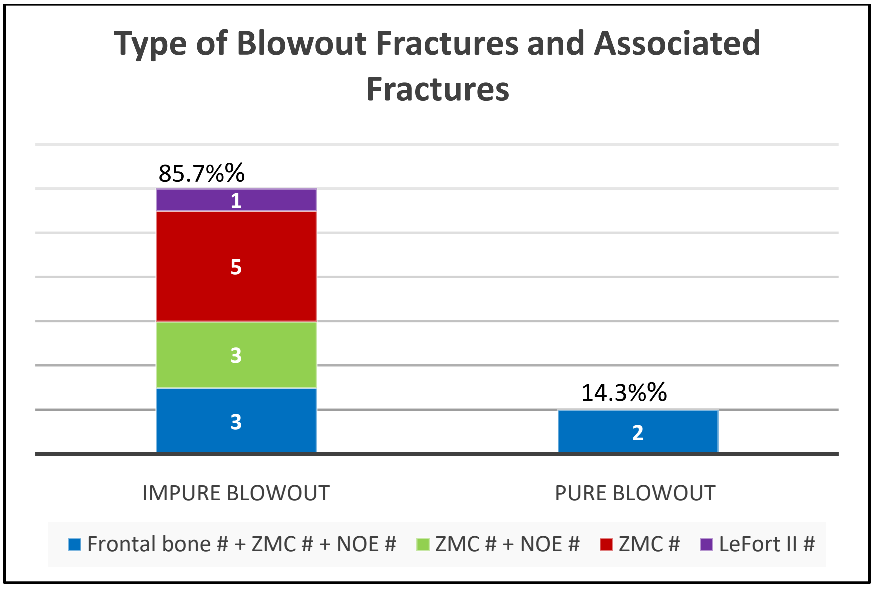

Fig no 3 – Distribution of type of blowout fractures and concomitant fractures

Clinical Findings

Among the preoperative clinical findings, circumorbitaledema and ecchymosis, enophthalmos and infraorbital step deformity showed the highest frequency of distribution (12 patients- 85.71%). Other findings are displayedin Fig 4.

Asymmetry was noted in 12 patients (85.71%). Diplopia was noted in 6 patients (42.85%). Hypoglobus was present in 11 patients (78.57%) (10mm to 2mm and mean of 3.9 ± 2.73). Enophthalmos was noted ranging from 2mm to 5mm (Mean of 3.43±1.01). Restriction of extraocular muscle movements was noted in 4 patients (28.6%). Figures 5 and 6 are clinical photographs of a patient showing some of the above mentioned findings.

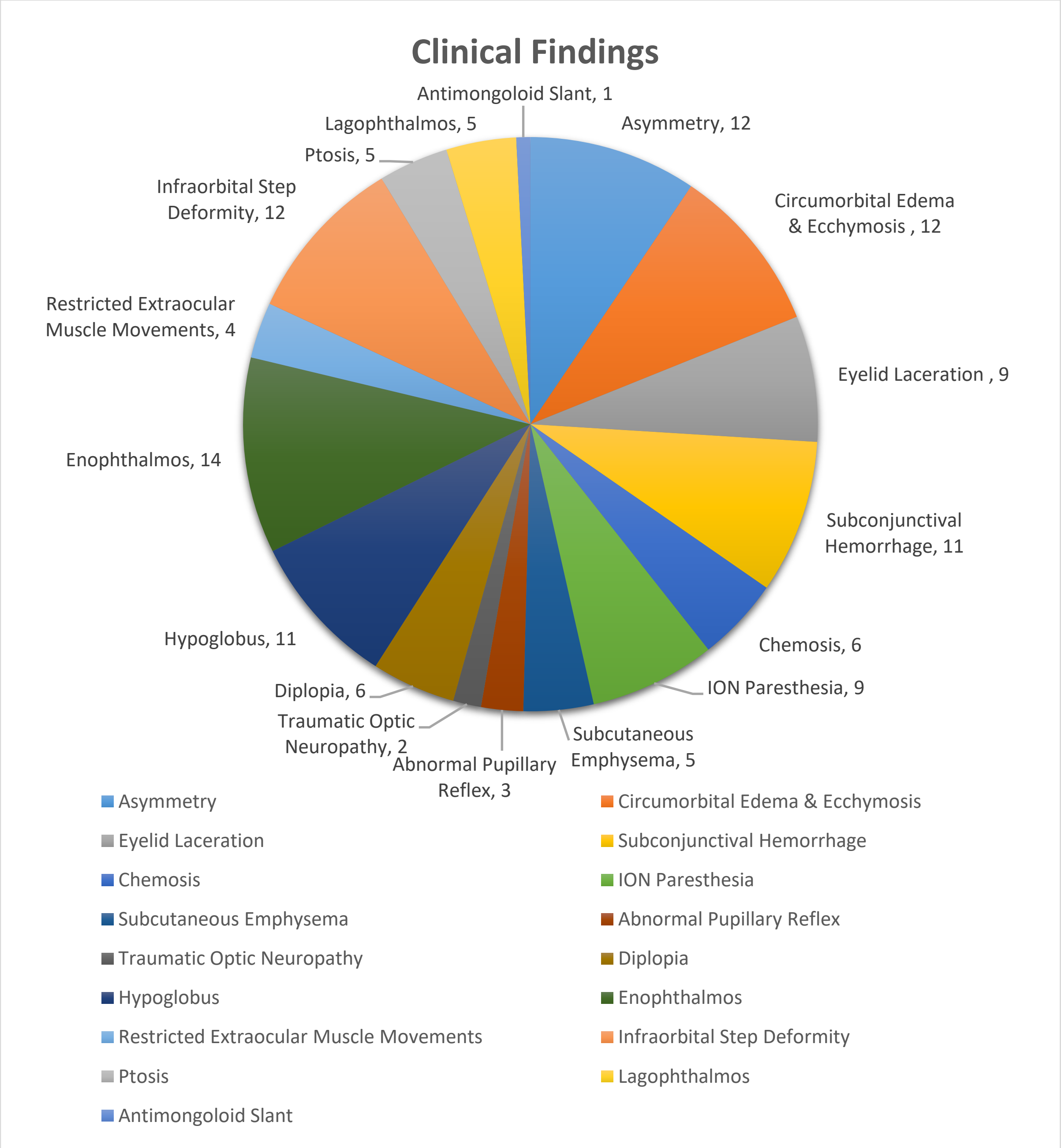

Fig no 4 – Distribution of clinical findings

Fig no 5 – Clinical photograph frontal view

Fig no 6 – Clinical photograph worms eye view

Radiological Findings

Orbital walls involved and extent of the fracture

A combination of fractures of the orbital floor, medial wall and roof were seen in 2 patients (14.28%); floor and medial wall in 4 patients (28.57%) and fractures of only the orbital floor in 8 patients (57.14%) as shown in figure 7.

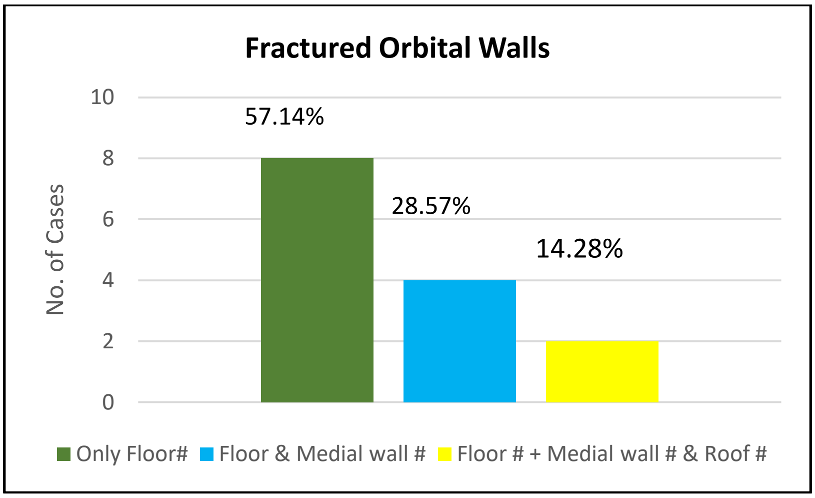

Fig no 7 – Distribution of fractured orbital walls

In 6 patients (42.86%), the fractures were limited to the anterior and middle thirds of the orbit while it extended till the posterior third in 8 patients (57.14%). (fig 8)

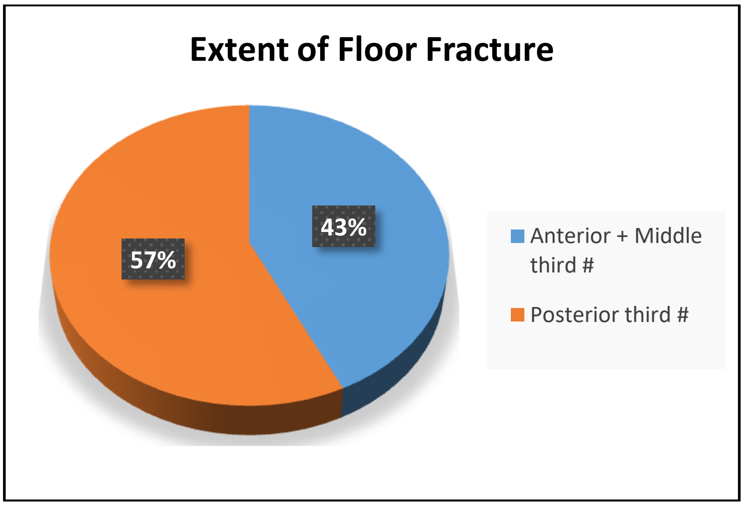

Fig no 8 – Extent of floor fractures in thirds

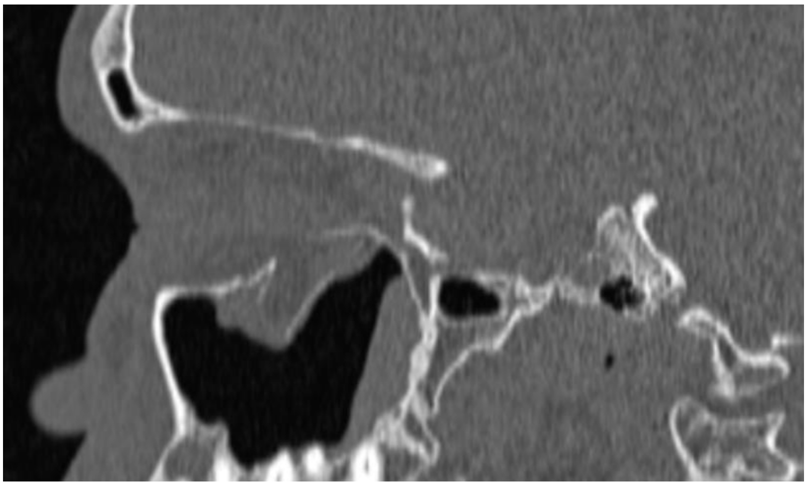

Fig no 9- Sagittal section of CT scan showing orbital floor defect of middle and posterior third and herniation of soft tissue

CT based classification of the orbital defect

El Degwis Type 3 fracture was found to be the most common fracture (6 patients- 42.86%) while the Jaquiery's Type 3 and 4 were most common and showed equal frequency (6 patients- 42.86% each).(Fig 10)

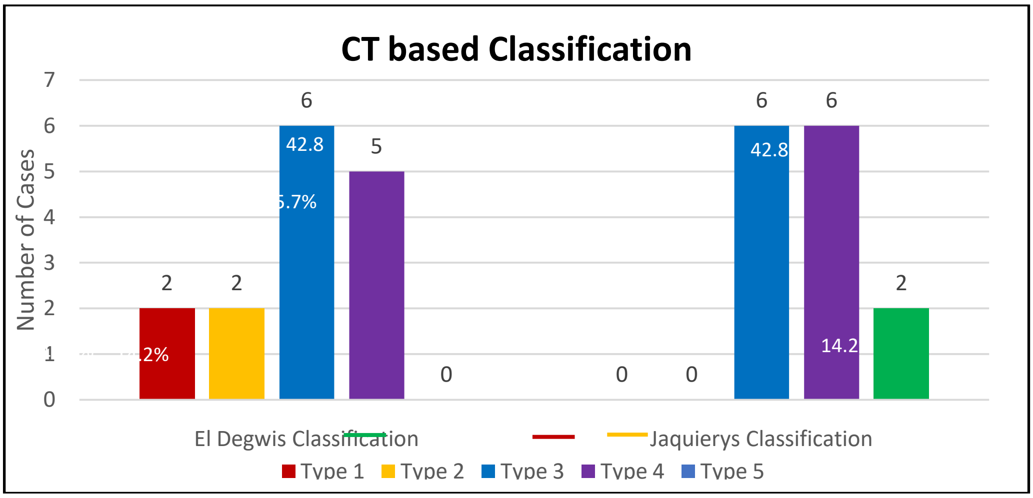

Fig no 10 – Distribution of CT based classification

Soft tissue herniation and Entrapment

Herniation of orbital contents was noted in 13 patients (92.85%) and incarceration of the IR muscle was seen in 4 patients (28.57%).

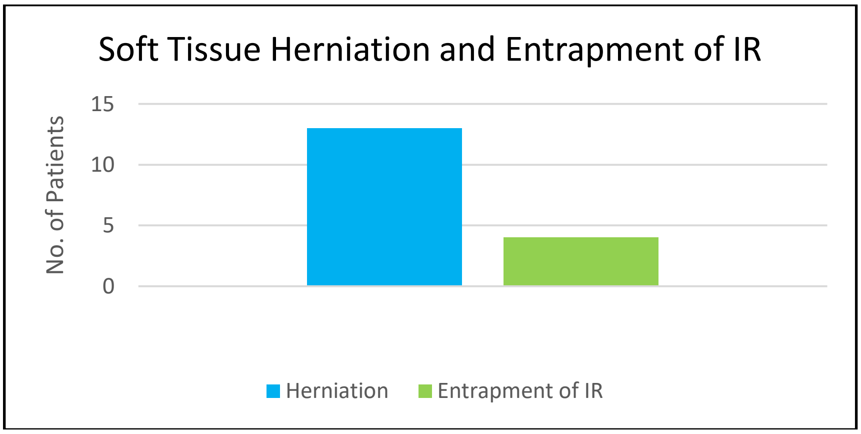

Fig no. 13– Soft tissue herniation and entrapment of IR muscle

Size of defect

- The size of the defect ranged from 2.59to 8.89 cm^2 with a mean of 5.25cm^2 ± 1.82.

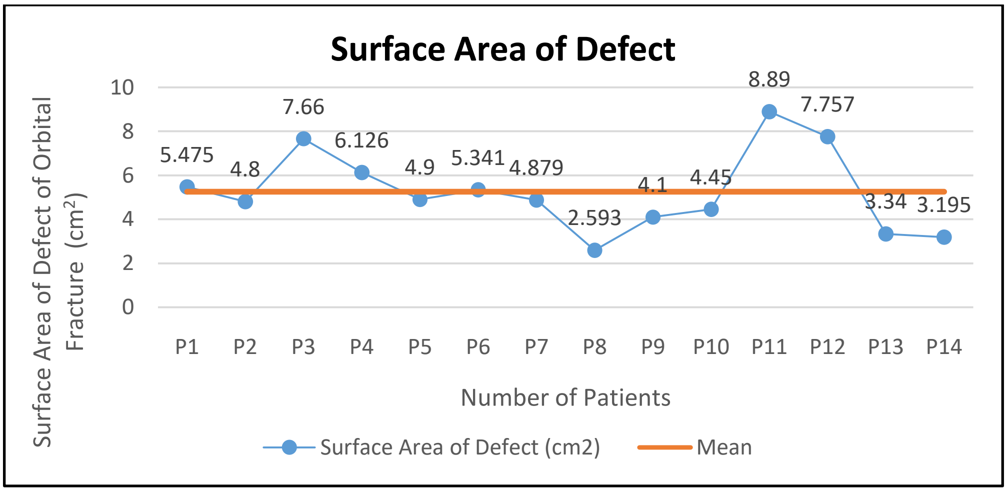

Fig no 11 – Surface area of the defect

Fig no 12 – Estimation of surface area of the defect

DISCUSSION

Orbital fractures have been reported to occur more commonly in adult and adolescent males (10). This was in congruence with findings of our study. The highest rate of patients with these fractures were seen to belong to the age group of 15-35years(6,11).

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The predominant cause for orbital fracture in our studywas found to be road traffic accidents. This was also noted in studies conducted by Khojastepour et al(12) and Cruz et al(13). In this study, 12 patients had other associated maxillofacial fractures like ZMC, NOE, frontal boneand Le Fort fractures, while 2 patients had pure blowout fractures. This study also showed that right and left sides had equal distribution as compared to studies that suggest a higher prevalence of fractures of the left orbit(14).Isolated orbital floor fractures were found to be slightly more common than floor with medial wall fractures with or without roof fractures in this study. Similar findings were reported in a study conducted by Giselle et al(15).A higher incidence of fractures involving the posterior third of the orbit (57.14%) were noted (Jaquiery's Type 3 and 4) in this study as compared to the study by Jaquiery et al where type 2 and 3 were more common(8).

In the current study, Enophthalmos was noted in all patients; 85.71% presented with asymmetry, circumorbitaledema & ecchymosis and infraorbital step deformity; 78.57% presented with subconjunctivalhemorrhage and hypoglobus; 64.2% had eyelid lacerations and ION paresthesia; 42.85% had chemosis and diplopia; 35.71% had subcutaneous emphysema, ptosis and lagophthalmos; 28.57% had restricted extraocular muscle movements while findings like abnormal pupillary reflex (21.4%), TON (14.3%) and antimongoloid slant (7.1%) were also noted. Similar findings have been documented in literature(2,15).

In a study conducted by Chiang et al, radiographic evaluation showed that 13% of the cases had entrapment of the IR muscle, and 7% had possible entrapment with fat herniation in the defect or deviation of muscle toward the fracture(14). In the present study, entrapment was seen in 28.57% and herniation of orbital contents was noted in 92.85%.

The size of the defect in this study ranged from 2.59 to 8.89 cm^2 with a mean of 5.25cm^2 ± 1.82. Mean fracture area in a study conducted by Ploder et al (2003) was 2.85±1.11 cm^2 (range 0.40–4.85) (16)calculated using a computer program for the calculation of the orbital fracture areas from coronal CT scans(17). The importance of measuring orbital defect size from CT imaging to indicate the need for surgery is stressed upon in various studies(18–20). Burnstinereported that, large orbital floor fractures with area greater than or equal to 50% of the orbital floor led to latent enophthalmos and that such fractures of the orbital floor must be repaired within 2 weeks(21).

The surface area of the orbital defect plays an important role in decision making with regards to conservative or surgical management and is also used to estimate the size of implant required for the repair(9). The correlation of defect size in relation to area of orbital floor and its implication on enophthalmos was not analysed in current study. Although, findings of diplopia, enophthalmos of >3mm and restriction of extraocular muscle movements was noted in all patients with fracture size ranging from 4.8-8.8cm^2. Jin et alconcluded that an enophthalmos of ≥ 2 mm, can be foreseen when the area of the defect is ≥1.9 cm^2, or the volume of herniated orbital tissue is ≥0.9 ml(20,22).

In the event of trauma, CT analyses should include assessment of indirect sings of fracture namely, air-fluid levels, fluid collections within the paranasal sinuses, abnormal density, emphysema and facial soft tissue asymmetry. CT scan is currently the gold standard for assessing orbital fractures. It aids in estimating the extent of bone and soft tissue damage, characterization by using different criteria and recognition of potential causes of complications(6,10).

CONCLUSION

CT has become an irreplaceable tool for theinitial evaluation of the orbit and its adjacent structures. The precise acquisition and evaluation of images in a timely and efficient manner is plays a crucial role in decision making with regards to management of the fracture. An understanding of the current trends in etiology, demographics and clinical findings of orbital fractures will help guide clinicians in efforts of prevention, assessment, and treatment.

REFERENCES

[1]. Yamanaka Y, Watanabe A, Sotozono C, Kinoshita S. Impact of surgical timing of postoperative ocular motility in orbital blowout fractures. Br J Ophthalmol. 2018 Mar;102(3):398.

[2]. Shew M, Carlisle MP, Lu GN, Humphrey C, Kriet JD. Surgical Treatment of Orbital Blowout Fractures: Complications and Postoperative Care Patterns. Craniomaxillofacial Trauma Reconstr. 2016 Nov;9(4):299–304.

[3]. Lima LB, de Miranda RBM, Furtado LM, Rocha FS, Parreira da Silva MC, Silva CJ. Reconstruction of orbital floor for treatment of a pure blowout fracture. Rev Port Estomatol Med Dentária E Cir Maxilofac. 2015 Apr 1;56(2):122–6.

[4]. Bord SP, Linden J. Trauma to the globe and orbit. Emerg Med Clin North Am. 2008 Feb;26(1):97–123, vi–vii.

[5]. Lee HJ, Jilani M, Frohman L, Baker S. CT of orbital trauma. EmergRadiol. 2004 Feb;10(4):168–72.

[6]. Reyes JM, Vargas MFG, Rosenvasser J, Arocena MA, Medina AJ, Funes J. Classification and epidemiology of orbital fractures diagnosed by computed tomography. :7.

[7]. Degwi A, Amer T, Azab M. Orbital Wall Fractures: Three-Dimensional Computed Tomography Classification. 2018 Dec 18;July 2002.

[8]. Jaquiéry C, Aeppli C, Cornelius P, Palmowsky A, Kunz C, Hammer B. Reconstruction of orbital wall defects: critical review of 72 patients. Int J Oral Maxillofac Surg. 2007 Mar;36(3):193–9.

[9]. Ang CH, Low JR, Shen JY, Cai EZY, Hing ECH, Chan YH, et al. A Protocol to Reduce Interobserver Variability in the Computed Tomography Measurement of Orbital Floor Fractures. Craniomaxillofacial Trauma Reconstr. 2015 Dec;8(4):289–98.

[10]. Reyes J, Vargas M. Classification orbital fractures. Rev Argent Radiol 2013772139-146. 2013 Aug 1;

[11]. Sabharwal S, Prabhakar S, Ravindran R. A prospective study on the incidence and pattern of orbital fractures and ocular complications in two wheeler drivers following road traffic accidents in South India. Invest Ophthalmol Vis Sci. 2014 Apr 30;55(13):5490–5490.

[12]. [12]. 12. Khojastepour L, Moannaei M, Eftekharian HR, Khaghaninejad MS, Mahjoori-Ghasrodashti M, Tavanafar S. Prevalence and severity of orbital blowout fractures. Br J Oral Maxillofac Surg. 2020 Nov 1;58(9):e93–7.

[13]. Cruz AAV, Eichenberger GCD. Epidemiology and management of orbital fractures. CurrOpinOphthalmol. 2004 Oct;15(5):416–21.

[14]. Chiang E, Saadat LV, Spitz JA, Bryar PJ, Chambers CB. Etiology of orbital fractures at a level I trauma center in a large metropolitan city. Taiwan J Ophthalmol. 2016 Jan-Mar;6(1):26-31

[15]. Jra G, Co A, Jr D. Clinical and Epidemiological Characteristics of Orbital Floor Fractures, Rebuilt with Titanium Mesh. 2020;3(1):6.

[16]. Ploder O, Oeckher M, Klug C, Voracek M, Wagner A, Burggasser G, et al. Follow-up study of treatment of orbital floor fractures: relation of clinical data and software-based CT-analysis. Int J Oral Maxillofac Surg. 2003 Jun;32(3):257–62.

[17]. Ploder O, Klug C, Voracek M, Backfrieder W, Tschabitscher M, Czerny C, et al. A computer-based method for calculation of orbital floor fractures from coronal computed tomography scans. J Oral MaxillofacSurg Off J Am Assoc Oral Maxillofac Surg. 2001 Dec;59(12):1437–42.

[18]. Lelli GJ, Milite J, Maher E. Orbital floor fractures: evaluation, indications, approach, and pearls from an ophthalmologist's perspective. Facial PlastSurg FPS. 2007 Aug;23(3):190–9.

[19]. Schouman T, Courvoisier DS, Van Issum C, Terzic A, Scolozzi P. Can systematic computed tomographic scan assessment predict treatment decision in pure orbital floor blowout fractures? J Oral MaxillofacSurg Off J Am Assoc Oral Maxillofac Surg. 2012 Jul;70(7):1627–32.

[20]. Jin HR, Shin SO, Choo MJ, Choi YS. Relationship between the extent of fracture and the degree of enophthalmos in isolated blowout fractures of the medial orbital wall. J Oral MaxillofacSurg Off J Am Assoc Oral Maxillofac Surg. 2000 Jun;58(6):617–20; discussion 620-621.

[21]. Burnstine MA. Clinical recommendations for repair of isolated orbital floor fractures: an evidence-based analysis. Ophthalmology. 2002 Jul;109(7):1207–10; discussion 1210-1211; quiz 1212–3.

[22]. Dubois L, Steenen SA, Gooris PJJ, Mourits MP, Becking AG. Controversies in orbital reconstruction--I. Defect-driven orbital reconstruction: a systematic review. Int J Oral Maxillofac Surg. 2015 Mar;44(3):308–15.