Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i6.1658
*Biol. Clin. Sci. Res. J., Volume 6(6), **2025**: 1658*
Original Research Article

Clinical and Radiological Indicators for Early Surgical Management in Pediatric Orbital Floor Fractures

Hina Afsar[1*], Laraib Siddiqui[1,2*], Adil Yousaf[1], Moeedurehman[1], Khaliq Hussain[1]

[1]Department of Oral and Maxillofacial Surgery, Lady Reading Hospital, Peshawar, Pakistan
[2]Implantology Ashiyana Abdul Aziz, near biodiversity park, Morgah, Rawalpindi, Pakistan
**Corresponding author`s email address:* tehminarafiq500@gmail.com

(Received, 24th April 2025, Accepted 18th June 2025, Published 30th June 2025)

Abstract: *Early diagnosis and management of orbital floor fractures is of utmost importance, especially in the presence of periorbita incarceration. This study aims to assess the common indicators of orbital floor fracture in pediatric patients, both clinically and radiologically, so as to determine early surgical intervention in these patients.* ***Methods:*** *A retrospective cross-sectional study was carried out at the Oral and Maxillofacial ward of Lady Reading Hospital, Peshawar, from January 2021 to June 2024. Pediatric patients with an age range of 5-16 years of both genders, a history of trauma not more than 14 days, diplopia in primary and downward gaze, along with gaze restriction in any direction, enophthalmos, and confirmed orbital floor fracture in coronal view of CT scan were included in the study. The Ethical Review Board of Lady Reading Hospital approved the study protocol. A structured questionnaire was used to collect the data. The collected data was analysed using the Statistical Package for Social Sciences (SPSS) version 25.* ***Results:*** *The most common mechanism of injury recorded was RTA, with 65.7%. The children injured by fall were 22.5 %, 3.9% by assault, and 5.0% firearm injury. Among the clinical features recorded in the study, 40.2% had nausea/vomiting, 81.4% diplopia, and 57.8% had both exophthalmos and restricted eye movement. Among them, 82.4% had a confirmed orbital floor fracture on radiograph, while only 33.3% had the classical trapdoor sign evident on coronal CT.* ***Conclusion:*** *In conclusion of the study performed at our Centre, clinical findings should prompt a CT investigation in case of orbital fractures. If there is restriction of eye movement and diplopia along with other features, surgical intervention is necessary. Rest can be managed by conservative treatment.*

Keywords: Child, Eye Movements, Orbital Fractures, Tomography, Wounds and Injuries

[***How to Cite:*** Afsar H, Siddiqui L, Yousaf A, Moeedurehman, Hussain K. Clinical and radiological indicators for early surgical management in pediatric orbital floor fractures. *Biol. Clin. Sci. Res. J.*, **2025;** 6(6): 172-175. doi: https://doi.org/10.54112/bcsrj.v6i6.1658

Introduction

The orbit is susceptible to injury because of its complex anatomical structure. Blunt trauma in this region of the facial skeleton may cause an isolated orbital "blowout" fracture or a combined orbital fracture and midface fracture. 1Orbital roof fractures tend to occur in children younger than 8 years, whereas orbital floor fractures are common in older children. Generally, a low incidence of paediatric facial skeletal fractures is reported in the literature. This is due to the immaturity of the paediatric facial skeleton, which serves to protect against fractures. Higher cancellous proportion and presence of cartilage in the growing suture lines allow the bone to absorb more energy during impact, thus, without resulting in fracture. (2)

The leading cause of trauma in children is sports, with 33%, followed by assault, 31%, playtime accidental trauma, 12%, and falls, 8%. The clinical presentation and severity of orbital fractures are variable depending upon the type, severity, and combination of fractures of the facial skeleton. Diplopia, paraesthesia of the infraorbital nerve, and enophthalmos are the clinical features described by Smith. In addition to these, the patient can also present with ophthalmoplegia, restricted ocular motility, nausea, and vomiting. (1,3) Rarely, orbital fractures can result in an oculocardiac reflex, an ophthalmological emergency consisting of a triad of bradycardia, syncope, and nausea.(4)

Despite the rarity, early diagnosis and management of orbital floor fractures are of utmost importance, especially in the presence of periorbital incarceration. Tissue entrapment in these fractures may lead to further complications, including retrobulbar haemorrhage and oculocardiac reflex. (4,5) In addition to the clinical presentation, computed tomography (CT) is the gold standard for the confirmed diagnosis of the orbital floor fracture. (1,5) The best treatment strategy with regards to orbital trauma in children remains controversial as there is no consensus upon the optimal time for surgical intervention and the type of surgical treatment provided in such cases. (6) There is scarce, if any, local literature present on pediatric orbital floor fractures, associated complications, and optimal time frame and type of surgical intervention in such cases. This study aims to assess the common indicators of orbital floor fracture in pediatric patients, both clinically and radiologically, so as to determine early surgical intervention in these patients. This will reduce the incidence of post-traumatic orbital deformity as well as the scarring due to muscle entrapment, resulting in diplopia, which in turn will improve the patient's quality of life and reduce patient morbidity in the long run.

Methodology

A retrospective cross-sectional study was carried out at the Oral and Maxillofacial ward of Lady Reading Hospital, Peshawar, from January 2021 to June 2024. Pediatric patients with an age range of 5-16 of, both genders, a history of trauma not more than 14 days, diplopia in primary and downward gaze, along with gaze restriction in any direction, enophthalmos, and confirmed orbital floor fracture in coronal view of CT scan were included in the study. Patients having associated head injury along with old trauma (more than 14 days) and having any surgical intervention done previously were excluded.

A structured questionnaire was made in which the gender, age, mechanism of injury, clinical features, radiological signs on coronal CT scan, and the type of treatment given were recorded. The clinical signs and symptoms included nausea, restriction of eye movement, diplopia, and enophthalmos. The radiological signs were observed on coronal CT scan, if advised, which included, tear drop sign as the diagnostic indicator. The treatment was recorded based on the clinical and radiological

indicators observed through the questionnaire, and whether the patient had any surgical intervention done or not.

The Ethical Review Board of Lady Reading Hospital approved the study protocol. The consent of the patients to be included in the study was obtained from the parents.

The collected data was analysed using the Statistical Package for Social Sciences (SPSS) version 25. Frequency and percentages were calculated for categorical variables like gender, nausea and vomiting, enophthalmos, diplopia, restriction of eye movement, and presence of fracture on CT scan. Mean ±SD were calculated for numerical variables like age. Post stratification was applied using a chi-square test to see the effect modification, keeping the p value less than or equal to 0.05.

Results

One hundred two patients with a confirmed diagnosis of orbital floor fracture were presented to the Oral and Maxillofacial ward of Lady Reading Hospital, Peshawar, from 2021 to 2024, and were included in the study. Out of these, 58 were male while 44 were female. The mean age was 8 years. The most common mechanism of injury recorded was RTA, with 65.7%. The children injured by fall were 22.5 %, 3.9% by assault, and 5.0% firearm injury.

Table 1: Gender distribution of the study patients

GENDER		
	N	**Percentage**
Male	58	56.9%
Female	44	43.1%

Table 2: Mechanism of injury of study patients

Mechanism of Injury	Percentage
RTA	65.7%
Fall	22.5%
Assault	3.9%
FAI	5.9%

Among the clinical features recorded in the study, 40.2% had nausea/vomiting, 81.4% diplopia, and 57.8% had both enophthalmos and restricted eye movement. It is to be noted here that the patients who had enophthalmos also reported restriction of eye movement. Coronal CT was performed in every patient having any of the above-stated clinical features, as they were taken as strong clinical indicators for orbital floor fracture. Among them, 82.4% had a confirmed orbital floor fracture on radiograph, while only 33.3% had the classical trapdoor sign evident on coronal CT

Table 3: Clinical features of study patients

Clinical Features	Percentage
Nausea/Vomiting	40.2%
Diplopia	81.4%
Enopthalmous	57.8%
Restricted Eye movement	57.8%

Table 4: Radiological Features of study patients

Radiological Features	Percentage
Orbital Floor Fracture	82.4%
Tear drop sign	33.3%

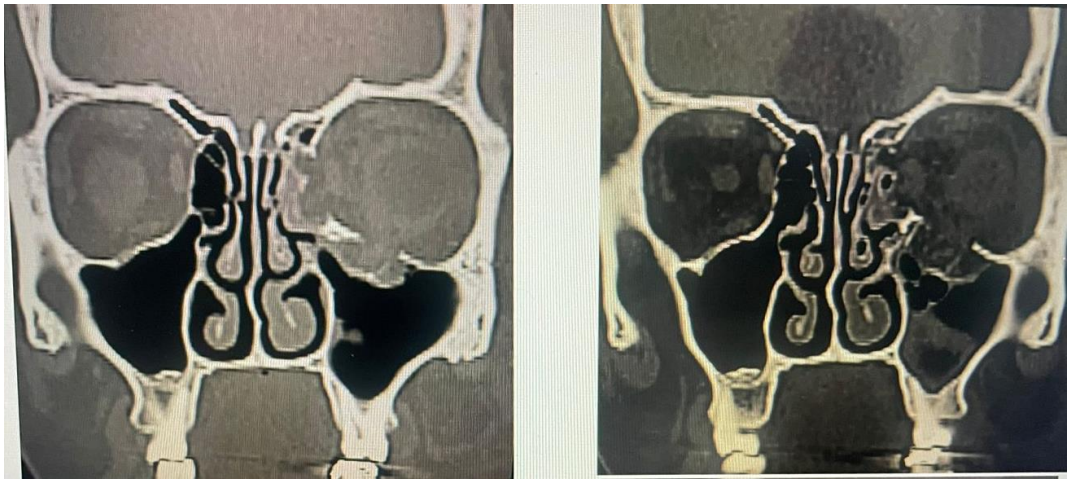

Figure 1. Orbital floor fracture in 8 year 8-year-old patient in coronal CT scan

Table 5: Type of Intervention in study patients

Type of Intervention	Percentage
Observation	63.7%
Surgical exploration	38.2%

Surgical intervention was performed in 63.7% based on both clinical and radiographic indicators. Only 38.2% were kept on observation and follow-up. A chi-square test was applied, and the results indicated a p-value less than 0.05, which meant the results were significant. The clinical and radiological indicators were also substantial.

Discussion

Due to the inherited elasticity of bone, paediatric patients encountering a blunt injury have a higher rate of trapdoor fractures than blowout fractures. The displaced bone would transiently snap back to its original position and impinge on the herniated tissue, causing the lower portion of the extraocular tissue to be incarcerated. In paediatric orbital trauma, not only the bony walls of the orbit, but also the eye as a functional organ of the body are affected. Progressive orbital swelling, imminent retrobulbar hematoma contribute to the risk of visual impairment. If retinal detachment and optic atrophy are present, this could contribute to the risk of blindness. Extraocular muscle entrapment, oculomotor nerve impairment, and impairment of orbital fascial structures are accompanied by oculomotor abnormalities and diplopia. Prolapse of orbital contents into adjacent cavities and atrophy of the retrobulbar cellular tissue may become a precondition for the development of enophthalmos. That is why early diagnosis of this type of trauma and selecting an optimal treatment strategy requires a multispecialty approach, (7).

Our study was designed to find out the common clinical and radiographical indicators that determined the type of treatment given to pediatric patients. As opposed to many international studies where the nature and incidence of orbital floor fractures between adults and children were compared, (1, 8, 9) this study solely focused on pediatric patients alone.

The mean age at the time of presentation with orbital floor fracture was between 7.66, which is in contradiction with the international studies where the presenting age was 10.78, 12.7, 12.33, and 11.6. (2,5,7,8) concurrence with other studies, male gender was commonly affected in our study as well when it came to orbital fractures (6-8).

The mechanism of injury reported in most studies was fallwhich was in contradiction with our result (3,7) . Our study retrospectively concluded RTA to be the most common cause of orbital fracture in children, with 65.7%. This was in accordance with studies performed by Karvak et al. They also concluded that hits and bicycle accidents were the most common causes of orbital floor fracture in pediatric patients in their research as well.

Early diagnosis of a trapdoor fracture may be decisive for the outcome for pediatric patients. According to previous studies, indications for surgical should not rely solely on radiographic evidence of entrapment. The correlation with clinical findings also plays an important role.(7) since children may be difficult to approach during an emergency, as they are unable to describe their discomfort, paired with poor cooperation, physical examination plays a paramount role in diagnosis. External clinical signs such as ecchymosis, edema, and enophthalmos are relatively minimal in children compared to adults. Instead, restriction of eye movements could indicate a high possibility of muscle entrapment even without radiographic findings. Moreover, muscle entrapment may also bring oculocardiac reflex (OCR), which is more commonly seen in children and adolescents (10).

The clinical features included in our study that necessitated the management of orbital floor fracture were nausea, vomiting, diplopia, enophthalmos, and restricted eye movement due to entrapment of extraocular muscles. The most common clinical feature in our study was diplopia (81.4%), which is in accordance with studies published in Ukraine, where diplopia was found to be the most common presenting feature as well (6) Kim et al. found a strong correlation between nausea and vomiting, and extraocular muscle entrapment which prompted an immediate radiographic confirmation of orbital floor fracture. (11) In our study, nausea and vomiting were reported only in 40.2%. The reason for this was that patients with a history of trauma up to 14 days were included in the study. There was a strong association between enophthalmos, restricted eye movements, and orbital fracture in our study, which was in accordance with previous studies (5).

CT is widely accepted as the imaging gold standard for orbital floor fractures. 1-11A good correlation between clinical examination and CT findings is necessary for optimal management of the patients with orbital fractures (5,7,9,11) . In our study, physical examination findings of traumatic paediatric patients were supported by CT scan findings for decision making. All the patients were advised to undergo a CT scan before the treatment modality was decided. Surgical exploration was based on the correlation of the presenting signs and symptoms with CT findings. The type of orbital fracture was not specified in our study. The tear drop sign was used as a strong indicator for trapdoor fractures on CT scans. However, only 33.3% patients had the tear drop sign on CT scan with a confirmed diagnosis of trapdoor fracture. In contrast, trapdoor fractures were seen in 51.9% of patients in the Ukrainian study. (6) This is due to the fact that impairment of orbital walls may not be seen on CT scan if the affected bone fragment restores itself, as is the case with paediatric bone morphology.

Patients who had enophthalmos and muscle incarceration were promptly managed with surgical intervention in our study, even though the percentage of them was only 38.2%.In studies performed internationally, the frequency of surgical intervention was higher than in contrast to our centre. (3,4,6,11). The reason for this was that patients with various orbital fractures were included in our study. The study wasn't inclusive of orbital floor fractures only.

Limitations of this study were that it was designed as a retrospective study. They reviewed the data obtained from the records in the emergency unit, and clinical follow-ups were out of scope. Also, various fractures of the orbit were included instead of only focusing on the floor fractures.

Conclusion

In conclusion of the study performed at our centre, clinical findings should prompt a CT investigation in case of orbital fractures. If there is restriction of eye movement and diplopia along with other features, surgical intervention is necessary. Rest can be managed by conservative treatment.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-23)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

HA (Specialist, Registrar)
Manuscript drafting, Study Design,
LS (BDS)
Review of Literature, Data entry, Data analysis, and drafting articles.
AY (Resident)
Conception of Study, Development of Research Methodology Design,
M (Resident)
Study Design, manuscript review, critical input.
KH (Resident)
Manuscript drafting, Study Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Seifert LB, Mainka T, Herrera-Vizcaino C, Verboket R, Sader R. Orbital floor fractures: epidemiology and outcomes of 1594 reconstructions. Eur J Trauma Emerg Surg. 2022 Apr;48(2):1427-1436. https://doi.org/10.1007/s00068-021-01716-x
2. Valente L, Tieghi R, Elia G, Galiè M. Orbital Fractures in Childhood. Ann Maxillofac Surg. 2019 Jul-Dec;9(2):403-406. https://doi.org/10.4103/ams.ams_185_19
3. Costa SM, Ribeiro BC, Nunes DB, Greco BB. Trapdoor Orbital Fracture in a Pediatric Patient. Case Report and 57 Years of Literature Review. Surg Insights. 2022;1:626. https://doi.org/10.55085/si.2022.626
4. Mehmood N, Hasan A. Oculocardiac Reflex: An Underrecognized But Important Association With Orbital Trap Door Fractures. Pediatr Emerg Care. 2021 Dec 1;37(12):1731-1732. https://doi.org/10.1097/PEC.0000000000001884
5. Kavak RP, Özdemir M, Kavak N: Injury and clinical patterns according to age groups in pediatric orbital fractures. Ann Clin Anal Med. 2020,11:37-41. https://doi.org/10.4328/ACAM.201223
6. Slobodianiuk A.S., Chepurnyi I.V., Efimenko V.P., Shuklina Iu.V., Kopchak A.V., Petrenko O.V., Iakovenko L.M., Rykov S.O. Pediatric orbital fractures: clinical and CT features and criteria for selecting a treatment option. Journal of Ophthalmology (Ukraine) - 2020 -5 (496);43-50.
7. Hsieh, P.-J.; Liao, H.-T. Outcome analysis of surgical timing in pediatric orbital trapdoor fracture with different entrapment contents: a retrospective study.Children 2022, 9, 398. https://doi.org/10.3390/children9030398
8.Takahashi Y, Sabundayo MS, Miyazaki H, et al.Orbital trapdoor fractures: different clinical profiles between adult and paediatric patients. Br J Ophthalmol. October 25,2017. https://doi.org/10.1136/bjophthalmol-2017-310890
9. Iftikhar M, Canner JK, Hall LN, Ahmad M, Divya Srikumaran, Woreta FA. Characteristics of Orbital Floor Fractures in the United States from 2006 to 2017. Ophthalmology. 2021 Mar 1;128(3):463–70. https://doi.org/10.1016/j.ophtha.2020.06.065
10. Sires, S.B.; Stanley, R.B., Jr.; Levine, L.M. Oculocardiac Reflex Caused by Orbital Floor Trapdoor Fracture: An Indication for Urgent Repair. Arch. Ophthalmol. 1998, 116, 955–956.
11. Kim, J.; Lee, H.; Chi, M.; Park, M.; Lee, J.; Baek, S. Endoscope-Assisted Repair of Pediatric Trapdoor Fractures of the Orbital Floor: Characterization and Management. J. Craniofacial Surg. 2010, 21, 101–105. https://doi.org/10.1097/SCS.0b013e3181c466e2