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Study of Orbital Fractures After Lockdown in Warsaw, 2022

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Abstract

Introduction: It is a retrospective analysis of the electronic medical records of patients with orbital bone fractures, one of the most frequent facial traumas, admitted to the Department of Cranio-Maxillofacial Surgery, Oral Surgery and Implantology, Medical University of Warsaw, Poland. The purpose of the study was to indicate the most common causes, treatment approaches, and complications of orbital fractures. Clinical data, such as circumstances of incidents, symptoms of traumas, and duration of treatment, is part of the analysis.

Methods. In 2022, 213 patients with orbital fractures were admitted to the Department of Cranio-Maxillofacial Surgery at the WUM. Collected data included gender, age, fracture classification, fracture position, loss of consciousness, insobriety, symptoms, period of hospital admission, type of treatment applied, and treatment results. Diagnosis and treatment were based on physical examination and results of computed tomography (CT) of the skull.

Results. Patients ranged in age from 17 to 86 (mean age 41). A total of 173 patients were male, and 40 were female. The most common causes of injuries were assault (37.6%), falls (16.9%), and traffic accidents (10.3%). The most frequent type of fracture involving the orbital wall was orbitozygomatic fracture, which occurred in 122 cases. Almost three-quarters of the patients were treated surgically, while the others were treated conservatively. Surgical procedures were performed, on average, within a time frame of 8.8 days following the occurrence of the incident. Less than one-third of the patients suffered postoperative complications such as paresthesias of regions supplied by the ophthalmic and maxillary nerves, diplopia, and other disorders of vision and/or numbness. Most of complications were transient.

Conclusion. The authors note a substantial prevalence of intricate orbital bone fractures requiring surgical intervention. It is worth noting that acts of violence emerge as a major causing factor, with males aged around 36 showing the highest susceptibility to such injuries.

Categories: Radiology, Trauma, Dentistry

Keywords: diplopia, maxillary nerve paresthesia, orbital fracture, orbital surgery, orbital trauma

Introduction

The orbit is a cranial cavity containing numerous vital anatomical structures, including the eyeball, lacrimal gland, and various cranial nerves such as the optic, oculomotor, trochlear, ophthalmic, and abducens nerves. The orbital cavity is formed by seven bones constituting its walls [1]. Its superior wall consists of the orbital part of the frontal bone and the lesser wing of the sphenoid bone. The inferior wall is composed of the orbital surface of the maxilla, a part of the orbital surface of the zygomatic bone, and the orbital process of the palatine bone. The medial wall consists of the posterior segment of the frontal process of the maxilla, the lacrimal bone, the orbital plate of the ethmoid bone, and a portion of the body of the sphenoid bone.

Lastly, the lateral wall consists of the frontal surface of the zygomatic bone and the orbital plate of the greater wing of the sphenoid bone. The orbit, composed of seven bones, is highly susceptible to injuries.Orbital fractures may occur as isolated injuries or in association with zygomatic, naso-orbito-ethmoid, and complex midfacial fractures [2,3]. In our study, we applied the clinical classification of fractures by Prof. B. Hammer [4]. Four classes of orbital fractures were based on their occurrence along with other fractures of the face.

Orbitozygomatic fractures (OZ) involve the fractures of the walls of the orbit along with the zygomatic complex. Internal orbital fractures (IO) involve isolated fractures of any of the walls, roof, and floor. Naso-orbito-ethmoid-type fractures (NOE) involve fractures of the naso-orbito-ethmoid complex which involve the orbit. Complex fractures (CX) of the face involve fractures of the orbit with concomitant fractures of the face other than the ones mentioned above [5].

Materials And Methods

A retrospective review was conducted on patients treated for orbital fractures at the Department of Cranio-Maxillofacial Surgery, Oral Surgery and Implantology, Medical University of Warsaw. Two hundred and thirteen charts of patients with orbital wall fractures archived in the Infant Jesus Clinical Hospital were reviewed. Patients were identified based on hospital admission record and medical documentation recorded between January 1, 2022, and December 31, 2022. The register gave a basis for further data collection carried out with the use of electronic patient records. Patient records included hospitalization details, follow-up visits, and radiographic findings (CT), all of which were analyzed. Out of 213 medical records, the factors that were taken into account in the data collection process were gender, age, fracture classification, fracture location, loss of consciousness, insobriety, causes, symptoms, period of hospital admission, and type of treatment applied as well as the treatment results and complications.

The orbital fractures were divided into four categories - orbitozygomatic fractures (OZ), internal orbital fractures (IO), naso-orbito-ethmoid-type fractures (NOE), complex fractures of the face (CX). For the purpose of analysis, patients were divided into three age groups: young (≤30 years), adults (31-60 years), and seniors (≥61 years)

Patients with pathological fractures, incomplete or unclear medical records (6) were excluded from the study.

Statistical analysis was performed using the chi-square test to assess categorical variables and ANOVA (Analysis of Variance) to compare means between groups. A significance level of $p < 0.05$ was considered statistically significant.

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Bioethics Committee of the Medical University of Warsaw (AKBE/138/2025).

Results

CLASSIFICATION OF ORBITAL BONE FRACTURE

One hundred and twenty-two cases out of 213, which constituted 57.3% of all patients, involved orbitozygomatic fractures. In most cases, the fracture was positioned on the left side (L=71; P=49; both sides=2). Another frequent type of fracture within the orbital wall was internal orbital fracture (n=40; 18.8%). Most fractures were located on the left side or involved both sides (L= 12; P=7; both sides=13). Thirty-two records (15.0%) considered complex fractures of the face - mostly left-sided (L=19, P=11). The least numerous categories of fractures within an orbit were naso-orbito-ethmoid-type fractures which concerned 19 cases (9.0%) - mostly right-sided (L=5; P=9; both sides=5). (see Table 1)

Fracture Classification	Number of Cases (N)	Percentage (%)
Orbitozygomatic Fractures	122	57.3%
Internal Orbital Fractures	40	18.8%
Complex Fractures of the Face	32	15.0%
Naso-Orbito-Ethmoid-Type (NOE) Fractures	19	8.9%
Total Cohort	213	100.0%

TABLE 1: Type of fracture within patients in the study.

AGE AND SEX

The mean age of patients in the cases studied was 41. Patients ranged in age from 17 to 86. The mean age of patients across different fracture types is relatively similar, ranging between 40 and 43 years (see Table 2) and did not differ statistically between the fractures types. Largest sex/ age gap, with women being significantly older occured in internal orbital fractures where women’ mean age was 65.6 years and men 37.9 years. A vast majority of the patients were male 173 (81.2%) and the rest were female 40. Men are the dominant group in all fracture types, especially in complex fractures of the face (93.3%) and naso-orbito-ethmoid-type fractures (89.5%). The highest proportion of female patients was found in internal orbital fractures, which was 10 cases (25%), and orbitozygomatic fractures 25 patients (20.49%), whereas in naso-orbito-ethmoid-type fractures with the result of only 2 cases (10.52%) and complex fractures of the face with the sama amount of patients (6.25%) the proportion was substantially lower.

Fracture Classification	Number of Cases (N)	Mean Age (Years)	Standard Deviation (SD)
Orbitozygomatic Fractures	119	42.9	±16.5
Complex Fractures of the Face	30	41.6	±16.0
Naso-Orbito-Ethmoid-Type Fractures	19	40.8	±18.5
Internal Orbital Fractures	38	40.3	±16.4

TABLE 2: Mean age of patients in the study with each type of fracture.

MECHANISMS OF INJURY

Taking into consideration all cases of orbital fractures, most commonly, the injuries resulted from assault - 37.6%, followed by falling - 16.9% and traffic accidents - 10.3%. This paragraph solely presents the essential causes of orbital injuries. Forty-one cases of orbitozygomatic fractures are reported to be caused by an assault, 25 by falling, and 28 by traffic and bike accidents. Assault (8), falling (3), traffic, and bike accidents (3), appear to be the most common causes of naso-orbito-ethmoid-type fractures. Complex fractures of the face were caused by an assault in 8 cases, bumping into something in 7 cases, and traffic accidents in 3 cases. Most patients with internal orbital fracture suffered from assault (23). The statistical analysis confirmed a significant correlation between age group and the causes of fractures ($p = 0.0016$). The findings indicate that assault is the leading cause of fractures in younger individuals (47.5%) and adults (39.6%). In contrast, falls from standing height are the predominant cause of fractures in seniors (23.5%). (see Table 3).

Cause of Injury	Number of Cases (N)	Percentage (%)
Assault	80	37.6%
Fall	36	16.9%
Traffic accident-hit-and-run	25	11.7%
Bike accidents	20	9.4%
Fall from height (for example stairs)	13	6.1%
Impact into/through an object	11	5.2%
Impact, accident - sports	9	4.2%
Scooter accident	7	3.3%
Other	4	1.9%
Hit by an animal	3	1.4%
Ice skating, skateboard accident	2	0.9%
No information	2	0.9%
War campaign	1	0.5%
Total	213	100.0%

TABLE 3: Causes of patients' fractures.

LOSS OF CONSCIOUSNESS, INSOBERITY

During the patient's ER or ward stay, medical history is collected, along with the description of the incident that brought the patient to the hospital. Information about insobriety (see Table 4) and loss of consciousness (see Table 5) during incidents is crucial.

Fracture Classification	Number of Insobriety Cases (N)	Percentage within the Specific Fracture Type (%)
Orbitozygomatic Fractures	29	24.4%
Complex Fractures of the Face	10	33.3%

Fracture Classification	Number of Insobriety Cases (N)	Percentage within the Specific Fracture Type (%)
Internal Orbital Fractures	7	18.4%
Naso-Orbito-Ethmoid-Type Fractures	6	31.6%
Total Insobriety Cohort	52	24.4% (of total N=213)

TABLE 4: Number of inebriated patients by fracture.

Fracture Classification	Number of Unconsciousness Cases (N)	Percentage within the Specific Fracture Type (%)
Orbitozygomatic Fractures	32	26.2%
Internal Orbital Fractures	10	25.0%
Complex Fractures of the Face	5	15.6%
Naso-Orbito-Ethmoid-Type Fractures	4	21.1%
Total Unconsciousness Cohort	51	23.9% (51 of 213)

TABLE 5: Number of patients who lost consciousness during fracture.

SYMPTOMS

The most common symptom, which were observed by doctors in patients with orbital fractures, were ocular hematoma, involving 57.27% of the cases studied, eyelid edema - 45.54%, maxillary nerve paresthesia - 34.27%, and diplopia - 21.12% (see Table 6). This paragraph solely presents the main symptoms of orbital injury. Patients with orbitozygomatic fractures, were admitted to hospital with symptoms of ocular hematoma - 74 cases, eyelid edema - 60 cases, maxillary nerve paresthesia - 50 cases, bone fault - 32 cases. Internal orbital fractures were presented most commonly with ocular hematoma - 25 cases, and diplopia - 21 cases. Patients with complex fractures of the face appeared with symptoms like ocular hematoma - 15 cases and eyelid edema - 14 cases. Eyelid edema (11), and ocular hematoma (8), were the most common symptoms of naso-orbito-ethmoid-type fractures.

Clinical Symptom	OZ Cohort (N=122)	IO Cohort (N=40)	CX Cohort (N=32)	NOE Cohort (N=19)
Blurred vision / vision disturbance	8 (6.6%)	4 (10.0%)	4 (12.5%)	3 (15.8%)
Bone fault	32 (26.2%)	0 (0.0%)	2 (6.3%)	0 (0.0%)
Collapse of the cheek / infraorbital area	19 (15.6%)	0 (0.0%)	7 (21.9%)	2 (10.5%)
Diplopia	11 (9.0%)	21 (52.5%)	9 (28.1%)	4 (21.1%)
Disturbance or painful abduction of the jaw	10 (8.2%)	0 (0.0%)	1 (3.1%)	2 (10.5%)
Enophthalmus	0 (0.0%)	3 (7.5%)	2 (6.3%)	0 (0.0%)
Exophthalmus	2 (1.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Eyelid edema	60 (49.2%)	12 (30.0%)	14 (43.8%)	11 (57.9%)
Limited eyeball mobility	5 (4.1%)	5 (12.5%)	2 (6.3%)	2 (10.5%)
Ocular hematoma	74 (60.7%)	25 (62.5%)	15 (46.9%)	8 (42.1%)
Paresthesia V2	50 (41.0%)	13 (32.5%)	6 (18.8%)	4 (21.1%)
Ptosis	0 (0.0%)	0 (0.0%)	3 (9.4%)	0 (0.0%)
Subconjunctival hematoma	17 (13.9%)	4 (10.0%)	1 (3.1%)	3 (15.8%)
Subcutaneous/intracranial pneumothorax	5 (4.1%)	6 (15.0%)	2 (6.3%)	4 (21.1%)
Trismus	8 (6.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

TABLE 6: Symptoms presented by patients

TREATMENT

Depending on the type, the extent of the fracture, and the patients' general health condition, they were treated surgically or conservatively. One hundred fifty-eight patients were treated surgically, while remaining were treated conservatively. Surgical treatment was based mainly on setting and stabilizing the broken bone fragments using osteosynthesis plates. Conservative treatment consisted of administering either Augmentin or Clindamycin antibiotics to prevent infections of sinuses. Surgical procedures were performed, on average, within a time frame of 8.8 days following the occurrence of the incident. The earliest surgery was carried out the day after the trauma. The longest time between trauma and surgery was naso-orbito-ethmoid-type fracture case where surgery was performed as much as 130 days after the incident, due to the need for live-saving procedures prior to craniofacial reconstruction. Women stayed in the hospital longer than men during treatment of all fracture types. The largest difference is seenin orbitozygomatic fractures (men: 1.8 days, women: 7.1 days). The longest hospitalization period is associated with complex fractures of the face (7.5 days on average). Older patients tend to have longer hospital stays. The longest hospitalization periods occur in patients aged 71+ years. The shortest hospital stays are seen in patients under 18 years. (see Table 7-10)

Fracture Classification	Surgical Treatment (N, %)	Conservative Management (N, %)
Orbitozygomatic Fractures	95 (77.9%)	27 (22.1%)
Internal Orbital Fractures	28 (70.0%)	12 (30.0%)
Complex Fractures of the Face	23 (71.9%)	9 (28.1%)
Naso-Orbito-Ethmoid-Type Fractures	12 (63.2%)	7 (36.8%)
Total Cohort	158 (74.2%)	55 (25.8%)

TABLE 7: Choice of treatment by fracture type.

Fracture Classification	Mean Hospitalization (Days)	Standard Deviation (SD)
Complex Fractures of the Face	7.5	±4.2
Naso-Orbito-Ethmoid-Type Fractures	6.8	±3.9
Internal Orbital Fractures	6.2	±3.5
Orbitozygomatic Fractures	2.9	±1.8

TABLE 8: Length of hospital stay according to fracture type.

Fracture Classification	Patient Gender	Mean Hospitalization (Days)	Standard Deviation (SD)
Complex Fractures of the Face	Men	7.4	±4.1
Complex Fractures of the Face	Women	9.0	±4.8
Naso-Orbito-Ethmoid-Type Fractures	Men	6.5	±3.8
Naso-Orbito-Ethmoid-Type Fractures	Women	9.0	±4.9
Internal Orbital Fractures	Men	5.7	±3.2
Internal Orbital Fractures	Women	7.5	±4.2
Orbitozygomatic Fractures	Men	1.8	±1.1
Orbitozygomatic Fractures	Women	7.1	±3.9

TABLE 9: Length of hospital stay according to sex.

Age Group (Years)	Patient Gender	Mean Hospitalization (Days)	Standard Deviation (SD)
<18	Men	4.0	±2.4
<18	Women	3.0	±1.9
18-30	Men	6.2	±3.5
18-30	Women	6.0	±3.3
31-50	Men	5.5	±3.0
31-50	Women	7.5	±4.2
51-70	Men	5.5	±3.2
51-70	Women	9.2	±5.1
>70	Men	8.4	±4.6
>70	Women	8.7	±4.9

TABLE 10: Length of hospital stay according to age.

POST- TREATMENT FINDINGS

After a surgical treatment or a conservative one, some of the patients were presented with posttreatment complications, which were monitored until hospital discharge and during follow-up examinations. One hundred patients did not experience any posttreatment complications. In 50 cases, there were no records about subsequent appointments in the medical history of the respective medical facility, or the patients did not attend them. Sixty-three patients with orbital fractures were reported to have encountered evidenced posttreatment complications. Most findings have been reported after surgical treatment of orbital fractures. Fifty-three patients with complications undergo surgical treatment and ten receive conservative treatment. Complications were observed in 33.54% surgically treated patients and 18.18% of patients treated conservatively. Further statistics on complications solely regarded patients with complications. The most common complications after treatment were - developed paresthesia (17 cases), which refers to paresthesia that arose following surgical intervention; persisted paresthesia (12 cases), which was present as a symptom of the fracture and did not resolve after treatment; diplopia (11 cases), and numbness (7 cases). (see Table 11).

Post-Treatment Finding	Number of Cases (N)	Percentage (%)
No complication	100	46.9%
No information	50	23.5%
Developed paresthesia V2	17	8.0%
Persisted paresthesia V2	12	5.6%
Diplopia	11	5.2%
Numbness	7	3.3%
Developed visual disturbance	5	2.3%
Collapse of the cheek/infraorbital area	2	0.9%
Pain around the fracture	2	0.9%
Persisted visual disturbance	1	0.5%
Hearing disorder	1	0.5%

Post-Treatment Finding	Number of Cases (N)	Percentage (%)
Total Outcomes Tracked	208	97.6%

TABLE 11: Findings observed after fracture treatment.

The table below present post-treatment findings depending on the treatment performed. (see Table 12)

Fracture Subtype & Treatment Modality	Persisted Paresthesia V2	Developed Paresthesia V2	Numbness	Collapse of Cheek / Infraorbital Area	Developed Visual Disturbance	Persisted Visual Disturbance	Diplopia	Hearing Disorder	Pain Around Fracture
OZ - Surgical (N=95)	5 (5.3%)	8 (8.4%)	3 (3.2%)	0 (0.0%)	1 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.1%)
OZ - Conservative (N=27)	2 (7.4%)	2 (7.4%)	0 (0.0%)	1 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
IO - Surgical (N=28)	1 (3.6%)	1 (3.6%)	1 (3.6%)	0 (0.0%)	1 (3.6%)	0 (0.0%)	7 (25.0%)	0 (0.0%)	0 (0.0%)
IO - Conservative (N=12)	0 (0.0%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	1 (8.3%)	1 (8.3%)	1 (8.3%)	0 (0.0%)	0 (0.0%)
CX - Surgical (N=23)	1 (4.3%)	5 (21.7%)	0 (0.0%)	1 (4.3%)	1 (4.3%)	0 (0.0%)	2 (8.7%)	0 (0.0%)	0 (0.0%)
CX - Conservative (N=9)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Fracture Subtype & Treatment Modality	Persisted Paresthesia V2	Developed Paresthesia V2	Numbness	Collapse of Cheek / Infraorbital Area	Developed Visual Disturbance	Persisted Visual Disturbance	Diplopia	Hearing Disorder	Pain Around Fracture
NOE - Surgical (N=12)	2 (16.7%)	2 (16.7%)	2 (16.7%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	0 (0.0%)
NOE - Conservative (N=7)	1 (14.3%)	1 (14.3%)	1 (14.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (14.3%)	0 (0.0%)

TABLE 12: Post-treatment findings observed after surgical and conservative treatment.

A significant part of diplopia cases involves internal orbital fractures (72.72%). Paresthesia of maxillary nerve mainly occurs in orbitozygomatic fractures (48.28%).

STATISTICAL ANALYSIS OF VARIABLES

Pearson’s chi-square test demonstrated no statistically significant association between patient sex and fracture type ($\chi2=5.77, p=0.124$) or between age groups and fracture type ($\chi2=6.94, p=0.862$). Similarly, no significant relationships were found for sex versus alcohol consumption ($\chi2=6.64, p=0.084$), sex versus loss of consciousness ($\chi2=0.94, p=0.817$), or general symptoms versus the duration of hospital stay ($\chi2=565.35, p=0.338$). One-way ANOVA also confirmed that the length of hospitalization did not differ significantly across different age groups ($F=1.15, p=0.332$).

However, a highly significant statistical relationship was identified between the patient's age group and the specific cause of the orbital fracture ($\chi2=187.40, p=0.0016$). Younger patients (≤30 years) and adults ($31-60$ years) sustained fractures predominantly due to physical assault (47.5% and 39.6%, respectively), whereas elderly patients (≥61 years) experienced orbital fractures primarily as a result of ground-level falls (23.5%). A comprehensive summary of the test statistics and corresponding p-values for all analyzed clinical and demographic relationships is presented in Tables 13-16.

Age Cohort Interval (Years)	Hospitalization Duration (Days, Mean ± SD)	Test Statistic Value	Asymptotic p-value
<18	3.7 ± 2.1	F = 1.15	p = 0.332
18-30	6.2 ± 3.5		
31-50	5.9 ± 3.2		
51-70	6.4 ± 3.6		
71+	8.4 ± 4.7		

TABLE 13: Mean Duration of Hospitalization Stratified by Patient Age Cohorts

Raw data are presented as Mean ± Standard Deviation (SD) measured in days of inpatient stay. The statistical significance of differences in the length of hospital stay across the continuous chronological age intervals was computed using a One-way Analysis of Variance (ANOVA) F-test (Significant at $p<0.05$).

Demographic Variable	CX (N=30)	IO (N=38)	NOE (N=19)	OZ (N=119)	Test Statistic Value	Asymptotic p-value
Patient Gender					$X^2 = 5.77$	p = 0.124
Male	28 (93.3%)	29 (76.3%)	17 (89.5%)	94 (79.0%)		
Female	2 (6.7%)	9 (23.7%)	2 (10.5%)	25 (21.0%)		
Age Group (Years)					$X^2 = 6.94$	p = 0.862
Younger Adults (≤30)	11 (36.7%)	13 (34.2%)	7 (36.8%)	43 (36.1%)		
Middle-Aged Adults (31-60)	14 (46.7%)	17 (44.7%)	9 (47.4%)	54 (45.4%)		

Demographic Variable	CX (N=30)	IO (N=38)	NOE (N=19)	OZ (N=119)	Test Statistic Value	Asymptotic p-value
Elderly Patients (≥61)	5 (16.6%)	8 (21.1%)	3 (15.8%)	22 (18.5%)		

TABLE 14: Demographic Distribution and Association Between Baseline Characteristics and Orbital Fracture Subtypes

Data for raw numerical values are expressed as absolute frequencies (N) and relative percentages (%) calculated within each specific fracture subtype column. Statistical associations were evaluated using the Pearson's Chi-square (X^2) test of independence to assess whether the distribution of patient gender or age cohorts significantly differs across the diagnostic fracture categories (Significant at $p<0.05$). OZ - orbitozygomatic fracture; IO - internal orbital fracture; CX - complex fractures of the face; NOE - naso-orbito-ethmoid-type fracture

Etiological Cause of Fracture	Younger Adults (≤30 Years)	Middle-Aged Adults (31-60 Years)	Elderly Patients (≥61 Years)	Test Statistic Value	Asymptotic p-value
Physical Assault	47.5% (N=38)	39.6% (N=32)	12.9% (N=10)	X^2 = 187.40	p = 0.0016
Fall	19.4% (N=7)	22.2% (N=8)	23.5% (N=21)		

TABLE 15: Distribution of Primary Etiological Causes of Orbital Fractures Stratified by Patient Age Cohorts

Data represent the absolute number of cases (N) and the corresponding relative frequency (%) of the primary etiological fracture mechanisms, calculated within each chronological age cohort: Younger Adults (≤30 years), Middle-aged Adults (31-60 years), and Elderly Patients (≥61 years) across the complete study population (N=213). Statistical independence and the significance of the categorical association between patient age intervals and injury etiology were determined using Pearson's Chi-square (X^2) test of independence (Significant at $p<0.05$).

Analyzed Relationship / Analysis	Test Statistic	p-value	Analysis Result
Sex vs. Fracture Type	$X^2 = 5.77$	$p = 0.124$	No statistical significance ($p>0.05$)
Age Group vs. Fracture Type	$X^2 = 6.94$	$p = 0.862$	No statistical significance ($p>0.05$)
Hospitalization Length vs. Age Group	$F = 1.15$	$p = 0.332$	No statistical significance ($p>0.05$)
Sex vs. Alcohol Consumption	$X^2 = 6.64$	$p = 0.084$	No statistical significance ($p>0.05$)
Sex vs. Loss of Consciousness	$X^2 = 0.94$	$p = 0.817$	No statistical significance ($p>0.05$)
Age Group vs. Fracture Causes	$X^2 = 187.40$	$p = 0.0016$	Statistically significant relationship ($p<0.05$)
Symptoms vs. Hospitalization Length	$X^2 = 556.35$	$p = 0.338$	No statistical significance ($p>0.05$)

TABLE 16: Summary of Statistical Analysis Results

Statistical analysis was performed using Pearson's chi-square test (test statistic denoted as X^2) to evaluate the associations between categorical variables (Sex vs. Fracture type, Age group vs. Fracture type, Sex vs. Alcohol consumption, Sex vs. Loss of consciousness, Age group vs. Fracture causes, and Symptoms vs. Hospitalization length). One-way analysis of variance (ANOVA) (test statistic denoted as F) was utilized to determine statistically significant differences in the mean duration of hospitalization across different age groups. A p-value of <0.05 was considered statistically significant.

Abbreviations: X^2 - Chi-square statistic; F - ANOVA F-statistic; p - p-value (probability value).

DISCUSSION

This retrospective analysis puts the spotlight on the prevalent patterns in the etiology, demographics, and clinical implications of orbital fractures.

Study shows a significant prevalence of middle-aged men with orbital fractures, which is notable for several reasons and warrants a deeper examination of the factors driving this demographic trend. Middle-aged men are often more involved in activities that increase the risk of facial trauma, such as contact sports, manual labor, and driving [6,7]. This demographic is also more likely to be involved in violent interactions, as suggested by the high percentage of fractures resulting from assault. We recommend that public health institutions consider implementing some violence reduction programs to prevent this type of hospital cases. A considerable number of hospitalized patients were under the influence of alcohol at the time of injury.

This fact puts alcohol consumption as a significant contributing factor evoking the incidents that result in orbital fractures. Alcohol impairs judgment, coordination, and reaction time, making individuals more susceptible to falling, fights, and accidents, which are the most common causes of orbital fractures [8].

The analysis of fracture causes in different age groups revealed distinct patterns. Among young individuals (≤30 years old), the most common cause of fractures was physical assault, accounting for 47.5% of cases.

Similarly, in adults (31-60 years old), assault was also the predominant cause, representing 39.6% of cases. In contrast, among seniors (≥61 years old), falls from a standing height were the leading cause, occurring in 23.5% of cases. These findings indicate that young individuals and adults are more likely to sustain fractures due to physical violence, suggesting greater exposure to high-risk situations such as public aggression, fights, or conflicts. On the other hand, seniors predominantly experience fractures due to falls, which may be attributed to muscle weakness, balance issues, and conditions like osteoporosis. From a practical perspective, preventive measures should be tailored to each age group. For younger individuals and adults, efforts should focus on reducing violence through public safety initiatives and violence prevention programs. For seniors, fall prevention strategies such as balance training, environmental modifications, and home safety interventions are crucial. Regarding treatment and rehabilitation, trauma-related fractures in younger individuals and adults often require surgical intervention, whereas seniors benefit from long-term rehabilitation programs aimed at preventing future falls and enhancing mobility. [9]

Fifty people (23.5%) in the study lost consciousness during the trauma. Most patients diagnosed with a concussion do not have an associated loss of consciousness, however, loss of consciousness is an important sign of a potentially serious head injury. Traumatic brain injury (TBI) is common in up to 50% of patients with facial fractures. Additionally, developing symptoms related to a concussion does not always occur immediately after an injury. Anyone with an orbital injury should undergo extended examinations for concussion, the main symptoms of which are loss of consciousness, post-traumatic amnesia, vomiting, and headaches. Diagnosis of concussion suspects trauma to the neurocranium, which requires neurological consultation [10, 11].

It is essential to pay attention to the characteristic symptoms of orbital trauma, the most common of which are trigeminal nerve dysfunction, oedemas and hematomas of the palpebra, and visual disturbances. Symptoms from the trigeminal nerve are caused by bone damage near the foramen of the terminal branches of the nerve - the supraorbital nerve runs below the orbital roof and then passes through the supraorbital foramen. The infraorbital nerve comes below the orbital floor in the maxilla's infraorbital foramen. In orbital injuries, the infraorbital nerve, a branch of the maxillary nerve, is more likely to be injured. The main symptoms of damage to these nerves are sensory disturbances and anesthesia in its sensory distribution.

Visual disturbances are caused by trauma to the orbital bones and their compression over the optic nerve entering the orbit through the optic canal in the superior orbital wall. Eyeball mobility disorders are caused by pressure on the oculomotor, trochlear, and abducens nerves entering the orbit through the superior orbital fissure. Ocular motility disorders are due to the pressure over the oculomotor, trochlear, and abducens nerves entering the orbit through the superior orbital fissure. Early recognition of the injury and extended diagnosis allow the patient to be treated efficiently and reduce the risk of complications [12-17].

One of the characteristic symptoms of an internal orbital fractures is appearance of diplopia after injury, which occures in 21 cases (52.5%). While post-treatment diplopia was detected in 11 patients. Ten of eleven patients were treated surgically and only one received conservative treatment. Diplopia is clinically demonstrable double vision. In most cases post-traumatic diplopia caused by oedema and hemorrhage is self-limiting and shows spontaneous resolution. The main cause of diplopia due to orbital fracture is muscle entrapment, intra-orbital oedema or hemorrhage, physical bony spicules or fragments acting as impediments following trauma, entrapment of the periorbita, and in rare cases large changes in intra-orbital volume including massive herniations or atrophy of periorbital fat. Comminuted fractures may leave fragments within the orbital cavity and may produce functional deficits with ophthalmic signs including restriction of extraocular muscle movement, diplopia, ptosis, and even blindness. These are generally caused due to increase in the intra-cranial pressure secondary to injuries [18, 19].

In Warsaw in 2022, the most common complication after treatment of orbital fractures was paresthesia of the infraorbital nerve, which was mainly associated with surgical treatment of orbitozygomatic fractures. This may be caused by manipulation of bone fragments near the course and outlet of the infraorbital nerve. [20]

The study enforces early and precise diagnostic protocols and advanced therapeutic interventions to improve patient care and limit the weight of orbital fractures. The significant need for surgical or conservative intervention depends on the complexity of these injuries and factors conditioned by patients. Both approaches aim to restore facial anatomy, function, and aesthetics [21]. According to statistics in 2022, most orbital fractures were treated surgically regardless of the type of fracture. The greatest disproportions between surgical and conservative treatment concern orbitozygomatic fractures. The zygomatic arch and zygomatic bone are structures that give our face its characteristic appearance. They are the bone elements that extend most to the side. During an assault fall or traffic accident, they are a place that is often injured. Due to the delicate structure, the orbitozygomatic fracture is often comminuted with significant bone damage. Therefore, surgical treatment predominates, enabling bone adjustment and restoring the desired facial features [22, 23].

Factors such as the degree of bone displacement, occurrence of function impairments, and overall health of a patient, should be consulted before choosing the treatment selection. The additional examinations are based on the radiology count in diagnosing. In the research, each patient underwent a CT scan, which helped to give an extended diagnosis and plan the treatment.

The findings of our study are consistent with trends observed in other post-pandemic analyses. In particular, Lorenz et al. (2024) conducted a large-scale retrospective cohort study across eighty-three healthcare organizations in the United States, analyzing craniomaxillofacial (CMF) trauma between 2017 and 2022 [24].

Their data demonstrated a significant decline in facial fractures during the 2020 pandemic lockdown (a decrease of seventeen and a half percent), followed by a marked increase in 2021 (an increase of sixteen and seven-tenths percent) as restrictions were lifted. Assault-related injuries also decreased during lockdown (by fifteen and a half percent) but rebounded in subsequent years. These trends mirror our observation of a high incidence of orbital fractures in 2022, predominantly caused by assault (thirty-seven and six-tenths percent) and primarily affecting middle-aged males. Unlike the broad approach of the Lorenz study, which included multiple facial injury types, our focused analysis provides detailed information about orbital trauma patterns, treatment approaches, and complication rates in the post-pandemic period. Notably, our surgical intervention rate was seventy-four percent, emphasizing the complexity and severity of these injuries. These differences may reflect regional variations in healthcare systems, referral patterns, and patient demographics. The comparison supports the notion that as social activity resumed following the pandemic, so did the prevalence of high-energy facial injuries, particularly those resulting from interpersonal violence.

Several study limitations must be acknowledged. First, the retrospective design of this analysis inherently relies on the completeness and accuracy of existing medical records, which can introduce data constraints regarding long-term patient follow-up. Second, this study was conducted as a single-center investigation within a specific metropolitan area of Warsaw, which may limit the generalizability of our epidemiological findings to other regions or healthcare settings with different patient demographics. Additionally, while the sample size was sufficient to identify statistically significant trends, larger prospective multi-center studies are required to further validate these clinical outcomes and establish standardized, universal management protocols for complex orbital trauma. Finally, incomplete follow-up in 50 patients and small NOE subgroup (only 19 patients) could be limitations that had an impact on the final result of the analysis.

CONCLUSIONS

Orbital fractures are complex, multifactorial injuries predominantly affecting middle-aged males, with interpersonal violence and alcohol consumption serving as leading etiological factors. Given the high prevalence of concurrent neurological and visual disturbances, a comprehensive, multidisciplinary diagnostic approach-centered on routine computed tomography is essential for accurate injury classification and optimal therapeutic decision-making. While conservative management remains appropriate for stable cases, severe or displaced fractures, particularly orbitozygomatic presentations, frequently necessitate surgical intervention. Ultimately, personalized treatment planning combined with continuous epidemiological monitoring is critical to optimizing long-term functional outcomes and mitigating the clinical burden of maxillofacial trauma.

DISCLOSURES

All authors have read and agreed with the published version of the manuscript.

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Declaration of use of artificial intelligent

During the preparation of this work, the authors utilized artificial intelligence (AI) as a supportive tool to enhance the readability, linguistic flow, and overall formatting of the manuscript, including citation structuring. The use of this artificial intelligence was strictly limited to technical and stylistic refinement. All scientific content, including literature selection, critical analysis, interpretation of findings, and final conclusions, was developed independently by the authors. After using this tool, the authors have reviewed and edited the content as needed and accept full resposibility for the substantive content of the publication.

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