

Midface fractures through human aggression: how can we prevent them? – a 10 year cross-sectional cohort retrospective study

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Abstract. Introduction: The increase in the incidence of mid-face fractures of the face through inter-personal violence (IPV) has been overwhelming in recent years both in Europe and worldwide. IPV is a special etiology in face trauma, being able to produce besides mutilations and considerable cosmetic deficits, psychological and major emotional disorders to the victim. Objective: The aim of this study was to identify the main category of patients with midface fractures which were victims of IPV in our geographical area in order to properly treat, advise and guide these patients, as well as to take measures to prevent this pathology in the future. Materials and methods: This retrospective study was performed on patients with midface fractures through IPV hospitalized and treated for a period of 10 years in an university clinic of oral and maxillofacial surgery. After the statistical analysis of the data, a value of $p < 0.005$ was considered statistically significant. Results: At the end of the 10-year period in which the retrospective study was conducted 168 patients met all inclusion criteria. The majority of patients were males (93.45%) with a mean age of 32.71 years ($p = 0.033$), belonging to the urban environment (58.33%) and having a low educational level (46.40%). All women in the study were victims of domestic violence (DV) (100%). The fractures of the zygomatic complex were the most common (49.32%), followed by nasal bone fractures (21.46%). Conclusions: Educating the population and combating alcohol consumption through legislative norms would lead to the reduction of midface fractures through IPV in our geographical area. Implementing measures to combat domestic violence against women is imperative.

Key Words: midface, fractures, human aggression, inter-personal violence, epidemiology, prevention.

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Introduction

The incidence of midface fractures due to interpersonal violence (IPV) has increased alarmingly in Europe in recent years, surpassing the one of road accident fractures (Boffano et al 2015). IPV can cover many aspects from urban violence (UV), domestic violence (DV), from direct punching, use of blunt objects, to stabbing or firearms (Bernardino et al 2017). Midface fractures due to close anatomical relations with the orbit, nasal cavity, maxillary sinuses, cervical spine and the skull may have an extremely varied clinical picture with multiple associated lesions and comorbidities (Cohn et al 2020). The management of these fractures often requires a multidisciplinary approach, requiring expensive materials and resources (Cohn et al 2020). Identifying, diagnosing, and evaluating midface fractures through IPV directly in an outpatient setting is often difficult due to the victim's avoidance to report the etiology because of fear, shame or emotional impact (Werlinger et al 2019). The classification of a trauma as a human aggression episode is extremely important for the distribution of funds in health care, the use of health insurance policies and nonetheless in order to avoid legal procedural defects (Hirvikangas et al 2020). Periodic epidemiological

studies are extremely important because only in this way we can assess what are the population's health problems, needs and how we, as doctors, can improve their quality of life (Arangio et al 2013). Knowing the epidemiology of IPV in a population helps medical staff to suspect and identify this etiology even if the victim avoids reporting it, as well as to determine the means to prevent it (Lee et al 2017).

The purpose of this study is to identify the main category of affected patients, in order to establish IPV prevention norms, as well as moral and psychological national support programs for the victims.

Material and methods

This retrospective research was performed on hospitalized and treated patients for a period of 10 years (01.01.2010 – 31.12.2019) in an university clinic of oral and maxillofacial surgery in north-western Romania.

This study was approved by the ethics commission of the University of Oradea, Romania (Irb No. 28200 / 27.03.2020). All patients included in the study signed an informed consent at the time of hospitalization, giving their consent for the use of

their medical data for scientific research purposes. In the case of patients under the age of 18, the agreement was signed by their parents or legal guardian. This study was approved by the Territorial Ethics Commission and has therefore been performed in accordance with the ethical standards laid down in the 2008 Declaration of Helsinki and its later amendments.

The inclusion criteria in the study were: the presence of at least one fracture line in the midface, the confirmation of an IPV by the patient in writing, an episode of acute trauma, the existence of imaging investigations in the observation sheets (radiography, orthopantomogram or computed tomography) to confirm the clinical diagnosis of the fracture and to highlight its topographic location, pattern and characteristics, an alcohol test performed at the time of presentation to the doctor.

We mention that in our service all patients who are victims of human aggression are subjected to alcohol tests. Any patient with an alcohol concentration in the expired air above 0.00 mg / L was considered under the influence of alcoholic beverages in this study.

The exclusion criteria from the study were: patient without a fracture line in the midface, etiology of the fracture other than IPV, patient's refusal to confirm the etiology of the fracture in writing, absence of the patients' complementary imaging examinations from the clinical observation sheet, the absence of one or more variables of interest from the observation sheets. The following variables were extracted from the clinical observation sheets: gender, age (classified by decades of life), environment of origin (urban / rural), level of education of the patients classified as follows: without studies - primary school cycle unfinished, primary school, middle school, high school and university studies, the association of trauma with alcohol consumption, the type of assault (urban violence/domestic violence), the type of physical aggression (body contact, blunt object, firearms), the topographic location of the midface fracture. To prevent bias the first author and one member of the statistical department double-checked the clinical sheets.

The size of this study was reached due to the 10-year period in which the patients were diagnosed of IPV midface fractures in our clinic.

The data were centralized in electronic format using Microsoft Excel software. Descriptive statistics of the evaluated cases was performed with a two decimal percentage accuracy.

Statistical analysis was carried out with MedCalc Statistical Software version 20.011 (MedCalc Software Ltd, Ostend, Belgium; 53 <https://www.medcalc.org>; 2021). Continuous data were expressed as mean and standard deviation, while nominal data were expressed as frequency and percentage. The comparisons of the frequencies of a nominal variable between the categories of another nominal variable were performed using the chi-square test. The comparison of a continuous nominal variable between two groups was performed via the T test for independent variables. A p value <0.05 was considered statistically significant.

We acknowledge that this study was conducted according to the STROBE guidelines.

Results

Following data collection, 542 patients were identified with midface fractures due IPV within the established 10-year time

period. 374 patients out of these were excluded from the study for the following reasons: 103 patients did not present data regarding the origin environment, 89 patients did not present data regarding the education level, 182 patients did not present imaging investigations. Thus, the inclusion criteria in the study were met by 168 patients with a total of 209 fracture trajectories in the midface.

The most affected age group was 20-29 years n = 72 (42.86%), followed by 30-39 years n = 30 (17.86%), 40-49 years n = 22 (13.10%), 10-19 years n = 18 (10.71%), 50-59 years n = 17 (10.12%), 60-69 years n = 8 (4.76%), 0-9 years n = 1 (0.60%).

Table 1. The mean age of the patients depending on sex

	Gender	N	Mean	Std. Deviation
Age	F	11	42	18.33
	M	156	32.71	13.492
P=0.033				

The majority of patients were male n = 157 (93.45%), women being a minority n = 11 (6.55%). The average age by gender is found in Table 1, the results being statistically significant.

Most patients belonged to the urban areas n = 98 (58.33%), followed by those from the rural environment n = 70 (41.67%).

The distribution of gender depending on the environment of origin can be seen in Table 2, the results being statistically significant. An urban predominance of female victims of IPV can be observed (p = 0.024).

Table 2. The distribution of gender depending on the environment of origin

		Gender	
		F	M
Environment of origin	R	2	68
		18.20%	43.30%
	U	9	89
		81.80%	56.70%
Total		11	157
P=0.024		100,0%	100.00%

Most patients were without studies n = 78 (46.40%), followed by those graduating from middle school n = 35 (20.80%), high school n = 26 (15.50%), university n = 18 (10.70%) and primary school n = 11 (6.50%). The distribution of patients by sex according to the educational level is found in table 3, the results being statistically significant. The predominance of uneducated victims regardless of their sex can be observed (p = 0.038). The majority of the injuries were by direct bodily contact n = 143 (85.12%), and the rest by hitting with a blunt object n = 24 (14.88%). No gunshot or stabbing injuries were reported. Most patients were intoxicated with alcohol at the time of presentation to the doctor n = 151 (89.88%), the sober ones being a minority n = 17 (10.12%).

All 11 (6.55%) women were victims of domestic violence (DV), while men were victims of urban violence (UV) n = 157 (93.45%). Two hundred and nine fracture trajectories were identified at the level of the midface, the most frequent being the fracture of the zygomatic complex n = 108 (49.32%), followed by the fracture of nasal bones n = 47 (21.46%), orbit n = 33 (15.07%),

Table 3. Distribution of education level by gender

	Sex	
	F	M
Without studies	8	70
	72.70%	44.6%
Primary school	0	11
	0.00%	7.0%
Middle school	2	33
	18.20%	21.0%
High school	1	25
	9.10%	15.9%
University	0	18
	0.00%	11.5%
Total	11	157
P=0.038	100.00%	100.00%

upper alveolar process n = 18 (8.22%), Fort II n = 8 (3.65%), Fort III n = 4 (1.83%) and Fort I n = 1 (0.46%). The majority of the zygomatic complex fractures (n=71, 65.74%), orbit (n=24, 72.73%) and alveolar process (n=11, 61.11%) fractures were located on the left side of the midface, those located on the right side being in lower number – zygomatic complex (37, 34.26%), orbit (n=9, 27.27%), alveolar process (n=7, 38.89%).

Discussions

The most affected life decade in our study was 20-29 years, similar to the results of other authors (Boffano et al 2015; Xiao-Dong et al 2020; Fomete et al 2021). In contrast, other authors indicate the decade 40-49 years as the most affected one (Arangio et al 2014) or 30-39 years (Bernardino et al 2017, Cohn et al 2020). In the third decade of life, men are more socially active, behaviorally more competitive and aggressive than women, and are more likely to engage in conflicts, especially under the influence of alcohol or drugs (Hoppe et al 2015; Roccia et al 2016). These statements are also supported by the inclusion period of this study, which ended before the Covid 19 pandemic and the related restrictions imposed in recent years by the authorities. Unhindered human interactions can lead to a higher risk of IPV. The alcohol-IPV relationship also emerges from our results. Most patients tested positive for alcohol in expired air. These results are supported also by other authors (Hoppe et al 2015; Roccia et al 2016; Lee et al 2019). Acute alcohol intoxication predisposes to an aggressive behavior, behavioral alterations in thinking, decision making, and unjustified risk-taking (Lee et al 2019).

The mean age of women in our study is higher by a decade compared to that of men. This can be explained by the fact that all women in our results were victims of domestic violence (DV). These results are supported by other authors who claim that DV often manifests itself after years of coexistence (Bulsara et al 2021; Ferreira et al 2014; Yamamoto et al 2019). These authors also recommend that the clinician should suspect an episode of DV in all cases of women with midfacial fractures through IPV, even if they avoid reporting it. Contradictions in

the literature regarding the incidence of IPV by decades of life can be attributed to the aging population in certain geographical areas (Arangio et al 2014).

Most of the patients in this study belonged to the urban environment, similar to other specialized research works (Cohn et. Of 2020; Schneider et. Of 2015). Other authors indicate the predominance of midface fractures by IPV in rural areas (Batista et al 2012). The rich social life in the urban environment offers a wide access to parties, bars, alcohol and drug use, thus increasing the risk of people getting involved in inter-human conflicts and implicitly the risk of suffering one or more midface fractures (Cohn et al 2020; Schneider et al 2015). The discrepancies regarding this aspect in the literature can be attributed to the geographical area served by the unit in which the study takes place (Batista et al 2012; Mericli et al 2011). Also, these authors indicate the increased incidence of IPV in rural areas due to poverty and low educational level of the inhabitants (Batista et al 2012; Mericli et al 2011; Vaibhav et al 2021). The increased incidence of midface fractures among the population with low educational level is also found in our results. However, the fact that a low educational level in our study is generalized to both the urban and the rural population is rarely found in the literature and emphasizes a major social and educational problem in our country. A low level of education leads to a lack of qualifications, unemployment, low or no income, lack of health insurance and difficulties in accessing the services necessary for a healthy life (Wainwright et al 2019).

The incidence of topographic location fracture lines in the midface depends on a variety of factors: etiology of trauma, type, shape and consistency of the vulnerable agent, kinetic energy and speed of movement, impact surface and position of the head at impact (Wusiman et al 2020). Regarding this aspect, it is reported in literature that secondary to an aggression by bodily force, zygomatic fractures occur more frequently (Jaber et. 2021). In our study the majority of zygomatic complex, orbit and alveolar process fractures were located on the left side of the face. This suggests that most of the aggressors were right-handed. These results are supported also by other scientific publications (Fomete et al 2021; Arangio et al 2014; Wusiman et al 2020). Aggression with firearms or explosives more frequently produce cominutive or panfacial fractures (Jaber et al 2021). The increased incidence of maxillofacial trauma by direct corporal aggression explains the high number of zygomatic complex fractures in our study. These results are also supported by other authors (Fomete et al 2021; Arangio et al 2014; Wusiman et al 2020). Contrary to our findings, other authors indicate the highest incidence that of nose fractures (Lee et al 2017) or orbit fractures (Wainwright et al 2019; Xiao-Dong et al 2020). Nasal bones frequently fracture because their resistance to trauma is biomechanically low (Lee et al 2017). The inter-relationship between orbital fractures and those of zygomatic complex is well known, the zygomatic bone taking part in the composition of 2 of the 4 walls of the orbit (Wusiman et al 2020). In this context, the two categories often intersect, an orbital fracture being statistically included by the authors in the category of zygomatic bones fractures and vice versa (Wainwright et al 2019; Xiao-Dong et al 2020). For example, in this study, the frontozygomatic fracture was included in the category of zygomatic bone

fractures. In this context, the differences between our results and those of other authors are plausible.

The limitations of this study are multiple and are due to its retrospective nature. Data in the observation sheets may be poorly or incorrectly recorded by clinicians. The possibility of a much larger number of patients with midface fractures by IPV during this time, which would have hidden the type of etiology at the time of fear or shame, should also be considered. Thus, by selecting only the complete data sheets, a large number of cases may have been lost. For these reasons, our results do not have the same impact as those of a prospective controlled study. A prospective study on this issue is needed in the future to cement our results.

Conclusions

Midface fractures due to IPV occur most frequently among men aged 20-29, uneducated and under the influence of alcohol. The most common are the fractures of the left zygomatic complex. A woman with zygomatic complex fracture secondary to IPV should be suspected of being a domestic violence victim. Educating the population and combating alcohol consumption through legislative norms would lead to the reduction of midface fractures through IPV. Opportunistic education on the harmful effects of drinking at the time of traumatic episodes can be highly beneficial.

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