

Traumatic causes of mandibular fractures – A 3-year prospective clinical study

¹Paul A. Țeț, ²Daniela Popa, ²Raluca Juncar², ³Antonia Haranguș, ⁴Teofil Lung,
¹Mihai Juncar

¹ Faculty of Medicine and Pharmacy, University of Oradea, Romania; ² Prosthetic Dentistry, Department IV- Prosthetic dentistry and Dental materials, Faculty of Dental Medicine, „Iuliu Hațieganu” University of Medicine and Pharmacy, Cluj-Napoca; ³ Leon Daniello Pneumology Hospital, Cluj-Napoca, Romania; ⁴ Department of Oral and Maxillofacial Surgery I, County Clinical Emergency Hospital of Cluj-Napoca, Cluj-Napoca, Romania.

Abstract. Introduction: Mandibular fracture is currently one of the most frequent pathologies found in the emergency oral and maxillofacial surgical services. It is unanimously accepted that the majority of mandibular fractures are of traumatic origin, but traumatic causes vary considerably in the literature. The aim of this study is to determine the main cause of mandibular fractures in our geographic area and to establish the main categories of patients affected by these. Materials and methods: For this prospective study, patients with mandibular fractures who presented to the emergency service of the Clinic of Oral and Maxillofacial Surgery I in Cluj-Napoca in the period 1 January 2014 – 31 December 2016 were available. Data were obtained from patients and were recorded on their observation sheets. Results: 60 patients were included in the study. The majority of the patients were male (88.33%), aged between 20-29 years (28.33%), from rural areas (76.67%). The most frequent traumatic cause was interpersonal violence (67.80%), followed by fall trauma (13.56%). Conclusions: The main cause of mandibular fractures, regardless of the patients' sex, mean age, environment of origin or level of education, is interpersonal violence.

Key Words: mandible, trauma, fracture, injury, maxillofacial.

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Corresponding Author: D. Popa, email: popa_dana@yahoo.com

Introduction

Despite prevention measures adopted and implemented over the course of years, trauma remains a major problem of maxillofacial pathology worldwide (Mijiti et al 2014). Head traumas have the highest frequency in moderately developed or developing countries, continuously raising public health problems because of the precarious economic situation (Hofman et al 2005). Unfortunately, the treatment of cervico-facial traumatic injuries requires considerable financial resources due to high hospitalization costs, as well as to the need for interdisciplinary treatment (Lee 2012).

The mandible most frequently represents the first and main point of contact in accidents and interpersonal violence episodes, thus having the highest incidence of all viscerocranial fractures (Ahmed et al 2004).

The etiology of mandibular fractures has been extensively studied in the literature. It varies considerably with time, depending on the different regions and their economic situation, and not least, due to law implementation (Kieser et al 2002). Many authors confirm a significant decrease of mandibular fractures in the studied population as a result of legislative changes related to a reduction of the driving speed limit, the increase of penalties for alcohol consumption when driving, as well as for drug

abuse in general, thus reducing the number of road traffic accidents and interpersonal violence episodes (Lee 2012, Kieser et al 2002, Kypri et al 2006).

We consider the assessment of the etiology and epidemiology of mandibular fractures in our population as absolutely necessary to observe their potential changes in time and to establish the need for measures contributing to the prevention of fractures in the future.

Materials and methods

For this prospective study, patients with mandibular fractures who presented to the emergency service of the Clinic of Oral and Maxillofacial Surgery I in Cluj-Napoca in the period 1 January 2014 – 31 December 2016 were available. The protocol was approved by the Ethical Committee of University of Oradea, Romania and all the patients had signed the informed consent for the use of their anonymized medical data in this study. The informed consent for minor patients was signed by the parent or legal guardian.

Data were obtained from the patients and were recorded on their observation sheets, which included the following variables: the patients' sex, age, environment of origin (urban/rural), level of education, type of traumatic etiology.

The following criteria were required for inclusion in the study:

- The patient's written informed consent;
- The presence of at least one mandibular fracture line;
- A traumatic etiology of the mandibular fracture;
- The presence of imaging investigations (posteroanterior panoramic facial radiograph or computed tomography scan) complementing and confirming the clinical diagnosis of mandibular fracture and at the same time allowing to evidence its characteristics and topographic location.

The exclusion criteria were:

- The patient's refusal to participate in the study;
- The absence of mandibular fracture;
- A mandibular fracture of other etiology than traumatic;
- Absence of complementary imaging investigations.

Data were centralized in electronic format using Microsoft Excel software. Descriptive statistics of the evaluated cases with a two decimal accuracy was performed. Statistical analysis was carried out with the MedCalc statistical software version 17.2 (MedCalc Software bvba, Ostend, Belgium; <https://www.medcalc.org>; 2017). Continuous data were expressed as mean and standard deviation, and nominal data as frequency and percentage. The comparisons of the frequencies of a nominal variable between the categories of another nominal variable were performed with the Chi-Square test. The comparison of a continuous nominal variable between two groups was performed with the T test for independent variables. A p value < 0.05 was considered statistically significant.

Results

At the end of the 3-year period during which the prospective study was carried out, 60 patients met all the inclusion criteria. The 20-29 year age group was the most affected. There was no patient aged under 9 years (Fig. 1).

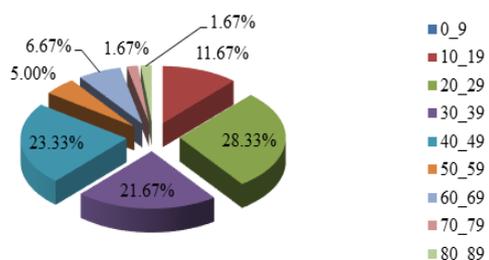


Fig. 1 Distribution of patients depending on age

Male patients (n=53, 88.33%) were more frequently affected by mandibular fractures of traumatic origin than female patients (n=7, 11.67%). The male/female ratio was 8/1.

Most of the patients came from rural areas (n=46), while those belonging to urban areas were a minority in this study (n=14) (Fig. 2). The distribution of patients depending on their level of education showed that mandibular fractures had the highest incidence among patients with middle school studies (Fig. 3). No illiterate patient was recorded.

Interpersonal violence proved to be the most frequent traumatic etiology in this study, followed by trauma from fall. No mandibular fracture caused by domestic accidents or iatrogenic disease was identified (Fig. 4).

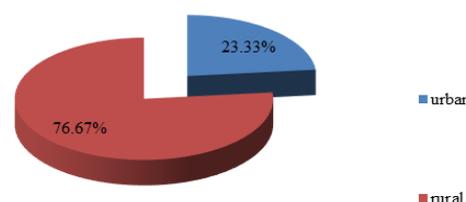


Fig. 2 Distribution of patients depending on their environment of origin

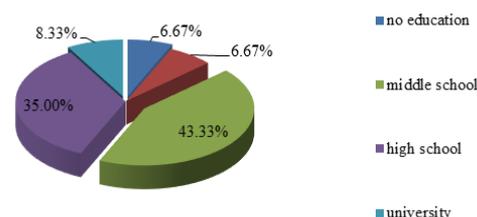


Fig. 3 Distribution of patients depending on their level of education

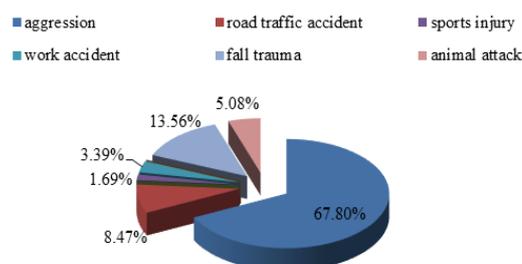


Fig. 4 Distribution of patients depending on trauma etiology

The frequency of the type of traumatic etiology was determined depending on sex, the environment of origin, the level of education, and the topographic location of mandibular fracture lines. Slight differences depending on sex, the environment of origin and the level of education were found, aggression being predominant among men, in rural areas, and among patients with middle school education. However, these differences were not statistically significant (Table 1).

Discussions

The age group most affected by mandibular fractures in this prospective study was the 20-29 year age group. This result is similar to those reported by other literature studies for other geographic areas: Canada (Grant et al 2012), Nigeria (Zix et al 2011), India (Subodh et al 2012), or Netherlands (Van der Bergh et al 2012). This can be due to the fact that individuals are physically and socially more active during this decade of life, which is why they are more exposed to trauma, and the risk of an increased number of mandibular fractures is high. The majority of sports careers also span this decade of life, making it susceptible to an increased incidence of sports injuries. We obtained the same results in a retrospective study of 709 patients in Cluj-Napoca, representing patients with mandibular fractures admitted and treated in the same clinic in the period 1 January

Table 1 Distribution of the frequency of traumatic etiology depending on sociodemographic variables (sex, age, level of education)

Variable		Aggression	Other etiology	P
		n=48	n=12	
Sex	M	44 (91.7%)	9 (75%)	0.135
	F	4 (8.3%)	3 (25%)	
Level of education	No education	2 (4.2%)	2 (16.7%)	0.064
	Primary school	3 (6.2%)	1 (8.3%)	
	Middle school	23 (47.9%)	3 (25%)	
	High school	18 (37.5%)	3 (25%)	
	University	2 (4.2%)	3 (25%)	
Environment	U	9 (18.8%)	5 (41.7%)	0.128
	R	39 (81.2%)	7 (58.3%)	

2002 – 31 December 2011 (Teñ et al 2016). In contrast to our results, similar studies conducted in other geographic regions such as China (Quing-Bin et al 2013), Brazil (Mendes et al 2013) and USA (Rottgers et al 2011) report the 10-19 decade to be the most affected by mandibular fractures. The possibility to get a driving license at the age of 16 exposes adolescents to road traffic accidents. Also, in China and Brazil, due to great discrepancies between social classes, many people are obliged to practice physical work since young ages. Certainly, these statements are purely speculative, further research being required to confirm them. On the other hand, other authors indicate an increase in the incidence of mandibular fractures in the 30-40 and 50-60 decades, on account of population aging (Jeon et al 2014, Kummoona 2011, Yamamoto et al 2011). In our study, no patient aged under 9 years was identified, a result supported by Anyanechi CE (Anyanechi et al 2011). This result could be due to the fact that at this age, children are usually supervised by their parents for a large part of the time, the risk of trauma being thus diminished. At the same time, bone elasticity and the thick periosteum characteristic of this age reduce the risk of bone fracture in case of accidents or injuries (Yildirgan et al 2016). The incidence of mandibular fractures in this study was by far higher among men than women, which is in accordance with the results reported in the literature (Adekeye 1980, Munante-Cardenas et al 2011, Rottgers et al 2011, Zix et al 2011). This result is due to higher alcohol consumption among men, as well as to their increased susceptibility to engage in interpersonal conflicts compared to women. On the other hand, in the majority of the countries, physical work is mostly done by men, who have a high risk of work accidents that predisposes them to mandibular fractures. The male/female ratio was 7.5/1. These results are also found in our retrospective study, in which the male/female ratio was 9.2/1. This difference can be explained by the great difference in the number of patients between the two studies, 709 patients in the retrospective study compared to 60 in the current study (Teñ et al 2016). The male/female ratio varies considerably in the literature (Adekeye 1980, Munante-Cardenas et al 2011, Kummoona 2011, Van Hout et al 2013). It can be observed that in countries where women's social activities are limited by tradition, such as the United Arab Emirates, the male/female ratio is increased, 11/1 (Kraft et al 2012). On the other hand, for example in Austria or Finland, where women's freedom and participation in many fields of activity are

high, the male/female ratio tends to become uniform, 2.1/1 (Jeon et al 2014).

In our study, patients from rural areas were obviously more affected than those from urban areas, a result similar to those of other studies (Smith et al 2012). This can be due on the one hand to work using animals or various tools specific to agriculture, the risk of work or domestic accidents being considerably increased in this situation, and on the other hand to the low level of education of rural inhabitants, which predisposes them to high alcohol consumption and leads to an increase of interpersonal conflicts. Contrary to our results, other authors report a higher incidence of mandibular fractures in the urban environment (Kraft et al 2012, Businger et al 2012, Oikarinen et al 2004, Rottgers et al 2011). The agglomeration of population, the presence of vehicles and infrastructure allowing high speed traffic, the great number of people involved in various sports in urban areas are a few factors that contribute to the increased rate of road traffic accidents or sports injuries in this environment and explain the high incidence of mandibular fractures (Kraft et al 2012, Businger et al 2012, Oikarinen et al 2004, Rottgers et al 2011). In the previous retrospective study conducted in our clinic, the urban environment was shown to be the most affected by mandibular fractures (Teñ et al 2016). This difference could be due to trauma prevention measures implemented in our country, which were probably more effective and better received by the urban population. Certainly, this statement is purely speculative, further research being required in this area.

Interpersonal physical violence is the main cause of mandibular fractures in our study, which is in accordance with the results of Bataineh AB (Jordan) (Bataineh 1998), Ogundare BO (Nigeria) (Ogundare et al 2003), Oikarinen K (Kuwait) (Oikarinen et al 2004), Lee KH (New Zealand) (Lee 2012). It can be seen that interpersonal violence has the highest incidence in developing countries with socioeconomic instability, but also in developed countries with discrepancies between social classes. Frustration resulting from poverty and the high rate of unemployment lead to an increase of delinquency, alcohol and drug abuse, favoring conflicts and implicitly trauma due to physical violence (Teñ et al 2016).

The second cause of mandibular fractures in our study is trauma from fall. Similar results are provided by other authors (Gandhi et al 2011, Munante-Cardenas et al 2011, Ravindran et al 2011).

The fact that interpersonal violence has persisted in time as a main etiologic factor of mandibular fractures compared to other studies conducted in our geographic area (TeŃ et al 2016) is alarming and emphasizes the ineffectiveness of physical violence prevention in our population. This leads us to support the need for a reassessment and improvement of non-legislative and legislative measures in Romania with a view to decreasing the level of delinquency, of alcohol and drug abuse, and implicitly, of interpersonal physical violence that has reached epidemic proportions.

The correlation of traumatic etiology with the mean age of patients with mandibular fractures evidenced the susceptibility of younger patients (mean age = 34.73 years) to mandibular fractures by interpersonal violence. However, the result has no statistical significance. Similar results are found in other studies (Ogundare et al 2003, Fridrich et al 1992, Hashim et al 2011). By correlating the patients' sex with the etiology of mandibular fractures, slight differences were revealed. Thus, the highest incidence of mandibular fractures was found for those caused by interpersonal violence among men and those from fall among women. However, differences were not statistically significant in this study. This result is in accordance with the results reported in the literature (Martins et al 2011, Momeni et al 2011, Oikarinen et al 2004, Yamamoto et al 2015) and could be due to the fact that women are less exposed to alcohol abuse or interpersonal conflicts compared to men. Nevertheless, it should be mentioned that fall trauma can be secondary to aggression, as some women may not declare the real nature of their trauma. Given that this cannot be certainly established, the above statement is purely speculative.

In our study, the rural environment favored mandibular fractures caused by interpersonal violence and animal attacks. The overwhelming proportion of interpersonal violence in rural areas can be explained by the fact that most of the patients belonging to this environment have a low level of education, being only middle school graduates. The lack of higher education and vocational training increases the rate of unemployment, implicitly leading to a low socioeconomic level and an increase of alcohol abuse, predisposing this category to interpersonal conflicts. These statements are supported by other literature studies, which highlight the fact that the incidence of interpersonal violence is extremely low among patients with higher education (Kapoor et al 2012, Zix et al 2011). The high rate of mandibular fractures induced by animal attacks in rural compared to urban areas can be explained by the use of animals in agriculture or other activities characteristic of the rural environment.

No significant differences in etiology relative to the environment of origin were found in the case of road traffic accidents, work accidents, fall traumas and domestic accidents.

The differences presented above resulting from the correlation of the traumatic etiology of mandibular fractures with sociodemographic variables are obvious, but not statistically significant. This can be explained by the small sample of patients included in the study.

Conclusions

The main cause of mandibular fractures, regardless of the patients' sex, mean age, environment of origin or level of education,

is interpersonal violence reaching epidemic proportions. This is an alarming fact that makes us support the need for implementation of laws and initiation of national programs for the prevention of interpersonal violence in our geographic area, which is currently the only measure that can significantly reduce the incidence of mandibular fractures. The implementation of legal norms against interpersonal violence would lead to an accelerated decrease of mandibular fractures in our geographic area.

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Authors:

- Paul Andrei Țeț, Faculty of Medicine and Pharmacy, University of Oradea, 10 Piața 1 Decembrie Street, 410073, Oradea, Romania, EU, email: tent_andrei@yahoo.com
- Daniela Popa, Prosthetic Dentistry, Department IV- Prosthetic dentistry and Dental materials, Faculty of Dental Medicine, „Iuliu Hațieganu” University of Medicine and Pharmacy, 32 Clinicilor Street, 400006, Cluj-Napoca, Romania, EU, email: popa_dana@yahoo.com
- Raluca Juncar, Prosthetic Dentistry, Department IV- Prosthetic dentistry and Dental materials, Faculty of Dental Medicine, „Iuliu Hațieganu” University of Medicine and Pharmacy, 32 Clinicilor Street, 400006, Cluj-Napoca, Romania, EU, email: ralucajuncar@yahoo.ro
- Antonia Haranguș, Leon Daniello Pneumology Hospital, 6 Bogdan Petriceicu Hașdeu Street, 400332, Cluj-Napoca, Romania, EU, email: Antonia.harangus@yahoo.com
- Teofil Lung, Department of Oral and Maxillofacial Surgery I, County Clinical Emergency Hospital of Cluj-Napoca, 3-5 Clinicilor Street, 400006 Cluj-Napoca, Romania, EU, email:-
- Mihai Juncar, Faculty of Medicine and Pharmacy, University of Oradea, 10 Piața 1 Decembrie Street, 410073, Oradea, Romania, EU, email: mihaijuncar@gmail.com

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