

Evaluation of the Epidemiology and Traumatic Etiology of Mandibular Fractures a 10-Year Retrospective Statistical Study

Paul Andrei Țeț^a, Daniela Popa^{b*}, Raluca-Iulia Juncar^c, Teofil Lung^d, Mihai Juncar^e

^{a,e}*Faculty of Medicine and Pharmacy, University of Oradea, 10 Piața 1 Decembrie Street, 410073, Oradea, Romania*

^{b,c}*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*

^d*Department of Oral and Maxillofacial Surgery I, County Clinical Emergency Hospital of Cluj-Napoca, 3-5 Clinicilor Street, 400006 Cluj-Napoca, Romania*

^a*Email: tent_andrei@yahoo.com*

^b*Email: popa_dana@yahoo.com*

^c*Email: ralucajuncar@yahoo.ro*

^e*Email: mihaijuncar@gmail.com*

Abstract

The mandible or lower jaw is the most frequently fractured bone because of the mandible's prominence and relative lack of support. Literature data differ considerably with respect to the epidemiology and etiopathogeny of mandibular fractures. The aim of this study is to evidence the incidence of mandibular fractures depending on sex, age and etiology in a significant group of patients. Materials and methods: For the current study, a 10-year retrospective evaluation of cases diagnosed with mandibular fractures in the period 1 January 2002 – 31 December 2011 at the Clinic of Oral and Maxillofacial Surgery I Cluj-Napoca was performed. Data were collected from clinical observation charts, processed and compared to literature results. Results: The study included 709 patients. The highest incidence of mandibular fractures was found in the 20-29 year age group (37.24%). Most of the patients were male (92.81%) and came from an urban environment (54.58%).

* Corresponding author.

The most frequent cause of mandibular fractures was interpersonal violence (67.28%), followed by falls from the same level. Conclusions: Taking measures to reduce interpersonal violence would significantly decrease the incidence of mandibular fractures in our geographic area.

Keywords: traumatology; mandible; fracture; epidemiology; etiology.

1. Introduction

Lower face trauma is a special subject in maxillofacial surgery worldwide, having a continuously increasing incidence that reaches almost epidemic proportions [1,2]. The mandible is one of the most frequently fractured bones of the head; due to its prominence and mobility, it is highly susceptible to trauma [3].

The epidemiology of mandibular fractures has been extensively studied across the world, data varying from one geographic region to another and from one time period to another [4].

The etiology of mandibular fractures can be divided into three main categories: traumatic, iatrogenic and “pathological bone”, of which the most frequent is traumatic etiology [5, 6, 7, 8, 9, 2, 10, 11]. Traumatic etiology differs globally depending on the geographic area, socioeconomic, cultural and technological status, and environment of origin. There is no literature consensus on the main causative traumatic agent of mandibular fractures [4, 7, 12].

Determining the epidemiology and etiology of mandibular fractures in a particular region, as well as their association, is essential for an optimal approach to the prevention, diagnosis and treatment of mandibular fractures [4, 6, 13, 14, 15, 16, 17].

The aim of this study was to determine the main general factors associated with the development of mandibular fractures, in order to establish the main categories of patients who present with traumatic mandibular fractures.

2. Material and methods

For our study, patients hospitalized and treated at the Clinic of Oral and Maxillofacial Surgery I Cluj-Napoca in the period 1 January 2002 – 31 December 2011 were available.

Data were collected from the patients’ clinical observation charts. The following variables were monitored: the patients’ sex, age, environment of origin and traumatic etiology.

The study inclusion criteria were: presence of at least one fracture line in the mandible, a history of an acute trauma episode, presence of imaging examinations (X-ray or computed tomography) confirming the clinical diagnosis of mandibular fracture and evidencing its location and characteristics, treatment of the fracture in the study’s host institution.

Study exclusion criteria: patient without mandibular fracture, mandibular fracture of other etiology than trauma, absence of complementary imaging investigations, treatment performed in another service, incomplete data.

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

3. Results

The study inclusion criteria were met by 709 patients who were registered with the diagnosis of mandibular fracture and treated in the study's host clinic in the period 1 January 2002 – 31 December 2011.

Patient distribution by age groups indicated the highest incidence of mandibular fractures in the third decade of age (**Figure 1**).

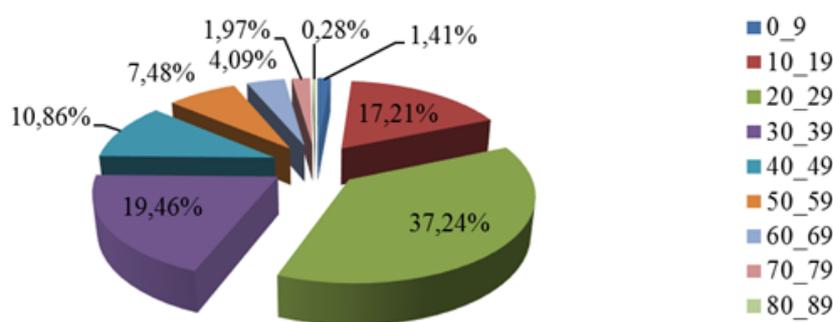


Figure 1: Distribution of patients included in the study by age decades

Male patients were the most frequently affected by mandibular fractures, their number being 658 (92.81%), while there were only 51 female patients (7.19%). The male/female ratio was 9.2/1. The percentage of patients from an urban environment who were affected by mandibular fractures was slightly higher compared to those coming from a rural environment (**Figure 2**).

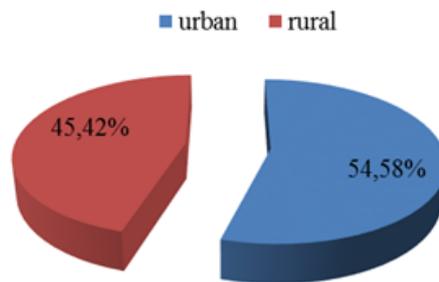


Figure 2: Distribution of patients depending on their environment of origin

The main cause that led to the development of mandibular fractures in our study was interpersonal violence, followed by trauma from falls from the same level, road traffic accidents and animals attacks. Other etiologies had a low frequency in our study (**Figure 3**).

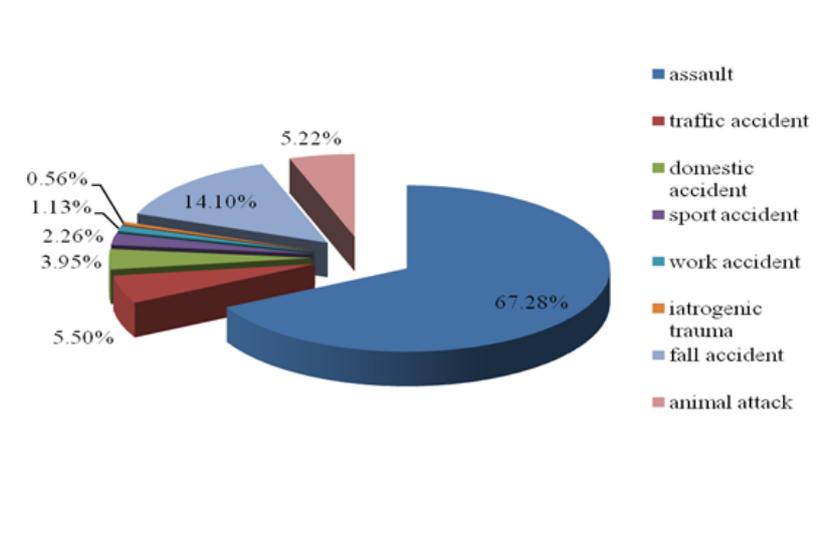


Figure 3: Percentage distribution of patients depending on the cause of mandibular fractures

The correlation of traumatic etiology with the patients' age group showed interpersonal violence to be the main cause of mandibular fractures in the 10-69 year age range (**Table 1**).

Table 1: Distribution of etiology depending on the age group

AGE (decades)	ETIOLOGY OF TRAUMA								TOTAL
	assault / interpersonal violence	road traffic accident	domestic accident	sports injury	work accident	iatrogenic trauma	fall accident	animal attack	
0 _ 9	0	2	0	0	0	0	6	2	10
10 _ 19	88	7	3	6	0	0	14	4	122
20 _ 29	209	16	9	5	3	1	17	4	264
30 _ 39	89	8	6	5	1	0	20	9	138
40 _ 49	47	4	3	0	2	1	15	5	77
50 _ 59	29	1	3	0	1	2	12	5	53
60 _ 69	10	1	2	0	1	0	8	7	29
70 _ 79	5	0	1	0	0	0	7	1	14
80 _ 89	0	0	1	0	0	0	1	0	2
TOTAL	477	39	28	16	8	4	100	37	709

The correlation of etiology with the sex of patients evidenced the fact that interpersonal violence had a high incidence among both men and women (**Table 2**).

Table 2: Distribution of etiology depending on sex

SEX	ETIOLOGY OF TRAUMA								TOTAL
	assault / interpersonal violence	road traffic accident	domestic accident	sports injury	work accident	iatrogenic trauma	fall accident	animal attack	
Male	457	29	27	16	8	3	85	33	658
Female	20	10	1	0	0	1	15	4	51
TOTAL	477	39	28	16	8	4	100	37	709

Regardless of the environment of origin, interpersonal violence was the main factor that led to the development of post-traumatic mandibular fractures (**Table 3**).

Table 3: Distribution of etiology depending on the environment of origin

ENVIRONMENT	ETIOLOGY OF TRAUMA								TOTAL
	assault / interpersonal violence	road traffic accident	domestic accident	sports injury	work accident	iatrogenic trauma	fall accident	animal attack	
Urban	273	28	15	11	4	4	49	3	387
Rural	204	11	13	5	4	0	51	34	322
OTAL	477	39	28	16	8	4	100	37	709

4. Discussions

The aim of the study was attained; the data obtained allowed establishing the profile of patients with the highest risk of mandibular fractures, as well as the main causative factor.

In our study, the most affected age group was between 20-29 years, which is also found in the results of Zix J. A. (Switzerland) [18], Anyanechi (Nigeria) [19], Natu S. (India) [11], Batista A. M. (Brazil) [20], Grant A. (Canada) [21], Wang K. (China) [17]. This is probably due to the fact that at this stage of life, people are physically more active, they practice many sports including contact sports, they are more prone to alcohol use, conflicts, and the risks of trauma are high. Other authors such as Qing-Bin Z. (China) [22], Mendes M. (Brazil) [23] and Rottgers (USA) [24] report the most affected age group to be between 10-19 years, but these authors do not clearly mention the highest incidence of mandibular fractures within this age range, so it is not known whether this is closer to the first or the second decade of life.

The male sex is the most frequently affected by mandibular fractures in the current study, with a male/female ratio of 9.2/1, which is in agreement with the results reported by the literature [1, 5, 7, 17, 18, 22, 24, 25]. In the literature, the sex ratio varies from one author to another between 1.2:1 and 16:1 [4, 5, 22, 26, 27]. It is not surprising that male patients are predisposed to mandibular fractures given that they have a higher rate of alcohol use and an increased tendency to engage in conflicts.

The population in urban areas was more affected in our study than that in rural areas, a similar result to those of other authors [6, 18, 20, 28]. According to some authors, this is explained by the living conditions specific to urban environment such as: the high agglomeration of population, the more frequent car use, the habit of practicing various contact sports [6, 18, 20, 28].

In this study, the main etiological factor of mandibular fractures is interpersonal violence, similarly to other regions such as North America, as shown by some studies [8, 9, 12, 15, 29, 30]. This is in contradiction with the results of other authors [17, 20, 21, 27, 31, 32, 33], according to which the main causes of mandibular fractures are road traffic accidents, sports injuries and work accidents, which are followed by interpersonal violence. It can be seen that interpersonal aggression is the main etiological factor in developing countries, with the USA being an exception: here, this can be caused by major discrepancies between social classes, the high unemployment rate, alcohol and drug abuse. The study of Yamamoto K. [4], in which interpersonal violence as a cause of mandibular fractures is completely absent, is noteworthy. Other authors report fall trauma as the main etiological factor [3, 22]. This is the second cause of mandibular fractures in the current study. In our study, no gunfire trauma was identified, unlike in other studies [8, 26, 29]. This is most probably due to socioeconomic and legislative conditions in the geographic area where the study was performed.

The correlation of etiology with age groups showed a very wide age range directly affected by interpersonal violence. This is in contradiction with other similar studies, where the age range affected by aggression is much more reduced, 20-49 years [8, 12, 29, 30]. In children under 9 years of age and elderly over 69, fall trauma is the main etiological factor. This is supported by other authors [1, 7, 10, 25, 34, 35]. In the case of children, this can be due to carelessness during play or sports practice. In the case of elderly persons, falls are most of the time post-syncope, because of age-specific associated neurological diseases.

By correlating etiology with patient sex, it was found that in females, interpersonal aggression was also the main causative factor. This result is contrary to those of the literature studies, where the main etiology of fractures in women is represented by road traffic accidents and fall traumas [2, 9, 15, 25, 33]. This can suggest a high level of domestic violence among the population of the geographic area in which the study was performed. It is possible that the incidence of females subjected to aggression might be higher in reality, some victims avoiding to declare the cause of the trauma.

Regarding the environment of origin, the urban environment significantly favored fractures caused by road traffic accidents, while the rural environment favored fractures caused by animal attacks. This is also supported by Batista A. M. [20]. The high frequency of road traffic accidents and sports injuries in urban areas was discussed above. Animal-related injuries are characteristic of rural environment due to animal breeding

activities and work with animals, which are not frequently found in urban areas. No significant differences of etiology in relation to the environment of origin were found in the case of interpersonal violence, work accidents, fall traumas and domestic accidents.

Despite the large number of patients included in the study, the current study has a series of limitations. The most important limitation results from the retrospective nature of the research. Data collected from observation charts are dependent on the accuracy of their recording and their standard over time. Another limitation is derived from the patients' ability or wish to report data accurately. Some patients might have distorted reality in order to avoid certain legal aspects. However, we consider that the data obtained are representative and have a scientific and clinical impact.

Our study still has its limitations as any retrospective study; the data were collected from the consultation sheets and some data might have been incomplete, or underreporting or misreporting may be possible. In order to exceed this lack, only complete consultation sheets were selected and therefore a series of cases from the statistical data base were lost.

We highly recommend the implementation of interpersonal violence prevention strategies in our geographic area, along with the prevention of drug abuse, alcohol abuse and delinquency in any age group. In order to clarify interpersonal violence's national impact further research in other Romanian centers is necessary.

5. Conclusions

Interpersonal violence is the main etiological factor of mandibular fractures in our geographic area regardless of sex, age and environment of origin, reaching epidemic proportions. Taking severe legislative as well as educational measures to reduce interpersonal violence could significantly decrease the incidence of mandibular fractures in our country.

References

- [1] Gandhi S, Ranganathan LK, Solanki M, Mathew GC, Singh I, Bither S. Pattern of maxillofacial fractures at a tertiary hospital in northern India: a 4-year retrospective study of 718 patients. *Dent Traumatol*, vol. 27, nr. 4, pp.257-262, aug 2011.
- [2] Martins MM, Homsy N, Pereira CC, Jardim EC, Garcia IR Jr. Epidemiologic evaluation of mandibular fractures in the Rio de Janeiro high-complexity hospital. *J Craniofac Surg*, vol. 22, nr. 6, pp.2026-2030, nov 2011.
- [3] Işık D, Gönüllü H, Karadaş S, Koçak OF, Keskin S, Garca MF et al. Presence of accompanying head injury in patients with maxillofacial trauma., *Ulus Travma Acil Cerrahi Derg*, vol. 18, nr. 3, pp:200-206, may 2012.
- [4] Yamamoto K, Matsusue Y, Horita S, Murakami K, Sugiura T, Kirita T. Maxillofacial fractures sustained in bicycle accidents, *J Oral Maxillofac Surg*, vol. 69, nr. 6, pp.155-160, jun 2011.
- [5] Adekeye EO. The pattern of fractures of the facial skeleton in Kaduna, Nigeria. A survey of 1,447 cases. *Oral Surg Oral Med Oral Pathol*, vol. 49, nr. 6, pp. 491-495, jun 1980.

- [6] Kraft A, Abermann E, Stigler R, Zsifkovits C, Pedross F, Kloss F et al. Craniomaxillofacial Trauma: Synopsis of 14,654 Cases with 35,129 Injuries in 15 Years. *Craniomaxillofac Trauma Reconstr*, vol. 5, nr. 1, pp. 41–50, mar 2012.
- [7] Bassey GO, Anyanechi CE, Chukwunke FN. Maxillofacial injuries in Calabar south-south, Nigeria: a 5 year study of jawbone fractures. *Niger J Med*, vol. 20, nr. 2, pp. 245-249, apr-jun 2011.
- [8] Fridrich KL, Pena-Velasco G, Olson RA. Changing trends with mandibular fractures: a review of 1,067 cases. *J Oral Maxillofac Surg*, vol. 50, nr. 6, pp.586–589, 1992.
- [9] Lee KH. Epidemiology of mandibular fractures in a tertiary trauma centre. *Emerg Med J*, vol. 25, nr. 9, pp.565–568, 2008.
- [10] Naveen Shankar A, Naveen Shankar V, Hegde N, Sharma, Prasad R.. The pattern of the maxillofacial fractures - A multicentre retrospective study. *J Craniomaxillofac Surg*, vol. 40, nr. 8, pp.675-679, dec 2012.
- [11] Natu SS, Pradhan H, Gupta H, Alam S, Gupta S, Pradhan R et al. An Epidemiological Study on Pattern and Incidence of Mandibular Fractures. *Plast Surg Int*, 2012.
- [12] Ogundare BO, Bonnicksen A, Bayley N. Pattern of mandibular fractures in an urban major trauma center. *J Oral Maxillofac Surg*, vol. 61, nr. 6, pp.713-718, jun 2003.
- [13] Depprich R, Handschel J, Hornung J, Meyer U, Kübler NR. Causation, therapy and complications of treating mandibular fractures – a retrospective analysis of 10 years. *Mund Kiefer Gesichtschir*, vol. 11, nr. 1, pp.19–26, 2007.
- [14] Ellis E 3rd, Moos KF, el-Attar A. Ten years of mandibular fractures: an analysis of 2,137 cases. *Oral Surg Oral Med Oral Pathol*, vol. 59, nr. 2, pp.120–129, 1985.
- [15] Oikarinen K, Schutz P, Thalib L, Sándor GK, Clokie C, Meisami T, et al. Differences in the etiology of mandibular fractures in Kuwait, Canada, and Finland. *Dent Traumatol*, vol. 20, nr. 5, pp.241–245, 2004.
- [16] Ravindran V, Ravindran Nair KS. Metaanalysis of maxillofacial trauma in the northern districts of Kerala: one year prospective study. *J Maxillofac Oral Surg*, vol. 10, nr. 4, pp.321-327, dec 2011.
- [17] Wang K, Peng GG, Wu JW, Ding XX, Yan X, Xie JY. Retrospective analysis of 2461 patients with maxillofacial fractures. *Zhonghua Kou Qiang Yi Xue Za Zhi*, vol. 46, nr. 3, pp.139-142, mar 2011.
- [18] Zix JA, Schaller B, Lieger O, Saulacic N, Thorén H, Iizuka T. Incidence, aetiology and pattern of mandibular fractures in central Switzerland. *Swiss Med Wkly*, vol. 27, pp. 141, may 2011.
- [19] Anyanechi CE, Saheeb BD. Mandibular sites prone to fracture: analysis of 174 cases in a Nigerian tertiary hospital. *Ghana Med J*, vol. 45, nr. 3, pp.111-114, sept 2011.
- [20] Batista AM, Marques LS, Batista AE, Moreira Falci SA, Ramos-Jorge ML. Urban-rural differences in oral and maxillofacial trauma. *Braz Oral Res*, vol. 26, nr. 2, pp.132-138, mar-apr 2012.
- [21] Grant AL, Ranger A, Young GB, Yazdani A. Incidence of major and minor brain injuries in facial fractures. *J Craniofac Surg*, vol. 23, nr. 5, pp.1324-1328, sep 2012.
- [22] Qing-Bin Z, Zhao-Qiang Z, Dan C, Yan Z. Epidemiology of maxillofacial injury in children under 15 years of age in southern China.. *Oral Surg Oral Med Oral Pathol Oral Radiol*, vol. 115, nr. 4, pp.436-441, apr 2013.
- [23] Mendes M, Borba M, Sawazaki R, Asprino L, de Moraes M, Moreira RW. Maxillofacial trauma and

- seat belt: a 10-year retrospective study. *Oral Maxillofac Surg*, vol. 17, nr. 1, pp.21-25, mar 2013.
- [24] Rottgers SA, Decesare G, Chao M, Smith DM, Cray JJ, Naran S et al. Outcomes in pediatric facial fractures: early follow-up in 177 children and classification scheme. *J Craniofac Surg*, vol. 22, nr. 4, pp.1260-1265, jul 2011.
- [25] Momeni H, Shahnasari S, Hamzeheil Z. Distribution assessment of maxillofacial fractures in trauma admitted patients in Yazd hospitals: An epidemiologic study. *Dent Res J (Isfahan)*, vol. 8, suppl. 1, pp.80-83, dec 2011.
- [26] Kummoona R. Management of maxillofacial injuries in Iraq. *J Craniofac Surg*, vol. 22, nr. 5, pp.1561-1566, sep 2011.
- [27] van Hout WM, Van Cann EM, Abbink JH, Koole R.. An epidemiological study of maxillofacial fractures requiring surgical treatment at a tertiary trauma centre between 2005 and 2010. *Br J Oral Maxillofac Surg*, vol. 51, nr. 5, pp.416-420, jul 2013.
- [28] Businger AP, Krebs J, Schaller B, Zimmermann H, Exadaktylos AK. Cranio-maxillofacial injuries in victims of interpersonal violence. *Swiss Med Wkly*, 142, oct 2012.
- [29] King RE, Scianna JM, Petruzzelli GJ. Mandible fracture patterns: a suburban trauma center experience. *Am J Otolaryngol*, vol. 25, nr. 5, pp.301–307, 2004.
- [30] Simsek S, Simsek B, Abubaker AO, Laskin DM. A comparative study of mandibular fractures in the United States and Turkey. *Int J Oral Maxillofac Surg*, vol. 36, nr. 5, pp.395–397, 2007.
- [31] Hashim H, Iqbal S. Motorcycle accident is the main cause of maxillofacial injuries in the Penang Mainland, Malaysia, *Dent Traumatol*, vol. 27, nr. 1, pp.19-22, feb 2011.
- [32] Roccia F, Boffano P, Bianchi FA, Ramieri G. An 11-year review of dental injuries associated with maxillofacial fractures in Turin, Italy. *Oral Maxillofac Surg*, vol.17, nr. 4, pp.269-274, dec 2013.
- [33] Yamamoto K, Matsusue Y, Murakami K, Horita S, Matsubara Y, Sugiura T et al. Maxillofacial fractures due to work-related accidents. *J Craniomaxillofac Surg*, vol.39, nr. 3, pp.182-186, apr 2011.
- [34] Exadaktylos AK, Evangelisti A, Anghern F, Keller U, Dopke K, Ringger A et al. Measuring attitudes, behaviours, and influences in inner city victims of interpersonal violence (VIVs) – a Swiss emergency room pilot study. *J Trauma Manag Outcomes*, vol. 4, pp.8, 2010.
- [35] Pranav Kapoor, Namita Kalra, A retrospective analysis of maxillofacial injuries in patients reporting to a tertiary care hospital in East Delhi. *Int J Crit Illn Inj Sci*, vol. 2, nr. 1, pp. 6–10, jan-apr 2012.