Motor –vehicle accidents related maxillofacial injuries: a multicentre and prospective study

Muhammad Ruslin DDS MS , Matteo Brucoli MD , Paolo Boffano MD , Arnaldo Benech MD PhD , Emil Dediol MD PhD , Vedran Uglešić MD PhD , Žiga Kovačič MD , Aleš Vesnaver MD PhD , Vitomir S. Konstantinović DDS MD PhD , Milan Petrović DDS MD , Jonny Stephens MMedSci , Amar Kanzaria BChD MFDS RCS , Nabeel Bhatti MFDS RCS MRCS , Simon Holmes FDS RCS FRCS , Petia F. Pechalova DDS MD PhD , Angel G. Bakardjiev DDS PhD , Vladislav A. Malanchuk MD DDS PhD , Andrey V. Kopchak DDS PhD , Pål Galteland MD DDS , Even Mjøen MD DDS , Per Skjelbred MD DDS PhD , Helios Bertin MD , Pierre Corre MD , Sigbjørn Løes DDS PhD , Njål Lekven DDS , Sean Laverick FDS FRCS , Peter Gordon MFDS MRCS , Tiia Tamme MD PhD , Stephanie Akermann DDS , K Hakki Karagozoglu MD DDS , Sofie C. Kommers MD DDS , Jan G. de Visscher MD , Tymour Forouzanfar MD DDS PhD

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Authors: Muhammad Ruslin DDS MS[1], Matteo Brucoli MD[2], Paolo Boffano MD[2], Arnaldo Benech MD PhD[2], Emil Dediol MD PhD[3], Vedran Uglešić MD PhD[3], Žiga Kovačič MD[4], Aleš Vesnaver MD PhD[4], Vitomir S. Konstantinović DDS MD PhD[5], Milan Petrović DDS MD[5], Jonny Stephens MMedSci[6], Amar Kanzaria BChD MFDS RCS[6], Nabeel Bhatti MFDS RCS MRCS[6], Simon Holmes FDS RCS FRCS[6], Petia F. Pechalova DDS MD PhD[7], Angel G. Bakardjiev DDS PhD[7], Vladislav A. Malanchuk MD DDS PhD[8], Andrey V. Kopchak DDS PhD[8], Pål Galteland MD DDS[9], Even Mjøen MD DDS[9], Per Skjelbred MD DDS PhD[9], Helios Bertin MD[10], Pierre Corre MD[10], Sigbjørn Løes DDS PhD[11], Njål Lekven DDS[11], Sean Laverick FDS FRCS[12], Peter Gordon MFDS MRCS[12], Tiia Tamme MD PhD[13], Stephanie Akermann DDS[13], K Hakki Karagozoglu MD DDS[1], Sofie C. Kommers MD DDS[1], Jan G. de Visscher MD[1], Tymour Forouzanfar MD DDS PhD[1].

[1]Department of Oral and Maxillofacial Surgery/Pathology, VU University Medical Center and Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam, The Netherlands.
[2]Department of Maxillofacial Surgery, University of Eastern Piedmont, Novara, Italy
[3]Department of Maxillofacial Surgery, University Hospital Dubrava, Zagreb, Croatia
[4]Maxilofacial department, UKC Ljubljana, Slovenia
[5]Clinic of Maxillofacial Surgery, School of Dentistry, University of Belgrade, Serbia
[6]Department of Oral and Maxillofacial Surgery , Royal London Hospital, Barts Health NHS, London, UK
[7]Department of maxillo-facial surgery, Medical University, Plovdiv, Bulgaria
[8]Department for Oral and Maxillo-facial Surgery, Bogomolets National Medical University, Kiev, Ukraine
[9]Department of Maxillofacial Surgery, Oslo University Hospital, Oslo, Norway
[10]Service de Stomatologie et Chirurgie Maxillo-faciale, Chu de Nantes, France
[11]Department of Maxillofacial Surgery, University of Bergen, Bergen, Norway
[12]Department of Oral and Maxillofacial Surgery, NHS Tayside, University of Dundee, Dundee, UK
[13] Department of Maxillofacial surgery, Stomatology Clinic, Tartu University, Tartu, Estonia

Address correspondence and reprint requests to Dr Paolo Boffano: Department of Maxillofacial Surgery, University of Eastern Piedmont, Novara, Italy.
E-mail address: paolo.boffano@gmail.com
Co-corresponding author is Dr Ruslin.

Statement

Most frequently, MVA related facial injuries are due to car accidents and involve the mandible.

No disclosures

ABSTRACT

Objectives: The purpose of this study is to obtain more precise information about the demographics and etiological/epidemiological patterns of MVA – related maxillofacial fractures of an European multicentre prospective study .

Study design: Of the 3260 patients with maxillofacial fractures admitted within the study period, 326 traumas were due to motor vehicle accidents with a male to female ratio of 2.2:1.

Results: The maximum incidence was encountered in Zagreb (Croatia) (18%) and the minimum value was observed in Bergen (Norway) (0%). The most frequent mechanisms were car accidents with 177 cases, followed by motorcycles The most frequently observed fracture involved the mandible with 199 fractures, followed by maxilla-zygomatic-orbital (MZO) fractures.

Conclusions: In all the three groups mandibular and MZO fractures are the two most frequently observed fractures with some variations.

The importance of the perseverance in analyzing MVA related facial injuries with their features and characteristics should be stressed.

KEYWORDS: Epidemiology; facial fracture; trauma; maxillofacial trauma; etiology; cause; mandible; motor vehicle accidents; road traffic.

INTRODUCTION

Injuries associated with traffic accidents are a problem faced in several countries, and their prevention is often a priority for public health authorities.[1-18]

In fact, facial injuries, including fractures, may have serious long term implications for victims of motor vehicle accidents (MVA) and important socio economic consequences. [1-8]

Thus, the knowledge of the factors associated with facial injuries stemming from MVAs is important for the prognosis, the identification of groups at risk, and the establishment of measures to minimize the economic, emotional, psychological, and social impacts of these events. [1-8]

Preventing maxillofacial injuries is a valuable pursuit for improving the quality of life of the involved subjects and decreasing the socioeconomic costs of motor vehicle collision injuries.[1-22]

Several studies in the literature have described the frequency and severity of facial injuries associated with motor vehicle accidents. However, to our knowledge, no prospective multicentre study about MVA – related maxillofacial injuries has been published. Therefore, several European centers, that had already shown research experience in maxillofacial trauma,[15-17, 23-25] decided to collaborate to start a prospective multicentre study about facial fracture epidemiology in Europe. The purpose of this study is to obtain more precise information about the demographics and etiological/epidemiological patterns of MVA – related maxillofacial fractures of an European multicentre prospective study .

MATERIALS

The present study was conducted at several European departments of oral and maxillofacial surgery: the Department of Oral and Maxillofacial Surgery/Pathology at the VU Medical Center and Academic Centre for Dentistry Amsterdam (Amsterdam, The Netherlands), the Department of Maxillofacial Surgery at the University Hospital Dubrava (Zagreb, Croatia), the Maxilofacial department at the UKC Ljubljana, (Ljubljana, Slovenia), the Clinic of Maxillofacial Surgery of the School of Dentistry at the University of Belgrade (Belgrade, Serbia), the Department of Oral and Maxillofacial Surgery of the Royal London Hospital at Barts Health NHS (London, UK), the Department of maxillo-facial surgery at the Medical University (Plovdiv, Bulgaria), the Department for Oral and Maxillo-facial Surgery at the Bogomolets National Medical University (Kiev, Ukraine), the Department of Maxillofacial Surgery at the Oslo University Hospital (Oslo, Norway), the Service de Stomatologie et Chirurgie Maxillo-faciale at the Chu de Nantes (Nantes, France), the Department of Maxillofacial Surgery at the University of Bergen (Bergen, Norway), the Department of Oral and Maxillofacial Surgery at NHS Tayside and University of Dundee, (Dundee, UK), and the Department of Maxillofacial surgery, Stomatology Clinic, Tartu University (Tartu, Estonia).

This study is based on a systematic computer-assisted database that allowed to prospectively and continuously record all patients hospitalized with maxillofacial fractures in the involved Maxillofacial Surgery Units across Europe, since Monday 31st December 2012 to Sunday 29th December 2013.

Therefore, the following data were recorded for each patient: gender, age, etiology, etiology mechanisms, site of facial fractures, Facial Injury Severity Score (FISS), date of injury. For this study, only patients that were admitted to the hospital for MVA related maxillofacial injury were considered.

FISS is an injury scale specific for facial trauma, that correlates with patient outcome and aims to provide a practical tool for communication between clinicians and healthcare personnel for management of facial trauma.[22]

MVA – related injuries were analyzed and divided according to the type of injury: car accident, motorcycle accident; pedestrian, unknown/other. Bicycle accidents were excluded. Fractures were determined from a combination of physical examination and imaging (computed tomography scans or conventional radiographs) at admission to hospital and classified in fractures of the mandible, orbito-zygomatic-maxillary complex (OZM), orbit, nose, LeFort, frontal sinus, and naso – orbital – ethmoidal (NOE) fracture. Orbital fractures were subclassified according to the involved walls and Le Fort fractures were divided according to Le Fort I, II, and III types. Frontal sinus fractures were divided according to the involvement of the anterior and/or posterior tables. Mandibular fractures included fractures of the symphysis, body, angle, ramus, coronoid, extraarticular condyle, intraarticular condyle.

Associated injuries were classified as orthopedic, brain, abdominal, or thoracic.

Patient characteristics were analyzed using descriptive statistics.

This study was exempt from institutional review board approval. We followed Helsinki Declaration guidelines.

RESULTS

Of the 3260 patients with maxillofacial fractures admitted within the study period, 326 traumas were due to motor vehicle accidents. Of course, in the different centers and countries the incidence of MVA –related maxillofacial trauma varied, with the maximum value that was encountered in the Zagreb (Croatia) center study population (39 patients, 18 %) and the minimum value that was observed in Bergen (Norway) (0 patients, 0 %).

On the whole, 225 patients were male and 101 were female, with a male to female ratio of 2.2:1.

Mean age was 36.2 years.

Alcohol addiction was found in 59 patients, whereas drugs use was noted in 4 cases.

The most frequent mechanisms of MVA related maxillofacial injury were car accidents with 177 cases, followed by motorcycles (91 patients), pedestrian hitten (33 cases), and other/ unknown mechanisms (25 patients). This result was quite uniformly observed in all centers, as showed in Figure 1.

The most frequently observed fracture involved the mandible with 199 fractures, followed by maxilla-zygomatic-orbital (MZO) fractures (136), orbital fractures (36), Le Fort fractures (32), nose fractures (16 fractures), frontal sinus fractures (15), and NOE fractures (8).
FISS mean score in the whole study population was 2.39 (range, 1 – 12; median, 2; standard deviation, 1.99). In the "car accident" group mean FISS was 2.54, in the "motorcycle" group the observed mean FISS was 2.47, and in the "pedestrian" group, the mean value of FISS was 1.6.
Figure 2 shows the differences in fractures distribution according to the three etiological categories. In all the three groups mandibular and MZO fractures are the two most frequently observed fractures with some variations: in the car and motorcycle groups mandibular fractures are the main site of injury, whereas in pedestrian MZO fractures are the most frequently observed fractures.
As for associated body injuries, brain and orthopedic lesions are the most frequently observed in all the three groups, as shown by Figure 3. A peak of traumatic brain injuries has been observed in motorcycle accidents, whereas the peak of orthopedic lesions was encountered in the car study population.
Finally, the analysis of the dates of injury showed that the summer and winter months present the highest incidence of MVA related maxillofacial injuries (Figure 4).

DISCUSSION

The analysis of the various patterns of motor vehicle accidents is crucial, although differences in legislations, regulations, socioeconomic conditions, and road features among countries may represent an important bias for any attempt of assessment.
For instance, in Europe, every country has its own regulation about speed limit, alcohol and driving policies, and safety equipment, just to mention some variables. For this reason, a multicentre and prospective study to collect epidemiological data regarding MVA- related facial fractures seemed to be the most efficient way to obtain reliable results about this peculiar injury.

Demographics

Of the 3396 patients with maxillofacial fractures admitted within the study period in the different centers, 326 traumas were due to MVAs. Of course, in the different centers and countries the incidence of MVA –related maxillofacial trauma varied, with the maximum value that was encountered in Zagreb. However, in most centers, the percentage of MVAs was about 10%. In comparison with the European literature, this was among the lowest values ever reported. In fact, most recent studies regarding European populations reported percentages ranging between 25% and 60%. This result could confirm the progressive trend of decreasing incidence of MVA maxillofacial

injuries in developed countries. On the other hand, recent articles[14] about maxillofacial trauma epidemiology in Africa or Asia highlighted percentages of MVA related fractures often higher than 50% to reach values of 90% (e.g. in Iran, Turkey or India).

On the whole, 225 patients were male and 101 were female, with a male to female ratio of 2.2:1. The predominance of males agrees with males/females proportions of European study populations in recent articles.[14]

Alcohol and MVA

Alcohol addiction was found in 59 patients, whereas drugs use was noted in 4 cases. Unfortunately, a thorough analysis of alcohol addiction is extremely difficult. Although almost 20% of patients victims of MVAs referred alcohol addiction, a strict and precise knowledge of quantity, and type of alcohol beverages would be crucial. This kind of analysis would be extremely difficult because several factors should be kept in mind, such as the little collaboration of some patients in speaking about a possible alcohol abuse and the different laws about this topic. Furthermore, alcohol intoxication has a close association with the incidence of head and neck injuries, in particular increasing the risk of injuries from interpersonal violence (IPV) and motor vehicle accidents.[19] Alcohol addiction was associated with a higher proportion of concomitant organ injuries including cervical spine and other organ injuries and fracture sites outside of the facial skeleton.[19] Screening for alcohol addiction among patients may carry many potential benefits, thus providing an opportunity to educate patients about low-risk consumption levels and the risks of excessive alcohol use.

Etiology and injuries

The most frequent mechanisms of MVA related maxillofacial injury were car accidents with 177 cases, followed by motorcycles (91 patients), hit pedestrian (33 cases), and other/ unknown mechanisms (25 patients) (Figure 1). This result was quite uniformly observed in all centers (Figure 1). In this article, bicycle accidents were excluded because they are characterized by specific features and populations. Instead, Figure 2 highlights the distribution of fractures according to the mechanism: the most evident result is represented by the pedestrian victims of MVAs, who report MZO or orbital fractures in more the 60% of cases, against the 30-40% percentages of car / motorcycle users victims of MVAs. In all the three groups mandibular and MZO fractures are the two most frequently observed fractures with just slight variations: in the car and motorcycle groups mandibular fractures are the main site of injury, whereas in pedestrian MZO fractures are the most frequently observed fractures.

Of course, further studies about safety equipment (seat belts, airbags, helmet) and their protective effect against MVA-related facial injuries are needed, in spite of the challenge of such enquiry. [10-14]
The most frequently observed fracture involved the mandible with 199 fractures, followed by MZO fractures (136), orbital fractures (36), Le Fort fractures (32), nose fractures (16 fractures), frontal sinus fractures (15), and NOE fractures (8).
Of course, the low number of nasal fractures is probably due to a selection bias, as in several trauma centers nasal fractures are treated by ENT surgeons, and not by maxillofacial divisions. An epidemiological radiological analysis of MVA related facial fractures pointed out that nasal fractures were the most frequent facial injuries, followed by orbital fractures.[20]

FISS

FISS mean score in the whole study population was 2.39. In the "car accident" group mean FISS was 2.54, in the "motorcycle" group the observed mean FISS was 2.47, and in the "pedestrian" group, the mean value of FISS was 1.6. Therefore, cars and motorcycles accidents seemed to determine more severe injuries than "pedestrian accidents". The reason could be the different mechanism of this last type of injury: probably, the most severe impacts to pedestrian may easily determine fatal outcomes, thus causing an underreporting of facial injuries in these patients. Our results are consistent with the current literature, as mean FISS values of 2.46 were observed in car accidents and 1.65 in motorcycle accidents.[21]

Associated body injuries

As for associated body injuries, traumatic brain and orthopedic lesions are the most frequently observed in all the three groups, as shown by Figure 3. A peak of traumatic brain injuries has been observed in motorcycle accidents, whereas the peak of orthopedic lesions was encountered in the car study population. The highest incidence of traumatic brain injuries associated with motorcycle accidents was an easily expected finding, due to the high velocity achieved by motorcycles in conjunction with the lack of protection in comparison with cars. In spite of the inconvenience of wearing helmets, the compulsory wearing of such protective equipment remains the only defense for such severe injuries.[10-14]

Monthly distribution of injuries

Finally, the analysis of the dates of injury showed that the summer and winter months present the highest incidence of MVA related maxillofacial injuries (Figure 4). The peak of pedestrian injuries was observed in December, whereas the peaks of incidence for car and motorcycle accidents were

found in August and November. This monthly distribution of MVA-related facial injuries confirms the acknowledged trend of maxillofacial trauma that focuses in Summer and Winter seasons.

Conclusions

In conclusion, this European multicentre study about MVA related maxillofacial injury may represent another important stand in our increasing understanding of vehicle accidents and their consequences. The importance of the perseverance in analyzing MVA related facial injuries with their features and characteristics should be stressed. Further prospective studies about alcohol addiction and driving, as well as about safety equipment could be fundamental to appropriately assess this socially important phenomenon.

Statement

Most frequently, MVA related facial injuries are due to car accidents and involve the mandible.

'Conflict of interest statement:

Nothing to disclose

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LEGENDS:

Figure 1: Percentages of mechanisms of MVA – related maxillofacial injury in the EUR.MA.T centers. (BG, Bulgaria; EST, Estonia; F, France; HR, Croatia; N1, Oslo - Norway; N2, Bergen – Norway; NL, The Netherlands; SLO, Slovenia; SRB, Serbia; UA, Ukraine; UK1, London – England, United Kingdom; UK2, Dundee – Scotland, United Kingdom)

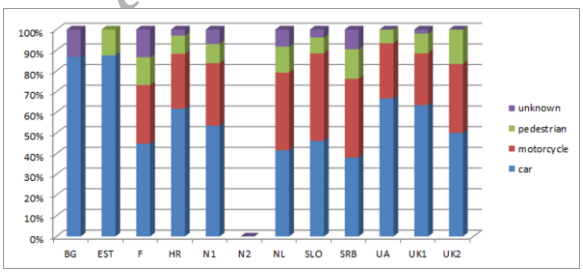

Figure 2: Fractures distribution according to the three etiological categories.

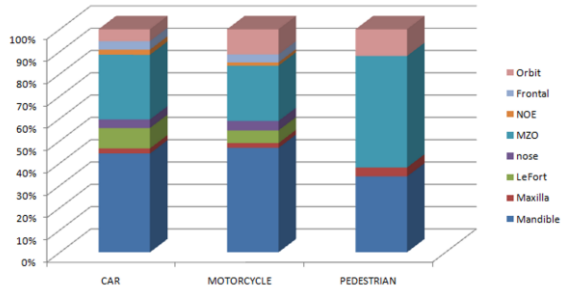

Figure 3: Associated body injuries according to the three etiological categories.

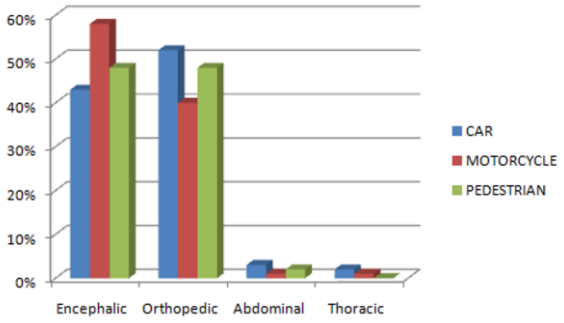

Figure 4: Fractures monthly distribution according to the three etiological categories