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Prevalence and etiology of midfacial fractures: A study of 799 cases

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ABSTRACT

Background and objective: The prevalence and etiology of midfacial fractures varies among countries. Until now, knowledge about such type of injuries in the region of the Baltic countries was rather scarce. The purpose of the study was to analyze the prevalence, etiology and localization of midfacial fractures treated at the Vilnius University Hospital Žalgiris Clinic, Vilnius, Lithuania.

Materials and methods: The medical records of patients treated for midfacial fractures during the period January 2005 to December 2010 were analyzed for gender, age distribution, frequency and type of injury, cause of fractures, consciousness status and alcohol abuse during trauma.

Results: The records of 799 patients were analyzed. The male-to-female ratio was 4.4:1. The mean age of the patients was 33.16 ± 14.0 years (min 1, max 87). As much as 68.8% of injuries were zygomatic fractures, 27.9% were maxillary, and 3.3% were isolated orbital floor fractures. The most frequent causes for injury were interpersonal violence (64%), followed by falls (16.3%) and traffic accidents (8.3%). Most midfacial fractures (65.3%) occurred between April and October ($P < 0.05$), on weekends (58.2%; $P < 0.05$) and at night (62.0%; $P < 0.05$). In 14%, trauma reports indicated the abuse of alcohol. More often such persons received more than one midfacial bone fracture ($P < 0.05$) concurrently.

Conclusions: This study revealed that the main cause of midfacial fractures was assault. Male patients, aged 15–34 years, more often sustain midfacial fractures. Preventive health care programs should seek measures in the reduction of aggression and violence in close future involving family, school and community institutions.

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1. Introduction

Maxillofacial injuries remain a challenge for oral and maxillofacial surgeons, demanding both skill and a high level of expertise [1]. The midfacial fractures (maxilla and zygoma) is a part of all skull fractures and their prevalence differs depending on the country, ranging from 17% in Brazil, to 26% in Austria and up to 60% in Turkey [2-4]. These differences might be due to the socioeconomic, cultural and environmental factors related to changes in the trauma pattern [5].

The main causes of midfacial fractures as reported worldwide are interpersonal violence, traffic accidents, falls and sports injuries [5]. Studies from Africa and Asia and some European countries have shown that traffic accidents are the main cause of midfacial fractures [6-18]. During the last decade, interpersonal violence as a cause of midfacial fractures has been increasing in such countries as the USA, Israel, Finland, and New Zealand [12,16,17].

No retrospective analysis of midfacial fractures has been performed in the region of the Baltic countries, and the publications were limited to the overviews of mandibular fractures [19]. An understanding of the cause and severity of trauma could assist in establishing clinical and research priorities for effective treatment and prevention of injuries [20]. The purpose of the present study was to analyze retrospectively the prevalence, etiology and localization of midfacial fractures treated in the Centre of Oral and Maxillofacial Surgery, Vilnius University Hospital Žalgiris Clinic, Lithuania.

2. Material and methods

Medical records of patients treated for midfacial fractures in the Centre of Oral and Maxillofacial Surgery, Vilnius University Hospital Žalgiris Clinic, Vilnius, Lithuania, from January 2005 to December 2010, were retrieved. Inclusion criteria for this study group were medical records of patients, coded according ICD-10 with code S02.3 (fracture of orbital floor) and S02.4 (fracture of malar and maxillary bones). All the records were analyzed thoroughly and data concerning patients' gender, age, prevalence and type of injury, etiology, consciousness status and alcohol abuse during trauma was extracted. The overall number of records of the patients with midfacial fractures treated at the VUHZC during the period covered by the study was higher than analyzed therefore, not all the relevant records were included in the study. Exclusion criteria were patients who: (1) refused to be treated; (2) were discharged before the examination; (3) were treated in other hospitals due to polytrauma; and (4) whose records contained incomplete data.

Statistical analysis was performed with SPSS version 17.0 statistical software package (SPSS Inc., Chicago, IL, USA). Descriptive statistics and the chi-square test were used. The degree of statistical significance was set at $P < 0.05$.

3. Results

From a total of 876 retrieved records, 799 were included. The male-female ratio was 4.4:1. Men accounted for 81.5% of the

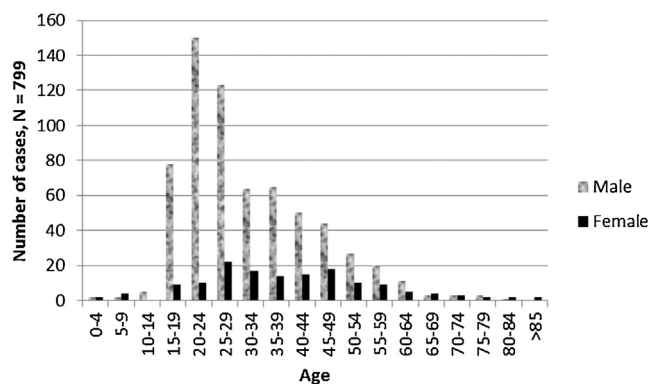


Fig. 1 – Distribution of midfacial fractures by patient age and gender.

total number of patients. A bigger proportion of the men with midfacial fractures was especially seen in the 15-64-year-old group (Fig. 1). The distribution of midfacial fractures among men and women is shown in Fig. 1. The mean age of patients was 33.16 ± 14.0 years (min 1, max 87). The mean age of the men was 31.71 ± 12.8 years (min 1, max 83). The mean age of the women was 39.57 ± 17.2 (min 2, max 87). Almost two-thirds ($n = 415$, 64%) of the men were in the 15-34-year-old group and 65% ($n = 96$) of the women were in the 25-49-year-old group.

Interpersonal violence was the main cause of trauma in 64% of patients ($n = 504$) and more common in males ($P < 0.05$) (Fig. 2). During interpersonal violence, 74% of the injured men were hit by strangers, while 62% of women reported domestic violence ($P < 0.05$), mainly from husbands (50%), familiar persons (42.5%), sons (5%), or neighbors (2.5%). Falls were the second most common cause of midfacial fractures (16.3%). The majority of falls (79%) were outdoor, followed by indoor falls (21%). The most frequent outdoor fall was falling on the ground (82%), followed by falling from a height (12%), etc. The most frequent indoor fall was falling downstairs (83.3%).

The number of men and women receiving injuries during sports events was nearly equal. Basketball and football were the leading sports causes of midfacial fractures (50%) followed by horse riding (10.5%) and boxing (7.9%).

Traffic accidents were one more cause of midfacial fractures where most of the patients suffered as passengers (70%), followed by drivers (22%) and pedestrians (8%).

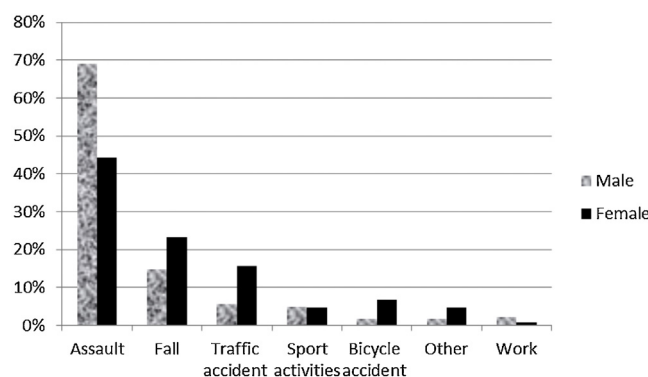


Fig. 2 – Distribution of midfacial fractures by cause and patient gender.

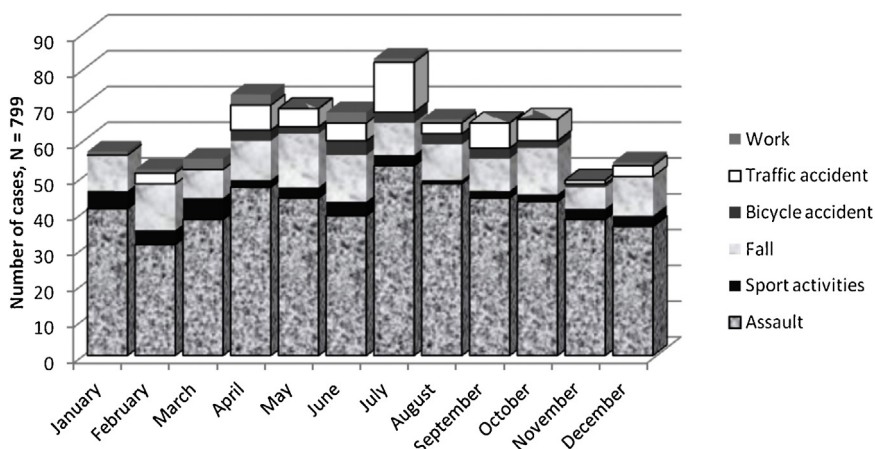


Fig. 3 – Causes of midfacial fractures and distribution by month.

The male–female ratio among patients aged 1 to 18 years (children group) was 5.8:1. The most common cause of injury in this age group was interpersonal violence (56%), followed by falls (17%), traffic accidents (13%), bicycle accidents (9.5%), and sports (4.5%). Children suffered traffic and bicycle accidents more often than did adults ($P < 0.05$). The causes of children's injuries by gender showed that fractures from assaults, falls and bicycle accidents were more common among boys ($P < 0.05$). However, girls more often suffered from traffic accidents and sports events ($P > 0.05$).

Distribution of trauma causes by month is shown in Fig. 3. Most midfacial fractures (65.3%) occurred during the warmer months of the year (April–October) ($P < 0.05$). There was no statistically significant difference between assaults and falls during various times of the year (Fig. 3). In terms of individual days of the week, midfacial fractures occurred mostly from Friday to Sunday (58.2%) ($P < 0.05$) (Fig. 4). The higher incidence of midfacial fractures ($P < 0.05$) was noted mainly between 8 PM and 3 AM (62.0%), peaking between 8 PM and 9 PM (Fig. 5). The causes of injury distributed by time of day showed that fractures from assaults were more common (66%) between 6 PM and 3 AM ($P < 0.05$) (Fig. 5).

According to the anatomical location, the most common subtype of midfacial fractures was the zygomatic fracture (68.8%), followed by maxillary (27.9%) and isolated orbital floor injuries (3.3%). In the case of maxillary fractures, the Le Fort II was diagnosed in 29.7%, isolated infraorbital margin in 23.6%, maxillary anterior surface in 22%, Le Fort I in 10.4%, alveolar ridge in 7.7% and Le Fort III in 6.6% of all cases. According to the location, the most common fracture in children was the zygomatic fracture (53.1%), followed by maxillary (40.7%) and isolated orbital floor injuries (6.2%). In the case of maxillary fractures, the maxillary anterior surface fracture was diagnosed in 30.3%, alveolar ridge in 24.2%, Le Fort II and isolated infraorbital margin in 18.2%, Le Fort I in 6.1% and Le Fort III in 3.0%. Children suffered alveolar ridge fracture more often than adults (24.2% and 5.3%, respectively; $P < 0.05$).

According to the medical records, one third of the patients were unconscious and 14% were documented as having been abusing alcohol at the time of the trauma. Patients with alcohol intoxication suffered multiple midfacial bone fractures more often than did sober patients (42% vs. 14% and 18% vs. 56%, respectively; $P < 0.05$). In 30% of the cases, it was difficult

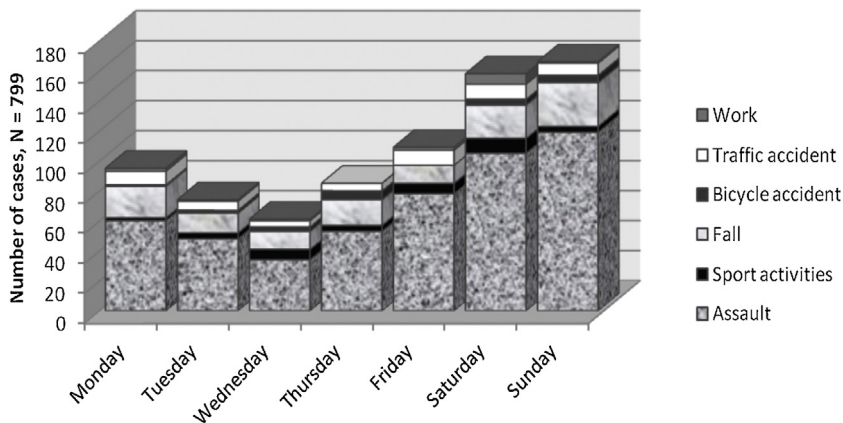


Fig. 4 – Distribution of midfacial fractures and causes by days of the week.

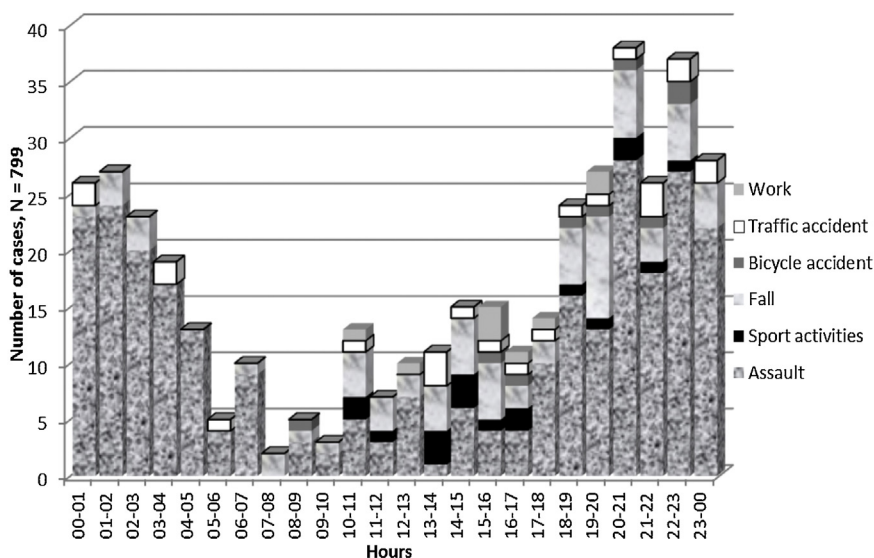


Fig. 5 – Distribution of midfacial fractures and causes by time of day.

to determine whether the patients were intoxicated during the trauma.

4. Discussion

Traumatic injury has been identified as the leading cause of work absenteeism constituting more than that caused by heart disease and cancer combined [3]. Trauma is also the leading cause of death among people aged less than 40 years [3]. The Centre for Oral and Maxillofacial Surgery in Vilnius University Hospital Žalgiris Clinic is one of the largest centers in the Baltic countries dealing with traumatic injuries, treating patients from eastern and central Lithuania. The total population of Lithuania in 2011 was 3.053 million [21]. The population of the regions from which patients are admitted for treatment in the Centre is more than half of total population of Lithuania. Geographical location, culture and socioeconomic status of the country play a role in the causes and incidence of midfacial fractures [5]. Midfacial fractures accounted for about 26% of all patients treated for facial bone fractures at Vilnius University Hospital Žalgiris Clinic.

Studies have implicated zygomatic fractures as the most common subtype among midfacial fractures in both children and adults [3-5,10-12]. The results of this study showed that only the alveolar ridge fracture occurred significantly more frequently among children than among adolescents. These differences could be related to the fact that children were hospitalized for this isolated trauma while adolescent were treated in the outpatient department.

The male-to-female ratio differs from study to study and, in the case of midfacial fractures, ranged from 2.9:1-12:1 [3,8,9,15,18]. The results of the present study showed that this ratio was 4.4:1. It is difficult to compare discrepancies of the studies due to the differences in inclusion criteria. There are not a lot of studies which overwhelms all inclusion criteria used in this study. The discrepancy between ratios might be

related not only to the culture, but also to the peculiarity of the study design. For example when comparing the male-to-female ratio and causes of midfacial fractures in Iran and the United Arab Emirates traffic accidents are the predominant cause of these traumas (75%-91%) and men are exclusively drivers in these countries [8,15]. In other studies only children were included and the main causes of trauma for them were falls and bicycle accidents [2,5,18]. The present study showed that the male-to-female ratio of children suffering from midfacial fractures was 5.8:1, with a high predilection for those older than 14, possibly because this group is more prone to violence and forced conflicts. Interpersonal violence as the cause of midfacial fractures in children was detected in 56% of the cases, and it is close to 64% in the entire study sample. According to other authors, children younger than 15 years are rarely affected—facial trauma in this age group is usually less severe and is limited to soft tissue or dental injuries [18].

According to the findings of the present study, men were in a higher risk group among treated patients for midfacial fractures than women under 64 years, with the predominance in the 15-34-year-old group. Above 65 years, the predominance of women was evident. This can may be explained by the differences in the lifespan: men's and women's life expectancy in Lithuania is 68.5 and 79.1 years, respectively, and the male-to-female ratio is changed [21].

Studies over the past 3 decades have shown that traffic accidents are the most common cause of facial injuries in developing countries, with interpersonal violence being the prevailing reason in developed countries of Europe and North America [5,8,22]. Results of our study reveal that traffic accidents as a cause of midfacial fractures constitute only 8.3% of all cases.

Lower mean age of men than women injured can be explained by the different circumstances related to interpersonal violence. Men experienced interpersonal violence on the part of strangers (74%), mostly in the time span 6 PM to 3 AM (66%) and on weekends, which is supported by reports of

increased crime. Vilnius, as the capital of Lithuania, is attractive for young people coming from all over Lithuania to live, work or study. They are at higher risk of experiencing midfacial fractures due to their active night life and increased alcohol consumption on weekends, which might be associated with the increased crime rate.

Even 62% of women in the present study received injuries due to domestic violence. This is in agreement with the results of other studies wherein domestic violence as the reason for midfacial fractures among women varies between 34% and 73% and represents a worldwide problem that crosses all cultural, racial and socioeconomic lines [23].

The estimated incidence of intimate partner violence in Lithuania is 50%, which is much higher than in other countries such as the United States (25%), England (30%) or South Africa (24.6%) [23,24]. It seems that this problem has been noted by a wide variety of authorities, who must take measures to address the problem and lower the numbers. Plastic and maxillofacial surgeons and other health care providers who treat patients with midfacial injuries are in a unique position to identify these victims and refer them to local domestic violence service programs for improving their safety and receiving referrals, support services and advocacy, depending on the victims' needs and choices [23].

The results of the present study reveal that sports trauma during basketball and football are the most frequent in more than half population of Lithuania. The results also showed that 14% of trauma patients were intoxicated at the time of trauma. This number might be even higher because in 30% of the patients, it was difficult to determine, whether they were under the influence at the time of trauma. We suspect that certain patients delay seeking medical care after trauma in an effort to conceal their inebriation or deny the influence of drugs for fear of losing their health insurance benefit. The tolerance of the maxilla, nose and zygoma to applied force is lower than that of the frontal and mandibular bones, which can transfer energy to the brain to cause brain damage [25]. Midfacial fractures increase the risk of accompanying intracranial hemorrhage by two to four times [26]. In such patients, rapid identification and assessment is important because surgical therapy is often urgently required. In this study, one third of patients lost consciousness at the time of trauma. A thorough examination of the patient is needed because loss of consciousness is indicative of intracranial injury and consultation of neurologists, ophthalmologists could be necessary.

Moreover, in contrast to other studies, our results showed interpersonal violence to be the most common cause of midfacial fractures among children (56%) [2,5,9,11,12,18]. Most of the victims were boys older than 15. It can be at least partly explained by the social problem of sneering, which has developed into a serious issue at both school and after school. On numerous occasions, this has been the reason for attempted suicide among children, which is a frightful fact because the suicide rate among Lithuanian children is one of the highest in the European Union [27].

According to our data, 65.3% of midfacial fractures occurred in the warmer period of the year, between April and October ($P < 0.05$), especially in July. Some authors attribute the preponderance of midfacial fractures in July to the increase in road and bicycle accidents [8,11,13,16]. We have also noticed

an increase in traffic accidents in July, although the rate of injuries caused by assault also increases in this month. Our investigation showed that children suffer traffic and bicycle accidents more often than do adults, the main reasons being not using safety belts and ignoring the rules of children transportation in vehicles [2,28]. Moreover, bicycle riding is one of children's favorite summer activities, and the limited use of safeguards may be one of the reasons [18].

5. Conclusions

This study revealed that the main cause of midfacial fractures was assault. Male patients, aged 15–34, more often sustain midfacial fractures. Due to the severity and complexity of facial trauma, treatment management requires close cooperation of maxillofacial surgeons, neurologists, ophthalmologists and also continued publicity on the importance of preventive strategies. Preventive health care programs should seek measures in the reduction of aggression and violence in close future involving family, school and community institutions.

Conflict of interest

The authors state no conflict of interest.

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