Maxillofacial Fractures Surgically Managed at Aalesund Hospital between 2002 and 2009

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Abstract

This study analyses the demographics, etiology, and complications in patients operated for maxillofacial fractures by oral and maxillofacial surgeons at the Aalesund Hospital between 2002 and 2009. A total of 188 fractures in 139 patients were studied. The male-to-female ratio was 3.6:1 and the mean age was 35.7 ± 17.2 years. Males were significantly younger than females ($p < 0.05$). Mandibular (52.7%) and zygomatic complex fractures (33.5%) were the most frequent. Most patients (41.7%) sustained their injuries as a result of interpersonal violence (IPV) followed by falls (25.9%) and traffic accidents (15.8%). Significantly more males were victims of IPV ($p < 0.05$). Almost half of the female cohort sustained their injuries from falling. More than half of those who sustained their injuries between midnight and morning were intoxicated. The majority of cases were treated by open reduction and internal fixation (56.8%). Posttraumatic and postoperative complications were seen in 25% of the patients, with infection (8.6%) occurring most frequently. Mandibular and zygomatic complex fractures were the most frequent in our study. IPV in association with alcohol and drugs was a major cause of maxillofacial fractures, especially among young adult males. Falls were the predominant cause of fractures among females.

Keywords

- ▶ maxillofacial fractures
- ▶ retrospective
- ▶ interpersonal violence

Maxillofacial trauma frequently occurs throughout the world and may be associated with severe morbidity, loss of function, disfigurement, and psychological problems. Furthermore, management of these patients may require substantial resources.¹ Most patients with facial fractures are in the third decade of life.² Males sustain maxillofacial fractures 2 to 32 times more often than females depending on the population studied.³ Females are generally afflicted at a later age and have a different trauma mechanism than males.^{3,4}

Global differences in the distribution and frequency of maxillofacial fractures have been attributed to socioeconomic, cultural, and environmental factors.^{1,3} Reports from various countries point to changing trends in the incidence,

etiology, and location of maxillofacial fractures. In general, the incidence of maxillofacial fractures has increased in the last decades. In industrialized countries, interpersonal violence (IPV) is the main cause of injury, while traffic accidents and falls dominate in the rest of the world.³

The purpose of this study was to describe the incidence, mechanism of injury, age and gender distribution, treatment, and complications of maxillofacial fractures operated at Aalesund Hospital, Norway from January 2002 to December 2009. There are only few internationally published reports from Norway on maxillofacial trauma. To the best of our knowledge the last retrospective report from Norway in English was published over two decades ago.⁵

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Patients and Methods

Aalesund Hospital is the main referral hospital in Moere and Romsdal region of western Norway and covers a population of approximately 260,000. Patient data were obtained from the archives of inpatients operated for maxillofacial fractures by the oral and maxillofacial surgeons between January 1, 2002, and December 31, 2009. Maxillofacial fractures associated with brain trauma were not included in the study as these cases are routinely referred to a university hospital. Fractures of the nose were also not included in this study, as these are managed by the ear, nose, and throat department.

The data collected included age, gender, fracture site, etiological mechanism, time and season of injury, treatment, complications, and posttraumatic morbidity. Data on intoxication (with alcohol and/or drugs) was also collected. A day was divided into three categories night–early morning (12:00 AM to 7:59 AM), morning–afternoon (8:00 AM to 3:59 PM) and evening–midnight (4:00 PM to 11:59 PM). The season of the year when the injury occurred was also registered.

Complications and unfavorable outcomes due to maxillofacial trauma were recorded. These included infection, nerve injury, persistent pain, malocclusion, temporomandibular complaints, and dental injuries. Statistical analyses were done by PASW Statistics 18 software (SPSS, IBM Inc., Armonk, NY). The level of statistical significance was set at $p < 0.05$.

Results

Over the 8-year study period, a total of 139 patients with 188 fractures were included in the study. Most fractures occurred in males (78.4%, $n = 109/139$, $p < 0.05$) resulting in a male-to-female ratio of 3.6:1. There were age-group specific differences in the male-to-female ratio. The most striking being a ratio of 5.6:1 in the 21 to 30 age group and 1:1 in the over 61 years group. The overall mean age of the study population was 35.7 ± 17.2 years. Females had a mean age of 45.4 ± 19.8

years (range, 12–91 years) and were significantly ($p < 0.05$) older than males (mean age, 33.0 ± 15.4 years; range, 4–85 years). Fractures occurred most frequently in the second to fifth decade of life irrespective of the gender. There was a clear peak age for males in the age group 21 to 30 years (31.2%, $n = 34$). Females showed no definite peak age; however, a tendency was observed in the age groups 21 to 30, 41 to 50, and 51 to 60 years (►Fig. 1).

IPV was the principal cause of maxillofacial fractures accounting for slightly over 40% (58/139) in this study. Males were overrepresented (91.4%, 53/58) in IPV-associated fractures ($p < 0.01$, ►Table 1). Falls accounted for about a quarter (25.9%, $n = 36$) of the injuries in our study. These included the following: falling outdoors ($n = 13$), indoors ($n = 11$), as a result of syncope ($n = 3$), or because of balance problems ($n = 1$). In eight journals, the mechanism of the fall could not be ascertained. Over a third (38.9%, $n = 14/36$) of those who sustained their injuries by falling were females and accounted for almost half ($n = 14/30$) of all the female cases. Thus, falls were a more frequent cause of maxillofacial fractures among females than males ($p < 0.05$, ►Table 1). Traffic accidents accounted for about 16% ($n = 22/139$) of all the fractures. The remaining cases sustained their injuries as a result of sports (mainly skiing or soccer) or iatrogenic injuries. The mechanism of injury could not be determined in six patient journals.

Fractures of the mandible were the most frequent and accounted for slightly over a half of all fractures (52.7%, 99/188). The condyle of mandible was the most fractured site (28.3%) in the lower jaw followed by the body of the mandible. IPV was responsible for 48.5% (48/99) of all mandibular fractures (►Table 1). Midface (zygoma, orbital, and maxilla) fractures as a group represented 45.5% of maxillofacial fractures. The remaining fractures ($n = 4$) were localized to the alveolar process (►Fig. 2). There were no significant differences between fractures in the left and right sides of the face. Concomitant injuries ($n = 24$) were recorded in 18 cases (12.9%) and included fractures of the upper extremities ($n = 11$), lower extremities ($n = 6$), pelvis ($n = 2$), spinal

Fig. 1 Number of fractures by age groups in males and females.

Table 1 Distribution of fractures by etiology, gender, and site

Etiology	Gender		Total	Site of fracture					Total
	Men	Women		Mandible	Maxilla	ZC	Orbit	Alveolar	
IPV	53 ^a	5	58	48	3	22	8	0	81
Fall	22	14 ^b	36	24	1	20	4	1	50
Traffic	15	7	22	15	2	9	2	3	31
Sports	10	2	12	7	1	6	0	0	14
Work	4	1	5	1	0	4	0	0	5
Others	5	1	6	4	1	2	0	0	7
Total	109	30	139 ^c	99	8	63	14	4	188 ^c

Abbreviation: ZC, zygomatic complex.

^a $p < 0.01$.

^b $p < 0.05$.

^cTotal number of patients, 139; total number of fractures, 188.

cord ($n = 1$), fingers ($n = 2$), nose ($n = 1$), and skull base ($n = 1$).

At the time of admission to hospital it was observed that 25.9% (36/139) of the study sample were under the influence of alcohol and/or drugs. Of these, 26/36 (72.2%) sustained their injury as a result of violence. There was a strong association between intoxication and violence in the mechanism of maxillofacial fractures ($p < 0.001$). The mandible was affected in 15/26 (57.7%) making the lower jaw the most affected site in injuries associated with violence under the influence of alcohol and/or drugs.

More patients sustained their injuries on Saturdays (22.3%; $n = 31/139$) and Sundays (17.3%; $n = 24/139$) than any other day of the week, making weekends the most likely part of the week when facial injuries occurred in our study (►Fig. 3). Intoxication-associated facial fractures predominantly occurred on weekends (64.7%) compared with the rest of the week (19.7%; $p < 0.001$). More than 30% of all the injuries occurred between midnight and 8 in the morning. Alcohol and/or drugs were involved in 52.2% (24/46) of the fractures

sustained at night. The time of injury was missing in 15 journals. Fractures were evenly distributed between winter ($n = 36$), spring ($n = 35$), summer ($n = 36$), and autumn ($n = 32$).

Open reduction and internal fixation was the treatment of choice in more than half of the study population ($n = 79$, 56.8%). Open reduction without internal fixation was used in 20.9% ($n = 29$). Closed reduction with intermaxillary fixation was preferred in 9.4% ($n = 13$) of the patients and closed reduction without fixation was used in 3 (2.2%) cases including 2 alveolar bone fractures and 1 mandibular fracture in a child. Six (4.3%) patients were treated by a combination of the above methods. Orbital floor reconstruction with porous polyethylene (PPE) or a composite of PPE and titanium mesh was used in nine (6.5%) cases.

Unfavorable posttraumatic outcomes and postoperative complications were recorded in 25% ($n = 35/139$) with infection occurring most frequently (8.6%; $n = 12/139$). Temporomandibular dysfunction and sensory nerve complaints occurred in four and three cases, respectively. Two patients

Fig. 2 Frequency and number of fractures by site.

Fig. 3 Frequency and number of fractures by the days of the week.

had chronic pain and two others had malocclusion complaints. Osteosynthesis plates were removed in four patients because of subjective symptoms. Teeth were injured during an internal fixation in two cases. Two patients were reoperated: one because of a malpositioned orbital floor reconstruction plate and the other because of persistent facial asymmetry after reposition of a zygomatic arch fracture. The rest were single cases with persistent diplopia, postoperative bleeding, a misaligned mandibular fracture, and accidental conchotomy during nasal intubation.

Discussion

This epidemiological study from a county hospital in western Norway found a total of 188 surgically managed maxillofacial fractures in 139 patients over an 8-year period from 2002 to 2009. Males sustained maxillofacial injuries nearly four times more often than females. The mean age of males was markedly lower than that of females. This corresponds to other studies conducted in the Nordic countries and other industrialized countries.^{3–6} The over representation of young men, particularly in the third decade of life may be due to biological differences between the sexes, particularly with regards to outdoor activities, temperament, and aggressive behavior.⁷ However, there are reports in the literature that show a reduction in the male-to-female ratio. This changing trend in male-to-female ratio has been observed in Nigeria and has been attributed to women taking part in work and activities that predispose to facial trauma.⁸ This is similar to previous studies from the United States,⁹ the Netherlands,¹⁰ and Brazil.¹¹ This trend may be explained by a higher rate of falls and a higher life expectancy among elderly females.³ We observed a similar trend in the age group 61 years and older, although the sample size of this group was small in our study.

IPV was the main cause of maxillofacial fractures in our study accounting for slightly over 40% of all facial fractures and 90% of fractures among males. Notably, intoxication was a factor in nearly three-fourths of the fractures where IPV was the mechanism. Our findings are similar to previous studies

from the West, where IPV is the principle etiological mechanism in maxillofacial fractures.^{2,4} The contribution of alcohol and drugs in the etiology of maxillofacial injuries is well established throughout the world and is implicated in 40 to 58% of the injuries.³ Alcohol and drugs result in inflated confidence, faulty judgment, poor coordination, and aggressive behavior.¹² Thus, people under the influence of alcohol and/or abusive drugs are more likely to be involved in IPV, traffic accidents, and falls.¹³ Previous studies from Norway have shown that alcohol is implicated in 54 to 68% of jaw fractures.^{6,14} In this study, we found that alcohol and/or drugs were implicated in a quarter of maxillofacial fractures. This is most probably an underestimation, as these central nervous system depressants were not systematically documented or tested for at the time of hospitalization. Alcohol consumption, particularly at weekends, is permissible in various social settings in Norway. This would explain our finding of a higher frequency of fractures at weekends, especially after midnight. This is consistent with a recent report from a neighboring region in Norway.⁶ We found no differences in the frequency of fractures, according to the seasons of the year. This is a contrast to a recent study from another part of Norway showing a higher frequency of fractures in the months of summer.⁶

The face is generally targeted in alcohol- and/or drug-related violence often leading to fractures of the midfacial skeleton.^{15–17} Violence against women is a major global problem, but is seldom documented, reported or investigated.¹⁸ Notably, no females in this study reported injuries as a result of domestic violence. Interestingly, almost half of the females in our study sustained their injuries as a result of falls. We suspect that victims of domestic violence choose not to report such incidences due to fear of stigmatization and possible legal implications.

In our study, slightly over half of all maxillofacial fractures occurred in the mandible. However, similar studies from Nordic countries show rates approximating 80% for the mandible.^{4,5} This difference is probably due to a high proportion of midface fractures in our study because oral and

maxillofacial surgeons at our hospital exclusively manage all facial injuries with the exception of nasal fractures and facial trauma associated with brain injuries. In Norway and elsewhere the spectrum of maxillofacial fractures managed by a department varies between hospitals, according to the activity of other specialties involved in the treatment of these injuries.

The majority of cases in our study were treated by open reduction and internal fixation. Closed reduction and intermaxillary fixation was often used in high condylar and bilateral mandibular collum fractures. Open reduction without fixation was preferred in zygomatic complex/arch fractures. Unfavorable posttraumatic and postoperative events were seen in a quarter of the study population with postoperative infection (8.6%) as the most frequent complication. The overall complication and infection rates are similar to a recent report from Norway.⁶ Our findings on unfavorable posttraumatic and postoperative events warrant further studies to reduce the complication rate.

This retrospective study has the following limitations: a relatively small sample size, difficulties in the evaluation of contributory factors, and insufficient information/missing data in patient journals. However, it provides relevant demographic information, especially since little has been reported on maxillofacial injuries from Norway. Our study found that fractures of the mandible often caused by violence were the most common injuries. The average person operated for maxillofacial fracture at the Aalesund Hospital was a male in his third decade, implicated in IPV, often under the influence of alcohol and/or drugs, and would have sustained his injury at night. The findings of this study provide a basis for future studies and for prevention of maxillofacial fractures especially among young males.

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